# BEST MANAGEMENT PRACTICES ANALYSIS FOR SOLID WASTE

## VOLUME III

## STATEWIDE FINDINGS AND RECOMMENDATIONS


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# SECTION A

# INTRODUCTION AND OVERVIEW

## 1. PURPOSE

Substitute House Bill 1684, enacted in the 1988 regular session of the Washington State Legislature, directed the Department of Ecology to determine the "Best Management Practices" for Solid Waste. This analysis was to be guided by the priorities established in the State's Solid Waste Management Act:

- Waste Reduction
- Recycling
- Energy Recovery and Incineration
- Landfilling

Volume III of this comprehensive waste stream analysis and evaluation focuses on:

- The feasibility of separating waste at the source of generation and after collection in order to increase recycling.
- Special waste singled out in Substitute House Bill 1684 as being potentially harmful--these categories of waste included tires, batteries, disposable diapers, waste oil, and expanded polystyrene.
- Market development strategies, which are critical to the success of recycling.
- Policy recommendations to support implementation of "Best Management Practices" throughout the State.

Section B of this volume summarizes statewide waste generation, disposal, and recycling data, and defines the composition of disposed and recycled materials.

Section C describes the findings of an economic model designed to evaluate source-separated collection, at curbside, of residential recyclable materials as compared with post-collection processing. Processing permits the recovery of recyclables as well as the composting or production of refuse-derived fuel.

Section D describes the problems associated with "special wastes" and lists a number of recommendations for handling tires, batteries, disposable diapers, waste oil, and expanded polystyrene.

Section E first describes market development programs being enacted throughout the United States, and then presents recommended market development strategies to be carried out by a number of Washington State agencies.

Section F reviews barriers to implementing "Best Management Practices" in Washington State, and Section G sets forth policy recommendations.

## 2. APPROACH

Barriers to effective solid waste management, strategies for market development, recommendations for handling special waste, and policy recommendations were developed through an interactive process involving representatives from the public sector, from business, and from the waste management and recycling industries. Members of the Washington State Recycling Association (WSRA) Technical Advisory Committee and the Waste Generation Area (WGA) working groups helped identify solid waste management barriers. The WSRA group also guided development of market development strategies and special waste recommendations. A Washington Department of Ecology (WDOE) Advisory Committee identified policy issues and helped shape final recommendations.

To create an economic model to determine the feasibility of source-separated recycling and post-collection sorting or processing, waste generation and composition data were combined with an economic analysis, which is presented in Volume II. The objective of the economic model was to determine the feasibility of curbside collection of source-separated recyclables as compared with processing at an intermediate site after collection.

# SECTION B

## SUMMARY OF STATEWIDE FINDINGS

### 1. QUANTITY AND COMPOSITION OF WASTE GENERATED

Approximately 5,100,000 tons of municipal solid waste were generated in the State of Washington in 1987. An average of 6.2 pounds per person of waste was generated every day. Of this amount, approximately 1.4 pounds were ultimately recycled. The remaining 4.8 pounds were disposed of by landfilling or incineration.

This estimate of Washington's total waste stream is comprised of five sources:

| | |
|---|---|
| | Residential Wastes |
| + | Commercial Wastes |
| + | Manufacturing Wastes |
| + | Self-Hauled Wastes |
| + | Recycled Materials |
| = | Total Generated Waste Stream |

Figure B-1 represents the proportional contribution of each of these five sources to the total waste stream. Figure B-2 shows the overall composition by weight of the total generated waste stream.

Individual Washington residents dispose of approximately 2.1 pounds of waste each day. This does not include waste which is generated by businesses or which is self-hauled to disposal sites.

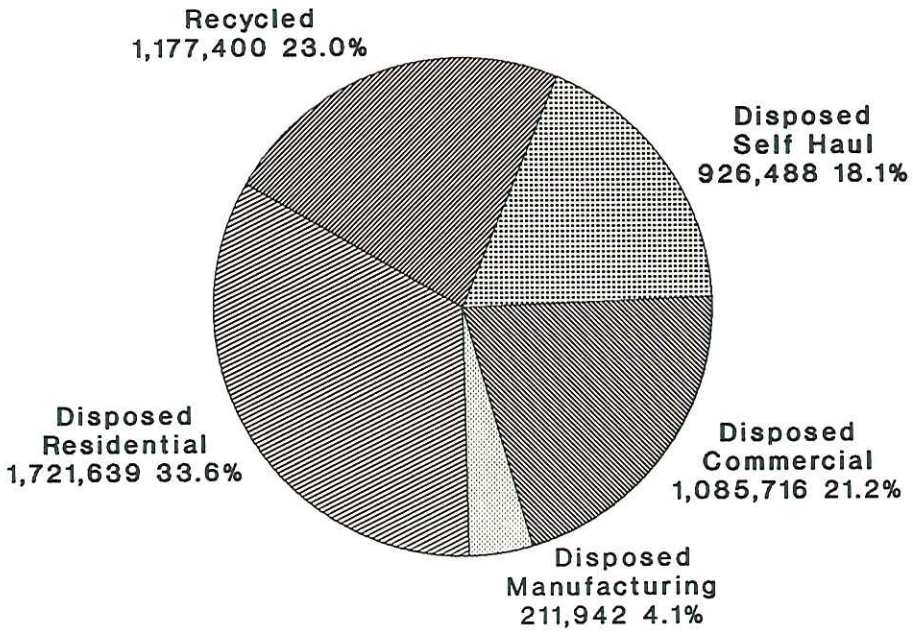
### 2. QUANTITY AND COMPOSITION OF WASTE DISPOSED

Approximately 3,900,000 tons of municipal solid waste were disposed of in Washington State during 1987. This amount includes waste commercially or publicly collected, as well as self-hauled waste. All waste which enters or could potentially enter the municipal waste stream was included in this estimate. Approximately 77% of the estimated total waste generated in the State was disposed through incineration or landfilling. Figure B-3 indicates the composition by weight of the disposed portion of the waste stream.

Components of the total were identified by subwaste stream: residential, commercial/institutional/manufacturing, and self-hauled wastes. Residential household wastes, both commercially and publicly collected, were estimated to weigh 1,700,000 tons, and this comprised 44% of the total disposed. Disposed wastes from business, manufacturing, or institutional activities, commercially or publicly collected, amounted to 1,300,000 tons and represented 32% of total disposed. Self-hauled wastes, both residential and commercial, contributed approximately 900,000 tons to the total, a share of 23%. Figures B-4, B-5, B-6, and B-7 describe the compositions of these waste substreams.

Figure B-1

# TOTAL GENERATED WASTE STREAM




TONS AND PERCENTAGES
AS PORTIONS OF THE TOTAL
5,123,185 TONS GENERATED

Figure B-2

# WASHINGTON'S 1987 WASTE STREAM

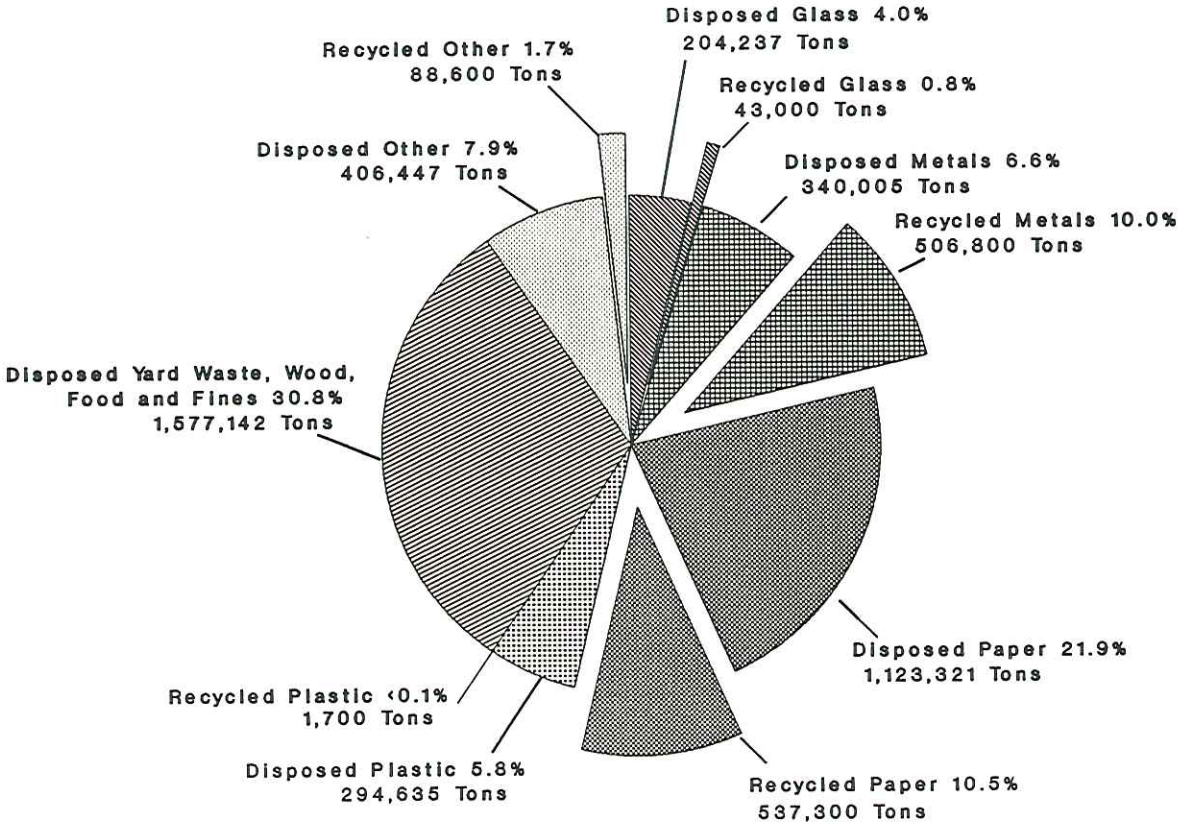
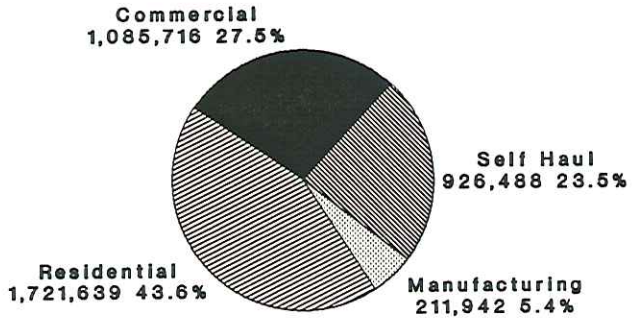
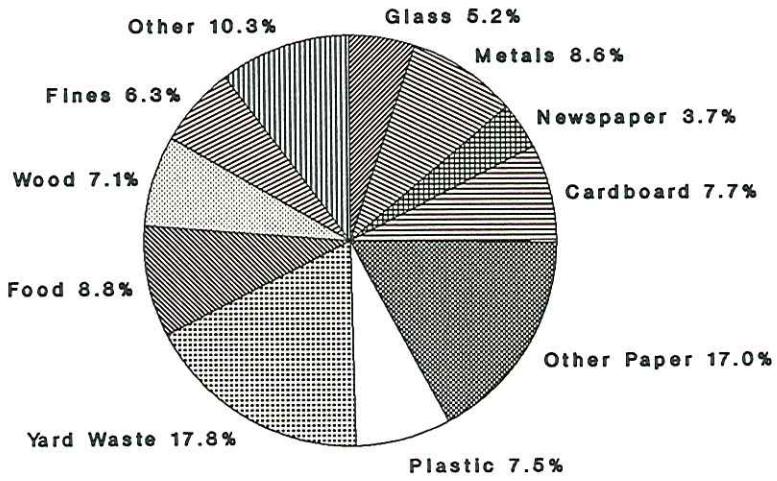


Figure B-3

# TOTAL DISPOSED WASTES



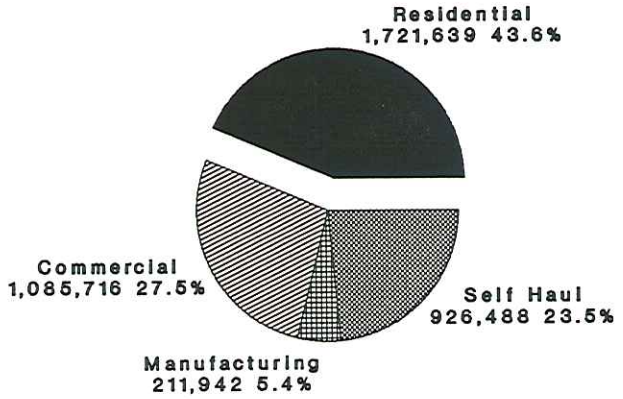

DISPOSED SUBSTREAM TONS
AS PORTIONS OF THE TOTAL
3,945,785 TONS DISPOSED



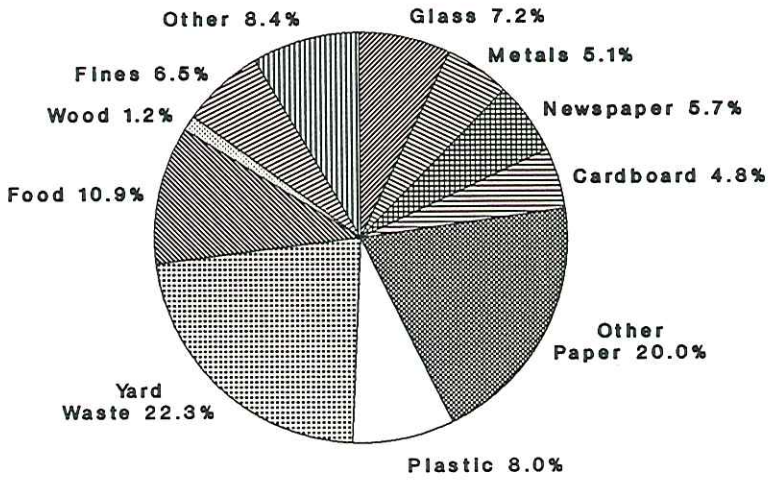

COMPOSITION BY WEIGHT
OF TOTAL DISPOSED WASTES

Figure B-4

# DISPOSED RESIDENTIAL WASTES



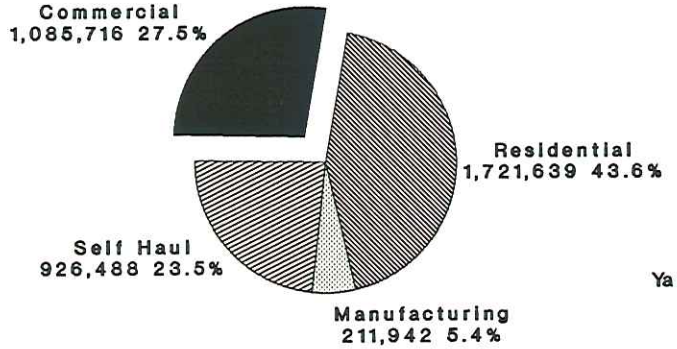

DISPOSED RESIDENTIAL TONS
AS A PORTION OF THE TOTAL
3,945,785 TONS DISPOSED



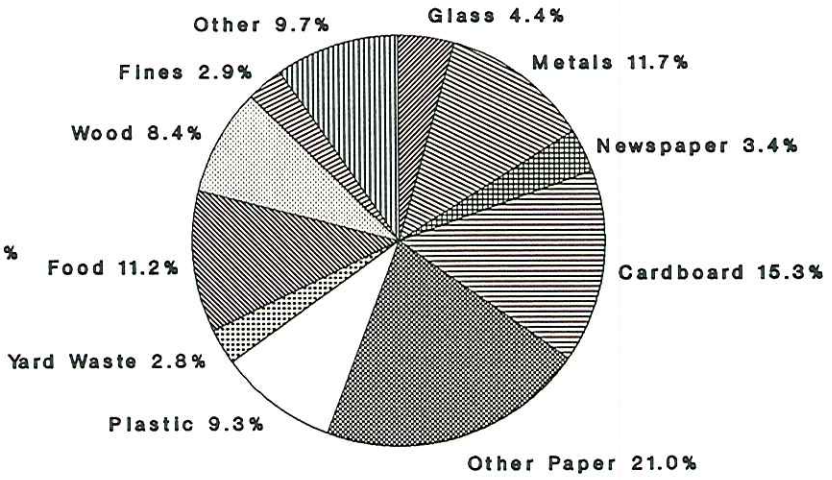

COMPOSITION BY WEIGHT OF
DISPOSED RESIDENTIAL WASTES

Figure B-5

# DISPOSED COMMERCIAL WASTES



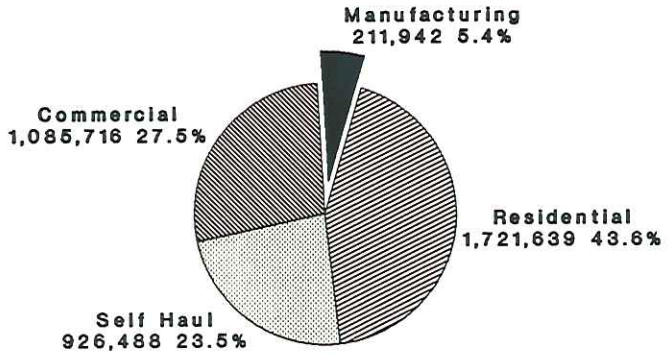

DISPOSED COMMERCIAL TONS
AS A PORTION OF THE TOTAL
3,945,785 TONS DISPOSED



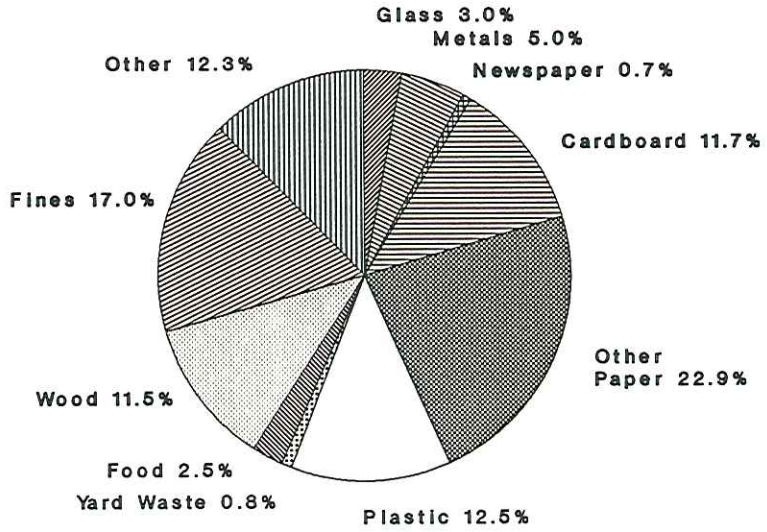

COMPOSITION BY WEIGHT OF
DISPOSED COMMERCIAL WASTES

Figure B-6

# DISPOSED MANUFACTURING WASTES



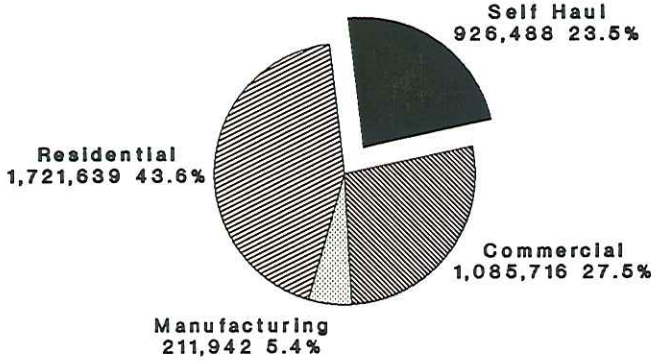

DISPOSED SELF HAUL TONS
AS A PORTION OF THE TOTAL
3,945,785 TONS DISPOSED



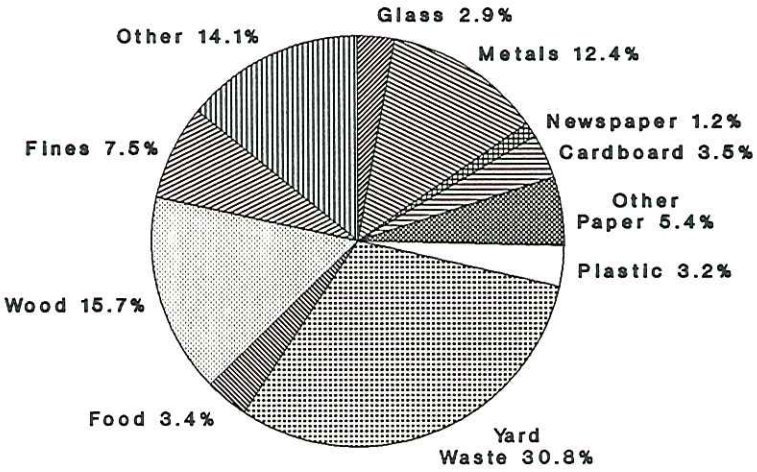

COMPOSITION BY WEIGHT OF
DISPOSED SELF HAUL WASTES

Figure B-7

# DISPOSED SELF HAUL WASTES




DISPOSED SELF HAUL TONS
AS A PORTION OF THE TOTAL
3,945,785 TONS DISPOSED




COMPOSITION BY WEIGHT OF
DISPOSED SELF HAUL WASTES

## 3. QUANTITY AND COMPOSITION OF RECYCLED WASTE

During 1987, recycling in Washington recovered an estimated 1,200,000 tons of materials from the generated waste stream. Comprised of various commodities, this recycled fraction represents approximately 23% of the total waste stream. Figure B-8 describes the composition of these recycled wastes.

The following table provides recovery rates for major recyclable commodities (tons of each material recycled divided by the total tons of each material generated).

TABLE B-1

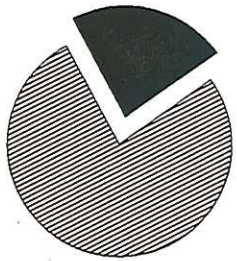
RECOVERY RATES BY COMMODITY GROUP

| Commodity | Tons Recycled | Recovery Rate |
|---|---|---|
| Glass ..... | 43,000 | 17.4% |
| Metals ..... | 506,800 | 59.8% |
| Paper ..... | 537,300 | 32.4% |
| Plastics ..... | 1,700 | 0.6% |
| Tires ..... | 10,300 | 24.0% |
| Batteries ..... | 22,100 | 79.0% |
| Oil ..... | 56,200 | 92.0% |

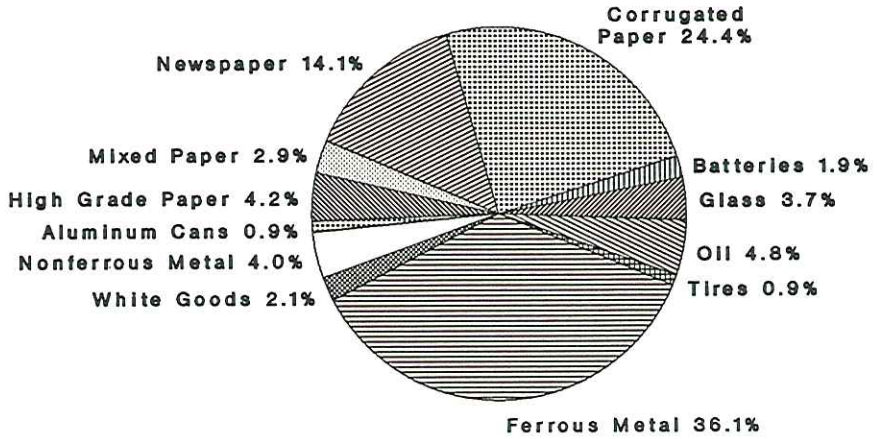
Figure B-8

# RECYCLED WASTES

1,177,400 TONS
23.0 %



RECYCLED TONS
AS A PORTION OF THE TOTAL
5,123,185 TONS GENERATED




COMPOSITION BY WEIGHT
OF RECYCLED WASTES

# SECTION C

# SEPARATION ANALYSIS

## 1. INTRODUCTION AND SUMMARY

This section of the Best Management Practices Report discusses the economic feasibility of home collection of source-separated recyclable and compostable materials. A linear optimization model on a Lotus 1-2-3 spreadsheet is used to determine the most economical solid waste management methods for single-family residential households. The methods included in the model are:

- Existing privately operated buy-back and drop box recycling systems.
- Weekly curbside collection of recyclables separated into three 11-gallon containers distributed to participating households.
- Biweekly collection of yard waste set out in containers provided by households.
- Weekly collection of food waste set out in 5-gallon tightly lidded containers distributed to participants.
- Weekly collection of refuse set out in 60-gallon containers provided to all households.
- Self-hauling of refuse accumulated in households' own containers.
- Mixed waste processing at a centralized, capital-intensive facility to recover recyclables and compostables.
- Low-tech, labor-intensive, centralized processing to recover only recyclables.

The costs of the weekly curbside recyclables, biweekly yard waste, and weekly food waste collection methods include the costs of sorting recyclables and composting yard and food wastes at centrally located facilities. Costs to transfer recyclables and compostables from processing facilities to markets are also included, as are revenues from selling materials recovered by source separation or mixed refuse separation.

The model is run for large urban areas such as the Puget Sound WGA, as well as for small urban areas and for rural areas. For large urban areas, sensitivity to both disposal costs and market prices is investigated.

It should be noted that this model assumes a 0-based approach where no existing system is in place. Thus, hypothetical communities are free to design and implement optimal systems based entirely on economic analyses and assumed conditions. This is not the case in most communities where existing systems are in place. There are costs associated with modifying existing systems and starting up new recycling or composting programs.

The greatest value of this model is the guidance it provides for selecting the most cost-effective programs and the materials that should be handled under a given set of conditions, e.g., market prices, participation rates, processing costs, truck costs, collection efficiency, etc. The model allows for changing these input variables. However, the results described herein are based on one scenario or set of conditions. These may not be representative of any specific community. Thus, the model is limited, as any economic model, by the assumptions and quality of data. While these costs and operational assumptions were based on the best available data at the time the model was run, results will vary from community to community.

The analysis of optimal recycling methods yielded the following conclusions:

- Curbside collection can recover about 40% of single-family residential household waste -- half from source-separated recyclables and half from source-separated lawn and garden waste.

- Where recyclable materials prices are strong (1988 prices), source-separation and mixed waste processing of residential waste in urban areas are complementary, not competitive.

- Curbside collection of single-family residential waste methods are most economical in urban areas near major markets (Seattle and Portland). Curbside collection is less cost-effective in small urban and rural areas.

- Lower cost-effectiveness of curbside collection in smaller towns and rural areas is primarily a function of waste quantity. However, cost-effectiveness of curbside methods also depends on materials prices, processing costs for recyclables and mixed waste, the portion of refuse self-hauled, and waste composition. Housing density is not critical.

- Regional programs for collecting and processing recyclables and for mixed waste processing are more cost-effective.

- To be most cost-effective, curbside collection programs, using separate trucks, should maximize the total quantity being collected, including low-value materials such as waste paper. Diversifying types of materials also reduces price risks.

- The cost-effectiveness of both yard waste collection and mixed waste processing is dependent upon avoided disposal costs. Also markets must exist for compost products.

## 2. DESCRIPTION AND MODEL

The linear programming optimization model takes specified waste management methods, operational assumptions, and financial parameters and determines which combination of management methods will minimize net cost. Net cost is defined to include revenues from material sales. Model results were generated for larger urban, smaller urban, and rural areas. For a larger urban area, Table 1 lists residential single-family subwaste stream composition data, household curbside and centralized mixed waste processing efficiencies, existing buy-back/drop box recycling rates for households, densities for waste categories when loaded on a recycling or refuse truck, and market prices for recovered materials. Market prices reflect deductions for transportation costs from the processing facilities to resale markets. The 1987 waste stream composition data, existing buy-back/drop box 1987 recycling rates, and 1988 market prices are for the Puget Sound WGA, which was chosen as representative of a larger urban area's waste stream and private industry recycling activity.

Table 2 lists collection system parameters:

- Waste stream quantity in tons per working day and residential household solid waste generation rate in pounds per week.
- Parameters defining the efficiency of the collection system including housing density measured as number of single-family residences per road mile.
- Participation rates for all collection methods and set out rate for recyclables collection.
- Collection stop times and truck unloading (tipping) times.
- Average truck speeds and distances between truck base, truck routes, and processing or disposal sites.

Table 2 also lists processing and disposal costs per ton, collection container and truck costs, truck operation and maintenance costs, and truck labor and administrative costs, as well as a summary of daily collection information for the optimal combination of waste management methods. These latter data are discussed in the next section. Except for optimal system truck requirements, all other data on Tables 1 and 2 provide the basic information needed to determine the cost minimizing mix of waste management methods.

## 3. RESULTS FOR A LARGE URBAN AREA WITH ACCESS TO MARKETS

Table 3 lists 23 waste categories and ways to manage each of them economically in a large urban area. Existing privately operated buy-back/drop box recyclers handle about 47 tons, or 9% of the 500-tons-per-working-day waste stream. About 41% of newsprint, or 24 tons, and 25% of aluminum cans, about one ton, are recycled through buy-back operations. About 22 tons in total of newsprint, corrugated cardboard, refillable and other recyclable

Table C-1

Waste Stream Composition and Quantity Data, Separation Parameters, and Material Price Parameters for a Larger Urban Area

| Waste Component | 1987 Residential Drop Off & Buy Back Rcyclng Rate | Recyclables Separation Efficiency | | | Compostables Separation Efficiency at MWP | 1987 PgtSnd Residential Sngle Family Waste Comp* | Collection Truck Waste Density(#/cu yd) | | Source Separated Materials Mkt Price Per Ton | MWP/LTP Recovered Materials Mkt Price Per Ton | MWP Composted Materials Mkt Price Per Ton |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Curbside Collection | Mixed Waste Processing | Low Tech Processing | | | Rcycl Trck | Refuse Truck | | | |
| Newsprint | 64% | 85% | 15% | 15% | 70% | 11.6% | 500 | 900 | $45 | $23 | $0 |
| Corrugated Cardboard | 29 | 85 | 50 | 50 | 35 | 5.2% | 150 | 600 | 65 | 33 | 0 |
| High Grade Paper | 0 | 85 | 15 | 0 | 70 | 0.3% | 500 | 900 | 100 | 50 | 0 |
| Mixed Waste Paper | 0 | 85 | 15 | 0 | 70 | 10.4% | 150 | 700 | 25 | 13 | 0 |
| Refillable Glass Cntnrs | 65 | 50 | 60 | 60 | 0 | 0.7% | 400 | 1000 | 116 | 12 | 0 |
| Other Recyclable Glass | 15 | 50 | 60 | 60 | 0 | 5.9% | 400 | 1000 | 40 | 12 | 0 |
| Alumimum Bvg Containers | 26 | 85 | 60 | 60 | 0 | 0.8% | 75 | 150 | 1,000 | 750 | 0 |
| Tin Food/Beverage Cntnrs | 2 | 40 | 80 | 0 | 0 | 1.9% | 150 | 300 | 49 | 37 | 0 |
| Ferrous Metals | 54 | 0 | 80 | 40 | 0 | 1.5% | 650 | 750 | 65 | 49 | 0 |
| Non Ferrous Metals | 29 | 0 | 40 | 40 | 0 | 0.4% | 400 | 500 | 800 | 400 | 0 |
| White Goods | 89 | 0 | 85 | 85 | 0 | 1.7% | 400 | 400 | 20 | 10 | 0 |
| PET Bottles | 0 | 50 | 25 | 25 | 0 | 0.3% | 40 | 300 | 160 | 48 | 0 |
| HDPE Bottles | 0 | 50 | 25 | 25 | 0 | 0.4% | 24 | 300 | 200 | 60 | 0 |
| Plastic Packaging/Film | 0 | 35 | 0 | 0 | 15 | 4.4% | 50 | 300 | 160 | 48 | 0 |
| Other Plastics | 0 | 0 | 0 | 0 | 15 | 0.9% | 50 | 300 | 0 | 0 | 0 |
| Tires | 0 | 0 | 75 | 75 | 5 | 0.4% | 500 | 500 | 0 | 0 | 0 |
| Other Rubber Product | 0 | 0 | 0 | 0 | 20 | 0.2% | 400 | 600 | 0 | 0 | 0 |
| Food | 0 | 90 | 0 | 0 | 95 | 8.2% | 750 | 1000 | 0 | 0 | 0 |
| Lawn & Garden Waste | 0 | 90 | 0 | 0 | 90 | 26.9% | 415 | 415 | 5 | 0 | 0 |
| Wood Waste | 0 | 75 | 25 | 25 | 65 | 1.6% | 300 | 600 | 5 | 0 | 0 |
| Construction/Demo (ex. Wood) | 0 | 0 | 25 | 25 | 10 | 0.7% | 800 | 1000 | 0 | 0 | 0 |
| Other Organic Waste | 0 | 0 | 0 | 0 | 90 | 9.2% | 600 | 900 | 0 | 0 | 0 |
| Other Inorganic Waste | 0 | 0 | 0 | 0 | 30 | 6.2% | 600 | 750 | 0 | 0 | 0 |
| | | | | | | 100.0% | | | $37.70 | | |

* Includes 11.7% of Self Haul

Table C-2

Truck Route and Collection Cost Parameters; Processing and Disposal Cost Parameters

| | |
|---|---|
| Daily Waste Volume | 500 tons/work day |
| Housing Density | 125 per road mile |
| Waste Per Household | 40 lbs per week |
| Participation Rate | |
| - Refuse | 95% |
| - Recyclables | 75% |
| - Self Haul | 5% |
| - Food Waste | 90% |
| - Yard Waste | 90% |
| Container Costs | |
| - 60 Gal Refuse | $50 |
| - 11 Gal Rcyc (3) | $18 |
| - 5 Gal Food Waste | $10 |
| Processing Costs Per Input Ton | |
| - Recyclables | $22 |
| - Mixed Waste | $40 |
| - Food Waste | $40 |
| - Low Tech | $20 |
| - Yard Waste | $23 |
| Disposal Costs Per Ton | $50 |

| | |
|---|---|
| Truck Speed: | |
| - Between Stops | 10 mph |
| - To/From Route and Tipping | 30 mph |
| Truck Capacity: | |
| - Yard Waste | 32 cu yards |
| - Recycling | 20 cu yards |
| - Refuse | 20 cu yards |
| - Food Waste | 2 cu yards |
| Collection Stop Time: | |
| - Recycling | 0.008 hours |
| - Refuse | 0.006 hours |
| - Yard Waste | 0.006 hours |
| - Food Waste | 0.006 hours |
| Average Distances: | |
| - Base to Route | 10 miles |
| - Route to Recyc Center | 15 miles |
| - Route to Proc/Dspl Center | 15 miles |
| - Center to Base | 15 miles |
| Tipping Time: | |
| - Recyclables | 0.500 hours |
| - Refuse | 0.500 hours |
| - Food Waste | 0.167 hours |
| - Yard Waste | 0.333 hours |

| | Daily Collection Information | | | |
|---|---|---|---|---|
| | Recycling | Food Waste | Yard Waste | Refuse |
| Potential Set Outs | 12,500 | 25,000 | 12,500 | 25,000 |
| Actual Set Outs | 9,375 | 22,500 | 11,250 | 23,750 |
| Collected per Household (lbs) | 21 | 0 | 19 | 20 |
| Average Density (lbs/cu yd) | 255 | 750 | 415 | 736 |
| Stops to Fill Truck | 247 | 0 | 685 | 745 |
| Time to Fill Truck (hours) | 2.85 | 0 | 5.02 | 4.77 |
| Unload Time (hrs/round trip) | 1.50 | 0 | 1.33 | 1.50 |
| Start/End Route Time (hrs) | 1.83 | 0 | 1.67 | 1.83 |
| Loads Per Day | 1.4 | 0 | 1.0 | 1.0 |
| Daily Drivebys | 922 | 0 | 761 | 784 |
| Required Trucks | 27 | 0 | 16 | 32 |
| Working Time Per Truck (hrs) | 7.32 | 0 | 6.69 | 6.60 |
| Truck Costs | | | | |
| - Purchase Price | $50,000 | $30,000 | $85,000 | $100,000 |
| -Amort (7 yrs @ 4%) | $8,330 | $4,998 | $14,162 | $16,661 |
| -Daily (260 per Year) | $32 | $19 | $54 | $64 |
| - Daily O & M | $45 | $45 | $65 | $65 |
| - Daily Labor | $160 | $160 | $200 | $200 |
| - Daily Administration | $59 | $56 | $80 | $82 |
| Truck Cost/Ton | $82.95 | $0.00 | $60.14 | $55.87 |

Table C-3

Summary of Optimized System Waste Allocations, Costs and Revenues

| Waste Component | Daily Tons Managed Through Indicated Method | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Buyback | Curbside | Yard Waste | Drop Box | MWP | LTP | Disposal | Total Tons |
| Newsprint | 24 | 22 | | 3 | 8 | 0 | 1 | 58 |
| Corrugated Cardboard | 0 | 17 | | 3 | 6 | 0 | 1 | 26 |
| High Grade Paper | 0 | 1 | | 0 | 0 | 0 | 0 | 2 |
| Mixed Waste Paper | 0 | 33 | | 0 | 16 | 0 | 3 | 52 |
| Refillable Glass Cntnrs | 0 | 1 | | 1 | 0 | 0 | 0 | 3 |
| Other Recyclable Glass | 0 | 11 | | 3 | 9 | 0 | 6 | 30 |
| Alumimum Bvg Containers | 1 | 2 | | 0 | 1 | 0 | 0 | 4 |
| Tin Food/Beverage Cntnrs | 0 | 3 | | 0 | 5 | 0 | 1 | 9 |
| Ferrous Metals | 0 | 0 | | 4 | 3 | 0 | 1 | 7 |
| Non Ferrous Metals | 0 | 0 | | 1 | 1 | 0 | 1 | 2 |
| White Goods | 0 | 0 | | 8 | 1 | 0 | 0 | 9 |
| PET Bottles | 0 | 1 | | 0 | 0 | 0 | 1 | 1 |
| HDPE Bottles | 0 | 1 | | 0 | 0 | 0 | 1 | 2 |
| Plastic Packaging/Film | 0 | 6 | | 0 | 2 | 0 | 14 | 22 |
| Other Plastics | 0 | 0 | | 0 | 1 | 0 | 4 | 5 |
| Tires | 0 | 0 | | 0 | 2 | 0 | 0 | 2 |
| Other Rubber Product | 0 | 0 | | 0 | 0 | 0 | 1 | 1 |
| Food | 0 | | 0 | 0 | 39 | 0 | 2 | 41 |
| Lawn & Garden Waste | 0 | | 109 | 0 | 23 | 0 | 3 | 135 |
| Wood Waste | 0 | 0 | | 0 | 7 | 0 | 1 | 8 |
| Construction/Demo (ex. Wood) | 0 | 0 | | 0 | 1 | 0 | 2 | 4 |
| Other Organic Waste | 0 | 0 | | 0 | 42 | 0 | 5 | 46 |
| Other Inorganic Waste | 0 | 0 | | 0 | 9 | 0 | 22 | 31 |
| Total Daily Tons | 25 | 97 | 109 | 22 | 177 | 0 | 70 | 500 |
| **Costs and Revenues Per Ton** | | | | | | | | |
| Collection | -- | $91 | $60 | -- | $65 | $0 | $65 | $63 |
| Processing | -- | $22 | $23 | -- | $56 | $0 | -- | $29 |
| Disposal | -- | $0 | $0 | -- | -- | -- | $50 | $7 |
| Less:Revenue | -- | $70 | $5 | -- | $8 | $0 | -- | $17 |
| Net Cost | $0 | $43 | $78 | $0 | $113 | $0 | $115 | $82 |
| Memo:Total Daily Cost | $0 | $4,151 | $8,518 | $0 | $20,051 | $0 | $8,048 | $40,768 |
| Memo:Annual Cost Per Household | $0.00 | $8.63 | $17.72 | $0.00 | $41.71 | $0.00 | $16.74 | $84.80 |

glass containers, ferrous and non-ferrous metals, and white goods are recycled through drop boxes.

Curbside recyclables amounting to almost 97 tons, or 19% of daily single-family residential waste, are collected by the weekly three-container collection system. The optimization procedure chooses the materials to include in curbside recyclables collection, as well as whether or not to use this source-separation method. Materials included for a large urban area program are all recyclable paper; glass, metal, and plastic food and beverage containers; and plastic packaging and films.

Biweekly yard waste collection is also cost-effective. This program diverts about 109 tons, or 22% of waste.

The only source-separation program that is not cost-effective is separate collection of food wastes. The amount of food waste available at each household is too small to warrant a truck and route for its separate collection. In fact, as shown on Table 2, recycling, yard waste, and refuse trucks collect an average of 19 to 21 pounds at each household. Only a little over 3 pounds of food waste are in each household's weekly waste stream. The model suggests that 20 pounds per stop as the lower limit for separate collection systems to be cost-effective.

Of much interest is the model's finding that mixed waste processing to recover recyclables and compostables is economical for a single-family residential, large urban waste stream even if over 50% of the recoverable waste is previously removed by source-separation methods, buy-back/drop box systems and home collection of both recyclables and yard waste. By processing the remaining waste that is collected or self-hauled as refuse, an additional 177 tons, or 35% of residential waste, is diverted from disposal.

Recovering compostables is critical to this result. Low-tech processing without compostables recovery is not economical because the recovery rate for just recyclables from mixed waste is too low to justify the costs of going through every ton of mixed refuse. Thus, a market for mixed solid waste compost products is essential for mixed waste processing. The model assumes mixed waste compost will generate no revenue, but that it can all be diverted from the landfill to productive uses, if given away.

That leaves only about 70 tons, or 14% of the residential waste stream requiring disposal. In a large residential urban area the model thus yields a recycling rate of 86% through a combination of source-separation and mixed waste processing methods. The annual integrated system cost per household for this high recovery rate is indicated on Table 3 at about $85 per household and $82 per ton.

In the analysis the existing private buy-back/drop box system is specified to have no cost. The same assumption is made for collection costs for self-hauled refuse. Of course, households are paying directly for hauling recyclables to private recyclers and waste to disposal sites. However, the prime concern established for the optimization problem is minimizing public sector costs of managing residential solid waste.

Table C-4

Summary of Optimized System Waste Allocations, Costs and Revenues

| Waste Component | Daily Tons Managed Through Indicated Method | | | | | | | Total Tons |
|---|---|---|---|---|---|---|---|---|
| | Buyback | Curbside | Yard Waste | Drop Box | MWP | LTP | Disposal | |
| Newsprint | 24 | 0 | | 8 | 23 | 0 | 4 | 58 |
| Corrugated Cardboard | 0 | 0 | | 8 | 16 | 0 | 3 | 26 |
| High Grade Paper | 0 | 0 | | 0 | 1 | 0 | 0 | 2 |
| Mixed Waste Paper | 0 | 0 | | 0 | 44 | 0 | 8 | 52 |
| Refillable Glass Cntnrs | 0 | 0 | | 2 | 1 | 0 | 0 | 3 |
| Other Recyclable Glass | 0 | 0 | | 4 | 15 | 0 | 10 | 30 |
| Alumimum Bvg Containers | 1 | 0 | | 0 | 2 | 0 | 1 | 4 |
| Tin Food/Beverage Cntnrs | 0 | 0 | | 0 | 7 | 0 | 2 | 9 |
| Ferrous Metals | 0 | 0 | | 4 | 3 | 0 | 1 | 7 |
| Non Ferrous Metals | 0 | 0 | | 1 | 1 | 0 | 1 | 2 |
| White Goods | 0 | 0 | | 8 | 1 | 0 | 0 | 9 |
| PET Bottles | 0 | 0 | | 0 | 0 | 0 | 1 | 1 |
| HDPE Bottles | 0 | 0 | | 0 | 0 | 0 | 1 | 2 |
| Plastic Packaging/Film | 0 | 0 | | 0 | 3 | 0 | 19 | 22 |
| Other Plastics | 0 | 0 | | 0 | 1 | 0 | 4 | 5 |
| Tires | 0 | 0 | | 0 | 2 | 0 | 0 | 2 |
| Other Rubber Product | 0 | 0 | | 0 | 0 | 0 | 1 | 1 |
| Food | 0 | | 0 | 0 | 39 | 0 | 2 | 41 |
| Lawn & Garden Waste | 0 | | 0 | 0 | 121 | 0 | 13 | 135 |
| Wood Waste | 0 | 0 | | 0 | 7 | 0 | 1 | 8 |
| Construction/Demo (ex. Wood) | 0 | 0 | | 0 | 1 | 0 | 2 | 4 |
| Other Organic Waste | 0 | 0 | | 0 | 42 | 0 | 5 | 46 |
| Other Inorganic Waste | 0 | 0 | | 0 | 9 | 0 | 22 | 31 |
| Total Daily Tons | 25 | 0 | 0 | 34 | 339 | 0 | 101 | 500 |
| Costs and Revenues Per Ton | | | | | | | | |
| Collection | -- | $0 | $0 | -- | $57 | $0 | $57 | $50 |
| Processing | -- | $0 | $0 | -- | $52 | $0 | -- | $35 |
| Disposal | -- | $0 | $0 | -- | -- | -- | $50 | $10 |
| Less:Revenue | -- | $0.00 | $0.00 | -- | $7.99 | $0.00 | -- | $5.42 |
| Net Cost | $0 | $0 | $0 | $0 | $101 | $0 | $107 | $90 |
| Memo:Total Daily Cost | $0 | $0 | $0 | $0 | $34,238 | $0 | $10,833 | $45,071 |
| Memo:Annual Cost Per Household | $0.00 | $0.00 | $0.00 | $0.00 | $71.22 | $0.00 | $22.53 | $93.75 |

disposal. Average revenue for materials recovered is $8 per ton, for a net cost of about $48 per ton. Thus when disposal costs drop to $45, mixed waste processing is no longer economical.

