The First Annual Report of the Recycling Public Advisory Council

Presented to the
Honorable Ruth Ann Minner
Governor of Delaware
and the
141st General Assembly

January 2002

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Executive Summary

The Recycling Public Advisory Council (RPAC) was established by former Governor Thomas R. Carper's Executive Order No. 82 in September of 2000. Executive Order No. 82 set a diversion rate goal of 30 percent for Residential Solid Waste (RSW) and charged the RPAC with advising and assisting the Department of Natural Resources and Environmental Control (DNREC) and the Delaware Solid Waste Authority (DSWA) in achieving this goal. In addition, the RPAC was given the responsibility of developing tools to measure waste generation and recycling as well as to define terms frequently used in solid waste management and recycling. To assist in achieving the 30 percent goal, Executive Order 82 established a recycling grant program and gave the DNREC and the RPAC the responsibility to determine the potential for recycling through new programs. RPAC efforts to date have primarily been development and implementation of the grant program and analyzing the results of the Citizens' Work Group on Recycling, the precursor of the RPAC. RPAC established committees to develop a measurement system, increase recycling education, and develop an understanding of the barriers affecting increased recycling and strategies to overcome the barriers.

Currently the primary means of recycling RSW is through the Delaware Solid Waste Authority's 'RECYCLE DELAWARE' drop-off program. This voluntary drop-off system is very efficient and collects high-quality recyclable materials that are remarkably free from most contamination. This ensures recyclables more marketable at a lower cost to the buyer. DSWA has markets for more than 96% of the materials collected. However, the drop off program to date is only able to collect approximately five percent of the RSW and although the DSWA has designed several other innovative recycling solutions and continually researches other recycling alternatives, Delaware's 1997 estimated recycling rate was fourteen (14) percent. This information will be updated for the year 2000 in 2002. This recycling rate is far short of the thirty (30) percent goal. Based on the information available to date, the RPAC recommends the following actions be taken to achieve a 30 percent diversion rate:

1. Provide grant funding of $100,000 for 2003 and increase $25,000 per year through 2005.
2. Maintain the DNREC's current recycling staff level of one Environmental Scientist and one Community Relations Officer and add a Planner position in fiscal year 2004.
3. Enhance the 'RECYCLE DELAWARE' drop-off program by:
   - ? Increasing awareness of the program during grant and educational outreach activities,
   - ? Revisiting the House Bill allowing DSWA easier access to shopping centers, where usage is typically highest, to site new 'RECYCLE DELAWARE' centers,

- ? Designing more aesthetic 'RECYCLE DELAWARE' centers to promote their acceptance.

4. Support and expand recycled materials markets through DEDO's Green Industries Initiative and DNREC's Recycling Assistance Grant Program.
5. Through legislation provide DNREC with the authority to require waste collectors (municipal and private) to provide DNREC, on a confidential basis, information on the tons of trash and recyclable material collected in Delaware. This could be a requirement imposed as part of the transporter permitting process. It is proposed this legislation be effective July 2002.
6. Encourage municipal and home composting and divert yard waste from landfill disposal as follows:
   - ? Encourage municipal composting by state purchase (Parks and Recreation, Administrative Services, Del DOT) of composted material for use in landscaping and,
   - ? Provide a rebate for the purchase of mulching mowers; double if the mower is battery or electric or,
   - ? Banning yard waste from the active landfill and provide space at the landfill to collect the material for processing.
7. Fund a study to determine the per-household cost of recycling/composting in different parts of the state. It is estimated such a study would cost at least $50,000 and take several months to complete.

   The following recommendations will require major action by the State of Delaware to realistically achieve the thirty-percent diversion rate.

8. Provide franchise district capability to New Castle and Sussex County.
9. Collect a recycling fee from all waste haulers* on a per ton basis as a part of the permitting process to support the building and operation of a Materials Recovery Facility (MRF). A MRF is needed to process commingled recyclables and market materials. The amount of the fee needed to support this recommendation could be determined as part of the study in recommendation number 7.
10. Build a MRF in New Castle County and adopt co-mingled curbside collection in the denser population areas.

