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MAINE AGRICULTURAL EXPERIMENT STATION
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Landfills and Municipal Solid Waste in Maine

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INTRODUCTION

In recent years, Maine and the nation have been experiencing what many have termed a waste crisis. The factors contributing to this crisis are:

1. Due primarily to poor design of the majority of Maine's older municipal landfills, most of these landfills recently have been closed or are scheduled for closure.
2. Many of the landfills that do meet modern engineering standards are near capacity.
3. Investments in new landfill facilities are not taking place, often due to local opposition to these undesirable land uses.
4. The quantity of waste generated is increasing steadily.

The declining number of available landfills coupled with an ever increasing supply of waste needing disposal is resulting in continuously increasing waste disposal costs. In response to these increasing waste disposal costs and a desire to protect the environment, many municipalities are attempting to reduce the stream of waste entering landfills by initiating recycling programs.

Municipal leaders need current information about alternative disposal methods to make rational decisions on handling their town's waste. To provide an overview of landfilling and other waste-handling methods used in the upper New England states, a group of university researchers from New Hampshire, Maine, and Vermont initiated a study of landfills and solid waste management practices. The study involved a comprehensive mail survey of municipalities in Maine, New Hampshire, and Vermont. Two reports regarding the data collected from these surveys have been published. The first deals with landfills and solid waste management practices in New Hampshire (Halstead and Cornelio 1989); the second compares the solid waste management activities of the three upper New England states (Halstead et al 1991). The purpose of this report is to focus upon and discuss the results of the landfill and solid waste management survey for Maine. By narrowing the focus of this report, valuable information concerning alternatives used in New Hampshire and Vermont is ignored. For this additional information, the reader is referred to the two previously cited documents.

In the summer of 1990, approximately 500 surveys were mailed to Maine municipalities, of which approximately 100 were returned. In an effort to increase the number of responses, the regional planning commissions of Maine agreed to encourage municipalities to complete their surveys. With this effort, the total number of towns that responded to the survey increased to 149.

In order to provide information on a local level, the survey responses were split by Maine's regional development councils. The list of regional councils, their acronyms, and the number of surveys received from each region are listed in Table 1. This paper is composed of five sections beyond the introduction -- survey results pertaining to landfill characteristics, recycling programs, financial issues and composting are presented in the first four sections. Discussion of the survey results and policy implications are presented in the concluding section.

Table 1. Regional Government Councils of Maine

Acronym	Name	Municipalities Responding	Total
AVCG	Androscoggin Valley Council of Governments	20	13.4
EMCRPC	Eastern Mid-Coast Regional Planning Commission	6	4.0
HCPC	Hancock County Planning Commission	18	12.1
MRPOLC	Municipal Resource & Planning Office of Lincoln County	5	3.4
NKRPC	North Kennebec Regional Planning Commission	13	8.7
NMRPC	Northern Maine Regional Planning Commission	14	9.4
PVCOG	Penobscot Valley Council of Governments	32	21.5
SMRPC	Southern Maine Regional Planning Commission	7	4.7
WCRPC	Washington County Regional Planning Commission	17	11.4
CCCG	Capitol Coastal Council of Governments	9	6.0
GPCG	Greater Portland Council of Governments	8	5.4
Total = 11 regions		149	100

Source: Municipal Solid Waste Survey, 1990.

MAINE LANDFILLS AND MSW DISPOSAL

Information on the methods of municipal solid waste (MSW) disposal/recycling used by Maine municipalities is present in Table 2. Typically, municipalities disposed of their wastes in a variety of ways. For instance, many municipalities have contracts with MSW incineration facilities that accept and dispose of the majority of their wastes. Two of the state's major waste incineration facilities, however, do not process and dispose of bulky items such as tires and white goods (e.g., stoves and washing machines). Thus, although these communities will take the majority of their wastes to incineration facilities, they still have a need to landfill, recycle or otherwise dispose of their bulky wastes.