When disposal cost drops to $30, home collection and centralized composting of lawn and garden waste ceases to be cost-optimal. At a disposal cost of $30 per ton, the savings realized by collecting yard waste with refuse (rather than separately) are no longer offset by avoided disposal costs.

Finally, at 1988 prices for curbside recyclables, disposal cost must drop to zero before home collection of source-separated recyclables is not optimal. At disposal costs of at least $5 per ton, disposal cost savings plus the net revenue from selling recyclables are greater than the expense of operating a recycling truck and providing household recycling containers.

To summarize the results of the disposal cost sensitivity analysis for a large urban area:

- At 1988 Puget Sound WGA materials prices, curbside collection of recyclables is cost-effective even at near zero disposal costs.
- Curbside collection of lawn and garden waste is economical at disposal costs above $30.
- Mixed waste processing is cost-effective as a supplement to source-separation methods at disposal costs above $45 per ton.
- Annual savings from public sector recycling programs depend on disposal costs. At disposal costs of $5 to $30, savings of $1 to $5 per year are realized. At disposal costs of $35 to $45, savings from home collection of both recyclables and yard waste are $6 to $10 per household per year. At disposal costs of $50 and up mixed waste processing can be combined with both source-separation methods to increase savings to $13 per household per year.

b. Sensitivity to Variation in Market Prices

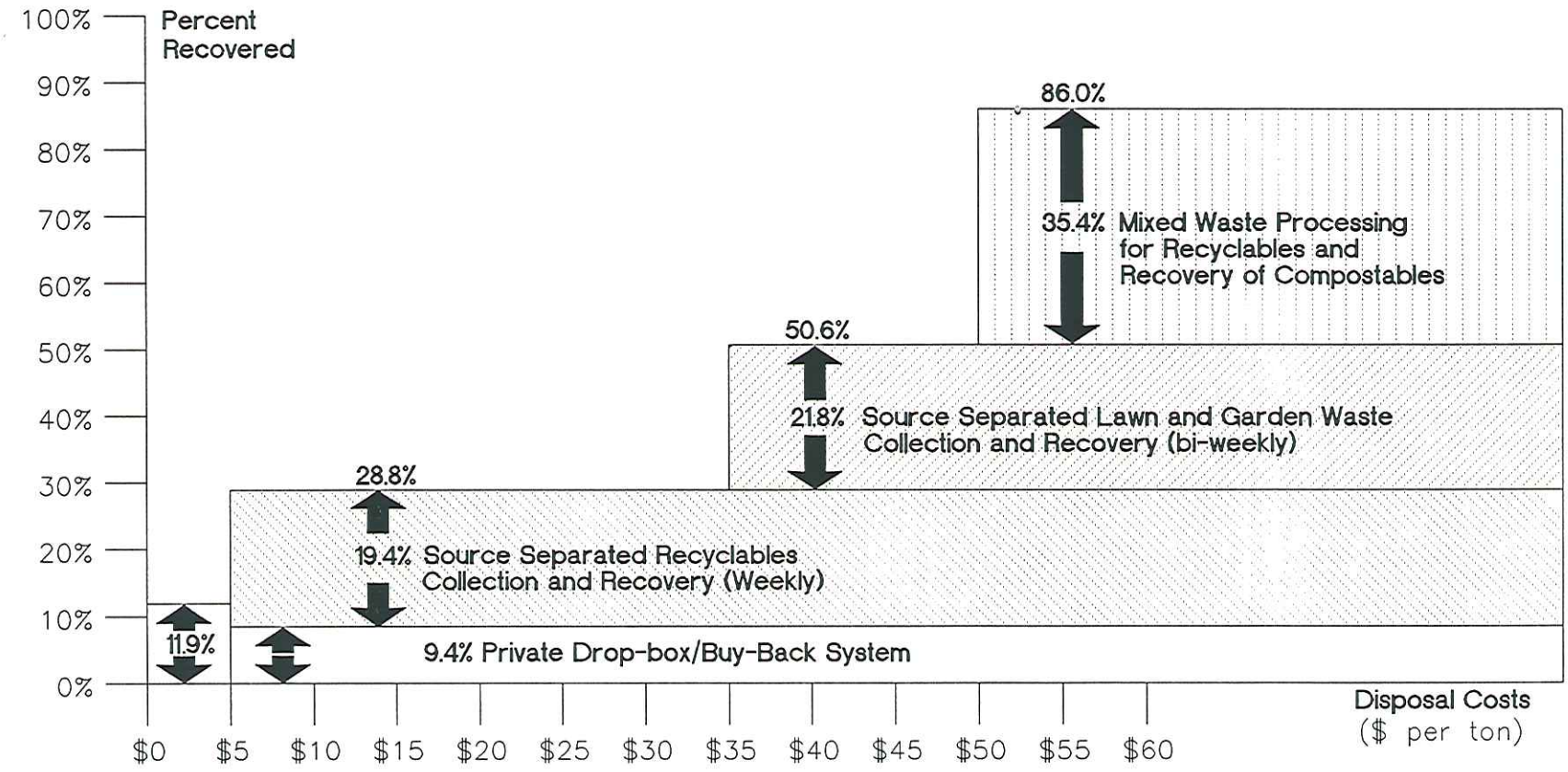
Sensitivity of model results for a large urban residential area to changes in market prices was also investigated. Prices shown on Table 1 above were varied in 5 percentage point increments for all materials. Variation of prices for just a few materials would have less impact than the same relative increase or decrease of all prices. In fact, prices are unlikely to all move simultaneously in the same direction at the same rate. A recycling program that includes more materials thus reduces price risk. However, to simplify the price sensitivity analysis, it is assumed here that all prices do change proportionately.

The 1988 Puget Sound WGA prices shown on Table 1 yield $37.70 per ton of waste having the composition of residential single-family households in the Puget Sound WGA. At this price, home collection of recyclables and yard

Figure C-1

# Effect of Disposal Cost on Recovery Methods and Total Recovery Rate

## 125,000 Urban Residential Single Family Households
(Based on Economic Model)



waste, as well as mixed waste processing of refuse remaining after home recyclables and yard waste collection, are all cost-effective recovery methods. The model shows these three public-sector-sponsored programs recovering 76.6% of the 500-ton-per-working-day single-family residential subwaste stream.

Mixed waste processing is most sensitive to lower material's prices. If prices average about $28, 75% of 1988 prices, mixed waste processing becomes uneconomical. This result is depicted in Figure 2.

Public sector recovery drops from about 77% to 42% when mixed waste processing is removed as a recovery method. The recovery figures given in Figure 2 exclude existing private recovery which accounts for a 9.4% recycling rate whenever home recyclables collection is available, and 11.9% recycling when curbside collection is not offered. Adding the appropriate private recycling rate to the public sector recovery rates listed in Figure 2 will yield total recovery rates consistent with those shown in Figure 1.

Removing materials from curbside collection as prices fall is not practical. Their removal reduces pounds collected per stop far enough below 20 to make curbside collection too expensive relative to refuse collection. This result suggests that to be most cost-effective, a weekly curbside program using a separate collection truck needs to target low-priced but high waste quantity materials such as mixed waste paper, in addition to the usual newsprint and container glass and metals.

At about 50% of 1988 prices, curbside recycling becomes inefficient relative to mixed waste processing, as shown in Figure 2. At 40-50% of 1988 prices, the recyclables that come back into the refuse stream when curbside collection is unavailable add enough value to mixed waste to make processing mixed refuse for recyclables and compostables recovery again economical, even when it would not be cost-effective to do so downstream from home collection of source-separated recyclables.

It had been expected that there would be a tradeoff between source-separation and mixed waste processing recovery methods. However, at 1988 price levels and $50 disposal costs, the methods are complementary rather than competitive. But when recyclable materials prices average $15 to $20 rather than $38, the optimization model suggests that the methods do become competitive. This means that future materials prices are a critical factor in making decisions about which recovery methods are appropriate for a particular community.

Finally, Figure 2 shows that home collection of lawn and garden waste is cost optimal even when compost products yield no revenue. This recovery method is driven solely by disposal cost avoidance rather than market revenue.

## 4. RESULTS FOR AREAS WITH LOWER HOUSING DENSITY

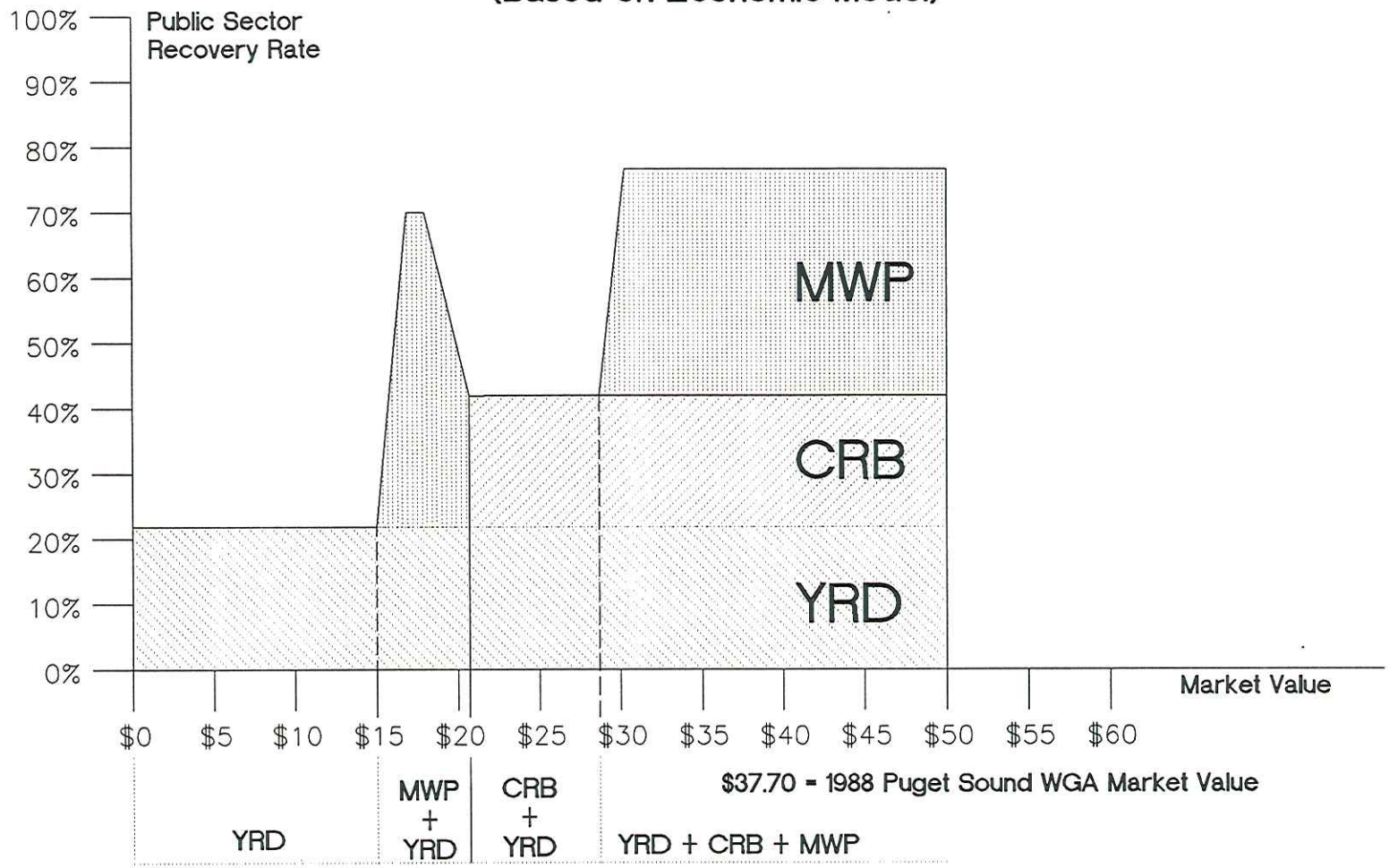
By varying the households per road mile density parameter listed on Table 2 it is possible to test housing density's impact on the optimal mix of

Figure C-2

# Effect of Material Prices on Public Sector Waste Recovery

## 125,000 Urban Residential Single Family Households

(Based on Economic Model)




KEY: Cost-Effective Public Sector Recovery Programs

MWP = Mixed Waste Processing
CRB = Source Separated Recyclables Collection and Recovery
YRD = Source Separated Lawn and Garden Waste Collection and Recovery

public sector recovery programs. In conducting this analysis it was assumed that daily waste volume is 50 tons per working day and that collection truck speed increases as household density decreases. All other parameters and data listed on Tables 1 and 2 remain constant -- except for number of collection trucks of various types, truck cost per ton collected, and other collection system characteristics determined by model optimization.

Table 6 lists the various household density and associated truck speed assumptions used to determine the impact of density on the cost-effectiveness of source-separation recovery methods. The table also shows annual costs per household with and without home collections of source-separated recyclables and yard waste as an adjunct to centralized mixed waste processing. Reducing household density from 125 households per mile, or about 85 front feet per lot, to 20 per mile, or about 528 front feet per lot, does increase the cost of managing waste. Collection costs for home collection of only refuse go up by less than they do for the system that includes home collection of recyclables and yard waste. But the increase in source-separation collection costs is not great enough to completely offset the additional recyclables recovery and disposal cost avoidance savings from home collection of recyclables and yard waste.

A density of 20 households per road mile could be associated with as few as 40 households per square mile (16 acres per dwelling) -- for example, a rural area that has roads spaced one mile apart. Thus the results exhibited in Table 6 suggest that household density is not the principal determinant of cost-effective collection of source-separated materials. The next subsection explores this issue in greater depth.

TABLE 6

EFFECT OF VARYING HOUSEHOLD DENSITY

| Households Per Road Mile .. | 125 | 80 | 40 | 20 |
|---|---|---|---|---|
| Truck mph | | | | |
| Between Stops ..... | 10 mph | 10 mph | 15 mph | 20 mph |
| To/From Route ..... | 30 mph | 30 mph | 45 mph | 50 mph |
| Annual Cost Per Household | | | | |
| With Source Separation .. | $88 | $90 | $90 | $94 |
| (% Recovered) ..... | (86%) | (86%) | (86%) | (86%) |
| Without Source Separation | $94 | $95 | $95 | $96 |
| (% Recovered) ..... | (80%) | (80%) | (80%) | (80%) |

## 5. RESULTS FOR SUBURBS, SMALL TOWNS, AND RURAL AREAS

Up to this point, model parameters have reflected the waste composition, collection and processing characteristics of a larger urban area, as shown in Tables 1 and 2. Waste composition and materials prices for the Puget

Table C-7

Waste Stream Composition and Quantity Data, Separation Parameters, and Material Price Parameters for a Small Town

| Waste Component | 1987 Residential Drop Off & Buy Back Rcyclng Rate | Recyclables Separation Efficiency | | | Compostables Separation Efficiency at MWP | 1987 Nrthwst Residential Sngle Family Waste Comp* | Collection Truck Waste Density(#/cu yd) | | Source Separated Materials Mkt Price Per Ton | MWP/LTP Recovered Materials Mkt Price Per Ton | MWP Composted Materials Mkt Price Per Ton |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Curbside Collection | Mixed Waste Processing | Low Tech Processing | | | Rcycl Trck | Refuse Truck | | | |
| Newsprint | 28% | 85% | 15% | 15% | 70% | 6.8% | 500 | 900 | $40 | $20 | $0 |
| Corrugated Cardboard | 5 | 85 | 50 | 50 | 35 | 4.4 | 150 | 600 | 61 | 31 | 0 |
| High Grade Paper | 0 | 85 | 15 | 0 | 70 | 0.4 | 500 | 900 | 88 | 44 | 0 |
| Mixed Waste Paper | 0 | 85 | 15 | 0 | 70 | 11.9 | 150 | 700 | 9 | 5 | 0 |
| Refillable Glass Cntnrs | 62 | 50 | 60 | 60 | 0 | 0.7 | 400 | 1000 | 94 | 9 | 0 |
| Other Recyclable Glass | 5 | 50 | 60 | 60 | 0 | 6.0 | 400 | 1000 | 29 | 9 | 0 |
| Alumimum Bvg Containers | 41 | 85 | 60 | 60 | 0 | 1.2 | 75 | 150 | 986 | 740 | 0 |
| Tin Food/Beverage Cntnrs | 3 | 40 | 80 | 0 | 0 | 2.2 | 150 | 300 | 42 | 32 | 0 |
| Ferrous Metals | 64 | 0 | 80 | 40 | 0 | 2.0 | 650 | 750 | 51 | 38 | 0 |
| Non Ferrous Metals | 9 | 0 | 40 | 40 | 0 | 0.3 | 400 | 500 | 786 | 393 | 0 |
| White Goods | 44 | 0 | 85 | 85 | 0 | 0.3 | 400 | 400 | 6 | 3 | 0 |
| PET Bottles | 0 | 50 | 25 | 25 | 0 | 0.3 | 40 | 300 | 115 | 35 | 0 |
| HDPE Bottles | 0 | 50 | 25 | 25 | 0 | 0.4 | 24 | 300 | 155 | 47 | 0 |
| Plastic Packaging/Film | 0 | 35 | 0 | 0 | 15 | 5.0 | 50 | 300 | 138 | 41 | 0 |
| Other Plastics | 0 | 0 | 0 | 0 | 15 | 1.1 | 50 | 300 | 0 | 0 | 0 |
| Tires | 0 | 0 | 75 | 75 | 5 | 0.4 | 500 | 500 | 0 | 0 | 0 |
| Other Rubber Product | 0 | 0 | 0 | 0 | 20 | 0.3 | 400 | 600 | 0 | 0 | 0 |
| Food | 0 | 90 | 0 | 0 | 95 | 9.3 | 750 | 1000 | 0 | 0 | 0 |
| Lawn & Garden Waste | 0 | 90 | 0 | 0 | 90 | 27.0 | 415 | 415 | 5 | 0 | 0 |
| Wood Waste | 0 | 75 | 25 | 25 | 65 | 1.8 | 300 | 600 | 5 | 0 | 0 |
| Construction/Demo (ex. Wood) | 0 | 0 | 25 | 25 | 10 | 0.8 | 800 | 1000 | 0 | 0 | 0 |
| Other Organic Waste | 0 | 0 | 0 | 0 | 90 | 10.5 | 600 | 900 | 0 | 0 | 0 |
| Other Inorganic Waste | 0 | 0 | 0 | 0 | 30 | 7.0 | 600 | 750 | 0 | 0 | 0 |
| | | | | | | 100.0 | | | 34.54 | | |

* Includes 12.1% of Self Haul

Table C-8

Waste Stream Composition and Quantity Data, Separation Parameters, and Material Price Parameters for a Rural Area

| Waste Component | 1987 Residential Drop Off & Buy Back Rcyclng Rate | Recyclables Separation Efficiency | | | Compostables Separation Efficiency at MWP | 1987 Nrthcnt Residential Sngle Family Waste Comp* | Collection Truck Waste Density(#/cu yd) | | Source Separated Materials Mkt Price Per Ton | MWP/LTP Recovered Materials Mkt Price Per Ton | MWP Composted Materials Mkt Price Per Ton |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Curbside Collection | Mixed Waste Processing | Low Tech Processing | | | Rcycl Trck | Refuse Truck | | | |
| Newsprint | 29% | 85% | 15% | 15% | 70% | 6.0% | 500 | 900 | $45 | $23 | $0 |
| Corrugated Cardboard | 6 | 85 | 50 | 50 | 35 | 4.4 | 150 | 600 | 65 | 33 | 0 |
| High Grade Paper | 0 | 85 | 15 | 0 | 70 | 0.4 | 500 | 900 | 100 | 50 | 0 |
| Mixed Waste Paper | 0 | 85 | 15 | 0 | 70 | 10.6 | 150 | 700 | 7 | 4 | 0 |
| Refillable Glass Cntnrs | 80 | 50 | 60 | 60 | 0 | 1.3 | 400 | 1000 | 76 | 9 | 0 |
| Other Recyclable Glass | 2 | 50 | 60 | 60 | 0 | 5.3 | 400 | 1000 | 31 | 9 | 0 |
| Alumimum Bvg Containers | 42 | 85 | 60 | 60 | 0 | 1.0 | 75 | 150 | 984 | 738 | 0 |
| Tin Food/Beverage Cntnrs | 0 | 40 | 80 | 0 | 0 | 1.9 | 150 | 300 | 39 | 29 | 0 |
| Ferrous Metals | 39 | 0 | 80 | 40 | 0 | 2.3 | 650 | 750 | 46 | 35 | 0 |
| Non Ferrous Metals | 8 | 0 | 40 | 40 | 0 | 0.4 | 400 | 500 | 781 | 391 | 0 |
| White Goods | 0 | 0 | 85 | 85 | 0 | 0.5 | 400 | 400 | 1 | 1 | 0 |
| PET Bottles | 0 | 50 | 25 | 25 | 0 | 0.3 | 40 | 300 | (251) | (75) | 0 |
| HDPE Bottles | 0 | 50 | 25 | 25 | 0 | 0.4 | 24 | 300 | (211) | (63) | 0 |
| Plastic Packaging/Film | 0 | 35 | 0 | 0 | 15 | 4.5 | 50 | 300 | (46) | (14) | 0 |
| Other Plastics | 0 | 0 | 0 | 0 | 15 | 1.1 | 50 | 300 | 0 | 0 | 0 |
| Tires | 0 | 0 | 75 | 75 | 5 | 0.5 | 500 | 500 | 0 | 0 | 0 |
| Other Rubber Product | 0 | 0 | 0 | 0 | 20 | 0.3 | 400 | 600 | 0 | 0 | 0 |
| Food | 0 | 90 | 0 | 0 | 95 | 8.4 | 750 | 1000 | 0 | 0 | 0 |
| Lawn & Garden Waste | 0 | 90 | 0 | 0 | 90 | 26.7 | 415 | 415 | 5 | 0 | 0 |
| Wood Waste | 0 | 75 | 25 | 25 | 65 | 4.1 | 300 | 600 | 5 | 0 | 0 |
| Construction/Demo (ex. Wood) | 0 | 0 | 25 | 25 | 10 | 1.7 | 800 | 1000 | 0 | 0 | 0 |
| Other Organic Waste | 0 | 0 | 0 | 0 | 90 | 10.0 | 600 | 900 | 0 | 0 | 0 |
| Other Inorganic Waste | 0 | 0 | 0 | 0 | 30 | 7.9 | 600 | 750 | 0 | 0 | 0 |
| | | | | | | 100.0 | | | 22.68 | | |

* Includes 12.0% of Self Haul

Sound WGA were used to specify parameters for a large urban area. This study now considers optimum waste management methods for smaller urban areas, suburbs, small towns, and rural areas. To do this, the Northwest and North Central WGA 1987 residential subwaste stream compositions and 1988 materials prices are used -- the Northwest WGA to characterize smaller urban areas, suburbs and small towns; and the North Central to characterize rural areas.

Tables 7 and 8 show waste composition, private recycling rates and prices for the Northwest and North Central WGA's. The most substantial difference from the Puget Sound WGA in waste composition is that newsprint comprises 6%-7% of residential waste rather than 12%. Table 9 details major differences in private recycling rates and materials prices. Table 9 also lists other comparisons for 50-tons-per-working-day waste quantity service areas in the three residential community types.

TABLE 9

COMPARISON OF PARAMETERS AND OPTIMUM SYSTEM COSTS

| WGA | Large Urban Puget Sound | Small Urban Northwest | Rural North Central |
|---|---|---|---|
| Waste Quantity ..... | 50 tons | 50 tons | 50 tons |
| Household Density ..... | 125/mile | 80/mile | 40/mile |
| Truck Speed | | | |
| -Between Stops ..... | 10 mph | 10 mph | 10 mph |
| -To/From Route ..... | 30 mph | 45 mph | 45 mph |
| Disposal Cost ..... | $50 | $50 | $50 |
| Average Price ..... | $38 | $35 | $23 |
| Private Recycling | | | |
| -with Curbside ..... | 9% | 4% | 4% |
| -without Curbside ..... | 12 | 5 | 4 |
| Refuse Self-Haul Percent... | 5% | 5% | 20% |
| Processing Costs* | | | |
| -Mixed Waste ..... | $40 | $40 | $40 |
| -Recyclables ..... | $22 | $33 | $33 |
| -Yard Waste ..... | $23 | $30 | $30 |
| MWP Optimal ..... | Yes | Yes | No |
| Source Separation | | | |
| -Yard Waste Optimal ..... | Yes | No | No |
| -Curb Recycling Optimal .. | Yes | No | No |
| Recovery Rate | | | |
| -With Source Separation .. | 86% | 84% | 44% |
| -Without Source Separation | 80 | 78 | 4 |
| Annual Household Cost | | | |
| -With Source Separation .. | $88 | $105 | $105 |
| -Without Source Separation | 94 | 102 | 98 |
| Number of Collection Trucks | | | |
| -With Source Separation .. | 8 | 9 | 8 |
| -Without Source Separation | 5 | 5 | 4 |

* Assumes regional facilities

a. Analysis of Optimal Systems

As Table 9 shows, residential source-separation collection is not optimal for small urban and rural areas. When smaller communities and rural areas have lower materials prices, lower housing densities, more self-hauling of waste to disposal facilities, higher processing costs, and reduced newsprint quantities, then home collection methods for source-separated recyclables and yard waste increase annual waste management costs. These integrated system costs exceed regular refuse collection and disposal costs by $3 to $7 per household. Of course other considerations, such as increased diversion from disposal, might still make source separation a desirable management practice.

Three further observations should be noted. First, the weekly curbside recycling system used in the model is quite likely one of the more expensive methods for collecting source-separated recyclables. For example, by reducing collection frequency, alternating refuse and recyclables collections, combining refuse and recyclables collection in the same vehicle, commingling recyclables in fewer than three containers, a small community might find that source separation could be cost-effective.

Second, the processing costs shown in Table 9 are based on the assumption that processing facilities are being shared with other communities. The quantity of recyclables or yard waste that can be source-separated from a 50-tons-per-working-day waste stream is too small to permit their processing at a reasonable cost in new capital-intensive facilities of the type assumed for processing large quantities from a 500-ton-per-day waste stream.

In fact, Figure 3 shows an estimate of the relationship between facility size and cost per ton for a processing facility to prepare source-separated recyclables for market. At quantities below 50 tons per day, processing costs begin to escalate rapidly. Small-scale facilities have per ton processing costs far exceeding the $33 used in the optimizing model for small towns and rural areas.

Third, mixed waste processing is not optimal for the rural area, primarily because of low net materials prices. In addition, processing costs would be higher than $40 per ton if a 50-tons-per-working-day waste management system built its own facility. As with recyclables and yard waste processing costs, the $40 cost parameter assumes new regional facilities shared with other waste management service areas.

b. Impact of Waste Quantity

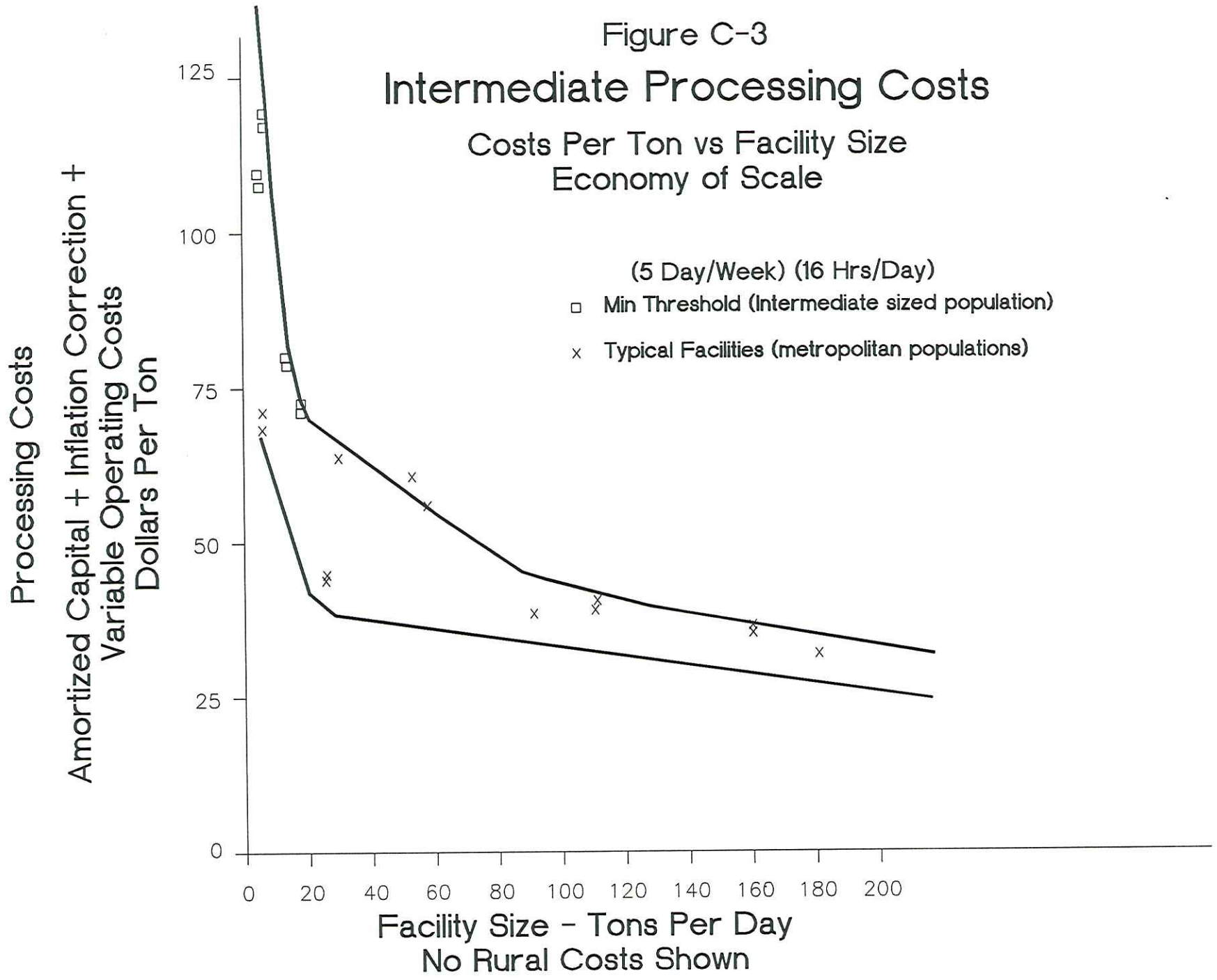
The results reported in Tables 6 and 9 suggest that quantity of waste managed may be more significant in determining the economic viability of source-separation methods than is household density. To examine this issue the optimizing model was run for a community having small town characteristics as given in Table 9, but waste quantity was reduced to 8.3 tons per working day.

At 8.3 tons of waste just one refuse truck is needed to collect waste when no home collection of source-separated materials is offered. However, three trucks, one for each type of home collection, are necessary if

Figure C-3

# Intermediate Processing Costs

## Costs Per Ton vs Facility Size
## Economy of Scale



both recyclables and yard waste are source-separated and collected at the curb. This raises the annual cost per household from $108 to $120, or $12 per household.

In comparison the 50 tons per working day system needs 5 trucks for refuse only, versus 9 trucks -- 3 recycling, 2 yard waste, and 4 refuse -- to manage source-separated materials. The extra home collections increase this system's annual costs by only $3 per household.

The conclusion would seem to be that waste quantity is much more important than household density in determining whether source separation is economically viable. As was the case with processing costs and facility size, collection costs for source-separation systems are also subject to some economies of scale. Expansion of service areas through cooperative agreements may thus make source separation economical in more remote areas or smaller communities where it would otherwise be too costly.

SECTION D

MANAGEMENT OF SPECIAL WASTES

## 1. INTRODUCTION

A number of materials found in the waste stream were singled out for special consideration in Substitute House Bill 1684 because they:

- Potentially threaten public health or the environment.
- Present a special handling problem.
- Present a special regulatory problem.
- Are recyclable but have low or no market value.
- Are perceived by the public as a problem waste requiring extraordinary management.

These materials are often referred to as special wastes or problematic wastes. The term "orphan wastes" has also been applied since these materials may slip through regulatory cracks and are not clearly claimed as either municipal wastes, hazardous wastes, or industrial wastes. The materials or waste categories included in this classification vary from community to community and from state to state. Substitute House Bill 1684 identified five specific materials for consideration in this report. These include:

- Used (Waste) Oil
- Tires
- Batteries
- Disposable Diapers
- Polystyrene Foam Packaging

A background discussion of each of these special wastes explains why this material is considered a problematic waste in the State of Washington and how it is currently managed. Alternatives for managing each of the wastes are evaluated and barriers to effective management are identified. Finally, this report recommends ways state or local governments might improve management of these wastes.

## 2. STRATEGIES FOR IMPROVED MANAGEMENT OF SPECIAL WASTES

### a. Used (Waste) Oil

#### (1) Background

The waste category of used motor oil consists of lubricating oils from automotive crankcases (56%), industrial and aviation lubricating oils (36%), and oils from specialized industrial processes (8%). Generally, these

oils pick up metals, water, and acids or other solid and dissolved contaminants as they circulate through the engine blocks and crankcases of gasoline or diesel engines. These contaminants can be removed through a re-refining or cleansing process making the used oil once again useful as either a lubricant or as a fuel.

The deleterious impacts of waste oil's improper disposal account for its classification as a special waste. The improper, but all too common, disposal of used motor oil by pouring it on the ground or into a storm drain or stream threatens public health, damages the environment, and wastes a valuable resource. Even landfill disposal of waste oil can be a problem when the oil finds its way into ground water aquifers. Waste oil that is put out with the trash can cause problems when packer units crush containers which then may leak onto the roadway after contaminating otherwise recoverable materials in the load.

The principal culprits in improper waste oil disposal are the large number of "Do-It-Yourselfers" (DIY's) who change their oil at home, or on vacant land, and dump the used oil on the ground, down the sewer, or throw it out with refuse destined for a landfill. Isolated instances of "midnight dumping" by irresponsible business operators -- who have been paid to legally dispose of waste oil, but who then dump it or illegally resell it as "discount heating oil" -- have also been noted in some locations. In the past, waste oil was applied to roads to control dust; however, this practice has been discontinued or restricted through regulations in most areas. Most waste oil generated by industries and commercial garages is currently managed appropriately through collection and processing networks.

EPA estimates that, nationally, do-it-yourself oil changers generate in excess of 200 million gallons of used oil per year, and that less than 10% of this is recovered for recycling. A national survey of DIY's found that only 14% even attempted to get used oil to a recycling collection point; most admitted to improper dumping or putting it in the trash. Clearly, do-it-yourself oil changers are of great concern in managing used oil. On the bright side, the increasing availability of convenient oil change services (some cities have seen an annual growth rate of over 300% in the last ten years), marks a trend towards fewer do-it-yourself oil changes.

Improper used oil disposal can cause environmental and health problems. Improperly disposed waste oil may be carried by runoff following heavy rains, making its way into the ground water or it may be discharged by sewage treatment plants not equipped to remove it. Oil in water takes years to break down and can be transported and dispersed across vast areas. The single largest source of fresh water oil pollution, waste oil, interferes with the re-oxidation process essential to healthy aquatic systems and is toxic to many types of fish and wildlife. Oil washed onto shores can destroy plant life and lead to erosion. Used oil spread on the ground damages the productivity of soil.

Toxic elements such as lead, arsenic, and zinc are commonly found in used oil and may originate in additives to either oils or gasolines. Human exposure to these carcinogenic substances may occur when people consume plants

or animals in which the toxic substances have accumulated. In addition, skin contact with used oil may cause cancer. Improperly disposed oil degrades drinking water. The U.S. Environmental Protection Agency has determined that one quart of oil will foul the taste of 250,000 gallons of water.

Of additional concern is the contamination of otherwise recoverable used oil by contaminants such as antifreeze, gasoline, solvents, and oils used in transformers. For example, in 1981 a New Jersey waste disposal firm was caught pumping toxic waste containing PCB's into waste oil which was later sold as fuel oil to an apartment in New York City. These contaminants are difficult to remove and make it difficult or impossible to recycle the adulterated oil. Concern about toxic substances in contaminated waste oil has lead to lengthy, and as yet incomplete, deliberation about whether waste oil should be regulated as a hazardous waste. In 1986, the U.S. EPA determined that used oil was not a hazardous waste (since classifying it as such would discourage its recycling); however, a 1988 U.S. Court of Appeals decision requires that EPA reconsider this decision.

Oil improperly disposed of is oil wasted, since used oil can be processed for reuse as a lubricant or burned as fuel oil. Proper disposal of oil through recycling not only protects public health and the environment but has the positive benefits of conserving petroleum. In fact, re-refining oil is more energy-efficient than producing new refined oil from crude oil. A number of states, including Washington, have determined that the best management practice (often the only acceptable and legal management) for used oil is collection and recycling.

Re-refining is the best way to prepare used oil for reuse. Out of a 42-gallon barrel of crude oil, less than 2% is economically suitable for use in the manufacturing of lube oil. On the other hand, over 50% of the volume of waste oil is recoverable as lubrication oil through the re-refining process. The highest quality virgin lubricating oils are obtained from limited and dwindling supplies of crude oil found in western Pennsylvania and west Texas. The production of new high-quality synthetic lubricants is not expected to keep pace with lubricating oil demand (2.5 billion gallons per year nationally) once these high-quality sources are depleted.

Through a thin-film distillation process, used oil can be cleaned to the point where it is comparable to and, in some cases, better than virgin lubricating oil. The equipment to re-refine used oil along with the necessary environmental controls and wastewater treatment facilities requires a significant investment. Thirty years ago, there were over 150 re-refiners in North America. Today there are only a few. These remaining re-refiners have capacity to handle only about 10% to 20% of the available supply. Potential purchasers of re-refined oil are often wary of the quality and may prefer to go with a brand name lubricating oil. However, the consolidation in the re-refining industry has improved the product's quality.

Over two-thirds of the waste oil collected is reprocessed for use as a fuel in industrial boilers or as bunker fuel for ships. Re-processed

waste oil is (20%-30%) cheaper than virgin burner fuel. Reprocessing to produce a fuel is less expensive than re-refining and may involve gravity separation, filtering, evaporation, or in some cases, chemical treatments. "Processing" of waste oil encompasses a range of treatments. Often waste oil is only blended (diluted) with other fuels before burning. Some large generators of waste oil maintain their own limited processing capability and consume their own used oils. Some waste oil is used as a fuel without being processed at all. (This may be acceptable for some hydraulic or other waste oils which burn cleanly.)

The burning of unprocessed waste oil can potentially create operational and environmental problems. Under the 1980 Used Oil Recycling Act, EPA has developed guidelines for the combustion of waste oil which require testing and, most often, some form of processing before burning so that emissions and toxics in ash are held within acceptable levels. Operational problems which may be created by burning unprocessed waste oil include boiler fouling, strainer clogging, accelerated nozzle wear, and reduced heat transfer efficiency. Environmental and health problems may result from burning unprocessed waste oil due to toxic substances contained in the oil or because of increased fire risk from inadequate burner and handling systems. In some areas, such as the Puget Sound region, stringent air quality rules restrict the burning of most processed waste oils.

Probably less than 10% of the waste oil collected is currently used for road oiling or other purposes. Regulations vary on required pre-processing of waste oil for these applications. Environmentally sound dust suppressing alternatives exist. The Times Beach, Missouri incident, in which the application of contaminated oil to roads and other areas killed livestock and forced evacuation of the town, points out the extreme risk of using waste oil in this way.

The 1987 Washington Recycling and Waste Stream Survey determined that 10.3 million gallons of oil were recycled or recovered in the State. (This is equivalent to 56,200 tons or 244,439 42-gallon barrels.) 0.9 million gallons (5,119 tons or 22,265 42-gallon barrels) of waste oil were disposed of in landfills during this period. Approximately 90% of the waste oil disposed in landfills originated in residential and self-hauled waste with the remainder coming more from the commercial than the manufacturing waste stream.

These totals show an apparent recovery rate of 91.7%. However, a comparison of these figures to estimates of waste oil volumes potentially available in Washington State (25.5 million gallons, or 139,670 tons based on national per capita sales figures) shows that as much as 14.3 million gallons are unaccounted for. This total may include errors in estimation, but also includes losses through inefficient operation (crankcase leaks, oil-burning engines, etc.; which are thought to account for up to half of the oil volume sold) and improperly disposed of waste oil. This indicates that from 1 to 5 million gallons of used oil are improperly disposed of in Washington State per year.

A 1983 Washington law, related to used automotive oil recycling, declares it a State policy to collect and recycle used oil and requires point-of-sale notification (by retail sellers of more than 100 gallons per year of

lubricating oil) about locations for recycling. This law also establishes a Washington Department of Ecology (WDOE) used oil information center and hotline to encourage voluntary used oil collection and recycling.

At this time fewer than ten companies in Washington collect used oil from garages, industrial generators, or recycling drop-off sites and transport it to a re-refiner or processor. More than 30 companies throughout the State are currently listed with the WDOE recycling hotline as accepting waste oil. About half of these are service stations or garages that handle oil as the only material they recycle, while the other half are drop-off or buy-back centers that accept waste oil. None pay for waste oil; some, however, charge to accept it.

A number of factors limit collection of waste oil in Washington. It may take as long as two years to establish a profitable waste oil collection route. The liability from one incident of contamination could result in the loss of the entire business. In addition, low prices for crude oil and other energy sources limit the profitability of collecting waste oil or maintaining a drop-off site.

Used oil processors serving Washington reportedly have capacity sufficient to manage 100% of the volume which could be recovered through increased collection. Major waste oil processing facilities are located in Seattle, Tacoma, Anacortes, Vancouver, Woodland, and Portland. Some of the waste oil going to the Portland plant is re-refined into lubricating oil while the remainder (greater than 95% of that collected from the state) is processed for use as fuel in Northwest forest products industries, asphalt plants, cement plants (or similar boilers) or on ships. Major re-refiners are located in Vancouver British Columbia, and in northern California.

(2) Management Options

Nationally, the Energy Policy and Conservation Act (1975), the Resource Conservation and Recovery Act (1976 and 1984) and the Used Oil Recycling Act (1980), stipulate requirements for the proper disposal and recycling of used oil from industrial, commercial, agricultural, and many other types of waste oil generators. Regulatory and recovery programs are well-established for this sector and, for the most part, no new management structures are needed, although some fine tuning to assure compliance may be required. The area of principal concern in waste oil management today is the recycling of used oil generated by do-it-yourself (DIY) oil changers.

Regulatory requirements and DIY-generated used oil recycling programs vary from state-to-state. Fourteen states have regulations stricter than those set by EPA, and only seven states have no used oil regulations at all. Nine states have regulated used oil as a hazardous waste, independent of EPA policies. Twenty-eight states have state used oil recycling programs for DIY's, and an additional 14 states have local DIY programs without state assistance. Of the 24 state level programs, only 12 are active. Similarly, of the 37 states with DIY programs at the local level only 20 are active. Only three states, California, Minnesota, and New Jersey, require residents to participate in DIY collection programs. Washington has used oil regulations

equivalent to EPA's as well as active DIY used oil recycling programs at the state and local levels.