*Note – One of the nine RPAC members does not support collecting a fee from waste haulers.

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1.0 INTRODUCTION

1.1 Purpose

In recognition of the need to conserve resources and save landfill space by increasing residential recycling within the State of Delaware, former Governor Thomas R. Carper issued Executive Order No. 82 in September of 2000 creating the Recycling Public Advisory Council (RPAC). He charged the RPAC to report annually on the status of recycling activities in Delaware. The members of the RPAC are pleased to present their first report to the Honorable Ruth Ann Minner, Governor of Delaware, and the distinguished members of Delaware's 141st General Assembly.

1.2 History of Recycling in Delaware

The State of Delaware first began promoting recycling in 1975 with the passage of the Delaware Solid Waste Authority's enabling legislation. This led to the opening of the Delaware Reclamation Plant, which held the title of the largest recycling/reclamation project in the world for nearly 11 years. About 2.5 million tons of MSW and 0.5 million tons of sewage sludge were processed through this plant. This facility was shut down in 1993 and the plant was modified to operate as the Delaware Recycling Center which processes and markets all the recyclables from the 'RECYCLE DELAWARE' Drop-Off Program.

The next major milestone was the implementation of the Beverage Container Law in 1979 designed to prevent roadside littering.

In 1990, the statewide drop-off recycling program, known as 'RECYCLE DELAWARE', was established by the Delaware Solid Waste Authority. The DSWA currently operates 145 'RECYCLE DELAWARE' centers and collects nearly 20,000 tons/year of recyclables. Included are brown, green and clear glass bottles, plastic bottles, newspaper and magazines, aluminum and steel cans (including aerosols), plastic grocery bags, textiles, motor oil and oil filters**,** corrugated cardboard, and household batteries (the batteries are not recycled, but disposed of properly).

Despite these recycling milestones, Delaware's former Governor, Thomas Carper, received frequent letters and phone calls from Delaware residents requesting implementation of curbside collection of recyclables. These requests spurred Governor Carper to call a meeting in late 1998 with representatives of the DNREC, the Delaware Economic Development Office (DEDO) and

the DSWA to discuss the feasibility of implementing curbside collection of recyclables in Delaware. The result of this meeting was the issuance of Executive Order No. 60 establishing the Citizens' Work Group on Recycling to evaluate recycling in Delaware. The work group would also recommend ways to increase recycling in Delaware.

Executive Order No. 60 set forth Governor Carper's reasons for establishing the Work Group. He found that:

- Delaware's households produce approximately 60 percent of the total solid waste as Residential Solid Waste (RSW), yet only 5 percent of Delaware's RSW was captured through the 'RECYCLE DELAWARE' drop off centers;
- Although curbside collection of recyclables came at an additional cost to homeowners, it generally had wide public support;
- Some of Delaware's citizens had expressed a desire for curbside collection of recyclables but did not have data that clearly supported implementation of curbside collection;
- And finally that it would be helpful to both the Governor and the General Assembly to have a better understanding of the public's view on curbside recycling programs, and charged the Citizens' Work Group on Recycling with:

    1. Commissioning a public opinion survey to determine the level of interest in, and willingness to pay for, curbside recycling, and
    2. Developing and recommend a course of action to increase recycling in the state, taking into consideration the results of the survey.

1.3 Findings of the Citizens' Work Group on Recycling

The survey run by the Work Group showed that the majority of Delawareans consider recycling important and would participate in curbside recycling if there were little or no additional cost. More than half are aware of and use the "RECYCLE DELAWARE" drop-off centers. The main reason for not recycling is inconvenience. The drop-off centers would be used more if the sites were more convenient. While approximately half of Delawareans are aware of the deposit on bottles only an estimated one third of returnable bottles are actually returned.

The Work Group concluded that the single largest barrier to a curbside recycling program that includes all the items collected by the drop-off centers and meets the survey requirements of cost and sorting is the lack of any Material Recovery Facility (MRF). The Work Group also concluded that the establishment of franchise districts for the collection of residential solid waste would be necessary in any area where curbside recycling is desired.