Sixty-seven of the responding municipalities stated that they are landfilling some or all of their MSW. Fifty-four municipalities reported recycling activities. Fifty-three reported incinerating some of their wastes. The least common solid waste management methods are composting and land application of sludge. Based on these survey results, the most common method of waste disposal in Maine is landfilling. Of the municipalities using landfilling, however, only 68% of their waste is landfilled, while those municipalities using incineration dispose of 77% of their waste by incineration. Eight of the municipalities responding to the survey reported having some type of a composting operation. The primary wastes composted at municipal composting operations included leaf and yard waste and municipal waste water sludge. Only two municipalities reported land applying any of their wastes.

Table 2. MSW Disposal Methods in Maine.

Disposal Method	Number Responding	Percentage of Municipalities Responding	Average percentage of MSW
Incineration	53	34	77
Recycling	54	36	12
Landfilling	67	45	68
Composting	8	0.05	5
Land Applications	2	0.01	4

Source: Municipal Solid Waste Survey, 1990.

Landfills and Landfill Capacity

Of the 149 Maine towns responding to the survey, 77 (51%) reported having at least one landfill, 7 (5%) reported having two landfills, and 1 municipality (0.7%) reported having three landfills. The average estimated closure date of the 94 landfills identified in the survey is 1993. This short period of time until most municipal landfills close, coupled with the need to locate new landfill facilities in areas acceptable to the residents of the community, has placed many Maine municipalities in very difficult positions.

Wastes Disposed at Maine Landfills

The types of waste accepted at Maine's landfills in 1987, 1990, and projected for 1993 is presented in Table 3. Seventy-seven municipalities completed the 1987 portion of the survey, 69 completed the 1990 portion, and 47 municipalities completed the anticipated 1993 portion. Since the number of municipalities completing this portion of the survey varied for the three years, the percentage responses are not directly comparable. By examining the responses for 1987 and 1990, however, one can see a significant drop in the number of landfills that accept household refuse. This drop is due, in part, to the inappropriateness of older landfills to handle household refuse (lack of a modern engineering design with such features as secure liners, etc.), and to the MSW disposal contracts that many municipalities have initiated with the two major refuse-derived-fuel electrical generation facilities in Maine. One of these facilities, the Penobscot Energy Recovery Co. (PERC), is located in Orrington and began operation in 1988. The other, Maine Energy Recovery Co. (MERC), is located in Biddeford and began operation in 1985. Many towns in Maine have contracted to dispose of their household, commercial, and institutional waste at these facilities. Bulky items such as white goods (e.g. washers and dryers) and stumps, however, are not incinerated and are disposed of in another manner or recycled.

Items that municipalities appear to be "phasing out" of their landfills include papermill sludge, incinerator ash, dredge spoils, and municipal wastewater sludge. The authors believe that these items are being phased out of the older municipal landfills since these items can contain toxic materials such as dioxin and heavy metals. Since very few of the older municipal landfills were designed to safely contain these materials, much of this type of waste is being sent to the state's few remaining secure landfills. It is likely that these materials will continue to be phased out of most municipal landfills.

Table 3. Type of Waste Accepted at Maine Landfills

Type of Waste	1987 Number Respond	1987* (%)	1990 Number Respond	1990* (%)	1993 Number Respond	1993* (%)
Household refuse	66	85	51	74	36	77
Papermill sludge	2	3	0	0	0	0
Municipal wastewater sludge	9	12	3	4	1	2
Wood ash or bioash	18	23	18	26	12	26
Demolition debris	64	82	58	84	35	74
Stumps	63	81	54	78	30	64
White goods	64	82	54	78	36	77
Brown goods	58	74	48	70	26	55
Scrap metals	63	81	54	78	35	74
Tires	67	86	52	75	35	74
Glass	66	85	53	77	31	66
Incinerator ash	5	6	2	3	1	2
Incinerator process residue	3	4	2	3	0	0
Agricultural wastes	16	21	9	13	6	13
Dredge spoils	2	3	0	0	0	0
Asbestos	7	9	4	6	4	9
Hazardous wastes	5	6	2	3	2	4
Brush	70	90	59	86	40	85

*Percentage of municipalities responding in particular year.
Source: Municipal Solid Waste Survey, 1990.