The established DIY recycling programs in the U.S. share common design characteristics, and are basically variations of a few common themes. These programs include components common to all recycling programs, such as public education and program publicity. DIY used oil recycling programs vary most dramatically in terms of the legislation governing them and in terms of collection system design.

(a) Legislation

Used oil recycling programs targeting DIY's are either mandated by state law or are voluntary. Both approaches have proven effective in the past. States that mandate used oil recycling often have also designated used oil as a hazardous waste and the resulting programs deal with hazardous waste storage, treatment, transportation, and disposal requirements as well as liability.

Some voluntary programs have been relatively successful, but often lack statistical proof of the program's success. Voluntary programs, however, face increasing difficulty in dealing with the issue of liability, especially now that a federal court has ruled the U.S. EPA must reevaluate its decision not to designate used oil a hazardous waste. This recent court ruling is expected to have a chilling effect on oil recycling programs. Service stations and recycling centers accepting DIY's used oil are unlikely to assume liability.

(b) Collection System Design

Four basic methods of DIY used oil collection are used in state programs:

- Drop-off at service stations or other businesses which serve as collection centers.
- Drop-off at a dedicated recycling or collection sites.
- Curbside collection.
- Designated drop-off days at specific locations on certain days.

Both voluntary and mandatory programs use these methods and DIY used oil recycling programs often use more than one method.

The first method, collection at service stations or retail stores selling motor oil, is very common. Collection centers accept oil, usually in no more than five gallon amounts, and store it for removal by a used oil collection service. Depending upon local markets and state laws, the collection center may charge for accepting used oil from DIY's.

Drop-off at designated collection centers requires used oil storage containers to be located at appropriate and convenient locations. These locations may be community recycling centers for other recyclable materials such as glass, aluminum, and paper, or may be municipal facilities such as transfer stations, landfills, Department of Public Works facilities, or fire stations. Clearly marked containers are often monitored by municipal personnel to prevent contamination of the collected oil. Specialized containers are used, notably in several European countries, for unattended waste oil collection.

Curbside collection is the third method of collecting used oil. Containers (usually plastic jugs) in which to store used oil until collection may be provided to DIY's. Curbside collection of used oil may be part of a broader recycling program, or conducted independently. Frequency of collection varies from once a week, with the collection of other recyclables, to monthly or quarterly.

The vehicles used for curbside waste oil collection vary greatly among programs. Some specialized recycling vehicles are retrofitted to collect used oil. Other types of vehicles can also be easily modified. Small tanks are attached to vehicles and used oil is poured into the tanks at curbside, or racks are installed to carry used oil in individual containers provided to residents. Oil from these containers is later transferred to a storage tank.

The fourth method of oil collection used in recycling programs is for used oil to be dropped of on certain days at specified locations. Used oil is often accepted during household hazardous waste round-ups. The frequency of these events vary, however, though most communities strive to offer them at least twice a year.

These methods of collecting used oil, though the most common State programs, are not the only possible strategies. A collection program for DIY used oil must meet a state's objectives and adapt to local conditions. Effective promotion and education is necessary to the success of any program. Options which the state may consider for managing waste oil include the following:

- Status Quo. There are locations in many areas of the State for drop-off of used oil. The State also requires notification, at points of sale, of sites where DIY waste oil can be taken. Drop-off collection services, often provided at no charge, are operated by recyclers, garages, and by local governments (often in conjunction with solid waste services). In addition, the 1-800-RECYCLE hotline will inform citizens of locations in their area where waste oil can be taken. Education about and promotion of used oil recycling continue at the state level and in a number of communities. A number of communities sponsor Household Hazardous Waste Days or similar events and programs which provide an opportunity to collect DIY used oil.

This system may be ineffective because of inconvenience, inadequate funding for promotion and education, and concern about liability.

- Address Liability Issues. The thought of liability poses a major barrier to "...decision directing the EPA..." not "allowing" management of waste oil. Since the recent court decision allowing the EPA to reevaluate listing used oil as a hazardous waste, liability has become a major concern in all states that have not already designated used oil a hazardous waste.

  In 1988, Florida adopted solid waste legislation which is revolutionary in its approach to the issue of liability for generation, transportation, and disposal of used oil. The Florida law states that, "No person may recover from the owner or operator of a used oil collection center any costs of response action resulting from a release of either used oil or a hazardous substance or use the authority of (another section of the law) against the owner or operator of a used oil collection center." If other defined conditions are met (which basically assume sound operating collection methods), the collection center operator is not liable for the release or disposal of hazardous waste resulting from collecting used oil from DIY's. Related legislation has been adopted in California, where small quantity handlers are exempt from provisions that regulate waste oil as a hazardous waste.

  Washington could develop legislation which reasonably reduces the liability of qualified and conscientious waste oil collectors. Safe-guards such as operator training or certification and prescription of precautionary measures to reduce the possibility of contamination should be developed. Currently, waste oil collectors are unable to obtain environmental liability insurance at a reasonable cost, or frequently, at any cost. Government's assumption of liability or funding of a program to protect prudent operators could be considered. These measures would assist collectors of DIY waste oil as well as handlers of commercial used oil.

- Enhanced Drop-Off Opportunities. The successful resolution of the liability issue would encourage private enterprise to stabilize and expand waste oil drop-off opportunities. The drop-off system for collecting used oil could also be made more convenient and effective by promoting their use, increasing the number of locations, standardizing operations, and reducing operating costs so that waste oil would continue to be collected without charge (or perhaps even provide some payment). Approaches to accomplish this include:

  - Offering pooled environmental liability insurance to collectors as a credit or payment for their service of diverting used oil from improper disposal.

- Financing, or providing storage tanks, collection containers, test equipment or other supplies which enable collectors to operate profitably. (This approach might also involve grants or diversion credits.)

- Requiring distributors of new motor oil to establish and fund "no-charge" collection centers to provide adequate DIY used oil collection in all areas where their products are distributed. Alternatively, as required in some states, this obligation could be assigned to retailers, although this alternative would be more difficult to administer.

- Providing incentives to private or non-profit developers of collection centers - e.g., operating sites, matching funds, low-cost loans, business development assistance, exclusive collection rights, etc.

- Providing incentives for citizens to use the waste oil collection system - e.g., discount coupons, prize drawings, promotional giveaways, etc. (The Florida program uses incentives such as these.) Although incentives can be useful in generating interest in new services, citizen participation should ultimately be based on appeals to environmentally responsible behavior: doing the right thing, protecting public health and the environment.

- Funding collection program enhancement, including education and promotion, through a product charge on new oil, cooperative programs with retailers, user fees or fines collected from those refusing to use the available system.

• Curbside Collection. Waste oil should be considered for pick up in those areas of the state where curbside collection of recyclables is underway or planned. Concern about liability and uncertainty about handling requirements and market values have been a barrier in some communities across the nation where curbside collection of used oil has been available. Nevertheless, this approach is one of the most convenient methods for collecting DIY used oil.

• Regulation of Disposal. Some states, including Michigan, California, and Rhode Island have chosen to regulate waste oil as a hazardous waste. This requires special handling and disposal procedures which prohibit the disposal of used oil in landfills and solid waste incinerators. Florida, though not designating used oil as a hazardous waste, has prohibited its disposal in landfills. Minnesota has made it illegal to dispose of waste oil with other household waste in garbage cans. Such bans on disposal can reduce the volumes of used oil disposed of improperly if alternatives for recycling are promoted and implemented.

- Regulation of Products and Activities. Additives in new lubricating oils or in gasolines make more difficult the production of high quality re-refined lubricant or burner fuel. Federal action to reduce gasoline's lead content has resulted in lower lead concentrations in used oil. Regulating gasoline and oil additives could reduce the toxicity of used crankcase oil and of ash from the combustion of processed used oil, without diminishing the lubricating or performance qualities of these products.

  The oil and automotive industries should be involved in evaluating how to improve the recovery and management of waste oil.

  Product charges on new supplies of lubricating oil have been mentioned as one way to fund used oil management. Taxes on automobile sales or licensing fees could provide an alternative source of funds. Self-imposed assessments by a particular industry could fund solutions to environmental problems caused by that industry's product. Reducing the number of people changing their own oil is another way to reduce the volume of unmanaged waste oil. With the rapid increase in quick service oil change services in the last ten years, the percentage of DIY oil changes has been reduced. Short of prohibiting all DIY oil changes, local government or private business could provide low-cost facilities for DIY's to change their own oil.

- Education/Promotion. The State of Washington already has the major components of its waste oil education program in place (notification requirements, the hotline and information center, as well as brochures and promotional material). Expansion of these efforts to the local level should provide a good return, particularly if collection opportunities are expanded as well. Increased visibility for the issue through frequent public service announcements, flyers, presentations, and other outreach activities would increase public awareness and understanding of proper used oil management. Project ROSE (Recycled Oil Saves Energy) in the state of Alabama is a notable example of a successful waste oil education program. Project ROSE is a cooperative effort among the state, the University of Alabama and volunteer community organizations. The program is effective in reaching the state's rural population as well as industrial, government and military facilities.

- Market Development. A number of actions could strengthen markets for used oil. Waste oil generators, collectors, processors, and purchasers need a central source of clear and dependable information about current regulations and programs. In the past, regulations were reportedly interpreted inconsistently. Governmental efforts to assure that products

manufactured from used oil and the businesses involved in their production both meet the highest standards might serve to improve the image of this industry and to stabilize recovery systems.

While boiler fuel has been the primary end-use of waste oil from Washington, the future should hold increasing opportunities to re-refine this resource into its highest and best use as a lubricant. (A 1986 California law defining recycling of used oil did not include incineration or burning as a fuel as recycling strategies.) Until re-refining capacity is more fully developed, a safely combustible fuel derived from used oil is an end-use sufficient to encourage continued collection.

To encourage the development of re-refining capacity, state and local government agencies might consider procurement preferences or incentive and promotion programs encouraging their contractors and others to purchase re-refined oil. Federal procurement standards for used oil have already been published (Federal Register, Vol. 53, June 30, 1988). Major suppliers of re-refined oil are located in Vancouver, British Columbia, and in Newark, California. The EPA recently issued procurement guidelines for re-refined oil procurement.

(3) Barriers to Management

The primary barriers to the management of waste oil in Washington State include the following:

- The lack of public awareness about used oil recycling and about the problems caused by the improper disposal of used oil.
- The lack of an established, convenient, and effective collection network for the do-it-yourself oil changers and the lack of incentives or direction for a coordinated collection network to be developed.
- Limited demand for re-refined oil products and capacity to re-refine waste oil for use as a lubricant. This barrier is partly due to a perception that re-refined oil is not as good as virgin lubricating oils.
- Low crude oil prices affect the economics of burning and re-refining waste oil and reduce the incentive to collect it.
- The concern over the potential regulation of waste oil as a hazardous waste has hindered the development of collection networks and processing/re-refining capacity. Associated barriers include:

- Concerns about the liability incurred by handling waste oil.

- The inability to obtain environmental liability insurance at a reasonable cost or at any cost.

- The expense involved in testing waste oil for contamination and maintaining records.

- The unwillingness to make investments until the implications of regulations are known.

- Vertical integration in the oil industry gives major companies control over crude oil reserves, refineries and distribution networks. The market for oil lubricants is controlled by the major oil companies who have made major investments; this makes it difficult for smaller re-refiners or processors to become established.

- There is misinformation about appropriate waste oil disposal practices. For example, some oil changing kits sold in stores encourage do-it-yourselfers to dispose of waste oil with regular garbage.

(4) Recommendations

Based on the options outlined, this study recommends measures the State of Washington should consider for improved management of used oil. These recommendations aim to:

- Reduce waste oil's pollution of the environment.

- Encourage the efficient and continuing collection and recovery of used oil for re-refining as a lubricant or for processing as a fuel.

- Increase collection of used oil generated by do-it-yourself oil changers.

- Increase public awareness of waste oil and motivate appropriate actions by citizens and businesses.

Recommendations:

- Develop legislation relieving qualified and responsible used oil collectors from potential environmental liability for contaminants contained in used oil that might be released despite their best efforts to prevent pollution.

- Provide for expansion of "Do It Yourself" (DIY) waste oil collection sites through:

- Requiring distributors of new motor oil to establish and fund "no-charge" collection centers to collect DIY-generated used oil in all areas where their products are distributed.

- Purchase of storage tanks, containers, or other collection equipment.

- Incentives for the establishment of collection sites.

- The establishment of a new motor oil product charge to help fund used oil education/promotion and collection programs.

• Provide aggressive waste oil recovery publicity and education programs at state and local levels to promote both the collection of used oil and the use of re-refined oil.

• Provide a preference for government procurement of re-refined oil.

b. Tires

(1) Background

About four million tires are generated each year in Washington. About 50% or 34,000 tons of these are landfilled, 25% are stockpiled or illegally dumped, and 25% are recycled or sent to Oregon to be shredded for use as tire-derived fuel (TDF). Tires compose an estimated 0.8% of the State's waste stream. In addition, at least 22 million tires are currently stored in piles around Washington. About 50% of the State's landfills do not accept tires.

Tires pose a waste management problem for these reasons. When stockpiled, they harbor disease bearing insects and rodents, are unsightly and pose a serious fire threat illustrated by the Everett fire of 1984. They create instability and vector problems in landfills if buried without costly shredding or splitting. In addition, alternatives to disposal are sought to conserve the energy available in the oil which composes two-thirds of the weight of tires.

While in the past regulation of tire disposal has been minimal in Washington, recent legislation addresses waste tires. In addition, funds have been allocated to better manage waste tires ($0.12 per $100 of tires sales), and the State is now implementing licensing requirements for tire collectors and regulations governing waste tire stockpiles. A Waste Tire Advisory Committee composed of State and industry representatives is examining policy alternatives. An economic feasibility study for the siting and operation of a tire recycling facility(ies) in Washington State was completed in January 1989. This study, sponsored by the Departments of Trade and Economic Development and Ecology, offered recommendations for State action in the following areas:

- Elimination of tire stockpiles.
- Collection/transportation system regulation.
- Alternative end-products from recycling and energy recovery.
- Feasibility of tire-derived fuel (TDF).
- Funding mechanisms.
- Regulations for a ban on landfilling and incentives to recycle and reduce stockpiles.

There are currently few end-users of waste tires in Washington. The retreading industry, which in the past has used as many as 20% of waste tires nationally, consumes between 5% and 10% of the waste tires generated in Washington. There are approximately 20 tire retreaders in Washington. Tire shredding capacity here is minimal. About 25% (1,000,000 tires per year) of the waste tires generated in the State are shredded by Waste Recovery Inc. in Portland, Oregon to make TDF which is used primarily by the pulp and paper industry. A number of smaller operations located in King, Pierce, and Snohomish Counties and in Oregon collectively use about 10% of the State's available tires for specialized products such as bumpers, railroad crossings, rubber asphalt, and marine products. Businesses in Spokane, Thurston, Pierce, and Lewis Counties have stockpiles of tires and plan to develop TDF, pyrolysis, or other end-use applications.

(2) Management Options

(a) Government Programs

Governments have approached waste tire management in these ways:

- Regulation of disposal
- Regulation of collection
- Consumer education
- Imposition of special fees to pay for tire management
- Model programs

Only a few state governments have tire management programs. Most are not comprehensive, and most are in the early stages of development.

Regulation of Disposal. Several local and state governments have banned tires from waste disposal sites or required that they be split or shredded before disposal. Tires may be stockpiled separately at landfills with the landfill operator or local government contracting with a collector. The collector may haul the tires to a retreading firm or a shredding operation. However, most used tires not being landfilled are being stockpiled. In a handful of cases, tires have been buried in separate areas of landfills so that they can be unearthed if a future use for them is found. The regulation

of disposal encourages privately initiated development of recycling, processing, or energy recovery by assuring a continuous supply.

Regulation of Collection. Collection and transportation of waste tires may be regulated so that only authorized individuals or firms may collect them. This allows the state to control the flow of waste tires, impose record-keeping requirements and choose acceptable collection sites. Unlike other recyclables, most scrap tires are already source separated. Tire dealers usually keep customers' old tires when new tires are purchased. Tire "jockeys" service these retailers sometimes without a contractual or other formal agreement. Some jockeys dispose of the used tires illegally creating litter and health problems. Imposition of licensing requirements on tire collectors would address the problem of illegal disposal.

Consumer Education. Consumer education is aimed at reducing the tire waste stream. Proper maintenance can extend the life of a tire; purchase of better quality tires can result in longer wear. Consumers wary of retreads can be encouraged to purchase them from reputable companies.

Waste Tire Fees. Governments and private disposal operators have imposed special fees on tires at waste disposal sites. Such fees offset the extra costs of tire disposal while making disposal alternatives more attractive. To raise money for tire management, governments have also levied special charges on each tire sold or on vehicle transfer permits.

This money may be used to pay for shredding or splitting before disposal, for Government's administrative costs of managing tire disposal, and to award grants or subsidies to recycling operators. The State of Washington currently asks retailers to collect $0.12 per $100 worth of tires sold while the State of Oregon requires retailers to collect a tax of $1 per tire. The State of Minnesota places a $4 tax on vehicle transfers.

Model Programs. Some governments have set examples by implementing model programs to encourage tire recycling and reduce the generation of waste tires: Government agencies use retreads on motor pool vehicles; keep tires properly inflated; and use recycled tires in public projects such as road paving, artificial reefs, or school playgrounds.

Draft federal procurement guidelines for rubber-asphalt and retread tires required by the Resource Conservation and Recovery Act were issued on May 2, 1988. The draft guidelines call for increased use of retread and recycled tire products by federal agencies and on projects that involve federal funds. Strong economic and safety objections to the use of retread tires have been raised by the General Services Administration, which buys over $4 million of tires each year; however, the American Retreader's Association has requested an additional review of the performance and quality of retread tires.

### (b) End-Uses for Tires

Currently, the principal end-uses for waste tires are retreading, recycling for conversion into other products, and recovery of energy through incineration or fuel production. In the latter two cases the technology to consume large numbers of tires is very expensive and not well established.

Retreading. The use of retreads has declined over the last few decades. The advent of steel-belted tires posed technical problems that took the industry time to surmount. In the meantime, the price difference between new and retreaded tires narrowed and became insufficient to motivate purchases by consumers wary of retread performance. While retreading is still a major use for recycled tires, the ability of this industry to expand is limited by the unsuitability of most tire casings for retreading. Improved tire designs, however, have increased the durability of tires which has resulted in waste reduction.

Recycling. The reclaiming industry puts tires directly back into rubber-based products. A major shift has occurred in this market over the past 50 years. While old tires used to be the major component of new tires, changes in tire technology have eroded this market so that only a handful of reclaiming operations remain in the U.S.

Several technologies have been developed to incorporate used tires into other products. There are two major technological developments which have aided this transition:

- Tires are shredded into "crumbs" of various sizes and used as an asphalt additive.
- Tire crumbs are used to produce a material that can be substituted for rubber in certain applications.

Neither of these uses has yet proven itself in the marketplace although each has potential. The federal government subsidized rubber asphalt research. The State of Minnesota financed a plant producing a substance composed of tiny tire crumbs treated with a liquid polymer that can be combined with virgin rubber to make a variety of rubber-based products.

After 15 years of on-and-off experimentation, rubber asphalt is still in the research and development phase. Road applications range from direct replacement of asphalt, to use only in the stress absorbing inner layer of a road surface, to repair of damaged pavement. Evaluation of the material demands 10 to 15 years and testing of different ratios of tire chips to asphalt. Some studies find rubber asphalt superior to regular asphalt; others find it inferior. Questions are also raised about the ability of this application to consume large numbers of tires.

The State of Minnesota has invested a large portion of its tire fund in the manufacturing of a recycled rubber product by Rubber Research Elastomerics Inc. at a TIRE CYCLE facility in St. Louis County. Several government agencies cooperated to fund the facility through grants and loans of about $4 million. Though in operation since March 1987, the plant is not yet operating at capacity. Designed to handle 4 million tires annually, current throughput is about 750,000 tires. It remains to be seen if markets can be developed to allow the plant to reach full potential.

Recycled tires are also used by smaller firms to produce a variety of products such as park benches, flower pots, chocks, and bumpers.

Energy Recovery. Pyrolysis is a new technology. Tires are heated in an oxygen-free environment, a process that breaks chemical bonds and produces crude oil, carbon black, combustible gases, and scrap steel. Though experts consider the technology sound, pyrolysis operations in Europe and the U.S. have had a shaky history. Plants are capital intensive and demand a steady supply of tires. Their ability to make money is affected by the price of waste disposal and energy. Just as some facilities began production, the price of oil dropped considerably making them uneconomical. However, with the rising price of waste disposal, the inevitable increase in oil prices and the increasing attention paid to the dangers posed by tire stockpiles, interest in pyrolysis is rising.

General Electric has financed a pyrolysis plant designed by Oxford Energy Company located in Modesto, California near a stockpile containing over 35 million tires. The $38 million plant has capacity to produce an estimated 12.9 MW of electricity. The major customer is a local utility. As of November 1988 the plant was burning 600 tires per hour. The environmental impacts of Oxford-designed pyrolysis plants have not been established. The company hopes to site plants on the East Coast but environmental concerns have thus far halted projects.

Tires may also be burned whole or in shreds to supplement other fuels. Shredded tires prepared for incineration are known as TDF, or tire-derived fuel. The proportion of tires to other fuel a facility burns is usually between 5% and 10% in order to meet air emissions requirements. For example, a refuse burning facility in Akron, Ohio uses about 150,000 tires per month to improve burning efficiency. The Pacific Northwest's largest shredding operation, Waste Recovery Inc., sells most of its product to paper mills. Paper mills have the sophisticated air pollution control equipment necessary to burn tires legally.

According to a State source, only two of Washington's nine paper mills use shredded tires. Many mill officials are reportedly unwilling to retrofit their furnaces to burn tires without a guaranteed supply of shredded tires. Cement factories have also been identified as potential users of TDF. The few research projects to date report that tires enhance cement kiln efficiency. However, the economics of processing (shredding) and delivery to these plants when compared to the costs of other fuels have often discouraged use of waste tires.

(3) Barriers to Management

A comprehensive approach to waste tire management should be consistent with the State's established priorities: reduce the amount of waste generated; recycle; incinerate with energy recovery; and properly dispose what remains. The major barrier to proper management is economic; eliminating, reducing, and regulating existing stockpiles; shredding or splitting tires before disposal; and the development of tire recycling or energy recovery capacity all require some form of state subsidy greater than current allocations. Other barriers are:

(a) Reduction

- Consumers lack information about how to maintain tires to make them last.
- Consumers are wary of retreaded tires and do not distinguish high quality from low quality retreads.
- Consumers may not consider tire life and life-cycle costs when pricing tires.

(b) Recycling

- Washington State lacks a reliable collection network that could efficiently supply users with waste tires.
- Shredding capacity in the State is underdeveloped.
- Investors are reluctant to sponsor tire recycling firms in the absence of a guaranteed supply.
- Tire-based products have difficulty competing in the marketplace when waste tire collection and processing costs are high.
- End-uses that consume large numbers of tires are capital-intensive; lack of an established track record makes them risky.

(c) Energy Recovery

- The lack of a collection, transportation and processing network and the expense involved in establishing and operating this system discourages recovering energy from waste tires.
- TDF lacks an established and diversified market. Its use may incur additional expenses such as pollution control or TDF storage facilities at boiler locations.
- The lack of a guaranteed supply of waste tires prevents major investment in capital-intensive energy recovery projects.
- New technologies for recovering energy from waste tires are unproven and expensive.

(d) Disposal/Stockpiles

- Citizens lack awareness of waste tire disposal problems and potential solutions.
- Data on existing authorized and illegal stockpiles are limited.
- Fees collected for existing stockpiles are inadequate to properly manage them.
- Shredding capacity is limited and expensive.
- Tire landfilling practices vary in acceptability across the State.

(4) Recommendations

Principal assumptions, objectives and rationale for study recommendations include the following:

- The State's waste management priorities (reduction, recycling, energy recovery, and disposal) should be applied to comprehensive waste tire management.
- Only 30 to 40% of the waste tires from the State are currently being recycled or processed for energy recovery - significant increases in recycling will require investment in large-scale technology.
- The State's stockpiles of waste tires should be reduced.

Recommendations for improved waste tire management are discussed according to Washington's waste management priorities and then summarized.

(a) All Priorities

- Increase the tire fund contributions (currently $0.12 for each $100 of tires retailed). The current contribution will not be adequate to support needed programs, reduce current stockpiles or establish a major end-use facility.
- Continue to increase tire shredding capacity in the State. Support development of capacity by providing economic incentives as allowed by State law. Most management alternatives require shredding.
- Implement waste tire collection and disposal regulations with the purpose of reducing illegal dumping and obtaining data on waste tires.

- Ban whole tires from disposal in landfills.

- Set minimum standards for tire life. Disallow the sale of tires that do not meet standards.

- Continue the work of the Waste Tire Task Force to develop legislative recommendations consistent with the findings of the State's recent tire recycling feasibility study.

- Make clear how the State can financially support private waste tire management. State of Washington law is restrictive in this regard, although an informal opinion issued by the Attorney General's Office suggests that the State can offer financial aid if it furthers State policy.

(b) Recycling and Waste Reduction

- Implement a model waste tire reduction/recycling program for all State-owned or leased vehicles. The State should practice good tire maintenance so that its waste tires are suitable for retreading. It should purchase retreaded tires for its own use, and it should consider durability when buying tires.

- Increase consumer knowledge of proper tire maintenance so that more used tires are suitable for retreading.

- Increase retreading industry capacity in the State through incentives.

- Certify retreaders and educate the public on the reliability of properly retreaded tires to increase use of retreaded tires.

- Monitor and increase the use of rubber asphalt in the State.

- Identify all uses for tires that are not capital-intensive and that can be undertaken by smaller businesses or incorporated into existing technologies (e.g., the production of embankment supports, retaining walls, chocks, rubber asphalt, artificial reefs, breakwaters, weights for plastic sheet covers, sports surfaces, abutments, and playground equipment). Determine which are acceptable. (Some consider the embankment supports in Washington along I-5 unsightly.)

- Determine how many tires can be diverted from disposal by an expanded retreading industry and all other uses. If this diversion rate is unacceptably low, consider capital-intensive options such as pyrolysis and production of a recycled tire material.

- Monitor innovations in waste tire management. The Oxford/General Electric project in Modesto is the first large-scale implementation of pyrolysis in the U.S. Minnesota has risked a large investment in Rubber Research Elastomerics. Neither project is fully operational. Information about these and similar projects will be useful to the State.

(c) Energy Recovery

- Develop the paper mill market for TDF. Only two of nine Washington paper mills now use waste tires as a fuel supplement. Assure other mills of a guaranteed tire supply by providing incentives for transportation of tires to the mills (e.g., look at freight rate structure; back-haul possibilities).

- Develop the cement kiln market for TDF. Studies have shown that kilns can effectively burn whole tires while increasing burning efficiency.

- Use TDF in environmentally safe amounts at any resource recovery facility sited in Washington if its pollution control system is adequate. For example, Skagit County has a state-of-the-art incinerator.

In summary, this study recommends the following actions:

(d) Legislative/Regulatory

- Implement and enforce tire collection and disposal regulations to reduce illegal dumping and obtain data.

- Ban landfilling of whole tires and the sale of tires not meeting minimum tire life standards.

- Develop further legislative recommendations by continuing the work of the Waste Tire Task Force.

(e) Market Development

- Encourage expansion of tire shredding and retreading capacities within the State.

- Encourage State agency buying of retread tires and rubber asphalt.
- Certify retreading operations and promote their products.
- Develop markets for TDF.

(f) Funding

- Increase contributions to the tire fund to support the State tire management program.
- Investigate State support and funding of private sector waste tire management.

(g) Research

- Evaluate the feasibility of capital-intensive pyrolysis or crumb rubber plants for the State or region.
- Evaluate alternative small scale uses for waste tires (e.g., slope stabilization).

(h) Education/Promotion

- Inform the public of tire maintenance and retreading requirements.

c. Batteries

(1) Background

Twentieth century American society has become accustomed to the use of electrical devices for convenience, recreation, and an improved quality of life. Whether to operate an automobile, flashlight, hearing aid, or smoke alarm, a steady supply of batteries is required; and a continuous supply of waste is created which must be managed in municipal facilities.

American consumers use and discard over 2.5 billion batteries each year. In relation to other wastes entering municipal disposal facilities, batteries seem insignificant; however, they contain high concentrations of toxic heavy metals and caustic chemicals which may pose a threat to human health and the environment.

Disposal of waste household batteries causes particular concern about environmental contamination. (The majority of auto batteries are thought to be recovered.) Household batteries are most commonly disposed of with other household wastes. They then make their way to municipal incinerators and landfills. When incinerated, batteries create toxic emissions which, in great enough concentrations, may endanger life. If landfilled, any spillage

or leaching may contaminate ground water. Either of these circumstances could be deleterious to human health and the environment. The incidence of contamination through these pathways is not well documented.

Batteries consist of four main components: the anode (or negative electrode), an electrolyte solution, the cathode (or positive electrode), and the casing. Electricity is generated by passing electrons from the anode to the cathode, through the electrolyte solution. In certain cells, this process also generates highly toxic or hazardous by-product compounds.

There are several kinds of battery cells on the U.S. market and, hence, in the waste stream. Each type of battery has distinct applications and poses a particular waste management problem. Battery types include: automotive and marine batteries (wet cells), small alkaline batteries used in radios and flashlights (dry cells), rechargeable dry cells, and small button-shaped cells used in watches and hearing aids.

- Wet cell batteries constitute about 3% by number, or 90% by weight, of yearly battery production in the U.S. Wet cells are comprised of a plastic shell, sulfuric acid (about 1 gallon in each battery), and lead strips. "Maintenance-free" batteries contain sulfuric acid in a gel form.

- Dry cell batteries constitute 95% (by number) of batteries sold in the U.S. Most popular is the long-lasting variety which is expected to control 75% of the battery market by 1990. These cells consist of a moist chemical paste which is either an acid or caustic mixed with manganese dioxide. A carbon rod runs through the middle of the paste. The casing is usually made of zinc; however, copper is sometimes a component. The fastest-growing segments of the primary (non-rechargeable) dry cell market are the alkaline-based batteries which incorporate small amounts of mercury or other metals in low concentrations to increase useful life.

- Rechargeable dry cells constitute a small percentage of sales (about 10 million each year) in the U.S. because of their initially higher cost, though their life-cycle cost results in an ultimate savings. Their electrolytic medium is most often constructed of a nickel-cadmium combination or, more rarely, of lithium. Their use is generally restricted to small household appliances or industrial-commercial applications. These batteries require a separate charger.

- Button cells account for the remaining 2% of yearly battery sales in the U.S. Button cells are also considered dry cells, but warrant a separate discussion because of the variety of their composition. Common components of these cells are mercury, silver, and

lithium. Mercury cells are commonly used in cameras and consist of zinc, mercuric oxide, and potassium hydroxide. Silver oxide batteries are used in watches, and lithium cells are typically used in computers.

Washington State waste battery generation is estimated at about 28,000 tons annually (based on the 1987 Recycling and Waste Stream Survey). Of this Washington State amount, 78% (by weight) were recycled (this represents exclusively wet cell batteries) and the remainder were disposed of (primarily in landfills). No data were collected to distinguish the proportion of this disposed volume which was either dry or wet cells. Waste composition, attributable to disposed batteries, thus consists of a large volume of caustics and several metals, including: zinc, nickel, cadmium, lead, manganese dioxide, mercury, silver, and potassium.

The health risks posed by most of these metals are well documented; however, conclusive information about the environmental effects of batteries in the waste stream is not yet available. Studies show that typical body burden concentrations of mercury, cadmium, and lead are higher than those in the pre-industrial era. It is also known that these metals accumulate in the environment and increase in concentration at successive levels of the food chain. Mercury, cadmium, and lead in particular have no known beneficial health effects at any level; however, in trace amounts, manganese, zinc, and potassium do have a nutrient value.

The Occupational Health and Safety Code sets work place exposure limits for all of the metals used in batteries. The allowable concentration of lead and mercury in open air is limited by health standards set by the Clean Air Act. Cadmium, lead, silver, and mercury are all regulated by the Safe Drinking Water Act.

These regulations are necessary to protect human health from the detrimental effects of ingesting or inhaling heavy metals. Mercury poisoning can cause kidney, central nervous system, and psychological disorders. Cadmium harms the liver, lungs, and prostate gland. Manganese causes respiratory disorders and also affects the kidneys, eyes, and nervous system.

There is no doubt that large doses of these substances are detrimental to health, but inconclusive research leaves unclear whether our current landfilling and incineration practices release metals in concentrations high enough to surpass safe limits.

Intact batteries pose no danger to the environment. Risks occur when a wet (lead-acid) or dry cell battery is broken through improper handling, incineration, or the corrosion of its protective casing.

If carelessly handled, lead-acid batteries pose particular problems due to the large volumes of acid they contain and the concentrations of lead dissolved in this acid. If this caustic is released, it can immediately harm people and the environment. When incinerated, the lead in emissions, if not controlled, can cause lead poisoning. A wet scrubber can reduce emissions to the point that only 2% of the lead burned is released to the environment. The

remaining 98% is caught in incinerator ash and control equipment; however, this material can still pose a threat when the ash is landfilled. When landfilled, lead is soluble with acetic and citric acids which are prevalent in household garbage, and thus may leach out into the water table if liners are inadequate. Environmentally sound ash disposal thus becomes very important.

Dry cell batteries are much more difficult to break open than wet cells, and thus do not pose an immediate danger to the consumer or waste handler. When their casings are broken through corrosion or incineration, however, these batteries can release mercury, cadmium, lithium, zinc, and copper. Tests in the United Kingdom have shown that dry cell battery casings can corrode in a relatively short-time when buried in a landfill (sometimes in as few as 100 days). Once casings are broken, a wide range of chemical and biological reactions can occur within the landfill environment that increase environmental hazards.

It has been estimated that household batteries are the principal source of mercury emissions in Canada. Similarly, 35% of the background levels of mercury in Sweden are linked to incineration of batteries. When mercury is incinerated in a facility equipped with only a wet scrubber, 96% is released to the environment. The behavior of this metal when landfilled is not well documented.

If not controlled, incineration also releases cadmium, which is not explicitly regulated by either federal or state air quality standards. When controlled by a wet scrubber, cadmium emissions are still on the order of 50%. The remaining 50% is contained in ash and dusts which have to be landfilled.

When concentrated quantities of cadmium are landfilled, there may be danger if the metal makes its way into a water source. Current research conducted in the United Kingdom, however, shows that it is unlikely that landfilled cadmium contained in unbroken batteries will pose an environmental problem. The study hypothesizes that, in general, batteries are not landfilled in large, concentrated volumes, and any cadmium released will be diluted to minute and harmless concentrations before it reaches a water supply. With significant variations in landfill design and performance, however, long-term pollution of aquifers as a result of cadmium battery disposal should not be ruled out. Neither concentrations nor the flow of cadmium in landfilled incinerator ash has been evaluated; the metal could be more mobile in this form.

Little information is available on the environmental effects of lithium, zinc, silver, and copper from disposed batteries. Lithium reacts violently with water which could make disposal in a landfill a potential hazard although batteries containing lithium are relatively rare. The behavior of lithium in an incinerator is also not well documented. Similarly, more information is required on the behavior of zinc and copper, silver, and manganese dioxide during disposal. These elements are not thought to warrant the same concern as lead, mercury, and cadmium.

(2) Management Options

One option for managing waste batteries is to continue current practices: landfilling and incineration of household batteries (dry cells), limited dry cell recycling and widespread, successful recycling (near 78%) of automobile (wet cell) batteries. Current data indicate, however, that incineration of wastes high in heavy metals should be reduced, and that a significant portion of the heavy metals in incinerator ash originate in batteries. There is also evidence that certain of these metals are released in incinerator emissions. In few cases, however, is there enough information to conclude that these emissions are of sufficient volume to endanger health or the environment. Similarly, research suggests that landfilling batteries could create a hazard if cell casings erode and release their contents, but, again, there is no conclusive evidence.

The State should develop a more effective approach for managing and reducing the potential toxicity of incinerator emissions and landfill leachate. Options for reducing environmental and health hazards associated with waste batteries are presented below:

- Reduction

  Prohibiting batteries containing certain heavy metals or reducing the toxic chemicals contained in batteries would eliminate some of the problems of managing waste batteries. Some metals replacement is already happening. For example, mercuric-oxide hearing aid batteries can be substituted with zinc-based batteries.

  Banning batteries containing certain metals would only regulate known hazards. Bans would end markets for certain battery styles which fill a consumer need. Manufacturers would react by trying to meet these needs with new products not containing banned substances. But the banned product may be replaced by a less acceptable substitute with unknown environmental and health effects.

  Regulating the hazardous metals in household batteries would be more effective than an outright ban. This approach would not remove battery styles from the market, or significantly alter the business of battery manufacturing. It would simply reduce the volume of known hazards from the waste stream. This type of regulation could immediately apply to mercury, and be extended to other materials. This approach would require legislation and would best be implemented nationally or regionally although State measures could be beneficial.

  Manufacturers of wet cell or automobile batteries have taken steps to reduce the number of waste batteries by producing more durable and maintenance-free batteries. Improvements in automobile design have also contributed to the durability of these batteries. The State might consider discouraging the use of cheap, shorter-life auto or boat batteries.

Promoting the increased reuse of batteries falls between the State's reduction and recycling priorities since rechargeable batteries are also generally the most recyclable batteries (even though elements used in their construction may be more harmful when incinerated or landfilled than those in disposable types). Reuse is currently confined to the rechargeable variety of dry cells and to wet cells. Most nickel-cadmium batteries last four years because they can be repeatedly recharged. The tonnages of these entering the waste stream is thus somewhat less than for non-rechargeables. Consumer use of rechargeables, especially the cylinder-shaped variety, could be promoted through household hazardous waste programs.

The U.S. military is already the largest consumer of nickel-cadmium batteries. Rechargeable batteries are also commonly used in commerce and industry. State and local government procurement policies could increase the use of rechargeables.

- Source Separation

A key to environmentally sound management of batteries is to separate them from the waste stream before wastes are incinerated or landfilled. This is called source separation. This is best done before waste collection because systems to recover household batteries from mixed waste are not generally available and because handling and health problems occur when auto batteries are mixed with municipal solid waste. Source-separating batteries does not necessarily mean that the segregated or collected batteries can be recycled. Recycling systems are well established for wet cells. However, alternative management approaches, such as stockpiling, may need to be developed for source-separated dry cells since end-users are not readily available.

Separation and recovery of batteries from the waste stream can be encouraged in several ways including legislated incentives or bans, promotion and education, and the development of deposit-return or voluntary collection programs.

An obvious method of reducing wet cell battery waste is prohibiting disposal at all municipal landfills or incinerators not equipped to handle hazardous or chemical waste. Restricting wet cell batteries from trash collection containers is a logical extension of this approach. Bans on the disposal of household or dry cell batteries would be very difficult to enforce, although the possibility of being fined would no doubt cause some residents to separate batteries from household waste. Prior to any sort of ban, alternative management systems need to be available and promoted.

The reusability of nickel-cadmium batteries make them attractive for general use. In homes, these cells are most commonly

found in household appliances, such as rechargeable razors, but they are often attached in such a way that removal for either recycling or safe disposal is difficult. Legislation restricting or taxing "hard wired" batteries could be adopted. Alternatively, a process to remove hard-wired batteries could be developed in coordination with appliance manufacturers.

A deposit-return system for household and automotive batteries could increase battery separation. Experience with beverage container deposit systems indicates that recovery through a deposit system can be 20% greater than through a voluntary return system. Experience in Japan shows that voluntary collection recovers a very small percentage of household battery waste. Widespread participation in curbside collection programs demonstrates that recovery is higher when recycling is made as convenient as possible. Therefore, a collection system combining incentives and convenience would result in the highest battery recovery rates.

One incentive could be a deposit applied to all household and automotive batteries. Such a deposit should affect all battery manufacturers equally and influence market shares as little as possible. In other words, all alkaline batteries would have the same deposit, as would all automotive batteries. The possible negative effects of implementing a combined voluntary/deposit program should not be overlooked. For example, scavenging for valuable batteries might result.

The ease of returning batteries for recovery is very important. Collection may be through household hazardous waste (HHW) programs. Permanent, HHW collection facilities offer residents greater convenience and, thus, divert more hazardous materials from disposal than intermittent collections. HHW collection programs, whether permanent or not, are very expensive. The State could provide financial and technical assistance to communities establishing these battery collections. A product charge on the sale of new batteries could provide a steady source of funds for battery management programs.

Recovery of batteries will be enhanced by convenient collection points. Programs in Japan, New York, and Missouri collect button batteries where they are sold, such as at jewellers and hearing aid stores and camera shops. Other points to be considered for dry cell collection are doctors' offices, electronics department, and hardware stores. Wet cell batteries may be collected at automotive supply stores. When automobile batteries are sold through retail outlets such as grocery stores, alternative collection facilities may be required. If retailers are encouraged or required to establish return programs for the batteries they sell, the liability of storing potential hazardous materials needs to be evaluated.

Household batteries can also be collected by curbside collection programs. This approach has been taken in much of Europe by using special lockable boxes distributed to residents for setting out household hazardous wastes, including batteries. Garbage collectors then unlock the boxes and remove the contents. Liability and risks to workers needs to be investigated. Curbside collection of automobile batteries is not likely to be as effective as point-of-sale collection.

Once effective separation and collection systems are developed, promotion and education are needed to assure public support. Promotion and education are particularly important for household battery collection since most citizens are unaware of any need to separate dry cells. Awareness of appropriate methods for managing auto batteries is greater since many repair shops have taken old batteries when replaced by new.

- Recycling

Recycling is the preferred practice for all batteries once they have been separated from the waste stream. For some battery types, such as wet cells, recycling is well-established and supported by a developed network of scrap collectors. Other batteries such as button cells have a less established market and network, and only certain types of these cells are accepted by recyclers. Alkaline cylinder batteries and nickel cadmium rechargeables are currently not considered valuable for recycling. Battery recycling has thus far been dependent on the economics of recovery programs and industry support. The wet cell battery industry has encouraged the recycling of its lead-acid product, while manufacturers of household dry cells prefer to market their product as "disposable" following a single use. Until recycling is economically and technically feasible for a particular type of cell, those cells should ideally be stored for future recycling at licensed hazardous waste treatment facilities.

Washington State could work toward developing recycling markets for waste dry cell batteries by providing an incentive to recycle. Imposing an environmental impact tax on all products, including batteries, would encourage manufacturers to produce recyclable products. This impact tax could be structured in degrees; i.e., products would be taxed according to the degree of their environmental impact or lack of recyclability. Under this system, a reusable or recyclable product, for example, one for which the industry had helped develop collection and end-uses, would be taxed less than a non-recyclable one. Tax monies could be used to educate the public, promote recycling, and fund research and development

of recycling techniques. The State should also consider contributing to national and regional efforts to establish end-users for household as well as for automobile batteries.

Although sorting the many different types of household batteries is very time consuming and costly, it is nonetheless necessary for recycling. The costs of separating batteries according to their metal content could be significantly reduced by a coding system. Several methods of coding have been suggested including color coding and printing the type of battery on the cell. Printing the mobius loop or chasing arrows recycling insignia or "return for recycling" on all wet cell and dry cell batteries would increase recovery. Further study is necessary to determine the most suitable labeling method for batteries, and any effort in this direction should be nationally or regionally coordinated and should involve battery manufacturers.

As with battery separation, recycling programs in Washington State need to be supported by vigorous, continuing State and local public education.

- Energy Recovery

Controlling toxic emissions from incinerators reduces waste batteries' environmental impact. Emissions are reduced by improving pollution control equipment on incinerators. The State could support a study to determine practical methods for reducing heavy metals in emissions from municipal incinerators. Such a study could evaluate existing systems as well as research new emission control equipment.

- Disposal

As with waste incineration, additional research would yield information about how to more safely manage household batteries in landfills. Evaluating mechanical systems to remove batteries from mixed municipal solid waste before incineration or landfilling would also be an appropriate role for the State.