Table 1 summarizes implementation of the Work Group's recommendations.

Table 1. Implementation Status of Work Group Recommendations

Recommendation	Status
1. Create an Office of Recycling within DNREC to promote and monitor all recycling efforts within the State. A Recycling Public Advisory Council should also be established to assist and advise the Office.	Implemented by Executive Order No. 82 and with the allocation an Environmental Scientist and Community Relations Officer (CRO) to DNREC in the FY 01 Budget. However, the CRO position is proposed to be cut from the FY 03 budget.
2. Establish a voluntary statewide residential solid waste diversion goal of at least 25%.	Executive Order 82 establishes a 30% diversion goal.
3. Establish a statewide education program on recycling within the Office of Recycling.	The RPAC in conjunction with DNREC has established a strategy for a statewide public education program on recycling. However, limited funding within DNREC and the loss of the CRO position severely restrict implementation of this strategy.
4. Provide funding for grants to encourage communities, counties and municipalities to implement measures to increase recycling.	The RPAC established the grant program in 2001. The Workgroup requested $500,000 in funding for the grant program. Only $49,000 was granted in FY 01 and $75,000 in FY 02.
5. Make it easier for the Delaware Solid Waste Authority to site 'RECYCLE DELAWARE' collection centers.	This recommendation has not been implemented.
6. Enact a State Recycled Products Procurement Law	Signed by former Governor Carper on September 14, 2000.
7. Enforce the Bottle Bill.	This recommendation has not been implemented.
8. Develop and publish a list of local companies who currently have products made from recycled materials available.	The Delaware Economic Development Office published the Delaware RECYCLERS DIRECTORY designed to help businesses and individuals identify businesses and programs that support recycling efforts.
9. Increase the number of igloos at 'RECYCLE DELAWARE' drop-off sites.	In 2001 DSWA added containers for plastic bags.
10. Review report on former Governor Castle's Executive Order No. 82.	This recommendation has not been implemented.
11. Support and expand recycled materials markets.	This recommendation has not been implemented.

The Work Group also made recommendations to reach a diversion rate of above 25%. These include a mandated residential diversion rate for local governments, increase grant funds to implement waste reduction and diversion measures and the establishment of waste franchise districts. None of these actions have been taken to date.

The Citizens' Work Group on Recycling finalized the report "A Course of Action to Increase Recycling in the State of Delaware" in February of 2000. A full copy the report may be viewed on DNREC's website at http://www.dnrec.state.de.us/air/recycle.pdf

1.4 Executive Order Number 82

In the spirit of conservation and pursuant to the report "A Course of Action to Increase Recycling in the State of Delaware," which was developed by and contained the recommendations of the Citizens' Work Group on Recycling, Governor Thomas R. Carper signed Executive Order Eighty-Two (See Appendix A) which:

1. Established the goal of a thirty (30) percent diversion rate for recyclables from Delaware's residential solid waste stream.

2. Required the Department of Natural Resources and Environmental Control (DNREC), Division of Air and Waste Management (DAWM) to work in concert with the Delaware Solid Waste Authority (DSWA) and the Recycling Public Advisory Council (RPAC) to

    a) develop a method for measuring recycling,
    b) establish a recycling grant program,
    c) establish a public outreach and education program aimed at educating the general public and students on the value of recycling as well as to increase the recycling rate,
    d) provide technical assistance to local entities to increase the recycling rate, and
    e) provide administrative support to the RPAC.

3. Established the nine (9) member RPAC and tasked the RPAC with

    a) advising DNREC and DSWA on all aspects of recycling,
    b) advising DNREC on developing grant criteria,
    c) advising DNREC and DSWA on outreach activities to increase recycling, and
    d) developing an annual report due on December 1st of each year detailing the status of recycling activities within Delaware.