Maine Landfill Clientele

The clientele or users of Maine's landfills are provided in Table 4. Note that on average, each landfill services 1,875 households. Only eight landfills reported receiving septage, and the average number of septage haulers was less than two. Few Maine landfills are receiving sewage sludge from waste water treatment plants or special waste from power plants. Some of the sewage sludge in Maine is being treated at composting facilities or being land spread.

Table 4. Clientele for Maine's Landfills.

Landfill Clientele	Number Responding	Average Number of Clients
Households	64	1,875
Septage Haulers	8	1.63
Sewage Treatment	6	1.0
Power Plants	2	1.5

Source: Municipal Solid Waste Survey, 1990.

Environmental Problems at Maine Landfills

Seventy-seven municipalities responded to the survey question regarding environmental problems associated with their landfill. Of those responding, 33.8% indicated that their landfill was experiencing some type of environmental problem. Of these 26 municipalities, 11 respondents noted specific problems. Eight landfills were experiencing some type of ground water contamination (particularly from heavy metals), and three noted problems with surface water contamination (in one case the contamination is from fecal coliform).

Thus one-third of the municipalities responding to the question stated that they were experiencing environmental problems with their landfill. This underscores the design problems with the older municipal landfills and is a primary reason that environmental authorities are moving to close these older landfills.

Maine Landfill Ownership

Most Maine landfills are owned and operated by municipalities. Survey results indicate that local governments own 92% of all landfills, local governments in a cooperative arrangement with other municipalities own 2%, and private companies own 6%. As the many local landfills close, however, they are unlikely to be replaced with single-municipality landfills. The primary reason for this is

that the nature of siting and constructing landfills has changed dramatically since the time when most of Maine's current municipal landfills were constructed. The enormous technical and financial effort required to site a state-of-the-art landfill makes it difficult for municipalities to acquire a new single-municipality landfill. Further, the economy of size in landfill design and operation results in a lower per ton landfill cost for larger landfills, which increases the need for cooperative efforts. These are some of the reasons why the state of Maine has recently begun a process of siting two secure landfills in Maine.

Maine Landfill Labor

On average, Maine landfills employed less than one full-time employee and less than one part-time employee. Of the 73 municipalities responding to this particular question, the typical landfill employed one full-time and one part-time employee.

COOPERATIVE SOLID WASTE MANAGEMENT EFFORTS

The survey included questions regarding cooperative solid waste management activities. Twenty municipalities reported being involved with a joint recycling effort, 32 municipalities reported being involved in a joint landfilling operation, and 19 municipalities reported being involved with a joint waste transfer station. The authors expect that the economies of size inherent in waste management facilities will increase the number of cooperative recycling ventures. In general, the more materials a facility handles, the lower the average cost. Along with a cost advantage, however, there can be difficulties with multiple municipalities in cooperative efforts. Certainly planning and communication are important in making cooperative efforts a success.

MAINE RECYCLING PROGRAMS

Sixty-three of the 118 municipalities responding to this portion of the survey report that their municipality has an established recycling program. Of these programs, seven municipalities operate curbside programs while 45 report considering adoption of a curbside program. The low number of curbside recycling programs was expected, since many of Maine's communities are small and do not have curbside trash collection. Also, many Maine towns operate

trash drop-off centers, sometimes known as transfer stations, where residents bring their trash for disposal. Since residents must frequent these locations to dispose of waste, many towns are combining recycling and drop-off centers for easy collection of recyclables and disposal of waste. Of all the towns surveyed, only five report having recycling ordinances although 86 report that they are considering a recycling ordinance.

The number of municipalities recycling, along with the materials being recycled, are listed in Table 5. The most commonly collected items were white goods (washing machines, refrigerators, etc.) and newspapers. Thirty-nine municipalities, or 70% of those responding to the question, reported collecting these items. The next most commonly collected items are scrap metal and glass. The least frequently collected items were office paper and tires, of which only 29% of those responding to the question reported collecting.