(3) Barriers to Management

The primary barriers to improved battery management in the waste stream are:

- Inconclusive information on the environmental and public health risks of battery disposal in landfills and incinerators.

- Lack of economic incentives for recycling of most dry cell batteries and of some wet cell batteries.

- Lack of established markets for most dry cell batteries and lack of domestic processors and end-users for wet cell batteries (attributable to some degree to concerns about the liability of handling potentially hazardous material).

- Lack of recyclers, and collection networks for dry cell batteries.

- Lack of economical recycling technologies for dry cell batteries.

- Lack of unified support from the dry cell industry for recycling.

- The public's lack of understanding of what happens when batteries are thrown away.

- Household hazardous waste collection programs accepting batteries are not offered in all areas or as frequently as desirable.

(4) Recommendations

Recommendations for dry cell and wet cell battery management were developed from the preceding options and are organized according to the type of action required. The rationale and objectives for these recommendations are to:

- Eliminate environmentally harmful disposal of batteries.

- Provide for increasing separation and collection of batteries.

- Increase the recycling of batteries that have markets and develop new markets for currently unrecycled batteries.

- Legislation

  - Reduce mercury in alkaline batteries through product legislation.

  - Develop a process for separating "hard-wired" dry cell batteries from appliances destined for landfills or incinerators. This may involve bans, product taxes, or special programs and assumes that battery separation programs will be developed.

  - Ban landfilling and incineration of wet cell batteries and consider a disposal ban for dry cell batteries once separation and collection systems are developed.

- Establish deposit programs for wet cell batteries to encourage greater collection.

- Develop strategies for collecting dry cell batteries.

- Establish demonstration/pilot programs.

- Assure end-use, storage, and disposal options.

- Encourage voluntary programs.

- Require mandatory/deposit programs.

- Set up hazardous household waste programs.

- Provide for curbside or other collection.

- Educate the public about the importance of careful battery waste management.

- Provide funding for battery waste management programs.

- Levy an environmental impact tax or product charge to encourage manufacturers to decrease the negative environmental impact of their products (batteries as well as other products). Use the resulting revenue for battery and other material recycling programs.

• Research

- Evaluate heavy metal emissions control technologies for municipal waste incinerators.

- Evaluate mechanical systems for removing dry cell (and wet cell) batteries from mixed solid waste.

- Evaluate/propose a system for labeling dry cell batteries according to cell type and contents.

• Local Government (with State Funding)

- Collect wet cell and dry cell batteries through household hazardous collection programs, landfills or drop-off sites, and at battery retail sites.

- Educate the public about proper battery management and disposal methods available in the community.

- Procurement

  - Provide a preference in procurement for rechargeable batteries.

d. Disposable Diapers

(1) Background

"Disposable diapers" spark controversy. From a waste management perspective, the name "disposable diapers" seems self-contradictory. The product has come to symbolize a multitude of other products such as paper plates, razors, plastic utensils and fast food containers which are purposefully designed to be put out with the trash after only one or or very few uses. Such products increasingly frustrate attempts to reduce the volume of solid waste.

From the perspective of many parents and those caring for infants or incontinent adults, "disposability" is a reason to buy this product. Perhaps people assume they are managed through sophisticated "disposal systems." However, with greater attention being paid to waste, many consumers are considering the disposal consequences of their purchasing decisions, including the consequences of buying disposable diapers.

The debate over disposable diapers centers on the extent to which disposable diapers:

- Contribute to the waste disposal crisis
- Pose a public health hazard
- Create problems in sewage systems
- Contribute in a particularly noxious way to litter
- Consume natural resources at an unacceptable rate.

The following discussion will address each. The issue underlying much of the controversy is the question of whether "disposable" is good or bad. Those involved in the debate over disposable diapers are consumers, environmental groups, the paper and diaper manufacturing industries, the diaper service industry and, in Washington State, the King County Nurses Association.

- Presence in the Waste Stream

A national study estimates that 18 billion disposable diapers are purchased each year in the United States. The U.S. uses two-thirds of all disposable diapers, although they were originally developed and first used in Europe. Single-use diapers when disposed amount to 4 million tons of waste at a disposal cost of around $300,000,000 per year. Disposable diapers comprise 1% to 2% of the national waste stream, though lower estimates have been made on the basis of dry weight.

The use of disposable diapers in this country has increased steadily since their introduction in the early 1960's to account for over 80% of all diapering changes. In addition to their use for infants, a significant increase is being observed in their use for geriatric care.

About 300 million disposable diapers were used in Washington State in 1988. The 1987 Washington Department of Ecology (WDOE) Recycling and Waste Stream Study found that disposable diapers make up 1.5% of the State's total waste stream (61,500 tons per year). 58,000 tons of these disposable diapers were contained in the residential subwaste stream where they contributed 3.2% by weight. The remainder were found primarily in the commercial waste substream.

Disposable diapers are composed primarily of fiber (paper or cloth) and plastic liners. Within the last few years, disposable diaper manufacturers have increased the use of super absorbent polymers (plastics) in place of some of the absorbent cellulose to reduce diaper bulk and dampness. After use, disposable diapers are bulky and usually wet.

No specific data are available on the volume of landfill space required for disposable diapers, although on a density basis it is probably not much more than the mean volume required for most items (disposable diapers probably do not significantly alter compaction or settling efficiencies in landfills). Information on thermal content, combustion efficiency, and emissions produced by disposable diapers when burned in municipal incinerators is not available; however, they likely have minimal impact on ash generation and do not contribute to emissions to any greater extent than similar paper and plastic materials which are fairly abundant in municipal solid waste.

Disposable diapers have rarely been dealt with under any strategy other than collection and disposal. They have not been targeted for recycling or separation other than on a limited and experimental basis. No end-use or processing technology is currently available to recover the material from soiled disposable diapers though some experimental recycling efforts are underway.

- Health Risks

Concerns about the risks to health posed by disposable diapers focus on three issues: health of diapered infants, health of waste handlers, and the fate of diaper viruses in solid waste landfills. Concerns about the adverse effects of disposable diapers on a child's health have included incidence of rashes, isolated incidents of children swallowing bits of plastic torn from the liner, and uncertainty about the presence of

dioxins in paper products and the effects of long-term exposure to absorbent polymers. On the other hand, disposable diapers' contributions to health, such as protection from dampness, reduction in rashes, and avoidance of allergic reactions have been cited. Information on the health risks or benefits of disposables for infants is inconclusive. Ninety five percent of U.S. hospitals and nearly all day care centers rely on disposable diapers. It is not clear whether this preference is based on convenience or health.

Over 100 different viruses are known to be excreted in human feces and some of these including polio and hepatitis are likely to be found in throw-away diapers left at the curb. Waste handlers (and diaper changers) may be exposed to these diseases, yet no studies have linked these occupations with any greater incidence of viral infection than other jobs.

Once disposable diapers are dumped in landfills, there is a risk that viruses will migrate off-site in leachate or be transmitted to humans by vectors. Though this is a valid concern, no studies have shown this to be the case. Studies by EPA and others indicate that the physical and biological environment of a landfill quickly destroys most viruses.

From a public health standpoint, the wastewater system is the preferred method of handling human wastes. Some jurisdictions may restrict human wastes from the solid waste stream, but this does not prevent people from placing soiled diapers in refuse.

Most disposable diaper packages instruct users to first rinse disposable diapers in the toilet before putting them in the garbage. Because of the inconvenience, very few people probably do this.

In summary, throw-away diapers pose health risks. Presently, this risk is not considered great enough to warrant special management or the classification of this item as an infectious waste. Household hazardous waste, designated infectious medical waste, and asbestos warrant greater concern than do disposable diapers. Additional objective research on the health risks of disposable diapers is needed.

- Sewage Systems

In the past, disposable diaper manufacturers recommended that users separate and then flush the paper section of waste diapers in toilets. Maintenance crews reported sewage system blockages tracing the cause to improper flushing of disposable diapers. These incidents were isolated; however, diaper manufacturers no longer recommend flushing parts of disposable diapers. It is also difficult to separate the plastic

- Bans on disposable diapers
- Product surcharges
- Requirements that disposables be biodegradable
- Consumer education

It has also been suggested that diaper service companies be eligible for waste diversion credits. One firm in Seattle, Washington and another firm in Ontario, Canada are experimenting with recycling technology for disposable diapers. The following discusses possible management measures, none of which have yet been implemented.

- Diaper Ban

Although legislative attempts have been made to ban disposable diapers, none to date have been successful. Legislation has also addressed biodegradability of disposable diapers. As many jurisdictions are considering bans on various products or packaging material as a way to reduce waste, it is safe to assume that bans on disposable diapers will again be attempted.

- Surcharge

A tax placed on disposable diapers to cover the costs of waste management would make alternatives such as diaper service or home laundering more economically attractive. However, it could also penalize users for whom alternatives are difficult or not available. Such users include low-income inner city residents who do not have access to diaper service or convenient laundering facilities. If the primary purpose of the surcharge were to discourage sales, it would need to be a significant amount. If the primary purpose of the surcharge were to fund recycling or waste reduction efforts, an analysis would be required to establish an appropriate amount.

- Biodegradability

A number of companies have recently developed "biodegradable" disposable diapers that are designed to decompose within 2 to 15 years rather than the estimated 500 years required for normal plastic components. (Cloth diapers degrade in about a year.) Whether biodegradation will occur in landfills when oxygen is absent is in dispute. Also in dispute is whether a biodegradable product is preferable when the chemical effects of biodegradation are unknown and when attempts to stabilize landfills and recycle plastics may be thwarted by biodegradable plastics. Making diapers completely from paper fibers has also been suggested as a means of promoting decay in landfills.

Other options include requiring that all diapers be recyclable (i.e., have established collection, processing, and

end-user infrastructures); that they be flushable; or that disposable diapers manufactured for sale in the State have a minimum content (e.g., 50%) of post-consumer recycled material.

- Consumer Education

Consumers should be educated about alternatives to disposable diapers (such as a diaper service). They should also be instructed about proper disposal of throw-aways. Education has thus far been undertaken almost exclusively by environmental action groups or by diaper services. Consumer education programs could use a variety of settings to reach parents or others who buy diapers. As with other waste management education programs, all economic and cultural groups must be addressed.

To reduce the potential for public health risks from disposable diapers, consideration could be given to requiring notification at the point of sale of proper and legal disposal methods. A program to educate waste haulers about requirements and precautions in handling residential waste containing disposable diapers and infectious and hazardous materials might also be considered.

- Diversion Credits

Nationwide, the diaper service industry reports recent increases in use of its service, reversing a trend in effect since the 1960's when disposables were developed. However, many areas still do not have access to diaper service. Granting waste diversion credits or some other financial assistance to diaper service companies could induce firms to establish themselves in underserved areas. It could also make diaper service more economically attractive to consumers.

- Disposable Diaper Recycling

Anderson Diaper Service of Seattle recently initiated a disposable diaper recycling service. A similar pilot scale operation has been initiated by the Tryon Trading Company in the region of Halton, Ontario, Canada which will provide curbside collection of waste disposable diapers for recycling. In the Seattle effort, new disposables are delivered to customers and used ones picked up. The company has developed a cleaning system that allows it to recover paper and plastic from the diapers. It has market arrangements with three paper recycling companies, a composting firm, and a plastics broker. The firm reports that it meets Health Department requirements. It is refining its technology with help from Weyerhaeuser chemists. While Anderson's intended

to start service in January 1989, a November article in the Seattle Post-Intelligencer prompted 300 calls causing the company to start its program early.

While the effectiveness of these efforts is yet unknown, they do signal a private sector response to an environmental problem. The potential for innovation is great and sound public policy should provide guidance to industry.

(3) Barriers to Management

Barriers to proper management of waste diapers impede each management objective. Particular barriers to managing disposable diapers include the following:

For achieving the State's goal of reducing the volume of disposable diaper wastes in the waste stream, major barriers are:

- Consumer preference for disposable diapers.
- The lack of a significant price difference between diaper service and disposables.
- The lack of consumer awareness of the potential problems caused by disposables.
- The lack of publicity for the diaper service option.
- The unavailability of diaper service or other alternatives to some potential users, due to economics, geographics, or age. (The incontinent and geriatric diaper market is especially resistent to alternatives.)
- The lack of a proven technology for recycling disposables.

For achieving the State's goal of proper disposal of throw-away diapers, major barriers are:

- The lack of definitive data on public health risks from disposable diapers in the solid waste stream.
- The lack of a published standard for proper disposal.
- The physical construction of disposable diapers - separating paper from plastic is difficult as is shredding the paper section for safe flushing.

(4) Recommendations

A management approach to disposable diapers as a special waste should focus on:

- Research directed at product design and safe disposal.
- Waste reduction and provision of alternatives.

(a) Research Directed at Product Design and Safe Disposal Should:

- Focus on public health, environmental and disposal impacts and benefits of disposable diapers.
- Develop state or federal standards for disposable diaper design which encourages recycling or allows them to be easily separated and flushed. A requirement that a percentage of recycled fibers be used in the production of disposable diapers would help develop market for recyclable paper.
- Clarify State and local regulations governing solid waste disposal practices for waste disposable diapers.
- Evaluate the effectiveness of privately conducted disposable diaper recycling projects in Seattle and elsewhere and support these efforts where possible.

(b) Waste Reduction/Provision of Alternatives

- Survey the use of disposable diapers at State-operated or funded hospitals, day care centers, and nursing homes and consider these locations for demonstration projects on alternatives to throwing away disposable diapers. If future findings warrant the need for a product ban or tax, State and county-operated institutions might test these restrictions or mandates requiring the use of cloth diapers.
- Survey the availability of diaper service to Washington residents. Evaluate opportunities for supporting and encouraging diaper service operations in unserved or underserved communities of the State. These services may be logical candidates for diversion credits should this incentive be offered for recycling and waste reduction.
- Educate the public about alternatives to disposable diapers (such as diaper service) through existing waste reduction and recycling educational efforts and through hospitals' maternity wards.

- Consider a product charge or tax, similar to that on tires, to finance the recommended study of public health and environmental impacts and benefits of disposable diapers, to fund pilot recycling efforts, and to fund incentives for using alternatives.

State policy may not significantly reduce the volume or potential health risks of disposable diapers. But State policy can focus public attention on the issues of disposal and responsible buying.

e. Expanded Polystyrene

(1) Background

Expanded polystyrene or polystyrene foam (PSF) is a low-density material often used in the manufacture of insulation, packing material and disposable containers, particularly for food and beverages. Polystyrene foam is frequently referred to as "styrofoam," although use of this term is reserved as a trademark for materials produced by the DuPont Company. Besides its low density (anywhere from 0.7 to 10 pounds per cubic foot), expanded polystyrene offers heat resistance, buoyancy, low cost per volume, and its high stiffness-to-weight ratio.

Polystyrene is one family of polymers in a group of four which represent approximately 70% of U.S. plastic resin sales.

(a) Polyethylene (PE)

This family consists of both high-density (HDPE) and low-density (LDPE) types which together account for 65% of the plastic packaging manufactured. LDPE is the material used in 70% of all packaging films or flexible plastics. Over half of the LDPE is used for "disposable" consumer products such as trash bags, sheeting, bottles, diaper backing and dairy, bakery or food containers. Over 50% of the HDPE is also for "disposable" packaging for such items as milk, motor oil, household chemicals, bleach, cosmetics, and ice cream as well as for many plastic caps and lids. More durable uses of HDPE include pipes, gas tanks, trash cans, industrial containers, and auto parts.

(b) Polyvinylchloride (PVC)

This versatile plastic has many subfamilies and its major use (48%) is for construction pipes and conduits. Other durable uses include wire insulation, auto parts, adhesives, coatings, records, shower curtains, garden hoses, dolls, inflatable toys, and house paneling or siding. Twenty four percent of the PVC produced in a year is discarded that same year. Disposable PVC is used in the manufacture of credit cards, blood bags, medical tubing, clear bottles for shampoo, cleaning solutions, and detergents and for food containers such as edible oil bottles and film wraps for meat. This family is the one most used in construction applications and the one for which toxic by-products from incineration are of greatest concern.

(c) Polypropylene (PP)

Use of polypropylene has increased rapidly over the last decade. This material is tougher than PE and is commonly used in applications such as molded hinges or lids which must have the strength to be open and shut many times. Durable applications include pipes, furniture, luggage, battery cases, coatings, and appliance parts. Other uses include containers and lids as well as fibers in rope strapping, string and carpeting.

(d) Polystyrene (PS)

Polystyrene accounts for 12% of packaging plastics. Nearly 40% of polystyrene resin goes to packaging. In its expanded or blown (foam) form, it is used for coffee cups, egg cartons, takeout food containers, construction board, thermal insulation, and flotation devices. Nonblown applications include durable items such as cassettes, toys, refrigerator liners, electrical outlets, auto parts, and furniture. Disposable, nonexpanded PS items include dairy and yogurt tubs and lids, disposable plates and cutlery, medical containers, combs and brushes. The expanded form of polystyrene and particularly its use in packaging or disposable containers and its impact on solid waste management are the focus of this discussion.

(e) Other

Other common plastics include: Polyethylene Terephthalate (PET) which is distinct from the other PE's listed and is used in soft drink and other bottles as well as in numerous other disposable and durable ways. PET is rapidly replacing some other resins for use in food containers. Acrylonitrile-Butadiene-Styrate (ABS) is used in engineering plastics (telephones, pipe, safety helmets) and for margarine tubs, among other items. Many other resin types such as polyurethanes, epoxies, nylons, polyesters, and vinyls are also found but are not as prevalent in the waste stream as those which have been discussed.

Polystyrene foam products, especially take-out food and beverage containers, have become an environmental concern or, in some communities, a problem waste. These concerns are:

Atmospheric degradation by Chlorofluorocarbons (CFC's)
Damage to Wildlife
Litter
Impacts on Solid Waste Disposal
Recyclability

- Atmospheric Degradation by Chlorofluorocarbons (CFC's)

Polystyrene foam is a type of plastic made from petroleum-based polystyrene beads. The beads are expanded through the use of hydrocarbon blowing agents -- chlorofluorocarbons, including CFC-11, CFC-12, and HCFC-22. A primary issue surrounding expanded polystyrene products is that the use of chlorofluorocarbons (CFC's) in manufacturing contributes to depletion of the ozone.

During production of polystyrene foam products, CFC's are released into the atmosphere and they continue to be emitted at a slow rate from products for up to 25 years.

CFC's are also used as coolants in refrigerators and air conditioners, and as cleansers for electronic parts. These applications also result in a loss of CFC's to the atmosphere. According to the Food Service Packaging Institute, only 3% of chlorofluorocarbons go into the production of polystyrene foam food packaging.

A chemical reaction involving CFC's results in ozone depletion in the upper atmosphere through the following process. A CFC molecule (composed of carbon, chlorine, and fluorine atoms) reacts with ultraviolet (UV) light releasing chlorine atoms that in turn react with ozone molecules (composed of 3 oxygen atoms) to form chlorine monoxide. If the chlorine monoxide encounters another oxygen atom, the two oxygen atoms combine, freeing the chlorine atom to react with another ozone molecule. One chlorine atom is capable of destroying up to 100,000 ozone molecules before it is removed from the atmosphere.

CFC's released at the earth's surface take as long as eight years to reach the upper atmosphere where the ozone layer is found. The reserves of CFC's which have built up in the lower atmosphere will result in ozone depletion well into the next century, even if their release ceased immediately. CFC-11 persists in the atmosphere for approximately 75 years, CFC-12 for about 100 years.

Since 1978, concentrations of CFC-11 and CFC-12 in the atmosphere have increased at a rate of 5% each year. The northern hemisphere ozone layer has decreased by 1.7% to 3.0% each year, with the greatest impact from CFC reactions occurring in the winter months. This depletion in the ozone layer has significant consequences for biological systems on earth.

The thin layer of ozone molecules in the stratosphere protects the earth from ultraviolet (UV) radiation which, at a high strength, is harmful to humans, plants, and animals. Scientists feel that an increase in UV light on earth will result in the increasing incidence of nonmelanoma skin cancers and cataracts as well as a reduction in the responsiveness of immune systems. Dermatological research indicates that for every 1% increase in ultraviolet radiation reaching the earth's surface, the incidence of skin cancer could increase by 2%.

Besides the destruction of ozone molecules, CFC's also contribute to the "greenhouse effect." CFC's in the atmosphere absorb infrared radiation from the earth's surface and trap

heat in the troposphere or lower atmosphere. Increasing levels of other chemicals in the troposphere, particularly carbon dioxide, also contribute to this effect. The greenhouse effect results in higher temperatures on the earth, which may have extreme adverse environmental consequences, including a rise in sea level, flooding, decreased agricultural production from disrupted rainfall patterns, and the extinction of certain plants and animals that are sensitive to temperature changes.

It is important to note that the production of CFC polystyrene foam packaging is a small contributor to the problems of ozone depletion and the greenhouse effect; however, there are alternatives to the use of CFC's in polystyrene foam production while other applications of CFC have not yet found acceptable substitutes. As a result of substantial evidence of both ozone destruction and contribution to the greenhouse effect, and as alternative blowing agents are found, CFC production is declining. Many manufacturers of polystyrene foam products have turned to newly FDA-sanctioned hydrochlorofluorocarbons (HCFC's) as blowing agents. Because these compounds have one hydrogen atom, they degrade more readily than CFC's.

Another alternative is HCFC-22. Although this compound has a relatively long atmospheric lifetime (22 years), its ozone-depleting potential is only approximately 5% of that of CFC's 11 and 12. However, a combination of continued economic growth and the substitution of polystyrene foam for other products could result in more CFC release -- the lower ozone-depleting potential of HCFC-22 may partially offset its increasing use.

Major producers of CFC-containing foam products, represented by the Food Service and Packaging Institute, after negotiating with environmental groups (the Environmental Defense Fund, Friends of the Earth, and the Natural Resources Defense Council) stopped using CFC's in manufacturing food service packaging at the end of 1988. The agreement also includes the pledge to develop an economical and environmentally safer substitute for HCFC-22.

The U.S. EPA recently issued a final rule which freezes CFC production at 1986 levels and calls for 20% and 50% reductions in CFC production over the next 5 and 10 years, respectively. Under terms of the "Montreal Protocol" agreement, major chemical companies have gone beyond the EPA mandate and are committed to spending millions of dollars to rapidly developing alternatives to CFC's and other ozone damaging materials. In many cases, a transition to new blowing agents will require major modifications to plant equipment. Pentane and butane are substitute blowing agents currently being used, although the use of pentane is regulated in some areas

because it contributes to air pollution. Given advances in technology, water could eventually become the primary blowing agent for a number of applications.

- Damage to Wildlife

When disposed of improperly, polystyrene foam is dangerous to marine and other wildlife. Carefully controlled studies of polystyrene foam's effects on wildlife have not been undertaken; however, necropsies of many species of seabirds, sea mammals, and land mammals such as bears have revealed pieces of foam in their digestive systems. This material is thought to interfere with proper metabolism of food, causing intestinal blockage and ulceration of the stomach. These conditions may lead to reduced appetite, lowered breeding activity and, in some cases, death.

Birds from a number of species have been known to die from ingesting various plastics, including polystyrene foam. Plastics, including foam products, have been found in the stomachs of at least 50 of 280 species of seabirds. Sea turtles have also been known to swallow pieces of polystyrene foam.

One report mentions that pieces of polystyrene coffee cups are known to be eaten by many marine life forms including birds, mammals, turtle and fish species. Polystyrene debris is common in the ocean; one study found that 80% of floating ocean debris was plastic and more than a third of that was pieces of polystyrene foam. It is not known what portion of this is comprised of packaging; expanded polystyrene is used for its buoyant qualities in many floating dock and buoy applications.

- Litter

Expanded polystyrene packaging and products and other plastics also raise concern because they add to the litter problem. In the 1987 WDOE litter survey, 6.3% of the litter items along Washington State highways were plastic packaging (aside from PET soft drink bottles which were counted separately). The survey did not specifically address the composition of polystyrene foam packaging in litter. Takeout food packaging in general was 2.6% of the litter stream, up 170% from 1982. More than 15 items of this type were found per mile. The "cups, lids, and straws" category (not included in "takeout food packaging") was 10.17% of the litter stream; such items were found 59.3 times per mile, an increase of 70% since 1982.

Nationwide, litter studies which have specifically quantified polystyrene foam, show it as a significant portion of the debris found along beaches. California has identified polystyrene foam as the largest component of beach litter besides glass and bottles; it was found to be 5.6% by weight of the material collected along 300 miles of coastline. Polystyrene products encountered included fast-food containers, coffee cups, packaging and ice chests.

Oregon beach clean-ups in 1984, 1985, and 1987 found that polystyrene foam items ranged from 20% to 60% of the number of pieces of litter picked-up. In some areas, as much as 92% of the items collected were composed of expanded polystyrene. A Texas coastal clean-up found an average of 11% of all items to be cups, buoys, and miscellaneous pieces of polystyrene foam. Similar results were found in Maine.

Besides beach surveys, several litter studies have specifically quantified polystyrene foam. A study of Ohio parks found that polystyrene coffee cups were the most prevalent item in the beverage container category. The total beverage container category ranged from 1% to 25% of the number of pieces found at various campgrounds, picnic areas, and beaches. In a 1986 Michigan Department of Transportation study, plastic food containers and plastic fast food drink containers made up 38% of the plastic items and 8% of the total items found in a 30-day accumulation of litter along state highways. The corresponding categories of paper items accounted for 10.4% of the total litter waste stream.

Designing plastics which are biodegradable or photodegradable is one way to reduce the land and marine litter problems associated with plastics. If certain compounds are blended with plastic resins in the manufacture of plastic coffee cups, takeout food containers, six-pack holders, candy bar wrappers, or plastic disposable diaper liners, the items will breakdown into very small plastic fragments in as little as 60 days or as long as two years of exposure to (UV) sunlight or microorganisms, depending on the concentration and composition of the special light-sensitive polymers or biodegradable additives/enzymes.

The concept of plastic degradability raises a number of issues which have not yet been thoroughly considered such as the effects of the tiny fragments biodegradation produces, the desirability of degradation in landfills, product performance and standardization, consumer preference and disposal behavior for materials identified as "environmentally safe," potential

for cross-contamination, and conflicts with efforts to recycle plastics. Even small amounts of degradable resins or materials found in post-consumer plastics could ruin large-scale efforts to recycle plastics, since most recycled plastic products are not meant to be degradable. Biodegradability is being considered for polystyrene foam packaging.

- Impacts on Solid Waste Disposal

The filling of valuable landfill space by expanded polystyrene and other types of plastics also causes concern. Data show that in 1987 an estimated 25,000 tons of expanded polystyrene (including food packaging, and packing material) were disposed of in Washington State, primarily in landfills. This represents 0.6% of the total tonnage of wastes disposed in the State. Nationally, industry figures place polystyrene foam food service items at approximately 0.25% of municipal solid waste (by weight). A study done in Quebec found that plastic foam products accounted for 0.33% of the total waste stream, while the Rhode Island Solid Waste Management Corporation has calculated that as much as 5% of that state's waste stream (by volume) could be composed of polystyrene foam fast food packaging.

According to the U.S. Environmental Protection Agency, plastics comprise 7.3% of the disposed national waste stream by weight. This compares to a Washington State figure of 7.4% in 1987 (0.2% PET, 0.3% HDPE, 4.7% plastic packaging, 0.6% expanded polystyrene, and 1.6% other plastic products). However, the preponderance of bulky packaging in plastics waste means that the volume of plastics in solid waste is much greater than its relative weight. Some solid waste managers have argued that, in a landfill, plastics do not compact well, thus creating pockets of differential settlement, leading to landfill instability.

Not much information is available on the amount of space plastics occupy in a landfill. Uncompacted mixed plastics weigh approximately 38 to 49 pounds per cubic yard. Compaction may increase their weight per cubic yard by two or three times. For comparison, aluminum cans weigh 74 pounds per cubic yard uncompacted and 250 pounds per cubic yard flattened; glass containers are 600 to 1,000 pounds per cubic yard whole, 1,000 to 1,800 semi-crushed and 1,800 to 2,700 mechanically crushed; corrugated cartons are 300 pounds per cubic yard loose and 1,000 to 1,200 pounds per cubic yard baled.

Like most other plastics, polystyrene foam is not considered biodegradable, though some manufacturers are promoting new

plastic resins which can be designed to degrade in the presence of light or other elements. Perceptions differ on whether biodegradability is considered beneficial or detrimental in a landfill. Items which degrade or decompose in the anaerobic conditions of a landfill generate methane, contribute to dissolved substances in leachate, and cause void spaces to develop which result in landfill instability. It may be preferable for plastics in a landfill to remain intact rather than to be gradually broken down and incorporated into leachate and potentially transported off-site as microscopic hydrocarbons (as may occur if plastic polymers were to incorporate degradable resins). Inert plastics are considered by many to be one of the safest items in a landfill; in fact hazardous waste landfills are normally lined with plastic (often HDPE) to protect ground water.

The incineration of plastics raises concerns about the generation and emissions of toxic compounds. Debate has focused on hydrochloric acid gases, dioxins, and furans which can be by-products of incinerating halogenated plastic resin (principally PVC plastics which have a high chlorine content). Toxic by-products can be minimized by proper combustion temperatures, and by efficient and well-maintained, state-of-the-art emission controls.

If all plastics were removed from the incinerated waste stream, toxic emissions might still be generated as a result of the chlorine and dioxin currently found in paper and other non-plastic components of the waste stream. Plastics packagers have shifted toward using more resins widely perceived as being "clean-burning." For example, halogenated or chlorinated resins can be replaced with polyolefins. Partly to alleviate public concerns over toxic emissions, PET has replaced PVC in the manufacture of many food oil containers. Polystyrene foam products have not been associated with the generation of toxic compounds in municipal waste incinerators.

- Recyclability

Another concern about polystyrene foam products and particularly those used in takeout food packaging is their limited recyclability. Difficulties with separating, collecting, transporting, and processing post-consumer plastics have limited most recycling of post-consumer plastics to PET soft drink bottles and HDPE milk jugs. While other post-consumer plastics recovery is beginning, it is primarily focused on mixed plastics and plastic films. However, a few sites in Washington accept polystyrene.

Technically, polystyrene foam containers can be recycled. According to industry representatives, nearly all polystyrene foam plant scrap is recycled. Often the scrap from a food-related product becomes a non-foam polystyrene product not for use with food. However, additional barriers impede the recovery of post-consumer polystyrene foam food packaging. Unlike plant scrap,post-consumer polystyrene foam waste is usually highly contaminated, not separated from other materials, and not always aggregated in large quantities at a single location.

In one experimental project, Amoco Foam Products, Inc. is working with McDonald's restaurants at 20 locations in New York City and on Long Island to use recovered polystyrene foam food containers in the manufacture of foam board for roofing and insulation. The material will be washed, chopped, and shipped to an Amoco plant. Amoco will pelletize the material and re-extrude it for insulation board. In a similar undertaking, Mobil Chemical Company is developing a plant in Massachusetts which will recycle and repelletize polystyrene foam from fast food containers and high school lunchroom trays in the Northeast to manufacture thermal insulation and packaging products.

Another possible application for post-consumer polystyrene foam is in mixed plastics recycling, which involves the blending of several resins. Researchers at Rutgers University are experimenting with using polystyrene foam in mixed plastics lumber. One manufacturer of mixed plastics lumber and bumpers reports there is no technical reason that post-consumer polystyrene foam could not be used in the company's process. Developmental work by the company has shown that polystyrene foam can be used at levels as high as 30%, depending on the material's end-use. Polystyrene foam is not, however, the manufacturer's first choice of materials because of its bulk in the production process.

Whether polystyrene recycling will prove commercially feasible remains to be seen. Transportation costs, cleaning costs, and undeveloped collection networks are the primary barriers that would need to be overcome.

The alternatives to the polystyrene foam in disposable food containers -- paper or plastic-coated paper -- are not being recycled either, though they are technically recyclable. One study mentions six technologies, some in the pilot stage, for recycling plastic-coated paper. Most of these systems target recovery of paper fibers, but two have the ability to recover the plastic coating as well. Four of the systems identified can use post-consumer materials.

(2) Management Options

A number of options for managing expanded polystyrene are available. The first option is to continue to deal with expanded polystyrene only as a non-differentiated waste stream component. Consideration of other options should focus on particular concerns. For example, objectives might be to reduce the contribution of expanded polystyrene to litter, or to reduce impacts on the ozone layer and increase recyclability. Approaches may be based on particular uses of the material, such as in disposable takeout food containers, or may target all applications and the manufacturing of the material.

A number of communities and states have banned polystyrene foam products.

- The City of Portland, OR -- In January 1989, Portland prohibited restaurants and retailers from serving food in polystyrene foam containers manufactured with CFC's or similar ozone-depleting substances and banned the use of any polystyrene foam food containers by these establishments after 1990.

- Berkeley, CA -- In September 1988, Berkeley banned CFC polystyrene packaging and instituted voluntary waste reduction program to reduce by 50% nondegradable takeout food packaging and to reduce related litter and waste.

- Los Angeles, CA -- Los Angeles issued an executive order banning city purchase of polystyrene foam products.

- Palo Alto, CA -- Palo Alto banned CFC polystyrene packaging by June 1989.

- Santa Monica, CA -- Santa Monica banned polystyrene from two McDonald's locations near beaches.

- Suffolk County, NY -- Suffolk County banned polystyrene and PVC or other non-degradable plastic packaging at retail food establishments after July 1989. The ban is being contested in the courts.

- Florida -- CFC polystyrene foam products will be banned in Florida by October 1990, and polystyrene and plastic-coated paper fast food containers which are not degradable in 12 months or less, by January 1992.

- Maine -- Maine has banned the state use of nondegradable food and beverage containers, and instituted a ban on CFC polystyrene foam products effective January 31, 1989.

- Massachusetts -- A Massachusetts executive order bans state purchase of disposable polystyrene cups and plates made with CFC's. All nonrecyclable polystyrene to be banned by June 1989.

- Minnesota -- Minnesota will ban CFC - containing products by January 1990.

- Rhode Island -- Rhode Island has banned CFC food service products, created a permanent commission to plan recycling of plastic and foam food service products and developed guidelines for the use of photo- and biodegradable products.

- Vermont -- Vermont has ended state purchases of polystyrene foam products.

- Washington -- In 1988, Washington's governor issued an executive order directing state cabinet agencies to stop using polystyrene unless no substitute was available.

- At least 14 states have enacted legislation requiring that certain plastics (most often plastic six-pack holders) be biodegradable: Alaska, California, Connecticut, Delaware, Florida, Maine, Massachusetts, New Jersey, New York, Oregon, Rhode Island, Tennessee, Vermont, and Wisconsin. Similar regulations are being developed at the federal level and should be ready in the fall of 1990. Congress has also instructed the Department of Defense to assess the feasibility of using degradable plastics. This study is due by March 1990.

The suit against Suffolk County, New York has been brought by the Society of the Plastics Industry, the Flexible Packaging Association and other industry groups. The suit alleges that the county violated state law and the U.S. Constitution by banning certain plastic materials. Court action on other state or local bans can be expected. When considering bans it is important to work with industry representatives so that ultimate actions are legal, practical and consistent with waste management and community goals.

Very few approaches other than bans have been proposed to regulate plastics, although a number of alternatives may be effective. For example, requiring that retailers provide alternatives to plastic or polystyrene foam packaging. Alternative management strategies could emphasize education, source separation, and recycling. Post collection recovery or special disposal are not considered effective for this material, as it is very difficult to separate from the waste stream.

(3) Barriers to Management

The primary barriers to best management of expanded polystyrene in the waste stream are:

- Dependence on and perceived consumer preference for disposable packaging for takeout food. A clear comparison, showing costs and benefits of alternative packaging, is not available.
- Lack of the collection, transportation, and processing capabilities and end-use markets required for expanded polystyrene recycling. These barriers impede plastics recycling in general.
- The lack of a clear and consistent national or regional policy on the biodegradability of plastics.
- The lack of economic incentives for consumers to use alternative packaging. The absence of incentives motivating manufacturers to devise production practices which reduce waste and environmental damage.
- The lack of data on the effectiveness of product regulations and bans.
- The lack of public concern or awareness about the need to reduce litter and protect wildlife from the irresponsible disposal of plastic trash.

(4) Recommendations

Objectives for the following recommendations are to:

- Ensure that the production of expanded polystyrene is as environmentally safe as possible.
- Appropriately manage expanded polystyrene in a manner which is consistent with similar packaging products. Management should take into account expanded polystyrene's impact on litter, wildlife, and the waste stream.

The principal concern surrounding expanded polystyrene is the impact of its production on atmospheric ozone. Industry is phasing out CFC's and developing alternative blowing agents. State action would reinforce and, perhaps, accelerate these efforts. In addition to this initiative, the State should undertake or support a broader review of methods to reduce CFC's and other emissions which destroy ozone. Leaks of CFC's from refrigeration systems and the wide-spread use of CFC's as a cleaner in the electronics industry should be of equal or perhaps even greater concern than their use in the manufacturing of polystyrene foam.

Recommendation

Ban the production or sale of expanded polystyrene foam products which are manufactured using chlorofluorocarbons (CFC's). Analyze the environmental effects of alternative blowing agents (such as hydrochlorofluorocarbons, HCFC's) and undertake a review of substances used in other applications which contribute to ozone depletion.

Human carelessness exacerbates the problems expanded polystyrene causes wildlife. Similarly, litter problems should not be attributed solely to the material itself. If polystyrene were replaced with some other material in takeout food container applications, the litter problem would not go away. Litter reduction programs are in place and should be the major focus in dealing with litter in general, including all plastics.

The degradability of polystyrene foam and other plastic and nonplastic materials is an issue the State must address. If the State requires degradability in certain items, consideration needs also to be given to the broader policy of plastics recycling. The following should be considered:

- Degradability in certain plastic products such as ring connectors can reduce litter and wildlife impacts.
- Degradability in plastics is not necessarily desirable in landfill or incineration disposal.
- Degradability in plastics is not desirable in items which have potential to be recycled.
- Degradability in plastics can contaminate other recyclable plastics.
- Degradability in plastics containing certain reactive resins may harm the environment.
- Degradability in plastics has implications for product performance and standardization.
- Degradability in plastics may affect public perception and buying and disposal practices. The end result may have both positive and negative implications.
- The degradability of plastics and alternatives to plastics should be analyzed similarly.

Recommendation

Evaluate whether or not degradability in plastics is an appropriate management strategy.

The waste stream impacts and recycling problems associated with waste polystyrene foam do not disappear if the material is replaced with an alternative multi-material or plastic-coated paper. The volume of expanded polystyrene in the waste stream is small in comparison to other components such as yard waste, wood waste, and waste paper. Expanded polystyrene takeout containers should be included in a larger examination of ways to reduce packaging and "disposable" products (which are estimated to account for over 30% of the municipal waste stream). Policy Recommendations in Section G of this report define methods to both reduce the volume of packaging and disposable products and expand recycling of these items.

Recommendation

In evaluating statewide packaging regulations (Policy Recommendations, Section G), target expanded polystyrene foam packaging.

Provide incentives or mandates to encourage manufacturers of disposable expanded polystyrene foam and other takeout food packaging materials to provide collection and recovery systems for cost-effective recycling of these materials.

# SECTION E

# MARKET DEVELOPMENT STRATEGIES

## 1. INTRODUCTION

Successful recycling requires that recoverable materials be separated and collected from the waste stream, supplied to end-users for remanufacturing into new products, and that these new products be purchased by consumers. In the past, many recycling programs have focused primarily on the collection of recyclable materials. Now, however, state and local governments are recognizing that providing assistance solely on the supply side of the secondary materials economy will not assure a demand for recycled products; that assistance must also be provided on the demand side. The purchase of recycled products completes the recycling circle.

The purpose of market development is to improve demand for recyclable materials, encouraging businesses and industries to process and use secondary materials. Government involvement to assure an adequate supply of non-contaminated materials has resulted in some new, unassisted expansion of markets for key recyclable commodities in such states as New Jersey and California (i.e., increased supplies in some areas have attracted new end-users). However, a potentially rapidly increasing supply of secondary materials throughout the country requires developing new demand for these commodities.

Government agencies can encourage demand for recyclable materials in a variety of ways. These are described in great detail in Subsection 2. Federal, regional, state, and local government involvement in market development is essential for the continued expansion of recycling efforts, particularly if collection efforts are to be increased. A number of governmental organizations, such as the National Conference of State Legislatures, the Eastern Regional Conference of the Council of State Governments, the New England Resource Recovery Conference as well as many state governments, have adopted policies supporting government involvement in recycling market development.

This new area of involvement by public agencies provides opportunities for economic growth, environmental protection, and reduction in waste disposal costs in addition to accomplishing materials recycling objectives. Successful market development requires cooperation among public agencies, the private sector, and independent jurisdictions.

The strategies outlined here cannot address all the uncertainties associated with future markets for recovered materials. None can be expected to prove 100% effective in guaranteeing strong markets. However, they should be judged worthwhile if they result in even a modest expansion or stabilization of market demand. Well-designed approaches can contribute to stabilizing markets, but may be limited in their impact on market development.

The purpose of market development is to lower and overcome barriers preventing markets from absorbing the full amount of available recoverable

material. Market barriers for specific commodities in Washington State are presented in Subsection 3. Generally, these barriers for particular materials fall into one of the following categories:

- Low demand for a recyclable material due to inadequate or inconsistent supply.
- Low demand for a recyclable material due to inadequate processing or consumption capacity.
- Low demand for products made from recycled materials.
- Market economics preventing recyclable feedstocks from being competitive with virgin material feedstocks. (High material prices used to enhance recycling activities may increase the cost of products made from recycled materials.)
- Other factors hindering the start-up and expansion of material markets, processors, or end-users.

Those involved in Washington State recycling markets have attended Market Commodity Group meetings and Technical Advisory Committee meetings coordinated by the Washington State Recycling Association (WSRA). The purpose of these meetings was to identify and review market development strategies for Washington State which would be effective in reducing the State's major market barriers for recyclable materials. These strategies are presented in Subsection 4. The recommendations provided in Subsection 5 are based on using the following criteria to evaluate market development options:

- Appropriate strategies must target specific barriers and materials markets for development.
- Appropriate strategies must provide a long-term impact on volumes of recycled material from Washington State.
- Appropriate strategies must be cost-effective and provide measurable results.
- Appropriate strategies must minimize adverse impacts on existing recycling levels and operations.
- Appropriate strategies must provide for an acceptable government role to help accomplish the intended objectives.
- Appropriate strategies must ultimately affect consumer and manufacturer attitudes and purchasing and production decisions.
- Appropriate strategies must promote development of self-sustaining markets.

## 2. REVIEW OF EXISTING MARKET DEVELOPMENT ACTIVITIES

This subsection reviews notable approaches taken for development of recyclables markets in other areas of the nation. More than two-thirds of the 50 states have undertaken market development activities: most frequently government agency procurement or market surveys. A smaller number of states have provided tax incentives or other financial assistance and promotional and educational programs. Figure 1 summarizes noteworthy market development efforts in other states and indicates the general approaches to market development around which this subsection is organized.

Many of the approaches undertaken elsewhere are workable in Washington State. Others, given regulatory differences, may be inappropriate. All, however, should be reviewed. The effectiveness of each approach has been evaluated according to available information on these current and past programs. Unfortunately, little information is maintained regarding the effectiveness and efficiency of government market development assistance programs. Evaluating market development strategies is difficult for a number of reasons:

- State agencies do not consistently gather and maintain data on program effectiveness. For instance, several states that waive sales taxes on recycling equipment do not collect information about the number and value of these exemptions.

- State agencies collect information but lack staff resources to compile and evaluate the data. For example, although the Oregon Department of Environmental Quality provides a 50% recycling investment tax credit and has issued credits for 15 years, the agency cannot provide a list of the awardees or their credit amounts.

- The data compiled by some states may not be consistently useful in evaluating program effectiveness. For example, several states that use affirmative recycled paper procurement standards know how much money was spent buying recycled printing and writing paper; they do not know the weight of these paper purchases. Also, many states that provide financial assistance, such as grants or loans to recycling companies, keep data on the value of the assistance but do not compile recovery or consumption level data.

- The data pool for many programs is too small to draw conclusions about program effectiveness. In Michigan, only three recipients of market development grants have completed their projects.

- Some state agencies will not report data or information about market development program effectiveness if the program is unsuccessful or has administrative problems.