Governor Minner appointed the members of the RPAC early in her Administration and the first RPAC meeting was held on February 27, 2001. A list of RPAC members can be found in Appendix B. The full Council met ten times in 2001 with all meetings opened to the public. DNREC also hired an Environmental Scientist and a Community Relations Officer to assist the Council. The Environmental Scientist aids the Council in developing the method for measuring

recycling and provides recycling technical assistance to Delaware's communities and local governments. Provided the Community Relations Officer position is maintained it will run both the recycling grants program and educational programs on the Council's behalf. These activities will be severely hampered in the absence of the Community Relations Officer position.

2.0 Why Should Delaware Recycle?

2.1 The Problem

Thomas Jefferson said, "The earth belongs to the living. No generation may incur more debt than can be paid during its own existence." While this quote may have been directed at fiscal responsibility during Jefferson's time, it also applies to conserving our finite supply of natural resources for present and future generations. Americans generate more waste per capita today than anytime in our history. This is due to a very high standard of living that we enjoy, an increasing population and the value placed on saving "time", sanitation, and convenience. Americans are also living in larger houses than ever before, resulting in the purchase of more and larger items for disposal.

As a result of the increasing waste generation rate and the economies of scale in landfill construction, today's society is producing landfills so large they've even been given their own name, "Megafills." While Delaware does not have any "Megafills" by the waste industry's standard, our small state already has nearly 400 hundred acres covered strictly in municipal solid waste (MSW). As Delaware's population grows, the need for new landfill space will only increase. Eventually, Delaware will have to look for new landfill sites or change its methods of handling MSW. In addition, these landfills currently require monitoring for at least 30 years after they are closed under the current DNREC Regulations; however, longer periods of maintenance and monitoring may be necessary. Any Delaware landfill failure is a contaminant threat to groundwater, surface water and air quality and is without question a potential long-term liability to future generations.

With several competing uses for land and the desire to maintain a "Liveable Delaware", recycling is an attractive, logical and responsible alternative to landfilling recyclable materials made from a finite supply of natural resources. We have a responsibility to future generations to conserve non-renewable natural resources. It is ironic that this nation will go and has gone to war over the petroleum supplies upon which we are so heavily dependent, yet many will discard the recyclable plastic bottle made from petroleum and never give it a second thought. Conserving these valuable resources is analogous to saving for retirement -- once you're in the habit you don't even notice it, and a little bit now goes a long way in the future. It is estimated the average household can recycle approximately twenty percent of its Residential Solid Waste (RSW) excluding yard waste. Not only is the sacrifice small and well worth it, it is the responsible thing to do. Efficient recycling is a responsible waste management policy.

2.2 The Benefits

Today, efficient industries, plants and businesses practice recycling of materials that they simply discarded a decade ago. Manufacturing processes often generate by-product streams of single homogeneous materials and those materials are relatively free of contamination and highly hazardous components. It makes sense economically – as well as environmentally – to recover value from those streams instead of simply discarding them. The corporate goal at DuPont is "Zero Waste and Emissions". Such a goal sets the stage for continual movement towards using the minimum amount of natural resources needed for business.

Solid waste generated by a municipality, by contrast, is constantly changing in composition and is contaminated with small amounts of hazardous or noxious materials. There are large quantities of recoverable and reusable materials in municipal solid waste, but the lack of diversified and sustainable markets and a single national "best approach" to their separation, recovery, reuse and recording of data has inhibited the progress of recycling. The best approach depends greatly on specific circumstances that exist in a given community. Since the demand for recycled materials fluctuates, so does the value. Therefore one cannot rely on the income from sale of recyclables to fund a recycling program. However, it has been shown in many areas that a well coordinated waste management system which provides for centralized control of all parts of the waste management infrastructure can minimize the added cost to households by using savings from one part to off-set cost incurred in another. Several communities, (Chatham, NJ, Dover, NH and Falls Church, VA to name a few) have cost effectively achieved waste diversion rates in excess of 50 percent with little or no per household increase in waste disposal cost (Reference EPA's "Cutting the Waste Stream in Half"). Delaware's current waste management infrastructure lacks the control mechanisms and funding needed to achieve efficient large-scale waste diversion.