Table 5. Material Recycled by Maine Municipalities.

Material	Number of Municipalities	Percentage
Glass	37	66
Aluminum	20	36
HDPE Plastic (e.g., milk jugs)	21	38
PET Plastic (e.g., 2-liter soda bottles)	18	32
Corrugated Cardboard	28	50
Newspaper	39	70
Steel Cans	20	36
Scrap Metal	38	68
Office Paper	16	29
Tires	16	29
White Goods	39	70

Source: Municipal Solid Waste Survey, 1990.

Curbside Recycling

Table 6 contains information regarding curbside collection of recyclables. Fewer than one in twenty of the towns stated that they currently collect recyclables through curbside pickup. However, almost one in three towns stated that they will consider curbside recycling in the future. There are a variety of materials currently being recycled. The top five materials being recycled are newspaper, glass, white goods, scrap metal, and corrugated cardboard.

Fifteen towns also have established a returnable beverage container redemption center; however, only one of these centers is in conjunction with a recycling operation. Eight more towns have plans to establish a returnable beverage container redemption center.

Table 6. Municipalities Reporting Current and Possible Future Curbside Recycling

Region	Current Curbside	Consider Curbside in Future	Percentage Considering Curbside
AVCG	1	6	30.0
EMCRPC	0	0	0
HCPC	1	8	44.4
MRPOLC	0	1	20.0
NKRPC	0	5	38.5
PVCOG	0	10	31.3
SMRPC	2	2	28.6
WCRPC	0	3	17.7
CCCG	1	5	55.6
GPCG	0	2	25.0
Total	7	45	15.6

Source: Municipal Solid Waste Survey, 1990.

As Table 7 illustrates, only six of the 149 towns have mandated recycling; however, 86 more towns are seriously considering it. The towns with recycling ordinances are currently picking up six categories, including newspaper, glass, cans, cardboard, leaves, and other.

Table 7. Municipalities Reporting Having Mandatory Recycling Ordinance

Region	Ordinance In-Place	Considering Ordinance
AVCG	1	13
EMCRPC	0	4
HCPC	1	11
MRPOLC	1	2
NKRPC	0	9
NMRPC	0	5
PVCOG	0	17
SMRPC	2	5
WCRPC	0	8
CCCG	1	8
GPCG	0	4
Total	6	86

Source: Municipal Solid Waste Survey, 1990.

Obstacles to Recycling

The high cost of waste disposal and society's desire to waste less has prompted communities to consider the following:

1. What are the most successful and cost effective methods of obtaining household, institutional, and business participation?
2. What are the options for processing and marketing recycled materials?
3. What is the most cost effective means of getting the recycled material from the waste stream to market and what are the best recycling funding options?

Probably the most troublesome of these elements is finding outlets for the recycled materials. Of the Maine communities responding, 61% felt that the lack of adequate markets was the greatest obstacle in establishing a recycling program. In addition, 56% felt that waste recycling costs would be higher than alternative waste disposal costs. Interestingly, only 27% of the respondents felt

that household participation in recycling programs would be difficult to acquire. Thus, the high cost of recycling was thought to be a problem. In this day of tight municipal budgets the issue of the cost of recycling will be receiving more attention.

MAINE MSW MANAGEMENT FINANCIAL ISSUES

Sources for MSW management funding for 1990 are provided in Table 8. As the data reveals, most funding for MSW management activity comes from municipal general revenues. Ninety-three towns reported that 97.3% of their MSW management funding came from general revenue. Eight municipalities received an average of 16.5% of their solid waste management funding from tipping fees. Four municipalities indicated that the state provided 17.5% of their revenue. None of the reporting municipalities receive federal funding or funding from a bond issuance. Four municipalities reported receiving an average of 12% of their funding from other sources. Thus, general revenues, which primarily comes from property taxes, are currently funding nearly all of Maine's municipal solid waste management.

Table 8. Municipal Solid Waste Management Funding.