- Some companies that have benefited from state market development programs consider the compiled data and information to be proprietary.

# Figure E-1
# Market Development Efforts In Other States

| | APPROACH | NOTABLE STATE PROGRAMS |
|---|---|---|
| 1. | Tax/Accounting Incentives | |
| | Sales Tax Exemption | IL. NJ. WI |
| | Property Tax Exemption | IN, KY, NC, WI |
| | Investment Tax Credits | MA, NJ, NY, NC, OK, OR |
| | Accelerated Depreciation | Various |
| | Consumption Tax Credits | Proposed CA |
| 2. | Financial Assistance (grants & loans) | CA, IL, MI, NJ, NY, OH, PA |
| 3. | Entrepreneurial Development (Business Recruit/Incubators/ Grants/Enterprise Zone) | CA, IL, WI, ID, MN, NY |
| 4. | Technical Assistance | CA, PA, NB, NY, multistate |
| 5. | Procurement | > 25 states have or consider |
| | Price Preference | WA, OR, CA, RI, NY, NJ, |
| | Set Asides | MD, FL, MI, VT |
| 6. | Promotion and Consumer Educ. | CA, IL, MI, PA, multistate |
| 7. | Market Factor Coordination (clearinghouse/cooperatives) | CA, MT, NH, PA |
| 8. | Legislation & Regulation (e.g. bans & mandates) | proposed NJ, RI |
| 9. | Removal of Barriers (e.g. transportation costs) | OR, TX, PA |
| 10. | Support Actions by Others | EPA, GSA, various multistate |

- Efforts to determine the effectiveness of programs often do not take into account the long-term nature of the programs. For example, campaigns in Michigan and Pennsylvania to educate citizens about the availability of recycled products cannot be measured using data from a short period of time.

- Many of the programs or market development projects considered have been launched within the last year and no results have yet been observed. In many states, officials are just beginning to consider how to monitor and evaluate program effectiveness.

a. Tax and Accounting Incentives

A tax incentive is a provision in a state's tax code which reduces the tax liability of a specific group of taxpayers in order to induce them to engage in specific economic activity. This desired activity is deemed to benefit the other members of society to whom the tax burden is then shifted. In the case of recycling, the purpose of most tax incentives is to reduce the amount of solid waste being landfilled and to promote the development of recycling industries. The taxes which may be included in these incentive programs are sales, property, gross income, or other tax bases. The incentives are commonly in the form of deductions, exemptions, credits, or reduced tax rates.

A significant attribute of incentives is that they benefit only some taxpayers, so unless they directly and quickly cause new taxable activity, public revenues will be reduced. For this reason, tax incentives are said to generate "tax expenditures," that is, they often have the same impact on a budget as expenditures for new services, such as grants.

Tax incentives can help a state promote recycling. But, it is necessary to assure that the revenue thus foregone by the state will produce the desired outcome of stronger recycling markets and healthier businesses. These goals should be pursued in an economical fashion. It must also be asked whether tax incentives are catalysts, prompting positive action, or if they simply reward actions that would have taken place anyway.

This subsection discusses various state tax incentive programs aimed at stimulating the recovery of recyclable materials. These incentives include: sales tax exemptions, property tax exemptions, and investment tax credits. In addition to these existing programs, California has proposed, but not yet adopted, the use of consumption tax credits against income taxes for users of recycled materials.

(1) Sales Tax Exemptions

Exempting sales tax from the purchase of recycling equipment allow individuals, companies, or organizations to reduce start-up or expansion expenses. States differ as to the definition of allowable equipment. Some only allow exemptions on manufacturing equipment while others permit exemptions on processing and collection equipment.

Only a few states offer sales tax exemptions specifically for recycling. However, Illinois, New Jersey, and Wisconsin do offer a sales tax exemption for the purchase of manufacturing or recycling equipment. These programs are described in more detail in the following discussion. Many more states have programs exempting manufacturers or businesses from sales tax on equipment, parts and supplies. In these states, exempt operations often include recycling processors and end-users. Many states also exempt non-profit organizations from sales tax. In all the cases examined, no information was available concerning the dollar value of equipment purchased, number of exempted firms or the amount of taxes exempted.

In Illinois, legislation exempts sales tax on the purchase of in-line machinery and replacement parts used to manufacture a product. Qualifying machinery is not subject to the state's 5% sales tax. This exemption is intended for manufacturers that use either virgin or recycled materials, but a legal interpretation may make it applicable to other recycling operations. According to the definition given by the Illinois Department of Revenue, equipment used in recycling operations that alters the form of the material is eligible for the exemption. In general, transportation equipment is not eligible. This exemption, therefore, could be applicable to recycling processors, such as waste paper dealers, as well as manufacturers, such as paper mills.

New Jersey offers a sales tax exemption to recycling processors and end-users for the purchase of equipment. The 6% sales tax exemption on the purchase of recycling equipment has been offered since 1981.

The Wisconsin sales tax exemption was originally for manufacturers using either virgin or recycled materials. In 1984, the state exempted collectors and processors of secondary materials, as well as manufacturers using such materials, from paying the 5% sales tax on equipment or on the recyclables themselves. Thus the law specifically makes recycling operations such as community recycling centers and scrap dealers eligible for this exemption. The Wisconsin Department of Revenue budgets a maximum of $700,000 per year for the recycling equipment sales tax exemption. However, no evaluation has been made to determine how much is actually used, and no estimate is available as to the number of companies which have utilized the exemption. Approximately 500 Wisconsin firms are eligible to use the program. This exemption reportedly has only minimally increased recycling.

Exemptions from sales taxes are feasible as long as the rules outlining the exempted activities are well written and clear-cut. Exemptions applying to the sales of goods made from secondary materials, can be more complicated because many goods consist of mixtures of virgin and secondary resources. In addition, sales tax exemptions may be difficult to draft in such a way that only in-state sources are affected.

Sales tax exemptions reduce the costs of exempted activities. However, the size of the cost reduction is not easily related to the size of the cost reduction required to increase recycling activity. The degree of benefit provided by sales tax exemptions depends on the nature of the exempted activity. There is no guarantee that an exemption from sales taxes will be the

cost reduction required to attract a business to use new quantities of secondary materials or recycled products.

Also, a sales tax exemption's cost to the state will depend on the behavior and characteristics of the qualifying firms and activities. There is a strong possibility that substantial revenue losses might occur if many existing activities are exempted.

For waste paper, sales tax exemptions are not likely to be beneficial since they probably will not be large enough to induce additional capacity expansion for paper mills. These mills are large, capital-intensive projects whose economics are not likely to be substantially affected by sales taxes.

Sales tax exemptions might be a better instrument for the materials which face transportation and related supply-side difficulties such as glass and tin containers or scrap plastics. However, there is no indication that the size of sales tax exemptions bears any relation to the cost disadvantages associated with the separation, packing and transportation of these materials. Thus, for these materials, sales tax exemptions could be too costly and poorly targeted.

(2) Property Tax Exemptions

Property tax exemptions are another incentive used to promote recycling activities, allowing an individual, company, or organization to avoid all or part of the property tax they would normally pay. The exempt property may be equipment, facilities, land, or any combination of these. Some states include these exemptions as part of a larger pollution control program. Property tax exemptions not specifically targeted to recycling are often used by states and localities to encourage industrial development and create jobs. However, reducing property taxes through statewide legislation often hurts local governments' finances and has, therefore, been found politically unacceptable in many states.

The Resource Recovery System Act in Indiana exempts from county property taxes equipment, buildings, and land used exclusively to convert disposable solid wastes and hazardous wastes into energy or other useful products. The exemption amounts to 95% of the assessed value of the recycling facilities. Companies must apply for certification each year using a two-step procedure. The first application goes to the state Department of Environmental Management for approval of the recycling system. The second step requires petitioning the County Auditor to exempt the qualifying property. About 60 companies have qualified. Among the qualifying recycling activities are steel and paper mills and waste oil recovery operations. The fiscal impact on local governments is unknown.

Kentucky exempts pollution control equipment from county property taxes. Some recycling industries use this exemption. The Kentucky Revenue Cabinet decides if equipment and facilities qualify and then issues certification. Equipment that typically qualifies is used for air pollution control, water pollution control, disposal or reclaiming of solid or hazardous wastes, sound emission control, and pretreatment of raw materials for environmental

protection. It is believed the exemption of recycling industries has a negligible impact on the state treasury. The effect on local tax receipts is unknown.

Corporations in North Carolina certified as recycling facilities receive a county property tax exemption on equipment. Delivery and shipping equipment, buildings, and office equipment are not eligible for the exemption. Approximately 200 facilities are certified. State officials are not able to determine the annual dollar value of property tax exemptions. The state certifies the facilities, but property taxes are collected (and exempted) by counties. Therefore, local counties have lost revenue due to the property tax exemption. In one case, a paper company that constituted 30% of a county's tax base was able to gain exemption. This significantly reduced the county's revenues.

In 1977, Wisconsin extended to certain qualified recycling firms a 1974 county property tax exemption on manufacturing equipment. Qualified firms previously included only manufacturers which met specific Standard Industrial Classification code definitions. The state Department of Revenue now determines whether a piece of recycling equipment qualifies. To qualify, a processor of paper, fiber, plastic, scrap iron, steel, or non-ferrous metals must use "large machines" to produce "tangible personal property for resale to the wholesale market." They must alter the material "into a different form, use and name."

Much dispute, including litigation, has centered on the Wisconsin Department of Revenue's interpretation of the tax code. A state supreme court decision was required to include scrap metal processors in the manufacturing category. The scrap iron, steel, and non-ferrous metals industry was able to demonstrate that it did more than simply compact or bale materials "for the convenience of transportation" -- a step that alone does not satisfy regulatory language governing manufacturing. For example, waste paper balers at collection points, such as supermarkets, do not qualify for property tax exemption. Bales must, at the least, be taken to a processing facility and be opened, shredded or ground, and then rebundled. Sorting and compacting equipment only qualifies if it is part of a more extensive system designed to produce a new substance. Therefore, some waste paper dealers have not been able to gain the exemption because they do not alter the material "into a different form, use and name."

Another type of property tax exemption program in Wisconsin concerns waste treatment or pollution abatement of industrial, commercial, and trade waste. While equipment such as an electrostatic precipitator is eligible, a boiler which burns wood waste and land which food processing waste is spread over are also eligible. Equipment and thus companies that handle residential waste are not eligible for the exemption. The waste treatment program certifies approximately 300 to 400 firms each year for the property tax exemption. Between 1976 to 1987 approximately $340 million of equipment has qualified or roughly $6 million of property taxes have been saved by industry, but not specifically by recycling companies. State officials indicate recycling's portion of this total is very small. One criticism of this program has been that tax officials ignore the intent of the program so as to reduce revenue

losses. The criticism continues noting that the department that enforces the legislation is not the one that proposed it. According to state officials, the property tax exemption has had little effect on the state treasury. The property tax exemption's stimulation of recycling firms has been described as minimal.

Property tax exemptions are probably not an effective market development mechanism for two reasons. First, exemptions only apply to in-state firms and activities. Second, they apply only to taxes owed on plant, equipment and land. Thus, only in-state, capital- and land-intensive activities would receive substantial benefits. Relief for low capital investment would be minimal.

The cost to the state and the localities of property tax exemptions depends, again, on the capital- and land-intensiveness of the qualifying activities. For example, new paper mills cost on the order of $100 to $400 million in land, buildings, and equipment. To exempt such a taxable investment could be costly. On the other hand, the costs could be low for many glass container and plastics recycling processors, where the investment is much smaller and not as capital- or land-intensive. For example, one large eastern scrap plastic processor has a total investment of about $3 million in land, facilities, and equipment.

Based on these considerations, property tax exemptions may be effective inducements to siting new capital-intensive projects in Washiangton such as waste paper mills. However, it is not clear that this relief would result in additional mill capacity. Prop- erty tax exemptions are probably not large enough financial inducements to attract new mills. In addition, they would be costly for local governments in terms of lost ton revenue opportunities.

(3) Investment Tax Credits

Investment tax credits allow individuals, companies or organizations that invest in recycling equipment, structures or land to apply some percentage of their investment against income tax owed. Although this option is an income tax credit, it is commonly referred to as an investment tax credit to reflect the use of the funds. The provisions associated with the various programs differ. However, some states have carryover provisions to account for situations in which tax credits exceed current tax liabilities. Typically, new and replacement equipment are both eligible as long as both are used solely for the purpose of recycling.

Massachusetts legislators recently considered House Bill 1824 to provide tax incentives to encourage the recycling of plastic and paper consumer products. The measure is still before the state legislature. The Act would allow corporations to take a credit against taxes for conducting research and development relating to the use of recyclable and recycled materials (plastic and paper only) in the manufacturing process. The credit is 50% of the cost of the research and development, or 100% if the corporation contracts with a Massachusetts institution of higher learning to conduct the activities on behalf of the corporation. A second part of the Act provides a credit in the amount of 10% of the cost of qualifying tangible personal property acquired

during the taxable year for use in either the manufacture of recyclable plastic and paper consumer products, or the manufacture of plastic and consumer products from recycled materials. The fiscal impact of the proposed Massachusetts legislation is unknown.

New Jersey has a new program offering income tax credits for recycling projects. The recycling equipment tax credit results from the 1987 passage of the New Jersey Statewide Mandatory Source Separation and Recycling Act. The program is overseen by the New Jersey Department of Environmental Protection's Office of Recycling. The 50% tax credit is available only to corporations. It must be taken over a minimum of five years at no more than 20% of the tax credit per year. In addition, the credit may be applied against no more than 50% of a company's state corporate business tax liability each year. However, the credit may be carried over until it is exhausted.

Transporters and processors of post-consumer waste and manufacturers using feedstocks containing at least 50% post-consumer waste are eligible for credits. Processors' recycling equipment must have been purchased after October 1, 1987 and used exclusively in New Jersey. The one exception to this requirement is transportation vehicles used to collect recyclable materials. These vehicles must be used primarily (at least 50%) in New Jersey, but are allowed to transport recyclable materials out of state. Between 150 and 200 applications will be processed for certification during the program's first year, 1988. As of June 1, 1988, 150 applications had been requested from the Office of Recycling and 30 of those had been completed. The number of returned applications is expected to increase as the program is publicized. Although officials believe it will be at least a year before the impact of the program can be determined, they estimate the fiscal impact for 1988 could be several million dollars.

A proposed New York law would provide an income tax credit for those purchasing recycling equipment. The legislation, which has been assigned to a committee for study, calls for a tax credit in the amount of 50% of the cost of the recycling equipment. It also provides for any unused portion of the credit to be carried forward for four subsequent tax periods. Recycling equipment must be used exclusively within the state and solely for the processing of secondary materials. Secondary materials include post-consumer material, industrial scrap and any other material "recovered from or otherwise destined for the waste stream" except for materials commonly generated from and reused within an original manufacturing process. The proposed bill would also offer a deduction for expenditures for the "construction, reconstruction, erection or improvement of recycling facilities."

North Carolina offers what is really a deduction of capital expenses from the tax base rather than a true income tax credit. Corporations in North Carolina can deduct the cost of recycling equipment and facilities, including land, from their capital stock, surplus and undivided profits in computing their corporate franchise tax. The deduction may be applied over a five-year period. In other words, the deduction amounts to a 60-month amortization schedule on equipment. The equipment and facilities are also excluded from the county property tax base. Approximately 200 facilities have been certified since the program began in 1976. Among the North Carolina certified

"recycling projects" are natural and synthetic textile recovery, waste paper reclamation, ferrous and non-ferrous metals collection and processing, making feed from animal remains, and reprocessing of agricultural wastes.

A survey of recycling businesses in North Carolina disclosed that the credits did not influence most investment decisions. Most projects were operating or well-advanced before companies knew of the tax credits. Other economic factors, including proximity to secondary material sources and markets, were a greater consideration for most of the projects. Some companies indicated they would have bought recycling equipment anyway. A food store chain with balers for corrugated containers, for example, also provides balers to its outlets in states that do not provide tax incentives. Several respondents, however, said the tax credit could influence future decisions, especially regarding siting facilities. One company financial officer said siting decisions often hinged on "the least tax consequences."

In May 1986, Oklahoma enacted a tax credit program for the control of hazardous industrial wastes. The state Department of Health oversees a program that extends a tax credit of up to 20% of the value for the installation, purchase, construction and use of facilities that recycle, reuse, or destroy hazardous wastes. The economic impact of the program is not yet known, but equipment such as distillation units, incinerators, and storage tanks are expected to qualify for the credit.

Oregon has three investment tax credit programs; one associated with energy savings, another under the heading of pollution control and the third for the reclaiming of plastics. An important factor is that income taxes are a major source of Oregon state revenues, as the state does not use a sales tax.

Since 1981, more than $26 million in recycling projects have been certified by the state Department of Energy under the Oregon Business Energy Tax Credit (BETC) Program. The loss of tax revenues to the state from the 35% tax credit program has not been quantified. More than 70 companies have used the credit. Fifty-six of these were surveyed, and almost half of these said their investment was dependent on the credit. Five companies received 85% of the total credit pool.

Under the Pollution Control Facility Tax Credit Program administered by the Oregon Department of Environmental Quality, a credit is given for 50% of the cost of facilities that control pollution. The credit will fall to 25% in 1989. Waste recycling processes are considered a pollution control operation. Included in the program are credits for land and structures, making this program more attractive to some firms than the BETC program. (Credits cannot be taken under both programs for the same investment.)

Since 1968, 1,823 pollution control facilities with a combined value of $706.5 million have been certified. Of this, $341 million were declared to be eligible to be taken as tax credits. The recycling facilities' portion of the eligible costs is about $95 million, with a now defunct battery recycling plant being the largest certified recycling firm with a $23.8 million credited investment. Other end-users receiving certification include newspaper de-inking mills, a flat glass recycling firm, two recycled paperboard producers and

a tire-derived fuel operation. The actual amount of recycling tax credits that have been claimed against income is unknown, although state officials estimate 100 new jobs were created by new business or expansion related to the recycling project share of the tax credits.

In addition to these programs, the Oregon Department of Environmental Quality also oversees a program targeted specifically at plastics recycling. The program applies only to capital investments made on or after January 1, 1986 and before January 1, 1989. The income tax credit applies to machinery and equipment that uses at least 50% recycled plastic that originates in Oregon and is manufactured into a product. Shredded plastic, regrind or similar intermediate forms of scrap do not qualify as a reclaimed plastic products. The plastic must be post-consumer or industrial waste, but cannot be an industrial waste generated by the entity claiming the tax credit and must be purchased from a scrap plastics processor other than the entity claiming the tax credit.

The portion of actual costs that can be used for a credit may be less than 100% if the facility is not solely dedicated to making products from reclaimed plastic. The credit is 50% of allocable costs, taken at 10% a year for five years. Any unused credit may be carried forward to the next year, but unused credits may not be carried forward after the fifth year.

The program has a limit of $1.5 million in certifications annually. In addition, a minimum of $500,000 of that is reserved for investments costing $100,000 or less. The maximum cost for any one investment is $500,000. As of the beginning of 1988, no Oregon firm had taken a plastics recycling investment tax credit. Testimony in the state legislature by plastics industry representatives suggests two problems with the program. First, Oregon's plastic industry is small, with a limited number of potential creditees. Second, the requirement that the scrap plastics be generated solely in the state is seen as unreasonable, given the state's small population.

Tax incentives for recycling are intended to divert secondary materials from landfills; to create new markets, jobs, and production; to attract investment; and to communicate a positive, cooperative climate for recycling businesses. A review of the economic development literature reveals disagreement over the efficiency of tax credits. Several reports suggest that some incentives work well to increase the desired activity; others hold that incentives create windfalls for companies that would be doing the job anyway. This split opinion was found in a survey of firms awarded recycling investment tax credits in Oregon.

It appears that companies with little inclination to incorporate reclaimed material in their production processes are not likely to do so just because of investment tax incentives. Similarly, businesses capable of utilizing secondary materials often do so without tax incentives. Therefore, it is difficult to determine if a significant degree of increased activity has occurred as a direct result of tax incentives. Investment tax credits are, however, considered a positive factor by industry when evaluating expansion alternatives.

As states pass mandatory recycling legislation, an opportunity is created for entrepreneurial investment. A potentially large tax credit may make the difference in a decision to invest. One-third of the respondents in an Oregon survey said their recycling investment hinged on the state's investment tax credit and 71% said the credit gave their plans a significant push. Oregon recycles 75% of its newspaper and actually imports newspapers for recovery. Oregon officials cite the approximately $13 million tax credit to a newspaper recycling mill as a critical factor in this recovery rate.

Recipients of tax credits are understandably likely to stress the importance of receiving tax credits. However, the relative importance tax credits play in investment decisions can be debated. Labor costs and proximity to markets are probably more important. The survey of users of the Oregon recycling investment tax credit showed that just one-third of the companies interviewed said the tax credit was essential to investment decisions. It is possible that the other two-thirds would have made the investment even without tax credits.

Investment tax credits reduce the effective costs of activities. Thus, they are better than most other tax incentives because they can be calibrated easily to the size and scope required for the particular policy problems to be addressed. For example, the Oregon plastics recycling investment tax credit has specific limitations on project size and source of scrap supply.

Tax incentives can increase some companies' cash flow and return on investment by reducing operating costs. Tax credits on equipment purchases may be important to some firms that collect, process or use recyclable materials because these businesses often have marginal profits and limited access to financing. Sizeable tax reductions can help sway the decision of a large operation to locate or expand in a state, although it is likely that other long-term factors such as product markets, work force and sales costs will have more influence than tax credits. Businesses are more concerned with reducing operating costs because these costs can be significant and savings can be directed into expanding operations. On the other hand, investment tax credits are not without problems. Investment tax credits, as with other tax incentives, can only be targeted at in-state tax liabilities of recycling firms, so that out-of-state firms using a state's secondary materials cannot benefit.

In addition, these tax incentives can only be effective to the extent that firms have or anticipate having tax liabilities. A firm's taxes may be too small for tax changes to make a significant difference. Often the problem that a business faces is a lack of cash flow, so a new or struggling business may not benefit from credit against current or future taxes. In Oregon, $24 million in investment tax credits were granted to a scrap battery recycling facility that is no longer in business. This was the largest tax creditee. In such cases, where profits are weak or nonexistent, credits against profit-based taxes will actually cost the state treasury little. At the same time, tax credits against a small tax bill or credits carried forward to future years will not help cash-poor companies, thus not significantly increasing recycling. In this case, granting tax credits in this situation may not contribute directly to reaching the primary goal.

(4) Accelerated Depreciation

Accelerated depreciation on state income tax offers a cost recovery system to business and industry for real and personal property purchases, thereby providing an incentive for increased capital investment. States that utilize accelerated depreciation have generally incorporated the Federal Accelerated Cost Recovery System depreciation method into their state tax code. For example, machinery and equipment used for research and development, vehicles and other short-lived intangible property are depreciated on the three-year method. The five-year method, which would apply to most industries including recycling firms, is used to depreciate machinery and equipment used for operating businesses, as well as all other tangible personal property.

(5) Consumption Tax Credits

Consumption tax credits are intended to encourage the use of secondary materials. Also called secondary materials use credits, they allow firms using recovered materials in manufacturing to apply a portion of the price paid for those materials as a credit against income taxes owed. Ideally, consumption tax credits would stimulate market demand for secondary materials by making their costs more competitive with primary materials.

There is no state experience with consumption tax credits applied to secondary materials, although California has made several attempts. California Assembly Bill 1109, proposed in the 1985-1986 session, sought to give a tax credit to users of recovered glass, paper, oil and plastics. The materials were required to be recovered and used within the state.

The bill allowed a tax credit against a company's state income tax in an amount calculated as a percent of the amount paid for qualifying secondary material. A varying credit amount by material (from 10% to 22%) was established according to estimates of the price advantage held by competitive raw materials. To qualify, a material was to be recovered and used in the state within one year of purchase. The recovered material did not include manufacturing wastes. The tax credit could be larger in any year than the tax liability, in which case there was a carryover provision. Thus, it would have been possible for state tax to be completely avoided by the use of secondary materials.

The California bill failed to become law in the 1985-1986 session although it passed one house. Reportedly the major problem was the lack of a funding mechanism. Subsequent versions have also failed. The latest version, the Recycling Tax Fairness Act (Senate Bill 188), was introduced in 1988. SB 188 would establish a separate state tax credit of 10% of a taxpayer's purchase cost for secondary materials that are used for producing new products. The act would provide tax credits to industries that purchase recycled paper, glass or plastics, excluding plastic beverage containers, that are used to make new products. The credits are designed to equalize tax benefits that currently apply only to virgin materials.

Proponents of the bill say it would divert over 300,000 tons of materials now being landfilled. They also calculate that it would create over 1,400 jobs. The bill has survived most of the legislative process, and is now

being considered in the Ways and Means Committee. The state has a current revenue shortfall of about $1 billion so funding of the bill, which is expected to require several million dollars annually, is again seen as a problem, according to the bill's sponsor. Even if the bill passes the legislature, it is likely to be vetoed by the governor.

In summary, there is no experience with which to assess the utility of a recycling consumption tax credit program. Consumption tax credits appear efficient in that the use of secondary materials and recycled products would be rewarded. Such a program could easily target specific materials and could be designed to reward only those firms increasing their consumption, rather than rewarding firms for existing behavior. The major economic problem with consumption tax credits is the desired behavior may cease once the credit is reduced or eliminated. In other words, to be effective such a program could end up being a perpetual market subsidy.

(6) Comparison of Tax Incentives

Investment tax credits are likely to be more effective and better targeted than most other tax incentives for the waste paper industry. They are more easily calibrated and controlled, and offer substantially greater cost reductions than sales tax relief. However, they are likely to be more expensive than the other programs. Tax credits may not address market development problems for glass containers and plastics. Finally, investment tax credits are not options in states, such as Washington, which do not have an income tax.

Sales tax and property tax exemption may not be a determining factor in investment decisions. These taxes are generally a small part of the cost of doing business. In addition, property tax exemptions can have a significant negative effect on local tax bases when granted to larger operations. There is no evidence that sales or property tax exemptions in other states have been a determining factor in a facility's decisions for start-up or expansion. Although they have probably contributed to some increased recycling activity, their effectiveness as a stimulant to recycling cannot be measured.

There has been a great deal of variability in the programs adopted by states both in the types of incentives offered and their areas of application. There has been no uniform approach in the use of tax incentives, making a comparison of programs from one state to another extremely difficult. In addition, states typically do not measure the impact of the incentives on their treasuries.

It is clear that tax incentives can produce positive benefits; the crucial question is whether the cost-to-benefit ratio is sufficiently low. Because a tax incentive costs the state a certain amount of money in foregone revenues and administrative costs, it is expected the state will benefit in terms of increased economic activity and in improved recovery of materials from solid waste. Unfortunately, the cost-to-benefit ratio is not known in detail.

In general, tax programs require little expense to administer in comparison to financial assistance or entrepreneurial development projects.

b. Financial Assistance

Direct financial assistance programs allow a state to aid only those projects it deems most beneficial for market expansion. Loan and grant programs can be aimed specifically at recycling processors and end-users or these businesses can be guided to existing state economic development programs for which they qualify. Seven states have recycling grant or loan programs assisting with market development-related feasibility studies and capital or operating expenses. In addition, Minnesota has a solid waste capital assistance grant and loan program with $10 million in bonding authority which has been used to develop tire recycling markets.

While recycling grant programs are more common than recycling loan programs, some states may be shifting their emphasis to loans, for both practical and political reasons. Grants, especially to for-profit businesses, may be less acceptable politically than loans. In addition, grants can create an immediate tax burden for firms. However, small loans are likely to be relatively more expensive to administer.

During 1978-1982 the California Solid Waste Management Board, now known as the California Waste Management Board, operated a recycling grant program funded by a litter tax. However, as a result of staff cuts, grant recipients have not been monitored, the program has not been documented and administrative personnel are no longer with the Board. Several grants were awarded to develop markets or aid processing of non-traditional recyclables such as plastics, wood, yard waste and food waste. Based on the limited available information results appear mixed.

Seven grants totaling approximately $500,000 were awarded to yard waste composting projects that involved processing and marketing of the end-product as well as collection. Four cities that received grants continue to operate programs: Davis, Lodi, Palo Alto, and San Mateo.

In mid-1988, the Illinois Department of Energy and Natural Resources (DENR) launched a recycling market development grant and loan program. The project was authorized by the Illinois Solid Waste Management Act, whereby DENR is mandated to develop and expand markets for recyclable materials. The market development program is funded by a statewide landfill disposal surcharge.

The Department is accepting applications for three types of projects. Financial assistance is available for manufacturing operations that use recycled material feedstocks, for recycled product marketing and for procurement and testing of recycled products.

DENR will make below-market interest rate loans to Illinois businesses for up to 50% of total project costs. Grants will be considered for businesses where the grant is a small percentage of total program costs. Non-profit organizations and governments are eligible for grants. The program

will only fund projects located in Illinois that use commercially proven technology. DENR will soon issue its first grants and loans. The program fund for 1988 is about $200,000. The Department has assigned a full-time staff person to market development.

Michigan allots 25% of its two-year-old Clean Michigan Fund to market development each year. In 1988 market development funds have amounted to $1.25 million. Recipients are not required to provide matching funds. Less than one full-time position is required to administer the program. Grants were given in 1988 to three companies that projected diverting an annual total of 75,000 to 80,000 tons from the waste stream. The grants are being used to expand a tire shredding operation, start a cellulose insulation plant and install equipment for cleaning old corrugated containers.

In 1987 three Michigan grants were awarded to waste paper processors and end-users. All three experienced or expected substantial increases in amounts processed. However, because of the tax liability incurred, one recipient was very displeased with the grant program even though he was able to triple his volume with the new equipment he purchased. The Department of Natural Resources has since added a statement to the grant application to the effect that the grantee may incur an increased tax liability. A new bond issue may give the department the option of offering loans. State officials view grants to for-profit companies (as opposed to loans) as politically risky.

The New Jersey Office of Recycling awards loans ranging from $50,000 to $500,000 for fixed assets such as recycling equipment. The loan ceiling varies from year to year according to the fund's balance. About $5 million is available each year. In addition, a loan cannot exceed 90% of the eligible project cost or more than 20% of the annual recycling loan fund. Loans are repaid over a maximum 10-year period at three points below the prime interest rate. Since the program started in 1985, 13 loans totaling $2.8 million have been disbursed. Companies managing ten materials are eligible, but waste paper processors constitute the largest group of loan recipients, usually using the loan to buy $150,000 to $250,000 balers. Few end-users have received loans and the program is relatively new; therefore, data on program effectiveness is limited. A half-time employee is needed by the state to administer the program.

Most loan recipients have been companies with fewer than 20 employees, although one had 500 employees. New Jersey has not yet quantified the results of its program; however, a program administrator said most firms receiving a loan experience a 50% to 100% increase in volumes of recyclable materials processed. Five loan recipients contacted had differing views of the program. One company felt that loan awards were too small. Four reported that the loan was influential in their decision to expand, though one company would probably have made the improvements in any event. Conversely, one company stated that it could not have made improvements without the loan.

Loans for small recycling business are one element of preliminary plans for a $3 million recycling market enhancement program to be administered by the New York Department of Development. However, the New York program is currently stalled by a state budget deficit and hiring freeze. The department has no staff or funds to implement the program.

A bill passed recently in Ohio gives the Department of Natural Resources, Division of Litter Prevention and Recycling, authority to make matching grants to businesses or universities to develop recycling markets or processes. Currently the bill does not provide additional funds for these activities, and the division anticipates opposition from local governments -- the current principal recipients of the litter prevention and recycling grants. The Division would like the legislature to allocate additional funds for market development grants and also to move administration of these grants to the Department of Development which already deals with private industry. The program will not be implemented until the 1990 fiscal year.

The Pennsylvania Solid Waste-Resource Recovery Development Act of 1974 (Act 198) authorizes the Department of Environmental Resources to provide grants to assist community recycling efforts. These grant funds typically aid governments in establishing materials recovery systems such as curbside programs, composting programs, or recycling and processing centers. For materials such as plastics and glass containers, Act 198 resources help provide materials to markets where demand exceeds supply. For instance, the City of Bloomsburg received a $21,000 grant this year to procure plastics processing equipment.

Act 198 funds have also been used for market development. For example, the Potter County Solid Waste Authority received about $6,000 this year for the implementation of a pilot animal bedding project. Initially, several local dairies will use waste paper animal bedding. An effort will be made to explain the merits of the recycled product to other farmers. In addition to Act 198 funding, DER is authorized to use oil overcharge funds for recycling project grants. During the 1986-1987 fiscal year, the Department funded 22 projects through this source, totaling over $300,000.

A number of other Pennsylvania financial assistance programs, though not intended specifically for recycling market development, are directed at economic development in manufacturing or at job creation and training and are available to recycling market participants . The primary direct financial assistance programs which the Commonwealth uses to expand economic development consist of low-interest loans for land, buildings, equipment, and infrastructure. Loans go primarily to smaller businesses. The emphasis is on lowering the cost of investment in capital facilities used to employ people. Almost all recycling firms are classified as manufacturers, and some are small businesses, making them candidates for state financial assistance programs. To qualify for funding, each program generally must meet a job creation standard.

Direct financial assistance programs, such as grants and loans, resemble tax incentives in that they provide direct cost reductions to selected activities. They are easier to target because decision-makers are directly involved in selecting from the candidate enterprises, although this imposes an administrative burden at the same time. However, for the most part financial assistance programs are unable to affect out-of-state entities. They are also restricted typically to capital equipment, so direct financial assistance is harder to direct to enterprises requiring assistance with costs or technical concerns other than the purchase of equipment.

The cost reduction made possible by direct financial assistance, of course, varies with the program in question. Hence, like tax credits, the cost reduction possible with this instrument can be as large as desired. The advantage of financial assistance over tax credits, however, is that decision-makers can retain more control over the size of the cost.

Based on these considerations, direct financial assistance might be most beneficial in solving problems of excess supply stemming from cost and equipment conditions in the separation/processing/transportation stages of materials recovery. These are the areas in which small businesses predominate. These firms traditionally have substantial difficulties obtaining conventional financing for equipment purchases. Direct financial assistance is likely to be very costly and largely ineffective at generating additional demand for waste paper, since the assistance level necessary to encourage additional capacity construction for these large and expensive mills is likely to be substantial.

For Washington State, the constitutional prohibition on extension of credit to private businesses prevents state government from providing direct financial assistance to some operations which would most benefit market development. However, there are some instances where grants or loans to other units of government could enhance markets.

c. Entrepreneurial Development

Some state recycling offices work to bring recycling firms to their state. In addition, several state recycling programs attempt to stimulate activity through entrepreneurial development programs which may be applicable to the recycling industry. These include enterprise zones and business incubators. Both enterprise zones and business incubators attempt to provide favorable conditions for business startup, survival, and growth. Several states, including: Minnesota, New York, and Wisconsin, have grant programs specifically to spur entrepreneurial activity in recycling. These include grants for feasibility studies, demonstration projects, and research and development efforts.

(1) Business Recruitment

California Waste Management Board personnel scout out and follow leads that might help recycling end-users locate in the state. Potential industries are linked with Department of Commerce incentive programs. This activity has not produced tangible results in recent years although state officials report that one firm is seriously considering an investment. Staff would not disclose the name of the firm.

(2) Enterprise Zones

An enterprise zone is an economically depressed area designated for special treatment to spark economic activity. The special treatment may consist of tax breaks, lifting of government regulations, and eligibility for particular loans and grants. Thirty-five states have enterprise zones. No example has been found where a recycling business was sited in an enterprise

zone, though current efforts by the Southeast Chicago (Illinois) Development Commission may lead to a successful program.

(3) Business Incubators

Like enterprise zones, the intent of business incubators is to provide favorable conditions for business. The incubator, however, does so on a smaller scale, offering to new businesses below market rent, shared services, business consulting services and access to financing. The national success rate for businesses established through incubators is 65% to 90%.

Two recycling companies are known to have been associated with business incubators, Bioconversion Technologies in Madison, Wisconsin and American Recycling in Pocatello, Idaho. This is too small a sample from which to generalize. However, the disappointing experience of a composting entrepreneur in Wisconsin suggests that much depends on the particular incubator, the company's business plan and whether the landlord delivers the services promised.

(4) Entrepreneurial Grants

The Minnesota Waste Management Board's new Market Development Grant Program has allocated $200,000 for feasibility studies of projects to expand existing markets or open new markets for designated materials. The studies will be performed by prospective developers selected through a request for proposal process. The developer must fund at least 50% of eligible costs. About one-third of a full-time position will be needed to administer and market the grant program.

In April 1988, after determining that Minnesota needs adequate and stable markets for waste plastic, the Board issued a request for proposal to perform feasibility studies for a plastics processing or recycling plant. Depending on the cost of the proposed studies, the Board may award more than one grant from the $75,000 available for plastics studies. Only firms or associations capable of developing such a facility are eligible for the grant. Consultants and research firms are not eligible. The award does not obligate the developer to proceed with development, but the company's ability and commitment to do so are one evaluation criterion. Eligible activities under the plastics study include market assessment, conceptual design and preliminary engineering, financial and business planning, environmental impact and site analysis, and permitting procedures.

The preliminary outline for New York's recycling market development program calls for technical assessment grants for businesses using new technologies. As mentioned in the discussion of financial assistance options, this program is currently on hold pending funding.

The Wisconsin Department of Natural Resources (DNR) demonstration grant program has awarded $378,000 to seven applicants in its first two years. The program comes up for funding annually. The maximum available to a grantee is $75,000, though this year the program's entire budget is only $50,000. The grant amount must be matched by the applicant. The grantee can request as much as 75% of the funds soon after receiving the award, but the final 25% is

not disbursed until the grantee's final report and accounting are approved. The grant coordinator noted that this system can put grantees in a financial bind if approval is slow.

Six projects have been funded thus far in Wisconsin and one more is being negotiated. Projects include bench-scale testing of a microfiltration system for paper mill sludge, using foundry waste in road construction, removing contaminants from plastics and experimenting with new uses for tires. None of the projects funded has yet moved to the commercial scale; therefore, it is too early to assess the program's effectiveness. Staff time devoted to the program is minimal. Dealing with entrepreneurs sometimes requires guiding them through the government bureaucracy. The grant coordinator thought the program could be improved if the department were able to request specific types of proposals.

Another Wisconsin program, under the auspices of the Division of Energy, dispenses grants for feasibility studies and engineering designs for recycling and waste-to-energy projects. The maximum amount is $50,000 and as with the demonstration grants the applicant must provide matching funds. The program, initiated last fall, is funded by $1.4 million in oil overcharges to be expended by early 1990. The department will probably ask for additional funds at that point. Four hundred fifty thousand dollars ($450,000) will be awarded in 1988. The total administrative budget for the 2.5-year program is $100,000. Staffing is approximately 1.1 full-time employees.

Firms sign a contract to perform the proposed project, but do not receive the funds until after the project is complete. The projects tend to be risky, and several firms, after receiving approval, have decided not to go ahead. Out of $800,000 awarded under the program, approximately $120,000 has gone to recycling projects, with recycling collection and processing receiving the most attention. For instance, three projects involved developing county-wide recycling systems. Three other projects included market studies, with one being part of a pilot program to place igloo drop-off containers around a county for collection of scrap bottles.

One company has received grants from both Wisconsin programs. A $75,000 DNR grant went to a three-way partnership between a town, a collector/processor of mixed recyclables and a plastics processor. The grant coordinator said the arrangement was unwieldy and in the future such arrangements would either be excluded from consideration or revamped to become subcontracting relationships. The plastics processor is planning to process polyethylene, polystyrene, and polypropylene to a high level of purity so as to command a better price. Thus far the company has purchased a grinder with the grant funds and investigated markets. The next step is to purchase a de-stoner and build a washing tank, then take samples to laboratories and potential end-users to see if the samples meet market specifications.

In June 1988 the company was also approved to receive $20,000 from Wisconsin's Division of Energy recycling grant program to research equipment purchases, set up the equipment, and do testing and pilot runs for removing contaminants from PET bottles and separating the basecups. This funding will start when the company's grant from the Department of Natural Resources expires.

Entrepreneurial development programs can address potential problems and benefit both in-state and out-of-state firms. The size of the assistance offered by the program, however, as well as its cost, depends on the specific problem addressed. However, the program is generally best suited to projects involving emerging technologies and innovations, such as plastics cleaning and processing.

One such form of entrepreneurial development is assistance in developing new and innovative production processes. Such technical assistance would not be particularly beneficial for waste paper recycling. It might be more appropriate for glass containers and plastics in which innovative technologies for separating, processing and transporting are needed. Such assistance is appropriate only for well-targeted situations, rather than across-the-board programs. If aimed carefully, this form of assistance is not exorbitantly costly. Washington State's prohibition against the extension of credit may limit the utility of entrepreneurial development approaches, although other state and regional programs directed at business development and diversification do exist.

d. Technical Assistance

Technical assistance covers a wide range of services and information which the State can provide to recycling processors and manufacturers. Common forms of technical assistance include labor and management training, marketing assistance, product testing, assistance with permits, export advice, help with applying for loans and assistance in facility siting.

Traditional technical assistance programs are often found under the auspices of the state commerce agencies. However, the state Recycling Office can also be helpful in assessing a company's needs, directing it to the appropriate program and providing accurate information on the availability of material supplies. Examples of some state programs are given below.

Some technical assistance efforts, like those in California, are oriented specifically to recycling end-users. The California Waste Management Board is working with the City of Los Angeles to establish a co-composting project in that community. The State has supported the project by requiring that its own offices give a purchase preference to co-compost products. The recycling office is also monitoring a testing program to determine appropriate uses for finished co-compost. This information will also be useful to potential private sector users. The California Recycling Office also sponsors conferences to inform local governments about market issues. Speakers include brokers, end-users, processors and other recycling specialists.

Pennsylvania has two programs offering technical assistance to recycling companies. The Pennsylvania Technical Assistance Program (PENNTAP) under the Ben Franklin Partnership, seeks to promote technology transfer. Firms needing technical assistance can contact any of the Pennsylvania State University campuses. For example, through PENNTAP firms in the plastics industry could evaluate technologies used in other fields for their applicability to the production of plastics.

Pennsylvania has also recently established a system of Industrial Resource Centers. While the Ben Franklin Partnership programs are oriented toward emerging technologies, the industrial resource centers are aimed at assisting existing small and mid-sized manufacturing companies. The state plans to establish nine centers which will receive an initial $10 million in state funding and matching funds from colleges and other sponsors. Manufacturers will be able to seek help in many areas such as job training, computer use and improved inventory controls. Fees may be charged for some services based on ability to pay.

The Nebraska Department of Environmental Control designates technical assistance and market research activities as eligible project categories in its $500,000 annual Litter Reduction and Recycling program, but few research awards have been given in this area. The principal projects funded to date involve the potential cryogenic processing of scrap tires and research into compost markets.

If implemented, New York's new recycling market development program may include a technical assistance element. The state's economic development department would provide market information and track market trends.

Some states have funded research projects jointly with other states. For instance, Rhode Island and Massachusetts fund the non-profit Plastics Recycling Applied Research Center in conjunction with New England CRInc. and other private companies. The Center, located in North Billerica, Massachusetts is devoted to advancing the field of plastics recycling.

Technical assistance programs to disseminate information can provide businesses and communities with details on innovative processes and techniques. This form of assistance will be most useful in complex situations requiring information about recently developed techniques, rather than in those in which recycling is a well-established process, such as waste paper recovery.

As is the case with entrepreneurial development, technical assistance efforts can be targeted to specific areas and problems both within and outside of the state. An example would be a state technical assistance program designed to increase the amount of waste paper-based animal bedding produced in rural areas. The program applies where the primary issues are technological and informational, rather than those of cost. Finally, the cost of the program is likely to be quite modest in terms of dollar outlay, depending on the number of staff involved in providing information and assistance. Washington State's newly instituted Office of Waste Reduction and Recycling is charged with providing technical assistance.

For the most part, however, technical assistance programs may not be very beneficial in the development of waste paper or metals recycling markets because technical issues and information are not at the root of these markets' problems.

e. Procurement of Recycled Products

Governments purchase materials and services under specific sets of laws, rules and guidelines set up by legislative bodies, and administered by

designated agencies. Frequently, qualified low bids win contracts for goods and services, but non-economic factors are also commonly considered, such as federal "Buy American" provisions and various affirmative plans targeted for women- or minority-owned businesses. The following section discusses government procurement of products containing materials recovered from the waste stream.