There is also an economic benefit to recycling that needs to be considered. According to the Northeast Recycling Council's 2000 report "Recycling Economic Information Study" in the recycling, reuse and re-manufacturing industry the State of Delaware is estimated to employ approximately 2000 people with an annual payroll of $56 million and estimated tax revenues of almost $10 million. These estimates demonstrate that the recycling, reuse and re-manufacturing industries make a positive contribution to Delaware's economy.

Not recycling also costs money, but most of these costs are in the future and not obvious. It's difficult to quantify the real economic benefits of recycling on a short-term basis. Yet in spite of the inability to provide precise dollars-and-cents quantification of those benefits, it is important to at least identify them. The Citizens' Work Group on Recycling identified the types of benefits that increased recycling provides to individuals, to the community, to Delaware – and to future generations:

? **Reduce consumption of non-renewable sources of energy and raw materials** - This is an ethical and moral issue: *Does this generation in general, and this nation in particular, have the right to waste the world's non-renewable resources?* Natural processes do not regenerate "non-renewable" resources in times comparable to human lifetimes. Such materials include for example natural gas and oil used for energy, and ores from which steel, aluminum and other materials of commerce are produced. These materials will gradually but inexorably rise in cost and perceived value as the supply gradually diminishes. This is a huge issue and involves responsibilities of individuals and nations that, by today's world standards, possess great wealth. Supplying industry with recycled materials, rather than "virgin" resources extracted from forests and mines, is environmentally preferable because it saves energy, reduces emissions of greenhouse gases and other dangerous air & water pollutants, and because it conserves scarce natural resources. In 1996, Delaware recycling programs supplied industry with over 207,000 tons of scrap commodities like paper, glass, metals, plastics, wood, construction & demolition and other materials. Recycling reduces the need for landfills and other disposal facilities, thereby allowing local lands to be used in more environmentally preferable ways. And, by substituting scrap materials for the use of trees, metal ores, minerals, oil and other virgin materials, recycling reduces the pressure to expand forestry and mining production. By recycling nearly 75,000 tons of scrap metal in 1996, Delaware recycling efforts reduced the need for virgin materials by twice that amount, including 93,600 tons of iron ore, 52,400 tons of coal and 4,400 tons of limestone.

? **Reduce environmental damage from industrial waste** - Recycling of household trash actually can reduce industrial waste. Consider: potentially recyclable material – glass, metal or plastic – that ends up in a landfill is replaced by new material whose manufacture may generate undesirable – some even toxic to humans and other living species. On the other hand, re-manufacture beginning with recovered, recycled material can be inherently "cleaner". For example, it is environmentally preferred to collect, remelt and reuse aluminum from soda cans than to dig more bauxite from mines and process it through today's environmentally-polluting process for manufacture of additional aluminum metal.

? **Reduce environmental damage from residential and commercial waste** - Residential and commercial waste causes environmental damage also. The list of hazardous materials that are discarded by homeowners is lengthy. It includes mercury in fluorescent light tubes and batteries, chlorinated cleaning solvents, heavy metals on old electroplated fixtures and as additives in PVC and other plastic materials, oil from automobiles, etc. In addition to greenhouse gases, recycling can reduce a range of pollutants from entering the air and water. This benefit accrues again because of reduced fossil fuel use and because recycled materials have already been processed once. But it also accrues because recycling keeps materials out of landfills, where they can introduce leachate into groundwater systems, and out of incinerators, which can emit pollutants into the air and

into ash residue. Recycling has been shown to produce less of 27 different types of air and water pollutants, compared with using virgin materials in manufacturing and disposing wastes. In 1996, Delaware recycling efforts resulted in reductions of as much as 641 tons of water pollutants and 8,800 tons of air pollutants (not including the greenhouse gas reductions mentioned above). Recycling reduced overall emissions of sulfur oxides, an important ingredient in acid rain formation, by about 1,000 tons, and reduced nitrous oxides by an additional 1,000 tons, an amount equal to nearly 6% of all such emissions from electrical utilities in the state.