Funding Source	Number Responding	Average Percentage
General Revenue	93	97.3
Tipping Fee	8	16.5
State Funding	4	17.5
Federal Funding	0	n/a
Bond Issue	0	n/a
Other	5	12

Source: Municipal Solid Waste Survey, 1990.

Waste management budget and recycling information is presented in Table 9. Fifty-seven municipalities reported operating recycling programs with an average 1990 budget of \$47,731. Five of these municipalities had recycling ordinances and seven had curbside recycling. The average number of years that the municipalities had been recycling was just under four years (3.9 years). Table 9 also lists the difference between municipal recycling revenues and recycling budgets.

Table 9. MSW Management and Recycling Budgets, and Recycling Revenues.

Year	Average MSW Budget	Average Recycling Budget	Average Recycling Revenues	Recycling Revenues Minus Recycling Budget
1987	\$69,986	\$30,062	\$8,250	(\$21,812)
1990	\$182,226	\$47,731	\$11,324	(\$36,407)
1993				
Forecast	\$256,015	\$62,451	\$20,177	(\$42,274)

Source: Municipal Solid Waste Survey, 1990.

Note: Values in parentheses are negative.

The information in Table 9 supports the popular notion that solid waste management expenditures have been increasing and are expected to keep increasing. Between 1987 and 1990, average municipal solid waste management expenditures increased from \$69,986 to \$182,226 (a 160% increase). The projected increase from 1990 to 1993 is from \$182,226 to \$256,015 (a 40% increase). A similar increase is seen for the portion of MSW management expenditures devoted to municipal recycling.

The projected increase of 266% in municipalities' expenditures for MSW management between 1987 and 1993 coupled with heavy dependance on locally generated general revenue (the property tax), will create a difficult position for most Maine communities. The reluctance of local officials to raise property taxes, the state's inability to initiate new programs due to its own financial position, and the statutory inability of Maine town governments to generate revenue from other sources (e.g., a local sales tax) cripples the ability of towns to address the MSW problem.

The extremely large percentage increases in MSW disposal and recycling budgets cited above are due primarily to the very low waste disposal costs that municipalities have paid historically. For example, several years ago many towns were not paying any tipping fee for waste disposal since the predominate practice was to bury virtually all municipal waste in town landfills. These landfills were operated at minimal annual expense relative to current tipping fees. Therefore, once tipping fees were charged and recycling programs were initiated, the percentage increases in municipal solid waste management costs seemed extremely large.

The above information regarding the financial situation of MSW management is somewhat bleak. Costs are increasing dramatically and recycling revenues are significantly less than recycling budgets. Unfortunately, from a strict municipal view, recycling is often uneconomical. In the upcoming years, Maine will need to work toward developing as cost effective recycling programs as possible. Already, some municipalities have dropped the recycling of certain items, and in some cases entire recycling programs have been dropped. The authors do not believe that this financial situation will change much in the next five years.

Municipal recycling budgets by region are presented in Table 10. From 1987 to 1990 the number of municipalities recycling increased from 10 to 35. The wide range in averages is a result of some municipalities including large capital outlays in their budgets. For example, one AVCG municipality reported a budget of \$734,000, which included capital outlay. The fact that only 33 municipalities felt comfortable with estimating their 1993 recycling budget may be in part due to the rapidly changing regulatory environment, changing market conditions and escalating disposal costs. In essence, the MSW problem is changing so rapidly many local officials lack a clear understanding of current and future issues.

Table 10. Municipal Recycling Budget by Region

Region	---- 1987 ----		---- 1990 ----		---- 1993 --	
	No.	Avg.	No.	Avg.	No.	Avg.
AVCG	1	\$10,620	8	\$101,921	5	\$152,216
EMCRPC	0	n/a	1	5,000	0	n/a
HPCP	1	500	5	5,650	5	18,900
MRPOLC	0	n/a	0	n/a	0	n/a
NKRPC	1	2,500	2	15,000	3	17,667
NMRPC	0	n/a	3	14,833	3	32,500
PVCOG	0	n/a	4	13,750	4	19,375
SMRPC	0	n/a	3	51,667	2	140,000
WCRPC	0	n/a	0	n/a	2	8,400
CCCG	3	36,667	5	63,495	5	79,100
GPCG	4	44,240	4	55,000	4	71,250
All Regions	10	\$30,062	35	\$47,731	33	\$62,451

Source: Municipal Solid Waste Survey, 1990.