The operating budgets of state governments appear quite large when compared to individual businesses and, thus, there is a general perception that states are large purchasers of materials. It is, therefore, felt that increasing governments' buying of recycled products would stimulate markets for recyclable materials. If a state purchased significant quantities of recycled paper, for example, it could stimulate recycled paper markets and increase the recovery and use secondary fibers. This theory of procurement policy holds that governments should purchase recycled products where possible, both to stimulate markets and to set a good example. In some cases, however, the direct effect of government purchasing on markets may not be great. Actual quantities purchased by the state may be relatively small, or the actual amount of recycled material in the purchased products may be limited. Nevertheless, increased use of recovered materials at even a low level may be important to an individual city, county or area where recovery takes place.

In addition to the market aspect, government leadership cannot be over-emphasized. Once local government agencies or businesses observe successful state procurement of recycled materials, they may also adopt such practices. This could significantly multiply the effect of state procurement. State agencies also set an example for industry and citizens of completing the recycling loop by purchasing products with recycled content.

Many government agencies are reviewing their procurement or purchasing practices to ensure recycled products are not intentionally or inadvertently excluded. In all, 18 states have procurement policies addressing recycled content, and at least ten others have the issue under study or have introduced legislation. Initially, the major emphasis in many procurement programs has focused on recycled paper products, where recycled products are defined as those that contain up to 50% secondary post-consumer materials. Key considerations in the development of procurement programs are discussed below.

(1) Definitions

Standardizing specifications and definitions could improve manufacturers' ability to produce recycled products. To stay consistent with the federal government's specifications, states are actively pursuing standardization.

After waiting for guidance from the federal government pertaining to specifications and procedures for procuring recycled materials, many states are now developing procurement guidelines. Individually states are establishing guidelines enabling recycled products to compete in the procurement process. For instance, in Michigan an independent five-member committee, including a waste hauler, recycling processor, and Chamber of Commerce representative,

is looking at procurement standards and issues. States are also trying to coordinate definitions and terms to enable manufacturers of recycled products to more easily and economically produce products which meet these specifications. Also, the ten members of the Northeast Recycling Council, a group of state recycling program officials, have adopted recommended recycled paper procurement guidelines and definitions which they will support for adoption in their respective states.

Currently, recycled paper specifications vary from state-to-state. Consequently, it is difficult and costly for mills to make these small, specialty runs to comply with those varied specifications. Consistent specifications by both state and federal governments should eliminate this barrier.

(2) Federal Role

The federal government is required by law to prepare procurement guidelines or minimum content standards for a variety of materials: rubber in asphalt, re-refined oil (lubricants), fly ash in cement or concrete, and paper/paper products which contain recycled fibers. Other materials may be considered in the future.

The General Services Administration (GSA) is the purchasing agency for most federal agencies. In the past, GSA has purchased paper with recycled content, and administered an affirmative procurement program by requiring recycled content at specified levels for a number of paper products. However, GSA has discontinued that program in favor of strict low-bid procurement. The agency cites numerous inconveniences, problems with quality control and administrative costs as the reasons to prefer virgin paper.

Paper purchased for the Government Printing Office is purchased by GSA under specifications set by the Congressional Joint Committee on Printing (JCP). JCP has been opposed to affirmative procurement programs. This Committee is concerned that recycled paper will be of inferior quality.

The U.S. Environmental Protection Agency (EPA), however, has adopted a legislatively mandated procurement guideline that will apply to federal purchases of paper and paper products. The guideline requires affirmative procurement. The two options provided by the guideline require either that minimum levels of waste paper content be set for specific paper and paper products, or that procuring agencies examine procurements case-by-case to ensure that recycled fiber is used to the extent possible.

EPA has recommended minimum content standards for over 20 classes of paper or paper products such as office paper, tissue, paper towels, and boxes, standards which specify percentage content requirements for post-consumer and other waste paper feedstocks. These recommended standards are included in the guideline to satisfy EPA's obligation to recommend levels of recovered materials to be contained in paper products. EPA's guideline includes recovered materials content in paper containing cotton fiber.

(3) State Procurement Programs

The number of states with affirmative procurement programs for recycled products is growing rapidly. In 1985 seven states purchased paper and paper products containing recycled materials through affirmative procurement programs. States without affirmative procurement programs may have also purchased recycled paper, but typically in only small amounts. Currently 18 states have procurement policies addressing recycled content, and at least ten others have the issue under study or have introduced legislation.

Procurement guidelines for recycled products have generally developed in two forms: price preference and set asides. The following discussion focuses on these and variations in their implementation.

(4) Price Preference

The lowest qualified bid wins most government contracts. In order to enable recycled products to better compete, price preferences have been established by some states. Preferences are modified open-bid procurements where products with recycled content are preferred. The preference usually takes the form of a bid price adjustment. For example, for purposes of selecting the "low bid," recycled products are considered competitive even though they may cost 10% more than comparable virgin paper. Once again, procurement officials sometimes object to this procedure, which interferes with the traditional low-bid process.

Currently five states use price preferences for the purchase of paper produced from recycled fibers. California, Oregon and Rhode Island offer a 5% preference while New Jersey and New York provide a 10% price preference.

To better understand price preferences it is useful to examine its effect on individual states. New York's policy stems from a statute adopted in 1980. A 1986 law clarified the 10% price preference in the original statute. State purchases of recycled paper and paper products have totalled over $24 million since the programs' initiation, or 40% of all paper purchases. The purchase of recycled paper has comprised between 59% in 1985 and 24% in 1987 of the total state paper purchases.

The premium paid by New York State for recycled paper has been significantly lower than the maximum 10%. For example, in 1986 approximately $98,000, or 1% of the total paper purchased, was due to the preference for recycled content and only $77,000, or 0.9%, was spent in 1987. Therefore, in New York the increased price paid for recycled paper is considered minimal.

In California the recycled procurement program has been in effect since 1977. A preference is given to recycled products if the bid does not exceed the lowest bid by more than 5%. The use of post-consumer waste is encouraged. Contracts are awarded to the bidder whose product contains the greatest percentage of post-consumer waste if the fitness, quality and price are otherwise equal.

Since the initiation of California's program, state purchases of recycled paper and paper products have totaled over $33 million or approximately 15% of total paper purchases. Recycled paper has comprised as much as 25% of the total paper purchases in 1986-1987 and as little as 4% in 1978-1979. The preference or the premium paid by the state has been less than 0.2% of the dollar value of all paper goods purchased since the program began.

These examples show that recycled paper has been purchased without a large extra expense.

(5) Set-Asides

A set-aside is a procurement policy requiring that a specific portion of purchases consist solely of products with recycled content. Set-asides are effective at increasing the use of recycled materials, but are strongly resisted by procurement officials. The reason for this is that set-asides may result in products costing more than they might otherwise, and may result in only one or two bids. Officials report that this reduced competition results in lower quality products, but this cannot be verified.

Five states were identified as having set-asides for the purchase of recycled products. Maryland has probably the best known set-aside program, having started in 1977. Since then, the state has purchased recycled paper products worth more than $17 million. Maryland's legislation requires that 40% of paper purchased be recycled paper. Unlike other states which report purchases with respect to the dollar amount spent, Maryland reports their procurement with respect to quantity purchased. Reportedly they have exceeded their 40% goal.

Set-aside programs do provide for increasingly larger percentages of purchases to incorporate recycled content. Set-aside programs can affect state purchases quickly.

(6) Summary

An assessment of existing state recycled product procurement programs reveals several points:

- Once programs are adopted, expenditures for recycled products appear in line with those for virgin products.
- Monitoring and promotion are necessary for continued program success.
- Most state employees do not notice the change to recycled products, although problems have been reported in some states by printers when using paper containing recycled fiber.

Overall, affirmative procurement programs have shown few detrimental effects on the agencies purchasing recycled products.

Interviews with State recycling officials indicate that state procurement practices have not led to mill expansion. These contacts did, however, believe that once standardized specifications for recycled paper are developed in many states that an increase in manufacturing will be observed. Manufacturing operations expanding to meet the demands of the new procurement market may not always be in those states that have adopted recycled product procurement rules.

A number of benefits from recycled product procurement have been noted. Government purchasing creates a market for recycled products and provides a positive example for other jurisdictions and businesses. In addition, procurement guidelines promote recycling by expanding markets, and improve the attitude of ultimate users by removing restrictive rules or specifications. Thus, it is not necessarily the size of the purchase but the act itself that makes recycled procurement a positive action. The cost of the program is small since it can be directly controlled and the overall additional cost of many recycled products is marginal (less than 5% above the cost of competitive virgin products).

Procurement regulations and programs target ultimate users of recycled products. Therefore, their primary value is to create additional demand. However, the impact of these programs would be spread over the surrounding region, rather than concentrated within a state. Increased recycled product procurement will benefit out-of-state suppliers that may or may not purchase that state's recyclable commodities.

The increase in market demand resulting from procurement programs cannot be assessed at this time, but it is believed to be small. For example, recycled paper procurement by the State of Illinois program is just 4,250 tons per year, or about a month's production at a small recycled paper mill. Washington state has adopted a paper and paper product price preference procurement program for which the administrative procedures are currently being developed.

f. Promotion and Consumer Education

Promotion and consumer education are designed to stimulate the demand for recycled products and packaging. Programs can target individual consumers, commercial and industrial consumers, or both.

California's program shows that the effectiveness of "buy recycled" campaigns may be limited. The 1981-1982 Environmental Shopping/Solid Waste Awareness Project in San Diego examined shoppers' attitudes rather than shopping behavior. This project, funded by the California Solid Waste Management Board and implemented by the San Diego Ecology Centre, sought to increase awareness of the chasing-arrows recycling symbol and recycled packaging. Cereal boxes and other products packaged in recycled paperboard were marked at five Safeway stores. Four Safeway stores served as a control group. A follow-up survey comparing shoppers in control stores and program stores found attitudes toward the recycling symbol, recycled packaging and solid waste issues not varying significantly.

The California Waste Management Board is also publicizing the State's procurement policy that allows cooperative buying. Governments such as school districts can buy materials through state contracts.

The Illinois Department of Energy and Natural Resources (DENR) has assigned a staff member to stimulate the procurement of recycled products by other state agencies. The DENR philosophy is that state purchasing practices should set an example for the private sector. Recycled paper, retread tires, plastic lumber, re-refined oil and reclaimed building materials, such as cellulose insulation made from old newspapers and bathtubs and showers made from PET, are the highlighted materials. A letter on the governor's stationary was sent to state procurement agents with the list of targeted products. The DENR staff then met with the agency staff to discuss their needs and concerns. Vendor reliability, product reliability and price were major issues. The DENR is currently completing a research report containing recommendations aimed at helping procurement officers locate products, make cost comparisons and determine recycled content. The DENR will hold a procurement workshop and fair in March 1989.

Michigan's consumer education program is too new to evaluate. The buy-recycled program was developed by a consultant at a cost of $63,500. Full implementation is on hold until a directory of recycled products is developed. The program will encourage both industrial and individual consumers to purchase products made from recycled material.

A private, non-profit group, the Pennsylvania Resources Council (PRC), organized an environmental shopping program in 1987 and will be conducting another program in 1988. Unlike California's program, the PRC's effort was directed at its member clubs and civic organizations, rather than the general shopping public. About 20 member groups participated in the program, which involved approaching a local merchant and securing permission to place shelf markers identifying approximately 200 products packaged in recycled paperboard. Members also wrote to manufacturers to identify items not on PRC's list. However, response from manufacturers was poor.

The project organizer identified several problems with the 1987 program: the project took on too many products and only expended $1,000. Therefore, it was severely underfunded, and not enough time was allowed for communication with merchants. Merchants were also annoyed because the stickers used to mark the shelves were very difficult to remove. The project organizer also noted the complexities inherent in such a program. For instance, environmental groups concerned with local water quality objected to the recommendation to purchase powdered detergent packaged in recycled paperboard because of the potential for increase phosphates in some powdered detergents.

In 1988 the PRC program was to focus for six months on a series of products. Both recycled and recyclable packaging will be highlighted. The targeted products will be listed on a sign which also offers information about the state's solid waste problem. Additional information will be contained in a handbook to be distributed to member groups. This handbook will list undesirable products such as those in mixed-material packages. The program is

expected to cost about $10,000, mostly for mailing and printing. The program coordinator stressed that shopping behaviors were deeply entrenched and modifying them was a long-term proposition. Program assessment will involve asking each participant to take a pledge to reuse, recycle, buy recycled materials, reject harmful ingredients and make their preferences known to merchants and manufacturers. At the end of the six-month program they will fill out an evaluation sheet.

Several states and agencies are considering joint funding of a national recycled products directory and a national exhibit of recycled products. Such efforts would publicize the existence of products with recycled content and help state procurement officers and others locate vendors of products which can be substituted for those made solely with virgin materials. The directory will be aimed at government procurement officers, small businesses and industries. It will categorize products and list vendor name and address, a contact person and the percent of recycled content. Start up costs are estimated at $100,000 for 2,000 listings. The hope is that the publication will eventually become self-supporting.

Business promotion and consumer education designed to increase the use of recycled products will be difficult to implement in many cases because many glass, paper, and plastic products are currently made with a mixture of secondary and primary materials. It is not clear how recycled products with higher percentages could be identified in such a program. As with procurement programs, promotion and education programs do not necessarily focus on products made from secondary materials in a particular state.

Targeting consumer education and related programs is not easy. In addition, consumer awareness programs are not likely to increase demand for glass containers and recycled plastic products. On the other hand, such programs are not generally expensive. Areas in which such a program might offer benefits could be the siting of collection facilities and in encouraging additional source separation, especially for scrap plastics and glass containers. The cost effectiveness of such education and promotion projects is difficult to assess.

g. Market Factor Coordination

Coordinating market factors attempts to stabilize the supply and demand for recyclables. A state agency could act as a clearinghouse for market information, organize sales cooperatives in order to get the best price for materials, sponsor materials recovery facilities and enact price supports to keep the market consistent or stockpile recyclables during periods of low demand.

Secondary material price supports and stockpiling are not used in this country. They would likely be unwieldy at the state level and controversial. Price support mechanisms, however, have been used in several European countries where market intervention strategies are more commonly employed. Actions most appropriate on the state level are establishing clearinghouses and cooperative marketing groups. These are particularly useful where consistent supply is a stumbling block to increased recycling.

(1) Clearinghouse

A clearinghouse functions as an information center on markets, consumer profiles, market lists, prices and specifications. The California Waste Management Board has provided some of these services. Recycling office personnel answer inquiries and link consumers and suppliers of recycled material. For example, import-export houses may have clients requesting specified amounts of particular recyclables. The state office will usually refer the inquiry to a government liaison in a city or county with a recycling program. In other cases, staff advise foreign companies selling products in the U.S. and seeking to fill their returning ships to advertise in a statewide recycling newsletter.

(2) Cooperatives

Cooperative marketing enables small local programs to band together to sell materials more easily and to ensure processors of a reliable supply. Pooling materials makes processing and transportation more cost-effective. Cooperatives have been formed by Montana and three neighboring states, by 150 municipalities, 50 businesses, and 100 individuals in New Hampshire, and by six curbside recycling programs in Montgomery County, Pennsylvania.

The New Hampshire cooperative, which receives state support, acts as a broker, makes contracts and arranges transportation of recyclables for a fee from members. It also sets material specifications. In the 1986-1987 fiscal year, the cooperative marketed 814 tons of waste paper, 582 tons of glass containers and 3,555 tons of ferrous scrap metals.

The City of Philadelphia is working to develop a recycling export shippers' association in order to lure additional shipping lines to use Philadelphia-area ports.

(3) Summary

Programs, such as clearinghouses and databases of material supplies, costs and end-users, can be aimed at recovering glass containers, yard wastes, and plastics or for other materials for which a primary market problem is the lack of information and coordination among many potential suppliers and end-users. These programs can be inexpensive.

h. Legislation and Regulation

Markets may be affected indirectly through product bans, disposal bans, packaging taxes and other legislation or regulation. For instance, bans of polystyrene or plastic cans may help glass and paper container producers increase or at least maintain market share. Numerous states have recently approved or proposed such actions.

A requirement that a certain product be available may have a market effect similar to banning a competing product. For example, proposed New Jersey and Rhode Island measures would require that paper sacks be available at grocery stores.

No evidence has shown that a regulatory approach will succeed in increasing market demand for secondary materials. Certainly a ban on a competitive product would enhance the marketplace for recycled paper, glass containers or plastics. On the other hand, this strategy may be viewed as an excessive and inappropriate intrusion.

i. Removal of Barriers

Removal of regulatory and other governmental impediments may increase recycling and strengthen markets. The cost of transporting recyclables to market is a barrier to recycling in many areas. Another transportation-related barrier may be inadequate state port facilities. The following describes how three states have challenged these transportation market barriers.

Texas has established special, reduced tariff rates for "Commercial Wastes Moving For Recycling." Materials that apply for these rates include "junk batteries, crushed or broken glass and other commercial wastes moving to be recycled, not including iron or steel scrap, subject to a minimum weight of 40,000 pounds per vehicle used." These rates do not apply to waste commodities transported to or from waste disposal facilities regulated by state authorities. The rates do apply to residential and commercial waste materials transported directly to recycling facilities where they are stored or processed in preparation for sale.

In Oregon, approved "conservation programs" can ship intra-state at whatever rate can be negotiated with truck lines rather than at the posted tariffs. A certificate must be obtained from the state Department of Environmental Quality, which then notifies the state Public Utilities Commission of the exemption. The participating trucker must pay a $50 fee, which is usually covered by the shipper. Since the late 1970's, when the program went into effect, only 10 certificates have been issued. However, several of these have gone to major end-users of secondary materials. Thus, anyone shipping to that company can use the exemption. The program allows recycling firms to make use of cheap back-haul trips.

Pennsylvania ports are infrequently used by in-state exporters. Port facilities are considered inferior and more costly to use than others available in the region, particularly those in New Jersey and New York. On the other hand, two recently proposed Pennsylvania port development projects, if enacted, should provide additional export opportunities for waste paper and plastics processors. The Philadelphia Port Corporation has proposed a $35 million modernization program to upgrade and restore cranes and infrastructure at its facilities. The corporation also proposes a new shipping yard for containerized cargo at its Packer Avenue terminal. Meanwhile, Delaware County officials are planning a $35 million terminal in Chester. Both proposed terminals are intermodal, allowing transfer of cargo between trucks, railroads and ships. Currently area ports have no direct link between railroad and ship container traffic.

Removing legal barriers to recycling markets can be an effective market development tool. In the programs noted above, officials say that the removal of unrealistic shipping regulations aided the local recycling market.

Other states may have unique barriers other than transportation which can be overcome relatively simply and inexpensively.

j. Support of Action by Others

States can support federal measures to improve markets, such as federal procurement guidelines favoring recycled content, or revision of federal tax codes that favor virgin materials. States commonly work to influence federal legislation. Most states operate a Washington, D.C. office in order to bring that state's interests to the attention of federal officials.

In the last year state officials around the country have contributed to the federal recycling policy-making process in three ways: discussions with the U.S. Environmental Protection Agency, involvement in an ongoing investigation of recycling by the federal Office of Technology Assessment, and testimony concerning recycling legislation.

In addition, State recycling officials in the Northeast and Great Lakes regions are meeting regularly to develop multi-state approaches to increased recycling and market development. As part of these regional actions, coordinated support of specific federal programs and regulations has occurred.

One state's recycling market development often benefits other states. For example, state officials in Oregon recognize that neighboring states have greatly benefited from Oregon's recycling investment tax credit programs. Increased demand in Oregon for recycled materials is being filled in part by volumes from Washington and California. Looked at another way, Minnesota officials are concerned that out-of-state scrap tires are flowing into a tire processing facility funded in part by state grants and loans.

3. MARKET BARRIERS

Barriers facing markets for recyclable materials in Washington State fall into 5 broad categories:

| | | |
|---|---|---|
| LOW MATERIAL SUPPLIES | - | Low demand for a recyclable material due to inadequate or inconsistent supply |
| LOW PROCESSING CAPACITY | - | Low demand for a recyclable material due to inadequate processing capacity |
| LOW PRODUCT DEMAND | - | Low demand for products made from recycled materials |
| UNFAVORABLE ECONOMICS | - | Market economics which make the use of recyclable feedstocks uncompetitive with virgin material feedstocks |
| OTHER FACTORS | - | Other factors which hinder the startup of materials, processors, or end-users |

In many cases, market impediments are specific to particular commodities. Some barriers, however, apply to a number of materials. The major barriers identified in the state are organized according to the commodities affected.

a. Paper

(1) Limited Demand For Recycled Paper
(Low Product Demand)

Some consumers are reluctant to purchase some paper products containing secondary fibers due to concerns about product quality, availability, or compatibility with equipment. For example, office copying equipment may not effectively use some recycled papers and cardboard boxes made from recycled fibers may not be as strong or as "clean" looking as those made from 100% virgin fibers. Certain products manufactured using waste paper, such as tissue, may not be regionally available and this can result in higher costs for purchases of recycled materials. Government and private sector standards for paper products often limit the recycled fiber content.

These concerns about the salability of paper products containing recycled fiber discourage the purchase of secondary feedstocks by many mills that could use them to a greater degree. This barrier affects markets for all types of waste paper (newspaper, corrugated containers, high-grade paper, and mixed waste paper) as well as those for plastics and yard waste compost.

(2) Limited Secondary Fiber Consumption Capacity
(Low Processing Capacity)

Paper mills in the Northwest and other accessible markets have limited capacity for post-consumer waste paper. This barrier primarily faces domestic end-user consumption of old newspapers and mixed waste paper. Considerable time and investment are required for mills to add de-inking systems or other plant modifications to allow greater consumption of these materials. Northwest mills which use only virgin wood fiber rely on waste from the forest products industry as primary feedstock. Thus, replacing waste wood with waste paper, in some areas, could result in a disposal problem for wood wastes. End-user or processing capacity is also a barrier to markets for plastics and yard waste.

(3) High Cost of Transporting Waste Paper to Market
(Unfavorable Economics)

Intra-state transportation regulations often do not allow shippers of secondary commodities to take advantage of back-haul or other cost saving shipping methods. These restrictions often increase the costs of marketing recyclables from parts of the state without access to major transportation corridors. Since major Northwest mills often pay freight costs for materials, this barrier applies mainly to the lower value paper commodities or those destined for export, especially mixed waste paper. The same barrier exists for marketing glass, tin cans, white goods, plastics and yard waste.

(4) Costs and Uncertainties of Complying with Environmental Regulations for Waste Paper Recovery (Other Factors)

Some existing mills able to expand to use supplies of post-consumer paper have been reluctant to do so because of uncertainties about the regulation of processes and wastes associated with de-inking technologies. The potentially high cost of pollution controls or disposal fees has been a consideration in some decisions to avoid secondary fibers as a feedstock. Similar concerns have hindered metals and yard waste recovery businesses.

(5) Limited Uses for Mixed Waste Paper (Low Processing Capacity/Low Product Demand)

Mixed waste paper, and to some extent waste newspaper, has a low value and limited use. Potentially, however, these materials may find new uses. For example, old newspapers have been successfully used on a small scale in the manufacture of cellulose insulation and specialty products such as fruit packing trays and molded flower pots or as animal bedding. The recognition of new applications and the development of cost effective large scale production processes for lower value materials such as mixed waste paper, newspaper, mixed color glass, mixed resin plastics and yard wastes could help to overcome barriers of low demand or inadequate processing capacity.

(6) Uncertainty About Export Markets for Paper (Other Factors)

The export market for waste paper has grown rapidly in the last decade and has provided an important new demand for materials when domestic consumption and prices have been low. Export markets have developed due to a number of conditions which may not recur, and many waste paper traders tend to view the international demand as fickle. Those dealing in international marketing of waste paper and scrap metals have often developed a sophisticated understanding of how these markets function, but lack of a particular experience with the current level of waste paper trading is a barrier to increased reliance upon the foreign market. Uncertainty about export demand is also a barrier for plastic and potentially for green glass.

(7) Supplies of Mixed Waste Paper are Limited (Low Material Supply)

Supplies of mixed waste paper for domestic consumption are limited. Because of low domestic prices and demand, most of this material is exported. Prices abroad are also relatively low though demand is higher. This situation has hindered the development of regional consumption capacity for mixed waste paper. In other words, a reliably steady volume of mixed waste paper for Northwest consumption could generate new demand.

b. Glass

(1) Limited Regional Demand for Glass Containers
(Low Product Demand)

If the Northwest demand for new glass containers were higher, the two existing plants would be capable of expanding production to use all available cullet. Much of the glass entering the waste stream is shipped in from outside the region as packaging for food and beverages not produced here. If most of this glass were recovered in the form of new containers, the Northwest food and beverage industry would not be able to use all the containers. This problem is clearly illustrated by the supply of green glass cullet available in the Northwest, a supply which exceeds the regional demand for new green glass containers.

(2) High Cost of Transporting Cullet Glass to Market
(Unfavorable Economics)

Cullet has a low value in relation to its weight which makes it costly to collect and transport. Intra-state transportation regulations often do not allow shippers of secondary commodities to take advantage of back-haul or other cost saving shipping methods. These restrictions often increase the costs of marketing recyclables from parts of the state without ready access to major transportation corridors or sufficient volumes of glass to generate frequent or large shipments.

(3) Limited Uses for Cullet Glass
(Low Processing Capacity/Low Product Demand)

This barrier is related to an earlier barrier cited for glass, in that cullet has uses other than to make new glass containers and the Northwest is a net importer of glass containers. One potential alternative use is the production of Glasphalt.

The barrier currently applies principally to green or mixed color cullet. However, there is also a need to develop uses for used plate glass and other waste glass for which is at this time no significant market.

(4) Uncertainty About Export Markets for Cullet
(Other Factors)

To date, no significant exports of cullet have occurred from the Northwest. Potential export options have not been thoroughly examined because the high costs of shipping are disproportionate to the material's value (raw materials for glass manufacture are globally available and relatively cheap). New markets are needed, particularly for mixed color glass.

c. Metals

(1) High Cost of Transporting Tin Cans and White Goods to Market
(Unfavorable Economics)

As with lower-valued waste paper and glass, the regulated cost of transporting tin cans to market can be a barrier for some communities in the State. Shipping white goods can also be a problem, especially if they have not been preprocessed. In some areas of the State, the limited available volumes of tin cans tend to increase transportation costs.

(2) Costs and Uncertainties of Complying with Environmental Regulations, Environmental Risk and Potential Liability Associated with the Processing of Scrap Metals
(Other Factors)

Recycling and regulation seem to conflict in the case of metals.

- Those who shred and recover ferrous metal from white goods have greatly reduced their demand and prices for these items because of a concern over the regulation of the "fluff" -- residual waste which has been identified as potentially hazardous due to possible PCB contamination.

- Lead acid batteries were previously recycled in the Northwest; however, new investments in battery recovery are considered risky because of the "potentially responsible party" liability element of environmental regulations.

Both of these issues have reduced demand for some recoverable metals and have hindered expansion of some operations.

(3) Some Metals with Market Potential Present Special Recycling Difficulties
(Other Factors)

Many items are designed without consideration of their recyclability. This especially affects metals recovery but is also a concern for other materials such as plastic. White goods, batteries and other sources of recoverable metals (e.g., aerosol cans) may contain electrical components or other substances which make them difficult to recycle. Though white goods with PCB's are no longer manufactured, they may continue to be a major component in the waste stream into the next century. Other concerns affecting the recyclability of metals, such as the heavy metal content of paints used in appliances, may develop in the future.

(4) Lack of Awareness About Recyclability of Tin Cans
(Low Material Supply)

Tin cans are not recognized by many consumers as recyclable. Their low value often does not allow payment for them at buy-back centers. This tends to reduce the volume of tin cans supplied by collection programs for recycling. Other metallic products, such as discarded toasters, may have reduced recovery because of a similar lack of awareness. The same is true for plastics.

d. Plastics

(1) Limited Domestic Demand for Products Made of Recycled Post-Consumer Plastics
(Low Product Demand)

In many applications, there is a greater demand for plastics made from virgin resins than from recycled resins. The use of recycled resins is prohibited in some food and engineering uses of plastics. For example, recycled PET plastic from soft drink bottles is not used in the manufacture of new soft drink containers. This barrier is especially important for products made from mixed plastics, such as plastic lumber.

(2) Limited Processing Capacity for Post-Consumer Plastics
(Low Processing Capacity)

Although there are a large number of plastic users, there are very few operations equipped for the cleaning and processing required to convert post-consumer plastics into a usable feedstock for these industries.

(3) Competing Waste Stream Demand for Plastics
(Low Material Supply)

Alternative strategies are proposed to manage plastics in the waste stream, such as energy recovery through incineration, or biodegradation. These strategies work counter to recycling objectives and reduce the supply of plastics for recycling or the quality of that supply.

(4) Limited Supply of Post-Consumer Plastics
(Low Material Supply)

To date, processes and businesses to recycle post-consumer plastics have been slow to develop because the material has not been consistently available. End-users are, therefore, reluctant to make investments. Collectors of plastic have thus far borne a major risk, since they have not had guarantees that their supplies could be marketed. Potential consumers of recycled plastic products, such as state programs may require that a minimum volume of material be guaranteed before bid specifications will be modified.

(5) Lack of Awareness About Recyclability of Plastics
(Low Material Supply)

The public is not aware of how to prepare plastics for recycling and which items can be recycled. This limits the ability to collect adequate supplies.

(6) Material Specifications for Post-Consumer Plastics are Not Well Defined and Supplies Tend to Have Mixed Composition
(Low Material Supply/Low Processing Capacity)

A large number of resins are used in manufacturing plastic products and specific resins are not always easily distinguishable by recycling collectors or processors. Recycling technologies either focus on separating supplies into distinct resins types (and even colors) or on processing of mixed plastics. The highest value is obtained when the purity of resin composition is maintained. However, this incurs higher processing and collection costs. To date, recycling has focused on one or two resin types found in beverage containers, although many other types of plastics are available in the waste stream.

(7) High Cost of Collecting and Transporting Plastics to Market
(Unfavorable Economics)

Plastics have a much higher value per pound than many of the other materials for which transportation cost is a barrier; however, the extremely low densities of most plastics prior to processing or baling make them costly to collect and transport. Effective methods of volume reduction for curbside or drop-off collection have not yet been proven. Transportation to market and tariff regulation is especially a concern for supplies from the less populated areas of the State. The unfavorable economics of collecting and transporting plastics reduce supply which in turn impedes development of markets.

(8) Some Plastics with Market Potential Present Special Recycling Difficulties
(Other Factors)

Often plastics are combined with metal, wood, or glass in durable goods or in packaging. This combination may limit recovering either the plastics or the other materials. For example, the 12-ounce PET and aluminum can recently introduced by one soft drink manufacturer had the potential to be recycled by plastics recovery processes but often ended up in supplies of aluminum cans because of its appearance, thus causing problems for aluminum can recyclers.

(9) Uncertainty About Export Markets for Post-Consumer Plastics
(Other Factors)

Most of the post-consumer plastics currently recovered from Washington State are shipped overseas. This export currently represents a very

small percentage of the potentially available supply, although we have not yet developed the same understanding of this market as we have of the international metals market.

(10) Difficulty of Financing Developing Plastic Recycling Operations (Low Processing Capacity)

Entrepreneurs seeking to develop new or unproven plastics recycling industries often have difficulty obtaining private financing because supplies and markets for material are unproven. Often these types of recycling industries are capital intensive, even on a small pilot scale. The state Constitution does not allow the state government to extend credit to private businesses.

(11) Limited Uses for Post-Consumer Plastics (Low Processing Capacity/Low Product Demand)

Problems with using post-consumer plastics in new food containers or for engineering applications have already been mentioned. Options for using secondary plastic resins in the manufacture of new products are currently limited. There may be as yet unrecognized uses for recoverable plastics, particularly mixed resins. For example, the manufacture of plastic lumber from mixed plastics is a fairly recent technology, and new uses for recycled PET and HDPE continue to develop. Greater diversification of applications for post-consumer plastics would lead to a broader and more stable market.

e. Organics

(1) Limited Local Demand for Yard Waste Compost (Low Product Demand)

Yard waste compost is currently not being used in many applications where it is appropriate. Where supplies of yard waste compost are available they are not always in high demand because of uncertainty about the quality, consistency and availability of the product. Other materials such as peat moss and bark dust, or other types of compost have an established market share which is a barrier to developing markets for similar new products.

(2) Potential Yard Waste Processors Have Difficulty Initiating Compost Projects (Low Processing Capacity)

A number of topsoil suppliers have the experience and the familiarity with markets to develop yard waste composting operations. In many cases, however, they have had difficulty dealing with overlapping and uncertain permitting requirements of government agencies at various levels. This has prevented some processors from developing new capacity.

(3) Markets for Yard Waste Compost are Not Established
(Low Material Supply/Unfavorable Economics/Other Factors)

Although there are many potential users of compost products, they may have no experience with compost and may be initially unwilling to use it. Establishing a new market is difficult. Users have no assurance that yard waste compost will be of sufficient quality and may be uninformed about appropriate applications. Yard waste compost may displace other organic composts derived from waste products (sludge, sawdust, bark, etc.).

(4) High Cost of Collecting and Transporting Yard Waste to Processing Centers
(Unfavorable Economics)

Unprocessed yard waste has a low density and is expensive to transport beyond a limited area. This requires that a region be served by a number of small yard waste processors rather than by a single large processor. These economics affect the cost of collecting and processing adequate supplies.

(5) Costs and Uncertainties of Complying with Environmental Regulations for Yard Waste Processing
(Other Factors)

Governmental agencies' lack of experience in regulating yard waste processing and composting operations causes uncertainty for operators about restrictions and conditions which may affect their ability to operate profitably. Uncertainty causes businesses to be cautious in initiating or expanding composting operations.

(6) Difficulty of Financing Developing Yard Waste Processing/Composting Operations
(Low Processing Capacity)

Entrepreneurs seeking to develop new yard waste processing and composting facilities often have difficulty obtaining private financing because markets for the material are unproven. Often these operations are capital intensive, even on a small scale. The state Constitution does not allow state government to extend credit to private businesses.

(7) Limited Uses for Yard Waste
(Low Processing Capacity/Low Product Demand)

The major use of yard waste is currently thought to be in the production of compost. Other uses, as hog fuel or to make residential fire logs, have been considered. Diversification of yard waste usage could broaden the market for the material.

(8) Supplies of Yard Waste are Limited
(Low Material Supply/Unfavorable Economics)

Supplies of yard waste are seasonal and are often not adequately separated from the regular waste stream. This has prevented some potential processors from developing operations.

f. General Market Barriers for All Commodities

(1) Consumers are Not Aware of Sources of Recycled Products (Low Product Demand)

Individuals, manufacturers, and agencies interested in purchasing products made from recycled materials do not have adequate information about where recycled products can be obtained. No single source currently lists Northwest suppliers of secondary products.

(2) Suppliers of Recyclable Materials Lack Information on Markets (Other Factors)

Businesses or agencies collecting recyclable materials do not always have current information about available markets for all commodities, their specifications, and records of past market performance or future market forecasts. Information may not be readily available about current product or process research and development potentially affecting future markets or about waste stream composition and recycling levels, potentially affecting future supplies. Users of specialized materials are often not aware of generators of small quantities of those materials.

(3) Lack of Governmental Coordination in Market Development (Other Factors)

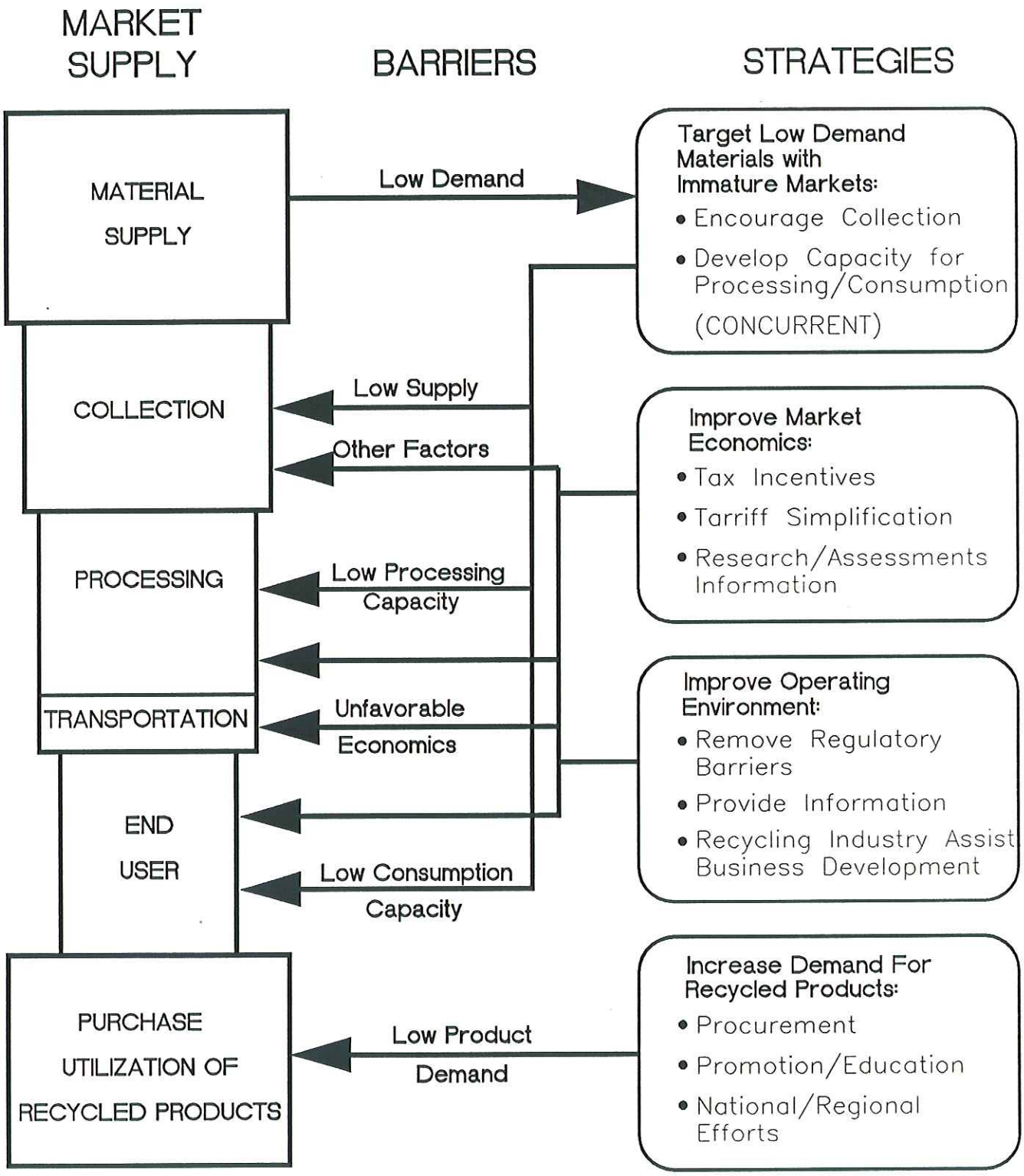
Since many markets for recyclables are regional, national or international, market development programs of states or local governments will affect markets for other jurisdictions. If these efforts are not coordinated, strategies may conflict. For example, different states or cities may individually set standards for recycled paper, all of which may be different. Some jurisdictions are requiring that certain plastics be biodegradable. This requirement works against the recycling of this material which may be a goal in other jurisdictions.

## 4. MARKET DEVELOPMENT STRATEGIES/OPTIONS

The following framework for considering market development options has been developed based on a review of market development in other parts of the nation and on an analysis of the market barriers facing Washington State. Broad strategies are outlined for each of the major market barriers identified in Subsection 3. Each strategy addresses market development options for important recyclable commodities. Figure 2 summarizes the Context for Market Development Strategies.

Figure E-2

# Context For Market Development



| BROAD MARKET BARRIERS | BROAD MARKET DEVELOPMENT STRATEGIES |
|---|---|
| Low Material Supply | Increase Supply of Materials |
| Low Processing Capacity | Increase Consumption and Processing Capacity |
| Low Product Demand | Increase Demand for Recycled Products |
| Unfavorable Economics | Improve Market Economics |
| Other Factors | Improve Business Operating Environment for Recycling Industries |

No single strategy will guarantee stable and adequate future markets. However, the aggregate effect of thoughtfully implementing a few of the right strategies can strengthen and expand markets. Recommendations in Subsection 5 identify the most effective strategies. Some strategies were deemed ineffective or inappropriate for Washington State. These are identified with an asterisk (*). The following discussion briefly describes strategic options.

a. Increase the Supply of Recyclable Materials

(1) Develop State Recycling Policies for Low Demand Materials

These policies would recognize and reinforce the State's intention to increase the cost-effective recovery of materials for which low supply currently limits markets. State policies would encourage implementation of local recycling programs which in turn would stimulate market demand for these materials. Policies should address the following materials:

(a) Plastics

Policy decisions about plastics need to be made: should recoverable plastics (especially PET, HDPE, and films) be targeted for source separation and recycling or should they be left in the waste stream to allow recovery of their energy content by incineration (when available)? If plastics are to be recycled, then a policy prohibiting biodegradability in those plastics to be recovered should be developed. Further, such a policy could allow the use of secondary resins in the production of food containers so long as protection of public health is assured. This would greatly expand the demand for post-consumer PET and HDPE.

(b) Yard Waste

A policy encouraging cost-effective source separation and centralized composting of yard waste.

(c) Mixed Waste Paper

A policy on the source separation and recovery of mixed waste paper should recognize the material's historically marginal market and that alternatives need to be provided for continuing use of collected supplies when prices

are low. This may require research and development of new processes or may involve shunt systems to produce RDF. Such a policy would encourage the development and expansion of domestic markets for mixed waste paper.

(2) Develop and Expand Recycling Collection Programs

Other policy recommendations within Volume III of this report relate to mechanisms for developing collection programs. In order to increase supplies of especially plastic, yard waste and mixed waste paper so that markets for these materials develop, assistance can be given in the following ways:

- Provide funding.
- Encourage collection system development.
- Provide promotion and education on why and how to recycle plastics and tin cans (another low supply material).

(3) Ban Disposal of Targeted Items*

Banning disposal of plastics, yard waste, mixed waste paper or other items for which markets are limited by inadequate supplies could increase the volume of available materials. Bans based on protecting the environment can be effective but bans to develop markets are inappropriate since supplies would no longer be sensitive to market demand. Bans may also preclude management options requiring disposal for some particularly contaminated or non-processible materials. This strategy was not considered desirable as a market development approach for Washington State.

(4) Mandatory Material Recovery Goals with Penalties*

This strategy would specify goals for recovery of low demand materials and require that the producers of products or packaging containing those materials participate in the funding and implementation of programs to collect those items. Programs of this type have been undertaken in Ontario, Canada to increase the recovery of beverage containers. Of the materials for which low supply limits markets, plastic is the only one for which such an approach could be considered. The strategy was not considered desirable for Washington State because growth in supplies would not be adequately sensitive to market strength and capacity. Manufacturers of plastic container and packaging could increase supplies for recycling by redesigning products to eliminate multiple resins and by labeling resin types. The latter is already underway in the form of a resin coding system.

(5) Market Assurance*

The State of Rhode Island has recently proposed a program in which the state will act as a "Market of Last Resort" to purchase collected materials which cannot be sold on the open market. This could mean that the state would become a broker for low demand materials where low supply is a barrier to expanded markets such as mixed waste paper, scrap plastic and yard waste.

This strategy was not considered desirable for Washington since the markets that would develop for these materials could become grossly distorted and would not be likely to function without continued financial assistance. This runs counter to a primary objective of market development programs -- to foster independent and self-sustaining demand.

b. Increase the Consumption and Processing Capacity for Recyclable Materials

(1) Technical Assistance

Those capable of expanding existing operations or developing new business ventures to process or use recyclable material would benefit from technical assistance in a number of areas. Technical assistance is mostly needed for those materials for which little demand currently exists, such as plastics and yard waste.

(a) Regulatory and Permitting Assistance

Plastics processing and yard waste composting ventures are often undertaken by small businesses with little experience in obtaining permits and approvals from the many agencies that may be involved. Assistance in working with the regulatory system would be beneficial to these businesses.