? **Extend life of municipal landfills** - This postpones the need to fund purchase and development of new landfill sites – as well as social and political conflicts accompanying selection of a new site. It also reduces the pressure for incineration as a landfill alternative. For example, the DSWA landfills today receive about 2,700 tons per day of trash and have an average remaining lifetime of 15-20 years. If 60,000 (25% of the residential waste stream) tons of reusable materials are recycled each year for the next 15 years, thereby diverting this material from the landfill, it would result in a 10-15% increase in landfill life.

? **Provide jobs** - Nationally there are many established jobs and small businesses supported 100% by the recycling business. Studies reveal that recycling, reuse and other materials-efficient practices generally create more, and more sustainable, employment. One example is Delaware's "Green Industries" program, which has helped to create 154 full-time and 40 part-time jobs since its inception in 1995. Recycling provides jobs in collecting, sorting, packaging, cleaning, processing and reselling products based in whole or part on recycled material. On average, pay is better than for jobs involved in collecting, transporting and landfilling waste. For every 100 jobs created by recycling, only 13 jobs are lost in the solid waste collection and disposal and in virgin materials extraction.

? **Satisfy a "waste not" ethic** - Many members of the generation that personally experienced scarcity of commodities and necessities in the depression years – the decade of the 1930s – have a strong natural aversion to throwing away materials that others might find to be useful.

? **Teach environmental values to individuals** - Wasteful use of non-renewable resources, coupled with indiscriminate disposal of products made from those resources, teaches the wrong message – especially to our youth. As the world's population increases, and natural resources are used at a faster rate, strong and informed leaders will be needed to create a balance.

? **Reduces emission of greenhouse gases** - On a per capita basis, the U.S. generates the largest emissions of greenhouse gases, those gases that cause earth temperatures to rise. Many scientists believe that if not slowed, the present rate of global climate change can

have near-irreversible and disastrous consequences for the earth's entire ecosystem. By reducing the amount of energy used by industry, recycling also reduces greenhouse gas emissions and helps stem the dangers of global climate change. This is because much of the energy used in industrial processes and in transportation involves burning fossil fuels like gasoline, diesel and coal -- the most important sources of carbon and other greenhouse gas emissions into the environment. Delaware recycling efforts in 1996 reduced greenhouse gas emissions by about 64,000 tons carbon equivalent per year, equal to about 2.1% of all industrial carbon dioxide emissions in the state.

? **Save Energy** - Energy savings may be the most important environmental benefit of recycling, because using energy requires the consumption of scarce fossil fuels and involves emissions of numerous air and water pollutants. The steps in supplying recycled materials to industry (including collection, processing and transportation) typically use less energy than the steps in supplying virgin materials to industry (including extraction, refinement, transportation and processing). But most energy savings associated with recycling accrue in the manufacturing process itself, since recycled materials have already been processed at least once. For example, it takes 20 times the energy to make virgin aluminum, 8 times the energy to make virgin plastic, and twice the energy to make virgin paper than to produce their recycled equivalents. The 128,000 tons of paper, glass, metals and plastic Delaware recycled in 1996 saved a total of about 2.2 trillion BTUs of energy, equal to nearly 2% of all energy used by industry in the state, or enough to power over 11,000 homes.

3.0 Waste Generation and Recovery in Delaware

The characteristics of RSW are constantly changing because of the dynamic open markets in this country. Because of this situation, the EPA supported the development of an "Input-Output" model. Franklin Associates has been retained by EPA to periodically update the information on what the nation is purchasing, recycling, and discarding in the solid waste stream. Franklin Associates prepared a separate study of the 1997 Municipal Solid Waste (MSW) for the State of Delaware using the EPA model procedures. The resulting report, "Assessment of Solid Waste Discards in Delaware and the Potential for Recycling Materials – April 1999" provides a good basis for understanding RSW generation and for targeting materials for additional recycling to move the state toward the 30% target.