Although finding close and profitable recycling markets in the Northeast is reportedly difficult, Table 11 shows that the revenues from the sales of recyclable materials is increasing and is expected to increase in the future.

Table 11. Municipalities' Recycling Revenue by Region

Region	--- 1987 ---		--- 1990 ---		--- 1993 ---	
	No.	Avg.	No.	Avg.	No.	Avg.
AVCG	1	4,500	3	21,000	1	15,000
EMCRPC	0	n/a	0	n/a	0	n/a
HCPC	1	6,000	1	17,000	3	20,667
MRPOLC	0	n/a	0	n/a	0	n/a
NKRPC	1	9,000	1	7,140	1	31,000
NMRPC	0	n/a	1	10,000	2	n/a
PVCOG	0	n/a	2	275	3	5,500
SMRPC	0	n/a	3	10,467	2	27,500
WCRPC	0	n/a	0	n/a	0	n/a
CCCG	2	12,750	4	6,435	2	13,000
GPCG	3	7,000	3	16,333	1	42,000
All Regions	8	\$8,250	18	\$11,324	15	\$20,177

Source: Municipal Solid Waste Survey, 1990.

The Maine Waste Management Agency (MWMA) has provided some municipal-level grants for the establishment of municipal recycling facilities. Forty-six municipalities stated that they had applied for a MWMA recycling grant. Table 12 contains the survey information relative to the issue of grant applications from the Maine Waste Management Agency.

Towns that requested recycling grants intended their use for a variety of items. These items included site preparation, land acquisition, construction, feasibility studies, equipment, and others. The equipment included items such as a plastic grinder, front-end loader, glass crusher, stump grinder, trailer, compactor, and a dump truck. The towns also asked for balers for cardboard, plastics, newspaper, cans, and office paper.

Table 12. Maine Waste Management Agency Recycling Grants

Region	Amount Requested	Amount Received
AVCG	\$2,155,238	\$1,400,000
EMCRPC	6,000	6,000
HCPC	522,000	145,000
MRPOLC	0	0
NKRPC	337,136	230,441
NMRPC	703,440	475,000
PVCOG	1,023,758	63,758
SMRPC	1,063,804	270,000
WCRPC	0	0
CCCG	1,525,975	610,000
GPCG	156,024	81,024
Totals	\$7,547,375	\$3,335,223

Source: Municipal Solid Waste Survey, 1990.

Note: In several cases, funding was granted to towns working cooperatively. It is not known exactly how many towns were involved in these cases.

MAINE COMPOSTING PROGRAMS

Fourteen Maine municipalities responded that they have some type of composting program in place. Nine of these municipalities reported that their facility was publicly owned, and no municipality reported having a privately held compost facility. Most of the composting operations accept leaves (11 of the 14) while others accept materials such as household food (1 compost operation), wood (3 compost operations), and sludge (7 compost operations). The development of these composting facilities can have a significant impact on the waste stream depending upon the nature of the municipality. In the more developed municipalities, with wooded suburban areas, leaf and yard waste can constitute up to 20% of the municipal waste stream.

DISCUSSION

With the Maine landfill average expected closure date of 1993, municipalities are facing impending problems. Very few outlets for waste disposal will remain since new landfills have not been sited. For this and other reasons, Maine communities are trying to tackle their solid waste management problems through other means. Many towns have mandatory recycling or are considering implementing a recycling ordinance. However, until strong markets exist within Maine or in nearby states, the true potential of recycling cannot be realized.