(b) Facilitate Development of Standard Product Specifications and Quality Assurance Programs

The well-established recycling industries for paper and metal have agreed on and published material specifications which allow purchasers and sellers to communicate and trade efficiently. The newly developing post-consumer plastics and yard waste processing markets do not have such standards and this is a barrier which discourages some businesses from using these materials as feedstocks. Washington State can support the plastics industry's development of national secondary material standards. State and regional standards and product categories need to be developed for yard waste compost and other organic materials. The State can be instrumental in developing these standards which could facilitate agency procurements. Compost testing and quality assurance programs, which would be an appropriate role for an agricultural extension program or some other government agency, could also foster increased yard waste processing.

(c) Provide Assistance in Obtaining Project Funding and Business Assistance

The Department of Trade and Economic Development and the Washington Business Center already provide assistance to developing small businesses. This assistance has not previously been targeted at small recycling businesses. This assistance would be particularly beneficial to collectors and processors of plastic and yard waste. Though the state has a constitutional prohibition on extension of credit to private interests, assistance could be provided in directing plastic and yard waste processor as well as other small recycling businesses to private or federal funding sources.

(2) Promotion and Education

Promotion and education can increase demand for products made from recycled materials. To increase processing of yard wastes, promotion and education can stress the value of all organic products available in a particular part of the State. Promotion and education would serve to stabilize processing capacity as it develops. A major concern is that this promotion not occur in isolation or in opposition to the marketing of other organic composts such as sludge compost, municipal solid waste compost or bark products. (Such opposition would destabilize markets for all organic products.)

(3) Tax Incentives for New Recycling Industries*

Tax advantages could encourage existing or potential businesses to develop additional capacity to consume recyclable materials. Tax savings which could be provided in Washington state include a waiver of the B&O (Business and Occupation) tax during the start-up of a new recycling business, or a reduction in the required workmen's compensation deposit. A waiver of sales tax on the purchase of new equipment for processors or end-users of recyclable materials might also be considered.

The tax incentive strategy was believed to have a low effectiveness in stimulating increased consumption capacity for the lower demand materials in Washington State because of the existing taxation structure. Modifications of existing business taxes could provide only a moderate incentive and these modifications are not likely.

c. Increase the Demand for Recycled Products

(1) Procurement

According to the National Institute of Government Purchasing, purchases by state and federal governments account for about 20% of the annual gross national product. Government purchases of products made with recycled materials can substantially strengthen demand for these materials both through direct purchases and by demonstrating to the private sector that recycled products can be used effectively. Government programs have purchased increasing amounts of recycled paper and paper products. Now, other materials with recycled contents, such as waste oil, post-consumer plastics, retreaded tires, yard waste composts, cellulose insulation, and pavement made from waste glass or scrap tires are also gaining attention in government procurement activities.

Increased procurement can come about in a number of ways. Washington State is already implementing a requirement that in purchasing state agencies give preference to recycled paper products. Products containing higher percentages of recycled material will be given greater preference. This allows suppliers of recycled materials to compete in instances where they might not otherwise have been be able to do so. The concern arises that out-of-state recycled supplies might thus have an advantage over both in-state virgin paper supplies and waste paper. However, the State already provides a preference for materials manufactured in the State and this along with the recycled content preference, should provide further incentive for Washington mills to

increase production of recycled paper products. Also, strengthening markets outside of the state will be beneficial because much of the recyclable material collected in Washington is consumed outside the State.

Price preference procurement is an effective strategy which Washington should continue to develop. Alternatives might involve mandated goals for purchasing recycled products or rewards to agencies that take affirmative action to buy recycled materials. Also effective is Washington State's approach of involving agency procurement specialists in the development of a state recycled materials procurement program.

Additional actions to increase procurement include the review of purchasing specifications and technology compatibility. Government standards which unnecessarily exclude recycled products can be modified. For example, the strength of cardboard boxes specified in a government purchase contract may require the use of virgin fiber. The actual use of the boxes, however, may not require such a high strength. Boxes partially or completely made from secondary fibers may be adequate and less expensive. An evaluation should be made to assure that any new equipment purchased will be able to use recycled paper.

The State can help local government procurement offices by identifying and evaluating sources of recycled materials and, in some cases, through consolidated purchasing of recycled materials which may reduce costs and bidding complexities. Washington State already is developing programs in both of these areas.

In addition to buying paper containing recycled fiber, the government can also test new or developing products containing recycled materials. These products include: yard waste compost, plastic lumber, re-refined waste oil, glasphalt or pavement containing recovered scrap tires. Test programs with appropriate applications of these types of products can demonstrate their value and enhance demand.

(2) Promotion and Education

The goal of this strategy is to assure that individuals, businesses and industries are aware of the quality and availability of products made from recycled materials and to encourage their use. This approach also supports agency efforts to demonstrate that recycled products can be used effectively.

A wide range of promotional and educational techniques can be used from announcing on letterhead, "printed on recycled paper" to media ads promoting recycled made produced from the State's waste resource. Promotion and education must be directed at overcoming some consumers' and manufacturers' sense that recycled products are of inadequate quality or utility. Washington State could promote recycled products in much the same manner as agricultural products are cooperatively promoted by industry and government. Information needs to be available to residents and businesses about where they can obtain recycled products as well as on the benefits of "buying recycled."

(3) Incentives to Purchase Secondary Materials*

Incentive programs to encourage buying recycled products have been considered in other states. For example, Florida recently passed legislation assessing a surtax on newsprint usage by newspapers. Credits towards the surtax are accrued by using recycled newsprint. This approach has not yet been implemented and is not recommended for Washington State because it would likely not provide sufficient incentive. In addition, this approach is administratively complex and requires continual provision of the incentive, thus hindering the development of a self-sustaining market.

(4) Support Market Development at the Regional and National Level

Since many of the markets for Washington State recyclables and products made from those recyclables are regional, national or international, there is considerable need to encourage greater demand for recycled products beyond the State. The State can support and initiate federal or regional efforts to develop these markets. Appropriate strategies include:

- Establishing national or regional procurement policies and standards to provide consistent bidding guidelines for manufacturers of recycled products and allow them to be more competitive within a larger market.

* • Market or price supports for recycled commodities to stabilize demand that may otherwise be seasonal. This is not a long-term strategy because its use may prevent markets from becoming self-sufficient.

- Tax credits for investment in plant equipment that uses recyclable or recycled materials and products.

- Quality assurance programs to maintain consistent quality standards in recycled products obtained from any supplier.

* • Surcharges on containers or products potentially made from recycled materials but which are not, in other words, disincentives to purchase non-recycled items, this is also not favored over the long-term because markets may fail to become self-sufficient.

- Promoting the concept of "designing for recyclability" among manufacturers of products, packaging and equipment for utilizing recycled products.

- Investigating local, state, and national market development strategies to improve demand for specific materials.

d. Improve Market Economics for Recycling Industries

Strategies for improving market economics should generally be directed towards those materials for which recycling or processing may be a marginal venture because of the low value of the material or high cost of handling or moving the material to market. Glass, tin, mixed waste paper, newspaper and yard waste are materials which clearly fit this description. Other materials may also be affected by market economics under certain conditions. For example, aluminum cans have high value and economics are not often a barrier to handling this material, though falling market prices can reduce volumes recovered if buy-back prices also fall. Excessively high prices for recyclables, such as paper, can also deter end-users who may find it more profitable to use primary materials rather than to invest in new equipment to handle recyclables.

(1) Tax Incentives

Processors may hesitate to install new equipment to handle recyclable materials if prices offered by end-users are too low. If, on the other hand, recyclable material prices are too high to compete with virgin feedstocks, end-users are likely to use less secondary material. An exemption of sales tax on purchases of new equipment to increase a processor's or end-user's ability to handle recyclable material would provide an incentive, but would not benefit existing processors or end-users. A credit on Property, Use, or B&O (Business and Occupation) taxes based on the volume of recyclable material processed or consumed could provide an incentive for greater volumes to be handled. The decision to modify the tax structure to stimulate markets must consider other state policy objectives in addition to those for solid waste management.

(2) WUTC Tariff Modification for Recyclables

An evaluation and modification to simplify WUTC tariffs for recyclable commodities could result in a substantial savings for recycling operations in some areas of the state that have difficulty in moving material to market because of high transportation costs. This is particularly true in those situations where in-state transportation rates exceed rates for moving material out-of-state over a comparable distance. By saving on transportation or other operating costs, processors may be able to handle more material and buy-back operations may be able to offer better prices.

(3) Market Research and Assessments

A reliable source of information on markets for recyclable materials would be beneficial, particularly to smaller recycling operations and those dealing in commodities without well-established markets. Areas in which market research and assessment would be beneficial include:

- The export market for lower value materials including plastic. Foreign trade missions should include enhancement of recyclable commodities markets.

- Clearinghouse for information on recyclable materials markets. This function would be especially valuable for smaller operators who trade in lower value materials such as yard waste, white goods and special waste. Users would be able to locate potential buyers, sellers, and handlers for specific materials.

- Expanded role for Department of Trade and Economic Development in establishing new recycling industries within the state. The identification and analysis of areas for future economic growth and diversification through recycling would enable those already in the business, as well as those in and outside the state not currently involved in recycling, to effectively prepare operating plans.

(4) Market Assurance and Support*

In a number of ways State and local governments can act to improve market economics for collection programs, processors and end-users. Activities include assistance in securing long-term orders or market agreements, establishing future markets for recyclable commodities or establishing cooperatives for marketing materials from rural areas.

These strategies are not considered an appropriate government role, although governments potentially could facilitate private sector initiatives.

e. Improve the Business Operating Environment for Recycling Industries

The business environment in which recycling collectors, processors, and end-users operate could be improved to encourage greater recycling by both established and new operations. Simplifying regulations, compiling and exchanging information and other assistance would allow recycling industries to operate more profitably. This approach can be applied to all recycled commodities.

(1) Establish Ombudsman Role/Legislation

This strategy would be directed at mediating problems which may develop for some recyclers from conflicting or complex regulations. For example, concern over regulation of hazardous waste in the recovery of metals from white goods, batteries, tin cans, or other items limits the interest and investments of businesses in this activity. An ombudsman or other advocate could simplify, coordinate or recommend modification of regulation to both safeguard public health and the environment and encourage recycling.

The ombudsman role has already been established as a function within some Washington State agencies. The Department of Ecology, Office of Waste Reduction and Recycling, may have elements of this function within its existing mandate. If this is the case, more specific direction and funding could be provided to fully implement this concept.

Often mediation or coordination is needed between conflicting or redundant requirements among various levels of government. Other areas of assistance may be evaluation and modification of compliance requirements for pollution controls for operations such as yard waste processing or waste paper de-inking. These requirements may have a high cost but minimal effectiveness. Consideration could be given to alternatives to existing environmental risk and financial liability provisions which discourage qualified and responsible businesses from undertaking battery recovery operations and similar activities.

(2) Establish Information and Coordination Network

This strategy would be directed at providing a reliable source of information about markets for recyclable materials. A clearinghouse or data/information exchange would provide the following benefits:

- Tracking or forecasting of market performance. This is already done on a national or international level for many of the established markets, but would be helpful at the state level and for the less-established commodity markets.

- Market referral and index service. This would be especially helpful for lower-valued materials such as organics, white goods and special waste or for newly recyclable commodities such as plastics. This function is similar to that of a waste exchange but would involve less of an active role in connecting buyers with sellers.

- Literature search and information retrieval for current research and development activities related to secondary materials. This would assist those interested in new processes and uses for recyclable materials.

- Ongoing data collection and profiling of waste composition and recycling within the state. This would assist businesses in understanding trends and planning new ventures to handle recyclable commodities.

- Special data needs or research. For example, plastics recyclers might be able to use historic data available from automotive manufacturers on the composition of potentially recoverable plastic automobile parts.

Many of these functions fit well within the role recently established for the Office of Waste Reduction by 1988 legislation, and some, in fact, have already been undertaken.

(3) Promotion and Education

Various promotional and educational strategies to increase demand for recycled products and processing capacity for recyclable materials have

been discussed. In addition, promotion and education can improve the business environment in which recycling industries operate. For example, promoting "designing for recyclability" among manufactures or packagers would help to reduce future difficulties potentially faced by recyclers of white goods or other products. Regional and national coordination would also be productive here. Promotion and education is probably more effective than regulation in developing a cooperative operating environment for both recyclers and manufacturers. Another promotion and education strategy is to recognize recycling industries as valued members of state and local business communities.

(4) Facilitate Development of New Recycling Industries Within the State

This strategy fits well within the existing role of the Department of Trade and Economic Development. This agency should designate as a high priority the development of recyclables markets in Washington. Specific assistance could include:

- Help in obtaining project financing.
- Help in undertaking the land use approval and permitting process.
- Help in coordinating with state and local government policies and programs.
- Guidance in business development planning, particularly for ventures which make a new use of recyclable materials and broaden and diversify markets.

Existing businesses in the State that could expand their use of recyclables, as well as new businesses and outside of the state could be encouraged to use recyclable materials. This would not only increase the proportion of materials with in-state end-users, but would also contribute to the general health of the state economy through increased employment and a broadened tax base.

## 5. CONCLUSIONS

Enhancing the demand side of recyclables markets is essential. Recommended market development strategies are outlined below. Before undertaking these efforts the State should outline a comprehensive market development plan. This plan should define objectives, tasks, responsible agencies, schedules, costs, funding mechanisms, as well as program evaluation and coordination.

### a. Recommendation

Undertake programs to develop markets focusing on new or expanded demand for secondary materials.

b. Desired Results

- Markets and market economics for all recyclable materials will enjoy long-term growth. (Results from any one market development strategy are not expected to be great or immediate.)

- Demand in immature markets, such as those for plastics and organic compost, will gradually increase. Demand in more mature markets, such as those for paper, metals and glass will become increasingly stable.

- Economics for the recycling of various materials from around the State will improve and gradually result in increased recovery rates.

c. Rationale

- Market uncertainty is a primary barrier to increased recycling. A number of state and local governments have recently committed themselves to market development, recognizing that successful recycling requires paying attention to the demand side as well as the supply side (materials collection).

d. Roles and Responsibilities

- Responsibility for funding and implementing recommendations would be shared by state and local government agencies. The key responsibilities for market development will involve the following groups:

| | |
|---|---|
| LEGIS | Washington State Legislature |
| WDOE | Washington Department of Ecology/Office of Waste Reduction |
| DTED | Washington Department of Trade and Economic Development |
| OP | Washington Office of Procurement in General Administration |
| L.G. | Local Government (Cities and Counties) |
| WUTC | Washington Utilities and Transportation Commission |
| OTHER | Other agencies or groups will also be involved in some strategies |
| PUBLIC | The Public and various interest groups will have some involvement in all strategies |

e. Special Conditions

- Because of the number of agencies involved, an overall plan for coordinating various market development strategies should be developed including priorities.

- Recommended strategies are organized according to the agencies responsible for implementation. Strategies have been assigned priorities of either "First" or "Second" and agencies with secondary responsibilities have been identified. The previous section -- Options -- explains the strategies. Agency responsibilities and recommended strategies are summarized in Table 1.

(1) Washington State Legislature

Strategies:

(a) Develop a State policy supporting the recycling of plastics; key positions should address:

- Recycling versus incineration.
- Biodegradability of plastics.
- Use of recycled plastics in food containers.

Priority -First
Secondary Responsibilities - WDOE.

(b) Establish an ombudsman role to mediate regulatory conflicts hampering the recycling industry.

Priority -Second
Secondary Responsibilities - WDOE

(2) Department of Ecology

Strategies:

(a) Fully fund and implement previously authorized market development activities.

- Procurement policies.
- Role of the Office of Waste Reduction and Recycling.

Priority - First
Secondary Responsibilities - OP, LEGIS

(b) Evaluate and modify market development activities and strategies now and in the future.

Priority - First
Secondary Responsibilities - LEGIS

(c) Develop standard product specifications for compost and other recycled organic materials.

Priority - First
Secondary Responsibilities - OTHER (industry)

(d) Initiate and support market development activities at the regional and federal level directed at:

- Procurement.
- Design of products and packaging for recyclability.
- Recycling industry tax credits.
- Quality assurance programs for secondary materials.
- Investigation and evaluation of effective market development strategies.

Priority - First
Secondary Responsibilities - LEGIS

(e) Establish a clearinghouse for market information about:

- The performance of recyclables markets (tracking and forecasting).
- Market referrals and index (especially for lower valued recyclables - organics, white goods, special wastes).
- Secondary material research and development activities.
- Waste composition and recycling.
- Waste exchanges.

Priority - First
Secondary Responsibilities - OTHER (industry)

(f) Promote the use of recyclable materials and the purchase of recycled products. Focus should be:

- Informing the public, including teachers and students, about the why's and how's of recycling.
- Overcoming bias against secondary products.
- Identifying why, where and how to obtain secondary products.
- Generic promotion of quality secondary products made in the State or region.

Priority - First
Secondary Responsibilities - OP, DTED

(g) Assist potential yard waste processors in meeting regulatory requirements.

Priority - Second
Secondary Responsibilities - L.G.

(h) Promote organic products such as compost in areas where processing capacity is being developed.

Priority - Second
Secondary Responsibilities - L.G.

(3) Department of Trade and Economic Development

Strategies:

(a) Support recycling businesses and industries by:

- Providing funding assistance for new ventures.
- Encouraging new businesses to use secondary materials.
- Promoting diversified uses of recoverable waste materials.

Priority - First
Secondary Responsibilities - LEGIS

(b) Encouraging the expansion of export markets for recyclable materials.

Priority - Second
Secondary Responsibilities - OTHER (industry)

(4) Office of Procurement,
Department of General Administration

Strategies:

(a) Increase procurement of products with recycled content and products which are recyclable.

- Modify purchasing specifications.
- Identify suppliers.
- Provide assessment of ability to use recycled products.
- Establish bid price preferences.
- Consolidate purchases of recycled products (so that local governments or other political subdivisions can benefit from pooled procurement).
- Set goals for testing new recycled products (e.g., compost, glass/rubber asphalt).

Priority - First
Secondary Responsibilities - WDOE, L.G., OTHER

(5) Local Governments (Cities and Counties)

Strategies:

(a) Develop recycling collection programs for materials such as plastics, waste paper, and yard waste, which are flexible and responsive to fluctuating market conditions.

Priority - Second
Secondary Responsibilities - OTHER (industry)

(b) Procure recycled products.

(c) Coordinate establishing market cooperatives for recyclable commodities, especially in rural areas of the State.

Priority - Second
Secondary Responsibilities - WDOE

(6) Washington Utilities and Transportation Commission

Strategies:

(a) Establish lower, simpler intra-state tariffs for transporting recyclable materials.

Priority - Second
Secondary Responsibilities - LEGIS, WDOE

TABLE E-1

o = Primary
x = Secondary

| RECOMMENDATIONS | LEGISLATURE | WDOE | DTED | PROCUREMENT | GOVERNMENT | WUTC | INDUSTRIES | PUBLIC |
|---|---|---|---|---|---|---|---|---|
| 1. Plastics recycling policy | o | x | | | | | | |
| 2. Ombudsman | o | x | | | | | | |
| 3. Fund and implement authorized market development activities | x | o | | x | | | | |
| 4. Evaluate market development activities | x | o | | | | | | |
| 5. Compost specifications | | o | | | | | x | |
| 6. Regional/Federal market development activities | x | o | | | | | | |
| 7. Clearinghouse | | o | | | | | x | |
| 8. Assist yard waste processors | | o | | | x | | | |
| 9. Promote use of recyclables and purchase of recycled products | | o | x | x | | | | |
| 10. Promote organic products | | o | | | x | | | |
| 11. Support recycling businesses and industries | x | | o | | | | | |
| 12. Expand export markets | | | o | | | | x | |
| 13. Increase procurement of recycled/recyclable products | | x | | o | o | | x | |
| 14. Recycling collection program for low demand materials | | | | | o | | x | |
| 15. Market cooperatives | | x | | | o | | | |
| 16. Intra-state tariffs | x | x | | | | o | | |

# SECTION F

# BARRIERS

## 1. INTRODUCTION

Major barriers to waste reduction, recycling, and disposal programs are presented below. Within each program, barriers to specific methods are listed.

## 2. WASTE REDUCTION PROGRAM BARRIERS

### a. Lack of Awareness and Motivation

Without an awareness of the need and without some reason to reduce waste, few reduction efforts will occur. The population, both producers and consumers, must be educated regarding the desirability of waste reduction. Reduction efforts cannot be effective without a general awareness of both the problem and the need to reduce the amount of waste which we throw away. In addition, some means of providing a source of motivation such as increased disposal costs is necessary.

### b. Cultural Bias: Throwaway Society

Society has been taught and encouraged to use items and throw them away. Often this approach is portrayed as being less expensive and easier. We use and throw away razors, cameras, eating ware, and diapers. Conservation and durability are a thing of the past. It is often easier for our affluent society to discard items than to clean them, reuse them, and thereby eliminate their disposal.

### c. Cost of Disposal Not Reflected in Product Prices

The ever-increasing cost of disposing of waste is not reflected in product prices. If it were, an "economic signal" or financial incentive would be provided to individuals and manufacturers to minimize their purchases of disposable products. An approach favoring durability and reuse would be preferred financially over disposable products.

## 3. WASTE REDUCTION METHODS BARRIERS

### a. Education/Awareness

While this method is essential to achieve waste reduction, the State of Washington will have little impact on nationwide practices of both consumers and producers. Ideally, education and awareness efforts should begin at the national level. This apparent barrier should not, however, prevent the State from pursuing education and awareness to send a message to Washington, D.C.

b. Incentives and Disincentives

Quite often, disincentives such as bans and taxes are difficult to impose because of their lack of popularity with the voters. Such measures also severely impact particular special-interest groups or industries. These types of approaches might also be administratively difficult to enact and enforce. In fact, the cost of enforcement and administration could be greater than any savings realized. In any event, these methods should be examined closely with respect to their administrative and regulatory requirements prior to enactment.

Another barrier to the use of incentives and disincentives, particularly financial ones, is that these approaches are designed to have an effect upon the marketplace. Since the marketplace and the effect of financial incentives is far from predictable, there is a large degree of uncertainty as to whether such approaches will actually produce the desired results without undesired side effects. Again, these considerations should be closely examined prior to implementing such methods. These barriers should not be accepted as reasons not to pursue incentives or disincentives.

c. Special Governmental Programs

Wasteful practices have been institutionalized and are difficult to overcome. These practices are naturally associated with the abundance of resources which we have enjoyed in this country. However, these practices must be overcome, and government, which is placing increasing emphasis on reduction and recycling, must set the example. If government does not set an example, it certainly cannot expect others to willingly embrace governmental mandates to reduce or recycle solid waste. There is also an inconsistent sense of priority regarding solid waste among various governmental agencies. While some see waste reduction to be of the greatest importance, others do not recognize it as a priority and would prefer to continue their "easier" but wasteful practices. The message to reduce must be promoted and recognized as a priority throughout State and local government.

d. Waste Exchange

The greatest difficulty in making waste exchange work is the realization of its mission: to match supply and demand. In order to be effective, such efforts will have to be supported and actively promoted. Information will have to be effectively distributed to all potential users, both those who have waste to dispose or exchange and those who potentially need these waste products. In order to be effective, a matching supply-and-demand service area must be regionwide or even international in order to increase the probability of successfully matching users and suppliers.

e. On-site Composting of Yard Waste

The major barrier to this method is educating individuals and organizations. There must be an awareness of both need and proper techniques. The primary perception is that it is apparently cheaper and easier to put out yard and garden waste with the garbage. As garbage-collection rate structures

change to encourage reduction and recycling, and as awareness of the need and methods increase, this barrier will become less of an impediment.

## 4. RECYCLING PROGRAM BARRIERS

### a. Markets are Uncertain and Undeveloped

Without markets or end-uses for particular types of solid waste, recycling is not possible. Potentially-recyclable materials will end up back in the waste stream. Currently, markets for recyclables are uncertain. Prices fluctuate and there are periods of low demand. These conditions are not conducive to making long-term commitments and major capital investments. Further, markets are undeveloped for some potentially recyclable materials such as plastics and organic products such as compost are undeveloped. Markets must be strengthened, sustained, and expanded in order to allow increases in recycling.

### b. High Transportation Costs and Tariffs

Currently, the transport of recyclable commodities within the State of Washington is regulated by the Washington Utilities and Transportation Commission. Rates vary dramatically by location and commodity. Costs are often several times what they would be in the absence of regulation. Often, these high transportation costs make it unprofitable to recycle certain materials such as wastepaper in areas distant from end users or export markets. This is particularly true in eastern Washington.

### c. Lack of County Authority

Counties have substantial authority under current State law to plan for and manage solid waste. Yet, they do not have authority to collect recyclable materials in unincorporated areas served by haulers operating under permits issued by the Utilities and Transportation Commission. Thus, they cannot establish programs to collect source-separated recyclable materials. This makes it impossible for counties to promote recycling by using the most effective method for collection of recyclable materials.

### d. Lack of Coordination Among Cities and Counties

While it is technically feasible to set up cooperative programs among cities and counties, it seldom happens. Cities do but counties do not have authority to set up collection programs, and the existence of separate authorities decreases the likelihood that cooperative agreements will be established covering the collection of recyclables. This is a major barrier since larger regional areas will produce greater quantities of recyclable materials needed to make collection programs cost-effective.

## 5. RECYCLING METHODS BARRIERS

### a. Residential Curbside Collection

State law is unclear regarding the definition of solid waste and authority over the solid waste stream in unincorporated areas of counties and in cities which rely on franchised haulers (regulated by the Washington Utilities and Transportation Commission). In particular, there is no clear authority over the collection of recyclable materials. Therefore, the authority does not exist in these entities to establish curbside collection of recyclables, either through the franchised haulers or by separate contract.

### b. Multi-Family Housing Collection

In addition to questions regarding authority over solid waste collection, internal collection systems and storage space are lacking in most multi-family units. Unlike single-family residences, multi-family residences require common space to accommodate larger collection bins. Without these facilities, collection processes cannot be efficiently operated. These processes are also expensive except in high-density urban areas with concentrations of multi-family developments having more than five or six units per site.

### c. Commercial Source-Separated Collection

The major barrier to implementing this method is the lack of efficient internal collection systems and space on-site for businesses to temporarily store recyclable materials such as corrugated paper. There is also a lack of financial incentives for haulers and building owners and managers to establish and operate these systems. As disposal costs increase, and as rate structures are modified to encourage waste reduction and recycling, these barriers will begin to disappear. Franchises and contracts for haulers should be structured to provide an incentive to recycle materials as well as to make recycling worthwhile for building owners and managers.

### d. Commercial High-Grade Collection

Except for the money received from the sale of recoverable materials such as corrugated and high-grade papers, there is no financial incentive to set up this type of collection and employ the additional equipment and personnel required.

### e. Drop-Off and Buy-Back Centers

Fluctuations in prices plus variations in quantities of materials dropped off or sold at these centers create unstable or cyclical markets. In addition, uncertainty creates extreme conservatism toward making large capital investments or expanding operations. Healthy markets may be short-lived, and such commitments of resources could prove fatal. Also, there are few drop-off and buy-back centers in some areas of the State. These are often inconvenient for the individual to use. Increased utilization of drop-off and buy-back centers requires more accessible sites properly promoted and publicized

throughout the State. Many existing municipal solid waste drop-off and transfer stations and disposal sites do not provide safe and easily-accessible facilities for collection of recyclables. Finally, counties have limited authority for the placement and operation of drop boxes. This prevents their effective utilization, both for recyclables and solid waste, in rural areas of the State where they may constitute a Best Management Practice.

f. Centralized Yard Waste Composting

Again, uncertain and undeveloped markets present the greatest barrier to this recycling method. Demand for compost and other products is extremely limited at this time. Very little processing capability exists, and that which does is in western Washington, predominately in the Puget Sound Waste Generation Area. Potential markets exist, according to industry experts; however, there is a need for product standards. The customer needs to be assured of the quality, composition, nutrient value, and physical properties of the product. The lack of product specifications is another often-cited barrier to centralized yard-waste composting. Finally, there is little operating experience with this method in the Northwest. As a result, private and public collectors, processors, and users are skeptical. This lack of experience will have to be overcome with demonstrations of viable processes, and the economic uncertainty overcome by developing long-term stable markets.

g. Mixed Waste Processing

Mixed waste processing systems are untried in the Northwest; thus, there are justified reservations concerning this method. The primary barrier, however, is the question of the variable quality and marketability of recovered recyclable materials, the compost product, and/or refuse-derived fuel (RDF) which could be produced by this method. Problems relating to the marketability of compost and RDF are covered below in the paragraphs on mixed waste composting and incineration and energy recovery.

h. Mixed Waste Composting

Like mixed waste processing, the greatest barrier to mixed solid waste composting is the uncertainty of markets for the compost product. Product quality varies with the process and the equipment used. The compost may contain contaminants such as heavy metals, toxics, and volatile hydrocarbons. As a result, its uses are restricted. Liability is a concern as well. Suitable uses will have to be identified for this product. Standard procedures, testing requirements, and quality standards will also have to be established to ensure reliable and consistent product quality. Also, like mixed waste processing, mixed waste composting systems are untried in the Northwest. Thus, there is a reluctance to seriously consider this method. While caution is warranted, the development of dependable markets for compost can eliminate the greatest real barrier to mixed waste composting methods.

i. Food Waste Processing

The most significant barrier to this recycling method is, again, that such systems are untried in the Northwest. Also, the storage, collection,

and handling of the food waste pose convenience and health concerns, particularly for single-family residences. Collection from restaurants and other food-related industries provides the best opportunity for use of this method.

## 6. DISPOSAL PROGRAM BARRIERS

### a. Difficulty of Siting Facilities

This barrier includes the difficulty, time, and expense associated with siting new facilities. The NIMBY ("not in my backyard") phenomenon presents a real barrier to siting and constructing incineration or landfill facilities, particularly in urban areas of western Washington. Public resistance has been widespread, vocal, and effective.

### b. High-Risk Perception

This barrier is the most likely reason for having siting difficulties. Risks associated with landfills and incinerators are debatable but are perceived as real even when using the best available technology. An increasingly aware and active public, particularly those representing environmental and health interests, is increasing the attention being focused on disposal methods. Their worries are based largely upon perception of risks, whether real or not.

## 7. DISPOSAL METHODS BARRIERS

### a. Incineration and Energy Recovery

Environmental concerns, including potential health risks, are the greatest reason for opposition to these types of facilities. This opposition has effectively blocked projects in Washington in the recent past.

A lack of markets for RDF precludes the manufacture of RDF and its use in existing thermogeneration facilities. The absence of markets is caused by the time and expense associated with meeting emission standards and other regulatory requirements. The operating efficiency of these thermogeneration facilities is also adversely affected when RDF is burned. Without markets, RDF preparation is not a viable method.

The uncertainties surrounding the standards and regulatory requirements to be imposed on the ash residue from incinerators is a major barrier to construction of mass burn facilities. Until this issue is settled, total future costs of such facilities cannot be accurately determined. This creates a degree of uncertainty and precludes accurate cost comparisons with other methods.

### b. Landfills

The primary barrier to landfills is environmental concern, particularly concern about the contamination of ground water. This barrier can never be totally eliminated; it can only be minimized through designs using caps and liners to prevent leakage.

# SECTION G

# POLICY RECOMMENDATIONS

## 1. INTRODUCTION

Policy recommendations are designed to support the implementation of best management practices for solid waste throughout Washington State. Implementing an effective, integrated waste management strategy that fosters waste reduction and recycling is an enormously complex undertaking, requiring a major shift in attitudes and individual behavior, as well as new technology and substantial investment in new collection, processing, and disposal facilities. This necessary transition is not without risk; certain economic advantages may be overturned. There will be winners and losers.

Such fundamental changes cannot be achieved through unilateral action by state or local government. This transition from disposal of enormous quantities of waste to widely practiced waste reduction, materials recovery, and recycling, is critical to the future well-being of Washington. This transition will require the support and active participation of waste haulers, recyclers, private industries and, most important, of every Washington citizen.

These ideas and the urgency of our situation were expressed well in the January 2, 1989 issue of "Time" magazine:

> "No attempt to protect the environment will be successful in the long run unless ordinary people...are willing to adjust their lifestyles. Our wasteful, careless ways must become a thing of the past."

This issue was devoted to recognizing the perils facing the planet Earth, one of which is waste disposal. Recommended national policies included better waste management through reduction and recycling, policies which are reflected in Washington State's priorities for solid waste management. Many of the following recommendations deal with reducing waste and increasing recycling.

These necessary, fundamental changes in behavior require the prevalence of four essential conditions:

- Awareness of the problem and of environmentally sound waste management methods.
- Financial and other incentives to encourage use of recommended methods.
- Institutional support for "Best Management Practices."
- Opportunities for all Washington citizens and businesses to use these recommended methods.

Policy recommendations are designed to provide these essential conditions.

## 2. GOALS AND OBJECTIVES

Policies are enacted to achieve intended results, which are often stated in terms of goals and objectives. Goals and objectives describe a future state deemed more desirable than present conditions. A general goal and seven objectives were established to structure policy recommendations for Best Management Practices of solid waste.

A goal is a general description of a sought-after future state or set of conditions. Objectives support goals and describe specific achievable and measurable results. The basis for this study and the driving force behind present legislation is the goal:

TO IMPLEMENT THE BEST MANAGEMENT PRACTICES FOR SOLID WASTE IN WASHINGTON.

Waste reduction, recycling, incineration with energy recovery and, lastly, landfilling: these priorities established by the Washington State Solid Waste Management Act determine the objectives for implementing best management practices.

Objective One: "maximize cost-effective reduction" states clear preference for source reduction as the best means to minimize waste generation. Reduction eliminates the need to deal with waste and thus, the costs of disposal and the associated environmental degradation.

Objectives Two through Five address source-separated recycling. Source-separated recycling, where cost-effective, was judged to be a "Best Management Practice" since:

- Source-separated recycling can divert significant quantities of recyclable commodities from less environmentally sound waste processing or disposal methods.
- Source-separated methods reduce contamination of recyclables and thus maintain the greatest value for recovered materials.
- Source-separation is the most effective means of removing potentially harmful materials prior to disposal.
- Source-separation requires that individuals take personal responsibility for at least a portion of the waste they produce, therefore, offering manifold opportunities for education.

The objectives for source-separated recycling include:

Objective Two: "Plan for source-separated recycling."

Objective Three: "Strengthen institutional support for source-separated recycling."

Objective Four: "Provide funding and incentives for source-separated recycling."

Objective Five: "Increase opportunities for source-separated recycling."

Objective Six: "Use effective and environmentally sound methods for separating recyclables after the collection of solid waste" is directed toward recovery of recyclable commodities as well as organic materials for compost production. Materials which can be transformed into refuse derived fuel are also recoverable using these methods. Solid waste can be processed in a variety of ways after collection but before final disposal. Use of these methods can significantly increase the proportion of the waste stream which is recycled or otherwise productively used.

Objective Seven: "Provide opportunities for better disposal methods" addresses ways to improve existing disposal practices.

Policies appear under each of these seven objectives. Policy descriptions address:

(1) Recommendation

(2) Desired results of implementing the policy

(3) The rationale for recommending the policy

(4) Key roles and responsibilities to be assumed by the State, local governments, and private industry

(5) Special conditions under which the policy recommendation applies

(6) Design considerations to be addressed in implementing the recommended policies

It is recognized that all recommendations have costs associated with them; the consultants believe that long-term benefits will outweigh costs. However, detailed cost-benefit analyses should be conducted prior to implementing any of these recommendations. These analyses should address impacts on existing Washington State businesses.

## 3. OBJECTIVE 1: MAXIMIZE COST-EFFECTIVE REDUCTION

### a. Require Education and Promotion

#### (1) Recommendation

- Develop and implement a waste reduction and recycling promotion and education program as a required element of local solid waste management planning.

#### (2) Desired Results

- Increased awareness of need for waste reduction and recycling.

- Educate people on how to reduce and recycle waste.

- Encourage voluntary change in behavior to increase reduction and recycling.

- Improve professional education on waste reduction and recycling for engineers, facility operators, and other waste industry professionals.

(3) Rationale

- Education and promotion is a cost-effective method of creating voluntary changes in wasteful practices.

- Education and promotion motivate and support individual efforts to reduce and recycle.

(4) Roles and Responsibilities

- Local governments would implement local promotion and education efforts, using support provided by the Department of Ecology. Support would include model program designs and promotional/educational materials. Funding support would be provided through secure funding sources, such as distributed disposal tax revenues (see Policy 4.a.).

- As provided by RCW 70.93 (Model Litter Control and Recycling Act), The Department of Ecology shall "develop Statewide programs to increase public awareness of and participation in recycling..."

- The Department should continue to develop model education and promotion programs such as the "A-Way With Waste" program, a unifying statewide theme and logo, and promotional materials that could be used by local jurisdictions.

- As provided by RCW 70.95C (Waste Reduction), the Department of Ecology Office of Waste Reduction (OWR) shall encourage waste reduction in several ways including:

  - Provide advice to waste generators on waste reduction techniques.

  - Sponsor technical workshops and seminars on waste reduction.

  - Administer a waste reduction hotline.

  - Coordinate a waste reduction public education program.

- Recommend courses and curricula in waste reduction to the State's colleges and universities.

(5) Design Considerations

- A commitment of continuing funds is important, and emphasis should be on implementation rather than planning.
- Efforts will require coordination at all levels of government, and should build upon and be consistent with past efforts.
- Efforts should focus on effective publicity such as:
  - Targeting all age groups (through schools, the media and public or industrial forums).
  - Actively involving the media.
  - Providing a consistent, visible and positive message through all solid waste programs and facilities.
- Allow local flexibility in designing and implementing programs, while providing consistency through a statewide model program.
- Evaluate program effectiveness.

b. Provide Rate Incentives

(See Recycling Funding and Incentives policies under Objective 4.)

c. Initiate Packaging Reduction and Recycling

(1) Recommendation

- Investigate ways to encourage reduction and recyclability of packaging and disposable products.

(2) Desired Results

- A task force will review possible statewide efforts to encourage the reduction and recycling of disposable products and product packaging, and will make recommendations.
- The State will review recommendations and enact appropriate statewide measures to reduce and recycle disposable products and product packaging.

(3) Rationale

- Specific guidelines for reducing wasteful disposal of products and packaging cannot be considered until additional information is obtained on ways to reduce and recycle disposable products and packaging, and on the functions and usefulness of disposable products and packaging.

(4) Roles and Responsibilities

- The Legislature should convene a special task force and authorize a supporting study.
- Affected manufacturers and retailers, public interest groups and local governments should be represented in identifying and reviewing options.

(5) Design Considerations

- Objectives of the task force investigation should be to:
  - Encourage waste reduction and litter abatement.
  - Encourage recyclability.
  - Discourage unnecessary disposal.
  - Evaluate the usefulness of disposable products and packaging, vis-a-vis the State's first priority of waste reduction.
  - Ensure that manufacturer and consumer have alternatives before banning or taxing products or packaging.
- Options should be evaluated using these and other criteria:
  - Impact on waste stream and cost.
  - Impact on health (i.e., of alternatives to disposable products and packaging).
  - Provision of an appropriate incentive or disincentive.
  - Ease of implementation and administration.
  - Fairness.
  - Predictability of outcome or usefulness for testing outcomes.

- Voluntary waste reduction and recycling by industry and consumer groups should be encouraged.

- Objectives for particular approaches should be clearly identified and justified. Implementation and evaluation should be practical. Implementation should come in phases and be linked with measurable results.

- Options should emphasize long-term results, and should provide for evaluation of the long-term effectiveness of all approaches.

- Consider environmental impacts of waste products created by packaging from production through final disposal.

d. Require Waste Plans for New Development

(1) Recommendation

- Modify the State Environmental Policy Act (SEPA) process to include evaluation of solid waste generated from a proposed project, and methods to reduce that waste.

(2) Desired Results

- Applicants for permits which require SEPA review would consider ways to reduce the solid waste which would be generated as a result of the proposed project.

- While the project is still in the planning phase, governmental agency review of a project proposal would result in additional specific suggestions to reduce the amount of solid waste potentially generated by a proposed project.

(3) Rationale

- Consideration of waste reduction methods during the project planning phase yields opportunities for cost-effective reduction that would otherwise be lost at a later date.

- SEPA is an existing process that is clearly defined and understood by both government officials and project proponents; one goal of SEPA is to maximize the recycling of depletable resources.

(4) Roles and Responsibilities

- The Department of Ecology would adopt amendments to the SEPA guidelines to require consideration of solid waste impacts and methods to reduce those impacts.

- Each State agency and every local government would adopt guidelines consistent with those of the State.

(5) Design Considerations

- Guidelines for categorical exemptions and determination of threshold levels should be reviewed to ensure appropriate exemptions for projects that generate insignificant amounts of solid waste.

- Modifications to the SEPA process might occur in three places: determination of threshold levels, the environmental checklist, and the elements of an environmental impact statement.

- Revisions of the SEPA process to identify solid waste impacts should help applicants and governmental agencies both identify and reduce or avoid adverse impacts.

- The environmental checklist would require information about solid waste impacts and how to reduce those impacts. (This requirement would be similar to that concerning energy use.) If an EIS is prepared, the SEPA process would require a full and complete discussion of solid waste impacts and ways to reduce those impacts.

e. Provide Waste Audits

(1) Recommendation

- Provide commercial/institutional waste audit programs to reduce and recycle waste.

(2) Desired Results

- Local governments would have the ability to conduct waste audits of interested businesses and institutions.

- A database listing categories of waste, effective strategies, and realistic reduction goals would be developed for use by similar businesses that elect not to participate in an audit.

- Businesses that voluntarily request an audit would receive an analysis of their waste stream, recommendations for reducing waste, and projections of potential savings.

- Seminars for businesses that are not audited would be conducted to share the results of audits.

(3) Rationale

- Most businesses and institutions can reduce waste.
- Businesses and institutions may not have the time or ability to identify waste reduction strategies.
- Waste reduction strategies should be tailored to the specific waste generation characteristics of a particular business or institution.

(4) Roles and Responsibilities

- The Department of Ecology would develop a model waste audit manual.
- State and/or local governments would provide waste audits.
- Private businesses would volunteer for audits.
- Governmental agencies would be required to undergo a waste reduction audit.

(5) Special Conditions

- A waste reduction audit of a private business would be conducted only if the business requested it.

(6) Design Considerations

- Government supported waste audits should focus on education and awareness, not direct service.
- Waste audits should be based on a consistent, uniform methodology.
- Information (such as waste quantity generated per employee, cost savings achieved through particular waste reduction strategies and amount of waste reduced) should be collected in a consistent manner and maintained in a central database; this data could benefit similar businesses that do not receive audits.
- Waste reduction audits should reinforce recommendations for recycling.

f. Encourage On-Site Composting of Yard Waste

(1) Recommendation

- Develop comprehensive programs to encourage on-site home and institutional composting of yard and garden waste, encourage sound environmental practices, and provide technical information.

(2) Desired Results

- Reduced reliance on disposal as a way to manage yard waste and landscape debris.
- Reduced reliance on centralized recycling and composting systems that operate at an expense to the community.
- Increased individual and institutional understanding of how to be more self-sufficient and capable of completing a recycling/reconsumption cycle on their own.

(3) Rationale

- Education is the key to the optimum management practice of having waste generators reduce and reuse potential waste materials on their own.
- The cost of home and institutional composting is much less than the public cost of source-separated collection, composting, and marketing.
- Creating an awareness or waste reduction ethic in households and institutions will indirectly benefit all reduction and recycling programs.

(4) Roles and Responsibilities

- The Department of Ecology would include in its education and promotion program (see Policy 1.a.) model programs for promoting on-site composting of yard and garden waste.
- Local governments would design and implement programs to promote and support on-site composting of yard and garden waste.
- Local health departments would develop and enforce regulations for on-site composting to prevent and control disease vectors (rodents and insects).

(5) Design Considerations

- Educational programs must explain the why's and how's of composting, the benefits of participation, and the consequences of continued widespread disposal of yard and garden waste.
- Educational programs would need specifically to address the prevention and control of vectors (e.g., rodents and insects).

- Establishment of self-help garden clubs such as Tilth would foster creative evolution of on-site composting activities.

- Providing start-up assistance to institutions with large quantities of landscape waste would create awareness and incentives.

- Providing assistance programs (e.g., compost bin distribution program) for households would create awareness and incentives.

g. Support Waste Exchange

(1) Recommendation

- Encourage the development of, and provide financial assistance for, regional/statewide waste exchange programs.

(2) Desired Results

- The reuse of certain commercial and industrial wastes which would otherwise be disposed.

- The establishment of long-term, economically viable relationships where one firm's waste is used by another as an input to production processes.

(3) Rationale

- The diversion of commercial and industrial wastes, many of which are hazardous, will both benefit the parties involved and provide an opportunity for effective waste reduction.

(4) Roles and Responsibilities

- The State should provide financial and marketing assistance.

- Other private and public funds should be pursued.

(5) Special Conditions

- A limited number of waste exchange organizations, possibly only one, should be sponsored in order to focus resources and standardize Washington's waste exchange program, in other words, provide a "one-stop" shopping approach.

(6) Design Considerations

- Waste exchanges should take advantage of state, regional, national, and international opportunities.
- The State should consider supporting existing waste exchanges, such as the Northwest Industrial Waste Exchange Research Project sponsored by Washington Water Power/Spokane Regional Solid Waste Disposal Project.
- Consideration should be given to broadening the program to include local/regional exchanges for commodities such as paint, lumber, etc.
- Liability issues will have to be addressed to protect participating firms.

4. OBJECTIVE 2: PLAN FOR SOURCE-SEPARATED RECYCLING

a. Treat On-Site Collection of Separated Recyclables as a Best Management Practice

(1) Recommendation

- Require that local solid waste management plans treat on-site collection of residential and commercial source-separated recyclables as a best management practice, unless shown to be otherwise by cost, practicality, or environmental impact.

(2) Desired Results

- Source-separated recycling services will increase as local jurisdictions respond to planning requirements, resulting in an increase in the amount of waste recycled.

(3) Rationale

- Although collection of source-separated recyclables is a best management practice for many areas, particularly urban and suburban areas, local conditions (e.g., quantity and composition of waste, and distance to markets) may render it uneconomical.
- This policy strongly supports collection of source-separated recyclables by requiring local jurisdictions to show why it may not be a best management practice for their area. At the same time, the policy provides leeway for local jurisdictions to consider and adopt alternative source-separated recycling methods when these prove to be more cost-effective, practical, and environmentally sound.

(4) Roles and Responsibilities

- The State would be responsible for establishing planning requirements to address this priority, and for defining criteria with which to evaluate on-site collection of source-separated recyclables. Criteria include cost, practicality, and environmental impact.

- Local jurisdictions would be responsible for evaluating on-site collection of source-separated recyclables and determining this method's appropriateness for their jurisdiction.

(5) Design Considerations

- In examining the feasibility of on-site collection of source-separated recyclables, local jurisdictions should consider:

  - Potential funding support both from a "recycling service charge" on regular garbage collection services and from disposal tax revenues.

  - Alternative collection methods (e.g., variations in equipment, type of recyclables collected, frequency of pick up, types of containers) in order to identify the most effective and efficient approach for their area.

  - Cross-jurisdictional routing for collection of recyclables, if this would help provide a more efficient and thus economical service. This could be accomplished through interlocal agreements and contracts with other jurisdictions or permitted haulers.

- When there is insufficient information to judge the feasibility of on-site recyclable collection programs, local jurisdictions should carefully evaluate demonstration projects.

b. Determine Operating Details Locally

(1) Recommendation

- Rely on local governments to determine operating details for source-separated recycling programs.

(2) Desired Results

- Local government would determine operating details such as specific types of service, collection frequency, locations, and materials to be handled, and design cost-effective programs suited to local conditions.

(3) Rationale

- Variation among Washington communities in terms of waste generation and composition, population and population density, and markets are significant enough that statewide standards would not be applicable.

(4) Roles and Responsibilities

- Local government should determine recycling program components suitable to local conditions.

- The State should establish performance objectives.

c. Assess Impacts of Collection

(1) Recommendation

- Assess the financial impacts of source-separated collection on existing recycling and waste management industries and public resources.

(2) Desired Results

- Protect existing cost-effective recycling programs.

- Development of new programs which would not duplicate existing systems and would yield increases in the quantities of materials being profitably recovered.

(3) Rationale

- Cost-effective recycling programs exist in many communities. Care should be taken so that these programs are not lost or supplanted by programs for which costs exceed gains.

(4) Roles and Responsibilities

- Assessments should be conducted by local governments as part of solid waste management planning.

(5) Design Considerations

- Assessments should address:

  - Existing recovery rates and costs for local private recycling industries.

  - Projected recovery rates and costs for proposed new programs.

- Impacts on quantities handled by local private recycling industries and waste haulers.

- Comparison of existing recovery rates and costs with projected cumulative net recovery rates and costs for new programs.

- Marginal cost of additional recovered quantities.

- Marketability of additional recyclable materials.

d. Require Waste Plans For New Construction

(1) Recommendation

- Develop and adopt a Waste Planning Code as a section of State and local building codes for new non-single-family structures and require that these buildings provide facilities to collect and store recyclable materials.

(2) Desired Results

- Establishing minimum uniform requirements for new buildings to facilitate collection, storage, and recycling of recyclable materials.

- Considering, before construction, how designers and builders could best accommodate collection, storage and recycling of waste generated by occupants of a building so that expensive remodels could be avoided.

- Overcoming the current major barrier to commercial/multi-family recycling posed by the lack of internal collection systems and facilities including storage space.

(3) Rationale

- Consideration of recycling requirements in the design and construction phases will yield opportunities for recycling that might otherwise be lost or not feasible after construction is completed.

- Integration of a waste planning element in the State Code will ensure widespread consideration of how to increase opportunities for recycling.

(4) Roles and Responsibilities

- The State Building Code Council would develop and adopt minimum uniform standards for a Waste Planning Code.

- Counties and cities would be required to implement the Waste Planning Code through the existing building permit process.

- Local governments could independently adopt a Waste Planning Code if the State does not.

- Builders would have to comply with the building code in order to obtain a building permit.

(5) Special Conditions

- Single-family residences would be exempt.

(6) Design Considerations

- The Waste Planning Code would address such specifications as amount of space needed for storage of recyclable materials, internal collection systems, access to storage space for collection vehicles, common-use storage spaces for apartment dwellers, and availability of balers or other machines to facilitate recycling of separated materials.

- A size threshold for submitting plans should be established based on expected generation rates.

- Model standards should be developed by the State.

- Opportunities for reduction of waste expected to be generated by the occupants of the new building could also be explored during the review of the building permit application. This would be primarily an educational process with interest in waste reduction driven by a desire to lower disposal costs.

5. OBJECTIVE 3: STRENGTHEN INSTITUTIONAL SUPPORT FOR SOURCE-SEPARATED RECYCLING

a. Develop Markets

(1) Recommendation

- Undertake programs to develop markets focusing on increasing demand for secondary materials.

(2) Desired Results

- Markets and market economics for all recyclable materials will show long-term improvements.

- Demand in immature markets will gradually increase; demand in more mature markets will stabilize.

- Economics for the recycling industry will improve and will gradually allow for increased recovery of more materials.

(3) Rationale

- Market uncertainty is a primary barrier to increased recycling.

(4) Roles and Responsibilities

- Key responsibilities must be assigned to appropriate agencies. (See Design Considerations)

(5) Special Conditions

- Because of the number of agencies involved, an overall plan for coordinating various market development strategies should be developed.

(6) Design Considerations

- Strategies should be assigned to particular agencies:

  Washington State Legislature

  - Develop a State policy supporting the recycling of plastics.

  - Establish an ombudsman role to mediate regulatory conflicts hampering the recycling industry.

  Department of Ecology

  - Fully fund and implement previously authorized market development activities.

  - Evaluate and modify market development activities and strategies now and in the future.

  - Develop standard product specifications for compost and other organic materials.

  - Initiate and support market development activities at the regional and federal level.

  - Establish a clearinghouse for market information.

  - Assist potential yard waste processors in meeting regulatory requirements.

- Promote the use of recyclable materials and the purchase of recycled products.

- Promote organic products such as compost in areas where processing capacity is being developed.

Department of Trade and Economic Development

Support recycling businesses and industries by:

- Providing funding assistance for new ventures.

- Encouraging new businesses to use secondary materials.

- Promoting diversified uses of recoverable waste materials.

- Encouraging the expansion of export markets for recyclable materials.

Office of Procurement, Department of General Administration

- Increase procurement of products with recycled content and products which are recyclable:

  Modify purchasing specifications.
  Identify suppliers.
  Provide assessment of ability to use recycled products.
  Establish bid price preferences.
  Consolidate purchases of recycled products.
  Set goals for testing new recycled products.

Local Governments

- Develop recycling collection programs for low demand materials such as plastics, wastepaper and yard waste which are flexible and responsive to fluctuating market conditions.

- Procure recycled products.

- Coordinate establishing market cooperatives for recyclable commodities.

Washington Utilities and Transportation Commission

- Establish lower, simpler intra-state tariffs for transporting recyclable materials.

b. Establish Lower, Simpler Intra-State Tariffs

(1) Recommendation

- Establish lower, easily understood, and consistent intra-state tariffs for the transportation of recyclable commodities.

(2) Desired Results

- Uniform rates for transport of similar recyclable commodities.
- Reasonable tariffs for recyclable commodities with the benchmark being unregulated rates.
- Rate tariffs, filed with the Washington Utilities and Transportation Commission (WUTC), that are easily understood and readily available through telephone or simple, written inquiry.

(3) Rationale

- Artificially high tariffs discourage recycling in some Waste Generation Areas.
- Variations in rates for shipping recyclable commodities by common carrier create artificial inequities among recyclers and Waste Generation Areas.
- Information about rate tariffs charged by regulated transporters for particular recyclable commodities is difficult to obtain and understand.
- Higher rates may be charged for recyclable commodities than for comparable virgin materials, creating a disincentive to recycle.

(4) Roles and Responsibilities

- The WUTC, with assistance from WDOE and representatives of the recycling industry, would determine how best to accomplish objectives.
- The WUTC would lead in implementing new tariffs.

(5) Design Considerations

- Design considerations will be defined by WUTC, recycling industry, and common carrier deliberation.
- Rates should encourage as much as possible the collection, sale, and use of recyclable commodities throughout the State.

c. Permit Counties to Establish Collection and Drop-Off Systems and Direct Flows

(1) Recommendation

- Provide authority to counties to establish source-separated recycling collection and drop-off systems.

(2) Desired Results

- Counties will be able to determine recycling service levels and to establish recycling systems.
- Drop-off systems would be provided in areas where collection is not cost-effective, enhancing public service and customer convenience, and increasing materials recovery.
- Counties would be able to fully integrate recycling into solid waste management systems.

(3) Rationale

- To integrate recycling into general solid waste management responsibilities, counties need the authority to plan, design, implement, and control recycling collection and drop-off systems, including arranging for the sale or disposition of recyclable materials.

(4) Roles and Responsibilities

- There are two alternatives for providing this authority to counties:

  1. Define recyclables as any material which can be reused or processed into usable resources or products, and grant counties full authority over all aspects of the collection and handling of these materials within unincorporated areas. This alternative would:

     - Give counties flexibility in establishing systems.
     - Create a competitive environment for collection of recyclables.
     - Enable cities and counties to contract with one another and create collection systems that cross jurisdictional boundaries.

  2. Enable counties (a) to establish recycling service levels and (b) to direct the WUTC to require permitted haulers, as a condition of their permits, to

provide services as specified in the county's solid waste management plan. This alternative would:

- Use existing infrastructure and avoid duplication of systems.

- Simplify the incorporation of recycling costs and revenues into regular MSW collection rates.

(5) Design Considerations

- Under Alternative 1, counties should have the choice of whether or not they wish to exercise authority over recyclables.

- Under Alternative 2, determination of service levels should include:

  - Methods or techniques to be used.

  - Area in which service is to be provided.

  - Frequency of service.

  - Categories of recyclables to be handled.

- Recycling costs and revenues should be included in the regular MSW collection rate base. (see Policy 4.b.)

- Regional collection and drop-off systems that cross jurisdictional boundaries should be encouraged.

d. Provide for Cross-Jurisdictional Collection

(1) Recommendation

- Provide for cross-jurisdictional collection of source-separated materials.

(2) Desired Results

- Regional collection systems that achieve cost efficiencies by operating across jurisdictional boundaries, including both incorporated and unincorporated areas.

(3) Rationale

- The flexibility of crossing jurisdictional boundaries for collection of recyclables yields maximum efficiency in routing.

- For small jurisdictions, economical operation of a collection system may depend on collection of sufficient quantities of recyclables, which could be achieved by a regional collection system.

(4) Roles and Responsibilities

- Roles for establishment of regional collection systems would be affected by Policy 3.c.

  - If counties are given full authority over collection and handling of recycled materials, regional collection systems could be established through interlocal agreements and contracts between municipalities. Where regional collection would be efficient, these agreements should be encouraged.

  - If counties determine recycling service levels, the WUTC would require franchised haulers to separately collect recyclables, and to modify service areas if necessary to meet the goals of counties' comprehensive plans. Also, special agreements would have to be enacted with municipalities using contract haulers for collection.

e. Maintain Data

(1) Recommendation

- Routinely collect and maintain data on waste generation, disposal and recycling.

(2) Desired Result

- The accumulation and organization of waste stream data which facilitate effective solid waste management planning and performance reporting.

(3) Rationale

- Accurate, current waste stream data is critical to solid waste management planning.

- As management programs are implemented, effects on the waste stream can only be determined by the continuing collection of data about waste stream composition and quantities of materials being recycled.

- Changes over time in waste stream generation and composition will require the continuing revision of information.

(4) Roles and Responsibilities

- The State would collect and maintain current waste stream and recycling information, providing this data to the State's solid waste management, disposal and recycling industries, both public and private.
- Local agencies and private industry would report solid waste and recycling information to the State for compilation and reporting.

(5) Special Conditions

- The confidentiality of disaggregate information provided by individual private companies must be guaranteed.

(6) Design Considerations

- A task force involving all interested parties should be convened to develop an acceptable information system.
- Information should be gathered on quantities, compositions and flows of wastes and recyclables.
- Information should be specific enough to be usable at the county level.
- Standards should be adopted for terminology, measurement, and reporting units.
- A standard methodology for determining amounts and compositions should be established.
- Information should be collected annually.
- Firm specific data must be kept confidential.
- Private industry reporting requirements should be considered.
- Reporting should be mandatory.
- Audits of records should be permitted.
- Only aggregate results should be released to the public.
- Reporting requirements should be minimal.
- Consideration should be given to compensating private industry for recordkeeping.

f. Streamline Project Review

(1) Recommendation

- Streamline permitting for new recycling projects.

(2) Desired Results

- Recycling and disposal projects using best management practices and state-of-the-art technology will be implemented in a more timely and profitable manner.
- Potential owners and operators of new or expanded recycling facilities will not be discouraged from implementing new projects by cumbersome review and permitting procedures.
- Coordinating the procedures required by various agencies would eliminate duplication of effort while maintaining desirable regulatory control.

(3) Rationale

- Cumbersome review and permitting procedures have been cited as a barrier to better management practices.
- Numerous review and permitting procedures by various local and State agencies increase the cost and time required to implement a project; improved coordination of these procedures could reduce the applicant's effort while maintaining regulatory control.

(4) Roles and Responsibilities

- The State (Governor or Legislature) should appoint a coordinating committee to investigate those State and local permitting and review procedures that apply to recycling and disposal projects, and recommend revisions and other ways to streamline these procedures.
- State and local agencies with project review and permitting responsibilities should be represented on the coordinating committee.
- The Department of Ecology should provide support to the coordinating committee.

(5) Design Considerations

- The Environmental Coordination Procedures Act (RCW 90.62) contains provisions designed to streamline permitting and review procedures. The effectiveness of

this Act, and additional actions that may be needed to better enforce it, should be examined by the coordinating committee.

- The coordinating committee must have sufficient authority to guarantee meaningful participation by State and local agencies, and to ensure that the committee's recommendations have substantial results.

g. Reduce Financial Burden of Liability

(1) Recommendation

- Reduce the financial burden on waste handlers of securing liability protection.

(2) Desired Results

- Prevent contraction or closure of existing recycling facilities and operations due to fear of liability risks or inability to meet liability coverage requirements.

(3) Rationale

- Owners and operators of some reuse and recycling facilities and programs, particularly programs that handle potentially dangerous wastes (e.g., used motor oil, batteries, white goods) are unable to expand or are driven out of business because they cannot meet requirements for liability coverage, or fear undefined and unlimited liability.

- For some types of operations, liability coverage is not available because the insurance industry will not assume the potential risk of unlimited liability.

(4) Roles and Responsibilities

- The Department of Ecology should clarify liability requirements currently imposed by federal and State regulations and case law, and identify the conditions that are inhibiting the provision of liability insurance or are driving up the cost of liability insurance for owners and operators of recycling facilities and programs.

- Once these conditions are identified, the Department of Ecology should take appropriate action to alleviate them including:

  - Implementing a pooled insurance fund for owners and operators of recycling facilities.

- Helping owners and operators of recycling facilities and programs understand liability risks and requirements.

- Revising liability requirements, where feasible, to support continuation and expansion of recycling facilities and programs, while maintaining financial reserves sufficient to comply with environmental safeguards.

(5) Design Considerations

- Issues of liability are related to enforcement of environmental safeguards and clean up requirements. Efforts to relieve recycling owners and operators of the sole financial responsibility for liability should focus on financing mechanisms and technical assistance, not on exemption from regulations ensuring safe operation.

6. OBJECTIVE 4: PROVIDE FUNDING AND INCENTIVES FOR SOURCE-SEPARATED RECYCLING

a. Impose Tax on Disposal and Provide for Sharing of Revenues

(1) Recommendation

- Impose a State tax on waste destined for disposal, and provide a mechanism for sharing these revenues among local jurisdictions to support waste reduction and recycling.

(2) Desired Results

- Amount of disposed waste will be reduced.

- Recycling and reduction programs will be integrated into solid waste management systems.

- Jurisdictions that implement source-separation recycling or waste reduction programs will have an ongoing, reliable source of funding.

(3) Rationale

- Increasing charges for disposal, as opposed to charging for recycling services, provides an incentive to reduce the amount of waste disposed.

- In most cases the increase in disposal costs would be passed on to waste generators through an increase in charges for garbage collection services, a direct incentive to reduce waste.

- Since the jurisdictions that have authority over disposal sites may not be the same jurisdictions that implement recycling and reduction programs, a mechanism for distributing disposal tax/surcharge revenues among the jurisdictions generating disposed waste be required.

(4) Roles and Responsibilities

- The State would be responsible for legislation to authorize the disposal tax/surcharge, for setting the maximum level of the tax/surcharge, and for establishing regulations for collecting and distributing the revenues.

- Local jurisdictions with disposal authority would have the option to impose and collect the disposal tax/surcharge. Local jurisdictions should also be involved in setting guidelines for distributing revenues.

(5) Design Considerations

- Some disposal sites serve multiple jurisdictions (i.e., more than one county); the structure for redistributing revenues would need to accommodate this variation.

- The disposal tax/surcharge should be based on a set amount per ton of waste, as opposed to a percentage of the tipping fee. This structure provides an appropriate incentive to reduce waste throughout the State, regardless of tipping fees.

- Mechanisms for redistributing revenues among jurisdictions with authority to implement waste reduction or source-separated recycling programs should be based on a structure that is equitable (e.g., based on population or employment), that monitors use of funds, and that maintains local (or regional) control over use of funds. For example, funds collected within a county should be distributed to jurisdictions within that county.

- If a jurisdiction imposes a disposal tax/surcharge, its comprehensive solid waste management plan should include data on actual and projected amounts of revenue collected, as well as plans for using these revenues, and for monitoring amounts of disposed waste before and after imposition of a tax surcharge.

- Some landfill operators do not weigh the amount of waste disposed. Use of a per-ton tax or surcharge would require that scales be installed.

- Areas with small populations and small waste streams might want to pool disposal tax/surcharge revenues, rather than distributing them among jurisdictions.

b. Recover Collection Costs

(1) Recommendation

- Recover the costs of on-site collection of source-separated recyclables through regular municipal solid waste collection service charges.

(2) Desired Results

- Individual generators will reduce the amount of waste disposed and use alternatives such as waste reduction, reuse and recycling.
- Local jurisdictions will have a direct means of funding recycling collection programs (instead of or in addition to revenues from a disposal tax/surcharge).
- Contract and permitted haulers will be able to recover the cost of providing recycling services to their customers.
- Recycling collection programs will be integrated into solid waste management systems and gain a reliable source of funding.

(3) Rationale

- Increasing the charges for collecting garbage, as opposed to charging for recycling services, provides an incentive to reduce the amount of waste being disposed.

(4) Roles and Responsibilities

- The State would pass legislation authorizing the inclusion of costs for on-site collection of recyclables in the rate base for regular solid waste collection.
- The State would also provide municipalities with the authority to collect and redistribute these charges.
- The WUTC's tariff schedules for permitted haulers would reflect these charges.

(5) Design Considerations

- Where source-separated recycling services are provided by the same permitted or contract haulers that collect garbage, the net cost for these services should be

included in regular garbage collection rates. If collection is provided by a municipality or by another contract or permitted hauler, a surcharge on regular garbage collection would be collected and redistributed to recycling service providers.

c. Provide Rate Incentives

(1) Recommendation

- Structure rates for regular garbage collection services so as to encourage waste reduction and recycling.

(2) Desired Results

- Individual waste generators will become more aware of the cost of garbage collection and disposal in relation to the amount of waste they generate, and thus will perceive the direct benefit of reducing waste.

(3) Rationale

- Typically, rate structures for collection of garbage set higher rates for the first unit (can, drum, dumpster, etc.) and lower rates for additional units collected at the same site. While such rate structures may fairly represent the marginal costs associated with collection of additional units, they do not encourage waste reduction or recycling and may even act as disincentives.

- A rate structure that charges the same rate for each similar unit of garbage, or an increasing rate for each additional unit, would send the right economic signals to waste generators and provide incentives to reduce waste disposal.

(4) Roles and Responsibilities

- Jurisdictions may need to revise ordinances that disallow this type of rate structure.

- The WUTC would also need to revise its tariffs for franchised haulers.

(5) Design Considerations

- The rate structure for collection services should accommodate and reward generators of the least amount of waste. For example, some households with weekly collection may not fill a standard-sized garbage can; thus, they would have no rate-based incentive to reduce their disposed waste unless a smaller unit was used to establish minimum rates.

- Rate structures would need to be carefully designed so that haulers recover their fixed costs, even as waste generators respond to incentives to reduce the amount of waste disposed. This requires predicting waste generators' responses to rate incentives. Since insufficient information is available to make this prediction, it will be important to monitor and evaluate responses as this type of rate structure is implemented.

- A disposal tax/surcharge or local "recycling surcharge" added to regular garbage collection charges should be allocated in the same manner as regular collection charges.

d. Establish Diversion Payments

(1) Recommendation

- Authorize local jurisdictions to provide diversion payments to recycling programs, using revenue from the State disposal tax.

(2) Desired Results

- With consistent funding, opportunities to recycle would increase and stabilize over a long period, despite cyclical changes in recycling markets.

(3) Rationale

- Recycling programs, such as drop-off and buy-back centers, that derived their sole income from the sale of materials would gain a reliable source of funds.

- Flexible funding based on results (i.e., the amount diverted from disposal) will encourage jurisdictions to develop the most effective recycling services for their areas, and will support those services, whether privately or publicly operated.

(4) Roles and Responsibilities

- The State would be responsible for legislation to allow distribution of diversion payments to private and nonprofit agencies and for setting guidelines, particularly for interjurisdictional or regional use of diversion credits.

- Local jurisdictions would have the authority to provide diversion payments; interjurisdictional and regional coordination would be required.

(5) Design Considerations

- Plans for using, monitoring and controlling diversion payments should be included in comprehensive solid waste management plans.
- Since many drop-off and buy-back recycling services cross jurisdictional boundaries, and since it is difficult to delineate the exact boundaries of the areas served, diversion payments may need to be allocated regionally (e.g., for one or more counties).
- An alternative would be to establish a statewide diversion payment fund to be used for specified types of recycling programs (e.g., drop-off and buy-back centers). This would allow the State to act on statewide priorities, set consistent criteria for diversion payments, and respond to cyclical changes in recycling markets. This would also circumvent problems with cross-jurisdictional recycling services.

7. OBJECTIVE 5: INCREASE OPPORTUNITIES FOR SOURCE-SEPARATED RECYCLING

a. Support Buy-Back/Drop-Off Operations

(1) Recommendation

- Promote and provide support for expanding buy-back and drop-off operations.

(2) Desired Results

- Strengthened and expanded buy-back and drop-off operations throughout the State.
- Development and stabilization of markets.
- Standardization and promotion of services.
- Development of new facilities and services in communities which are currently unserved or underserved.
- Increased materials recovery.

(3) Rationale

- Drop-off and buy-back operations are a "Best Management Practice" throughout the State.
- Public support of existing, private drop-off and buy-back operations will encourage greater use of this cost-effective system.

- Existing levels of recycling achieved through drop-off and buy-back operations are not guaranteed without assistance.

(4) Roles and Responsibilities

- Local governments would address needs and the desired level of drop-off and buy-back service as a part of the local solid waste management planning process.
- Local governments working with private recyclers would implement new and expanded drop-off/buy-back services.
- WDOE and other State agencies will endeavor to develop markets (See Policy Recommendation 3.a.).
- WDOE would develop model standards for appearance, design, signs, etc.
- WDOE would develop a modifiable promotion program usable by local governments and private recyclers.

(5) Special Conditions

- In order for drop-off and buy-back operations to become an integral component of a solid waste management system, they must be viewed as a solid waste management service rather than merely as business ventures.

(6) Design Considerations

- Consideration should be given to providing diversion payments or other forms of public financial assistance to buy-back and drop-off operations.
- Projections of market conditions are essential in determining and planning the materials to be collected in each jurisdiction.
- Expansion of drop-off and buy-back systems needs to be coordinated with existing public and private systems in each jurisdiction.
- Materials collected, and delivery specifications should be standardized throughout a community.
- Consideration should be given to standardized, uniform appearance, design, signage, and logos for drop-off and buy-back operations.
- Public investment in either direct or contracted service may be necessary in underserved areas.

- Disposal sites throughout the State which accept self-hauled wastes should offer a standardized drop-off service.

b. Support Centralized Yard Waste Composting

(1) Recommendation

- Encourage and support centralized yard waste composting.

(2) Rationale

- Centralized yard waste composting is a feasible, environmentally sound, cost-effective approach to diverting waste from traditional disposal facilities.

- Yard waste is easily kept separated from other household garbage since it derives from a different source.

- Yard waste comprises a large proportion of both the residential and self-haul subwaste streams.

(3) Roles and Responsibilities

- The Department of Ecology should establish quality standards, operating requirements and testing procedures for compost and compost products in order to facilitate marketing and guarantee product quality. The Department should provide technical assistance to local jurisdictions in developing composting facilities.

- The State should support development of markets for yard waste compost, including requiring the use of yard waste compost in publicly funded projects and operations.

- The State should require that the opportunity to divert yard wastes from disposal be provided for all Washington residents.

- Local governments should provide residential collection or neighborhood drop-off systems for yard waste in urban and suburban areas, and opportunities for diversion of yard waste at drop boxes, transfer stations and all disposal facilities.

- Local governments should ensure the availability of centralized facilities to compost yard waste.

- State and local governments, through collection and distribution of disposal tax revenues (see Policy 4.a.),

should support yard waste composting facilities by providing diversion payments (see Policy 4.d.). In addition the State should provide financial assistance to develop composting facilities.

(4) Design Considerations

- Curbside collection of yard waste should be provided where economical. In addition, the following strategies should be considered:
  - Weekly year-round collection.
  - Use of biodegradable fiber bags for collecting yard waste prior to pick up.
- Minimal Functional Standards should be developed for compost facilities to control leachate and other environmental impacts. To encourage the development of composting facilities, permitting processes should be streamlined (see Policy 3.f.), and technical assistance provided to facility developers and operators to meet regulations.
- Encourage yard waste collection or drop-off through incentive-based rate structures (Policy 4.c.) and disposal tax (Policy 4.a.), and ban disposal of yard waste in landfills and incinerators by 1993.

c. Provide Recycling Facilities at All Sites

(1) Recommendation

- Provide clearly identified and accessible recycling facilities and promote their use at all drop-off, transfer and disposal sites, and provide financial incentives to separate and recycle self-hauled waste.

(2) Desired Results

- Increased public awareness of and participation in source-separated recycling.
- Allow greater opportunity and convenience for generators of self-hauled waste to recycle.

(3) Rationale

- Significant opportunity exists to capture self-hauled recyclables (including wood, metals, and yard waste) that are currently being disposed of.

- Point-of-disposal recycling opportunities and promotion are not aggressively pursued at this time.

(4) Roles and Responsibilities

- Facility operators would be required to provide point-of-disposal recycling opportunities as a condition of approval for solid waste management plans, franchises, contracts, or permits.

- The granting or approving agency would enforce these provisions as part of their jurisdictional or functional authority.

(5) Design Considerations

- Accessibility and ease of use should be emphasized.

- Recycling facilities should be actively promoted on site (with signs, handouts, etc.) and off-site (in conjunction with education about and promotion of recycling).

- Charges for disposal at drop-off sites, transfer stations or landfills/incinerators should not be applied to materials brought in for recycling.

- Facility staff should be trained so as to assist self-haulers in recycling.

- If space in disposal facilities is inadequate to accommodate recycling, providing a nearby recycling facility should be considered.

- The following commodities should be considered for recycling:

  - Newsprint
  - Cardboard (corrugated containers)
  - Glass
  - Metals
  - Recoverable plastics
  - Tires
  - Lawn and garden, and wood waste
  - Oil
  - Batteries
  - Reusable goods (white goods, furniture, etc.)

d. Support Commercial Collection

(1) Recommendation

- Provide rate-based incentives or diversion payments to owners of multi-family and commercial properties and to haulers and recyclers for collection of source-separated recyclable materials from these generators.

(2) Desired Results

- On-site separation of commercially generated wastes will become more economically advantageous.
- Local governments will develop incentive programs.
- WUTC regulation of hauler's rates will permit incorporation of incentive mechanisms.
- Commercial recycling will increase.

(3) Rationale

- Implementing a source-separated collection program in commercial or multi-family businesses may require additional expenditures by property owners, tenants, or collectors.
- There is a high potential for increased recovery from commercial and multi-family waste streams.
- Providing incentives or financial assistance will increase the number of businesses and multi-family dwellings participating in recovery programs and thus the volume of materials recycled.

(4) Roles and Responsibilities

- Local governments will provide diversion payments or other financial incentives to increase collection of recyclables from commercial/multi-family generators.
- WUTC will have to incorporate incentives into the rate bases of permitted haulers.

(5) Special Conditions

- Each community needs to identify and evaluate appropriate incentives. Programs are likely to be most applicable in urban areas with a concentration of commercial generators.

(6) Design Considerations

- Haulers and business interests should be involved in the design of incentive or diversion credit programs.
- Model programs or pilot scale demonstrations should be considered.
- Incentives should first benefit those required to act.
- The development of anti-scavenging ordinances may be necessary.

e. Reward Efficient Collection Systems

(1) Recommendation

- Provide incentives to promote increased efficiency in the collection of source-separated materials through:
  - Experimentation and demonstration of alternative methods.
  - Development of new and innovative equipment.
  - Incorporation of incentives in rates and regulations.

(2) Desired Results

- Local governments, waste haulers, recyclers and equipment manufacturers will implement more efficient collection systems.
- Source-separated collection programs, including curbside, multi-family, commercial and drop-off/buy-back systems, will be implemented in previously unserved areas and materials recovery will increase.

(3) Rationale

- Collection costs are a barrier to recycling.
- Greater efficiency will reduce the costs of collection.

(4) Roles and Responsibilities

- WDOE would administer financial assistance programs to help local governments.
- The State would fund research to develop new and innovative collection equipment.

- The WUTC would incorporate incentives in rate bases to promote efficient collection.

- Local governments would establish rates and contracts for collection of recyclables to provide incentives for maximizing efficiency.

(5) Design Considerations

- Collection systems should:

  - Balance cost, convenience and recovery factors.

  - Be compatible with existing waste management systems.

  - Be sensitive to materials markets, and responsive to market changes and the advent of new markets (such as for recoverable plastics).

- Efficient internal systems and programs for commercial and multi-family residential sites need further development.

- Increases in the efficiency of collection of source-separated recyclables and the amount of materials recovered need to be accompanied by an increase in processing capacity. Intermediate Processing Centers (IPC's) or upgraded existing facilities can stimulate increased efficiencies in collection programs.

- Rates and regulations should incorporate incentives enabling haulers and recyclers to improve profits through cost efficiencies. (Under current regulations profits increase in proportion to costs.)

f. Support Reuse Systems

(1) Recommendation

- Support the expansion of systems to reuse materials which would otherwise become wastes.

(2) Desired Results

- Increases in reuse of items such as furniture and white goods would reduce the volume of waste to be handled through more costly recycling or disposal alternatives.

(3) Rationale

- Reuse provides an economical and environmentally sound alternative to other processing or disposal methods.

(4) Roles and Responsibilities

- The State would provide technical assistance to support both non-profit and for-profit reuse efforts.
- Disposal and recycling facility operators would support reuse activities by providing facilities and equipment such as space and bins, and promoting separation of reusable items (see Policy 5.c.).

(5) Design Considerations

- Diversion payments could be used as incentives for reuse operators.
- Systems for salvaging reusable items could be implemented at disposal sites; salvaging operations should be designed with due attention to the potential for methane explosions and other health risks at disposal sites.

8. OBJECTIVE 6: USE COST-EFFECTIVE AND ENVIRONMENTALLY SOUND METHODS FOR SEPARATING RECYCLABLES AFTER COLLECTION OF SOLID WASTE

a. Consider Mixed Waste Processing

(1) Recommendation

- Acknowledge mixed waste processing as a recycling method; consider it before using disposal methods.

(2) Desired Results

- Recognition of mixed waste processing as an effective method of achieving disposal diversion goals through recycling and composting.
- Identification of MSW compost as a useful material.
- Development of a procurement policy for MSW compost.

(3) Rationale

- Mixed waste processing permits the inclusion of MSW composting as a recycling method.
- Separate collection of source-separated recyclable materials may be costly. Mixed waste processing does not increase total system collection costs.
- In certain waste generation groups like multi-family housing and mixed commercial areas, source-separation programs are difficult to implement.

- Mixed waste processing requires little promotion, education, or provision of multiple containers at the waste generation source.

(4) Roles and Responsibilities

- If source-separation of recyclable materials is judged uneconomical, the State should require local governments to consider mixed waste processing.

- Local governments would evaluate alternatives for MSW processing, conduct analyses of MSW compost markets, and implement MSW processing.

- Before initiating mixed waste processing projects, the State should undertake MSW market development, including establishing procurement policies and standard specifications for public works projects.

(5) Special Conditions

- Because of the level of capital investment, sensitivity to economics of scale and expertise required, this method is best undertaken regionally.

- Markets for MSW compost must be identified before each new mixed waste processing facility begins operation.

(6) Design Considerations

- Contingency plans for infectious and hazardous wastes and for mitigation of odors through compost process control and odor control equipment would be required.

- Minimizing health risks for workers must be addressed.

- Special consideration has to be given to the marketing of MSW compost. An analysis would have to document an existing long-term market with contingency opportunities.

- Well defined process control systems are necessary to maintain adequate and consistent quality of the finished compost.

- Standards of compost quality need to be established for three classes of use: raw food crops, food chain crops, and horticultural uses. In addition, standards would have to be set for permissible total concentrations of various hazardous compounds.

- Requests for proposals for mixed waste processing facilities should incorporate a standard proposal format to obtain: basic engineering data, estimated process mass balance information, estimated land requirements, odor control systems, infectious and hazardous waste control plans, and a marketing plan for each recovered material.

b. Require Preprocessing at New Disposal Facilities

(1) Recommendation

- Require pre-processing of wastes before they reach new MSW processing facilities, incinerators, or landfills. Remove potentially harmful materials from the solid waste stream before incineration or landfilling.

(2) Desired Results

- Increased material recovery and reduced reliance on disposal methods.
- Reduction of environmental degradation resulting from the inadvertent disposal of hazardous materials.
- Improved efficiency and sizing of incinerators.
- Identification and removal of materials which, when incinerated or landfilled, harm human health and the environment.

(3) Rationale

- This method increases recovery of recyclable materials.
- Pre-processing permits greater process control and increases reliability and safety of incinerators.
- Pre-processing allows for inspection of all waste materials before they enter disposal facilities, and for removal of harmful materials.
- This method can be used as a pollution control measure to reduce heavy metals and other toxic compounds that are volatilized or which remain in the ash residue of incinerators. Likewise, it will improve the quality of MSW compost products.
- Particularly harmful components of solid waste (e.g., mercury, cadmium, and lead) should not be allowed to contaminate the environment or threaten human health particularly when removal from the waste stream could alleviate these threats.

(4) Roles and Responsibilities

- Statutory requirements would be established by the State Legislature.
- WDOE would develop regulations and enforce them.
- Local governments would implement systems as part of future MSW processing and disposal projects.

(5) Special Conditions

- This method would be most cost-effective if used in conjunction with regional processing or disposal facilities since unit costs decrease dramatically as the quantity of waste handled increases.

(6) Design Considerations

- Would require contingency plans for dealing with infectious and hazardous wastes and for mitigation of odors and other adverse sensory impacts.
- Methods for removal of specific harmful materials vary widely. Disposal bans, targeted collection programs, special drop-off facilities, and financial incentives should be considered.
- Product and material bans are most effective if adopted statewide. Bans would require State legislative or administrative action.
- Incentives (such as recycling subsidies) to remove particular materials from the waste stream should be carefully considered along with product or material bans.
- Minimizing health risks for workers must be addressed.

9. OBJECTIVE 7: PROVIDE OPPORTUNITIES FOR BETTER DISPOSAL METHODS

a. Resolve Ash Disposal Issues

(1) Recommendation

- Resolve issues related to the disposal of ash from municipal solid waste incinerators.

(2) Desired Results

- The cost of incineration would be more reliably determined. The full cost of ash disposal cannot be determined until regulations governing ash disposal are made final.

- Public concern about the toxicity of disposed ash would be reduced. Public concern about the toxicity of ash disposal cannot be alleviated until decisions about ash characteristics and requirements for land disposal are made.

(3) Rationale

- Costs associated with disposal are significant and must be determined in order to evaluate incineration.

- State, federal, and local regulations governing ash disposal could dramatically impact the cost of incineration. Since regulations have not been finalized, the true cost of incineration cannot be reliably determined.

(4) Roles and Responsibilities

- Under State law, the Department of Ecology (WDOE) has the primary responsibility to adopt ash regulations. The Environmental Protection Agency is the federal agency charged with regulation of hazardous air emissions and land disposal of ash. The WDOE must work closely with the Environmental Protection Agency and local governments (including air pollution control authorities) to resolve these issues.

(5) Design Considerations

- A special Task Force on Ash Disposal should be convened with representatives of WDOE and the Environmental Protection Agency. The task force would be charged with resolving ash disposal issues in a manner consistent with State and federal law.

- Ash disposal raises numerous scientific, political, environmental, and health considerations. Successful resolution of these issues is necessary in order for incineration to become a viable option for disposal of solid waste. Convening a special task force would highlight the importance of resolving ash disposal issues.

b. Conduct RDF Market Analysis/Eliminate Barriers

(1) Recommendation

- Conduct a market analysis for Refuse-derived fuel (RDF) and identify ways to eliminate barriers to its use.

(2) Desired Results

- Identification of potential users of RDF.

- Elimination of barriers to use of RDF by facilities currently permitted to use other fuels.

- Replace use of non-renewable resources such as fossil fuels with our plethora of solid waste.

(3) Rationale

Using solid waste as a fuel would:

- Divert a substantial portion of the solid waste stream from landfills and incinerators.

- Use existing incineration and energy recovery facilities.

- Conserve non-renewable fuel resources.

- Provide an alternative use for some recyclable materials, and offer flexibility in responding to changes in markets for recyclable materials.

(4) Roles and Responsibilities

- The State, through the Department of Ecology and the Energy Office, would conduct or sponsor research into markets for RDF.

(5) Design Considerations

- A thorough and detailed investigation is needed, combining information from several fields.

- The study should involve potential users of RDF and address operational feasibility.

- Research should address emerging technology for production and use of RDF and alternative fuels.

- The study should also address displacing alternative fuels (such as recycled oil and wood waste) and related impacts on solid waste management and recycling.

- Regulations and requirements for permitting, risk (liability coverage), emissions and ash disposal should be examined with the goal of reducing barriers to use of RDF while maintaining environmental safeguards.

- Processes for regulatory review and approval should be clarified and streamlined (see Policy 3.f.).

c. Improve Incinerator Operations

(1) Recommendation

- Improve incinerator operations.

(2) Desired Results

- Savings in environmental and incinerator system costs.
- Improved reliability of technology.
- Stricter standards for operation including operator certification.

(3) Rationale

- Incinerators have experienced operational problems. There is a need to assure safety and minimize actual or perceived health risks.

(4) Roles and Responsibilities

- The State would establish operational requirements and design standards.
- Local governments would incorporate design standards into new projects and would implement new operating procedures on all facilities.

(5) Special Conditions

- Incinerator efficiency must be balanced with other reduction and recycling methods and goals.

(6) Design Considerations

- Optimize configuration of combustion units and improve maintenance to maximize operating efficiencies and ensure reliability.
- Consider preprocessing as an emission control technology that can minimize heavy metals and toxics in gas and ash.

d. Separate Construction and Demolition Debris

(1) Recommendation

- Dispose of nonreusable construction and demolition waste at dedicated landfills. Compost the biodegradable fraction of land clearing waste with yard and garden waste at centralized composting facilities.

(2) Desired Results

- Separation of construction and demolition waste, including land clearing waste, from the MSW stream.
- Conservation of valuable MSW disposal capacity.
- Reduced disposal costs.

(3) Rationale

- Construction and demolition landfills are less difficult to site and less expensive to build than MSW landfills because design standards are not as stringent.
- Disposal of construction/demolition debris and land clearing waste in MSW landfills is not cost-effective.
- Some land clearing wastes are either compostable or reusable.
- As a result of air pollution controls, land clearing wastes are being disposed in MSW landfills, especially in urban areas.

(4) Roles and Responsibilities

- Local governments should provide separate demolition/construction debris landfills and composting facilities.
- The State should ban the disposal of land clearing and construction/demolition debris in regular MSW landfills and incinerators by 1993.
- Assistance should be provided by the State in the form of:
  - Grants to develop composting facilities.
  - Diversion payments for materials being diverted from regular landfills or incinerators.

e. Undertake an Analysis of Global Impacts

(1) Recommendation

- Base selection of disposal options on global environmental impacts.

(2) Desired Results

- Identification of specific atmospheric and waterborne compounds with the potential to be carried to other regions, and to have adverse global environmental impacts.

- Expansion of direct project costs to include the deferred or exported environmental costs of each option.

- The inclusion in planning and analysis of the environmental impacts of programmatic decisions -- impacts and mitigation costs that persist long after the service life of a facility or project and extend beyond regional boundaries.

(3) Rationale

- Evidence documenting a deterioration of the global environment is increasing. The buildup of greenhouse gases, depletion of the ozone layer, and pollution of ground water are problems partly caused by consumption and by disposal practices based on local economics. As the problems carry over into the global environment, so does the responsibility for mitigation.

(4) Roles and Responsibilities

- The State would identify those compounds handled or produced by waste management systems which have long-term adverse impacts on the global environment.

- The State would (a) establish standards, a methodology, and a uniform review process for disposal alternatives or (b) undertake a one-time conclusive study.

- Local governments would abide by the findings of a State-sponsored impacts analysis or conduct individual analyses for specific projects.

(5) Special Conditions

- Until analyses are completed, eliminate the State's priority of incineration over landfilling and rely on local solid waste management planning to determine best management practices for local disposal of solid waste.

(6) Design Considerations

- An analysis and comparison of emission rates would be more effective and scientifically reliable than general discussion or speculation.

- Balancing local costs with global impacts will require a well-defined and widely-accepted methodology to avoid prolonged political debate and legal challenge.