Further, as suggested by these survey results, one of the greatest obstacles to municipal recycling is the high cost of solid waste management and recycling. This is a problem of several dimensions. Solid waste costs seem astronomically high since municipalities historically have paid very little for disposal methods that are inadequate by current standards. Nonetheless, given other major municipal expenditures such as road maintenance and education, coupled with decreased state financial aid, increasing municipal solid waste management costs will be a problem for years to come. The weak market for most of the recycled materials, along with the low public participation that some municipal recycling programs are experiencing, suggests that in the foreseeable future recycling programs will be deficit operations.

One MSW management method that deserves a closer examination is composting. An extremely large portion of the waste stream is compostable, yet only 9.2% of the municipalities have composting programs. Materials that could be composted include paper products, yard waste, and food waste. Composting will be most attractive in areas where paper recycling is expensive (smaller and/or remote towns) and in municipalities where leaf and/or other yard waste is currently being collected and landfilled or incinerated.

The authors recommend that municipalities explore composting options. Residents could be encouraged to start backyard composting of leaf and yard waste and possibly some portion of their food waste. Backyard composting of yard waste could be encouraged by a ban on the collection of yard waste at the curb in municipalities that have curbside rubbish pickup. Municipalities may be able to initiate a cost effective composting program with a nearby farmer to compost not only yard waste, but perhaps also low value paper and food waste. The University of Maine Cooperative Extension has a Master Composter program (for backyard composting training) which should be expanded.

Many are taking a new look at the use of in-home "garbage disposals" for the disposal of food wastes. At least one study has demonstrated that a municipal waste water treatment plant could handle its community's food wastes with no ill effects. P.H. Jones, a professor of environmental engineering at the University of Toronto, states that "there is a myth that grinding food wastes and passing them to the sewage treatment plant will overtax the sewerage system" (Samuels 1991:20). Although most Maine municipalities do not have sewerage systems, the majority of Maine's residences are serviced by wastewater systems. The impact of in-sink food grinding on septic systems, and the impact of food wastes from institutions, however, need to be addressed.

At the state level, innovative solid waste management options need to be explored. For instance, some municipalities have three systems: curbside rubbish collection, drop-off recycling (usually for newspaper and perhaps some glass), and the private bottle bill recycling system. Perhaps there are ways of combining some aspects of these systems to reduce the per ton costs of recycling. For example, with some creativity perhaps one or more redemption centers would also serve as the municipal drop-off center.

Two waste management schemes that deserve further study are what the authors shall call the "bounty" system and the "German retail" system. At the core of the bounty system is a cash payment or some other reward to those who bring recyclable materials to recycling centers. Such a system would have the powerful reward incentive that has made the return rate for beverage containers under deposit higher than any other system. However, the details of such a reward system could prove very difficult to workout and would require a government subsidy.

The German retail system is truly innovative, and, unlike most waste management systems, strikes at waste generation rather than increasing recycling. In its essence, the German retail system allows consumers to leave unwanted extra packaging at the retail store.¹ If retailers notice an annoying amount of a certain package piling up at their store (for which the retailer would have to pay to dispose), the retailers will require manufacturers to abandon the use of unwanted packaging surrounding the product.

¹The package that surrounds the actual product is called the "primary package". If there is another package surrounding the primary package, this is called a "secondary package". Pain relief medicine is one of many products available in retail stores which are available for sale, depending on the manufacturer, in both packaging types. It is available packaged only in a bottle (the primary package, which does have a tamper resistant seal), and it is also available in packaged in the bottle surrounded by a box (the secondary package).

REFERENCES

- Halstead, J.M., and J.A. Cornelio. 1989. Solid waste management in New Hampshire: current practices. University of New Hampshire, Agricultural Experiment Station, Research Report Number 122, Durham: NH. 14 pp.
- Halstead, J.M., S.D. Myers, G.K. Criner, and S.C. Deller. 1991. Solid waste management in New Hampshire: Current practices. University of New Hampshire, Agricultural Experiment Station, Research Report Number 124, Durham: NH. 73 pp.
- Samuels, Janice. (April) 1991. "Garbage grinders may provide alternative to landfilling," *Civic Public Works*, pp 19-20.