This report was used extensively by the Citizens Work Group providing the data that led to many of the recommendations. Table 2 reproduces the Residential Solid Waste data of Table 8 of the Franklin Associates report. Table 2 of this report lists the generation, recovery and discards of both product waste and other waste, primarily yard trimmings. These data show DSWA's 'RECYCLE DELAWARE' and other programs had an overall recovery rate of 14% of Delaware's RSW in 1997.

Table 2. Residential Solid Waste in Delaware 1997

NUM	DISCARD ITEM	GENERATION[1]	RECOVERY[2]	DISCARDS[3]	% Recovered[4]
		TONS	TONS	TONS	
1	NEWSPAPERS	27,200	15,441	11,759	56.77
2	BOOKS	2,320	116	2,204	5.00
3	MAGAZINES	4,290	448	3,842	10.44
4	OFFICE PAPERS	3,024	0	3,024	0.00
5	TELEPHONE DIRECTORIES	780	38	742	4.87
6	THIRD CLASS MAIL	8,580	1,290	7,290	15.03
7	OTHER COMMERCIAL PRINTING	12,155	1,460	10,695	12.01
8	TISSUE PAPER AND TOWELS	4,920	0	4,920	0.00
9	PAPER PLATES AND CUPS	520	0	520	0.00
10	OTHER NON PACKAGING PAPER	5,600	0	5,600	0.00
11	CORRUGATED BOXES	8,020	270	7,750	3.37
12	BEVERAGE CARTONS	800	0	800	0.00
13	FOLDING CARTONS	8,940	0	8,940	0.00

NUM	DISCARD ITEM	GENERATION[1]	RECOVERY[2]	DISCARDS[3]	% Recovered[4]
14	OTHER PAPERBOIARD PACKAGING	300	0	300	0.00
15	BAGS AND SACKS	4,950	0	4,950	0.00
16	WRAPPING PAPERS	90	0	90	0.00
17	OTHER PAPER PACKAGING	3,330	0	3,330	0.00
A	**TOTAL PAPER PRODUCTS**	**95,819**	**19,063**	**76,756**	**19.89**
18	GLASS BOTTLES - BEER & SOFT DRINK	5,920	5,600	320	94.59
19	GLASS BOTTLES - WINE & LIQUOR	5,040	698	4,342	13.85
20	GLASS BOTTLES - FOOD & OTHER	9,095	1,485	7,610	16.33
B	**TOTAL GLASS PACKAGING**	**20,055**	**7,783**	12,272	**38.81**
21	STEEL CANS - FOOD & OTHER	6,630	2,028	4,602	30.59
22	OTHER STEEL PACKAGING	25	0	25	0.00
C	**TOTAL STEEL PACKAGING**	**6,655**	**2,028**	**4,627**	**30.47**
23	ALUMINUM CANS - BEER & SOFT DRINK	2,460	1,574	886	63.98
24	ALUMINUM - OTHER CANS	50	0	50	0.00
25	ALUMINUM - FOIL & CLOSURES	900	23	877	2.56
D	**TOTAL ALUMINUM PACKAGING**	**3,410**	**1,597**	1,813	**46.83**
26	PLASTIC BOTTLES - SOFT DRINK	1,840	1,214	626	65.98
27	PLASTIC BOTTLES – HDPE	1,568	456	1,112	29.08
28	PLASTIC - OTHER CONTAINERS	2,800	225	2,575	8.04
29	PLASTIC - BAGS & SACKS	3,420	0	3,420	0.00
30	PLASTIC WRAPS	4,080	0	4,080	0.00
31	PLASTIC - OTHER PACKAGING	5,040	0	5,040	0.00
32	PLASTIC TRASH BAGS	2,280	0	2,280	0.00
33	PLASTIC PLATES & CUPS	440	0	440	0.00
E	**TOTAL PLASTIC PACKAGING**	**21,468**	**1,895**	19,573	**8.83**
34	WOOD PACKAGING	0	0	0	
F	**TOTAL WOOD PACKAGING**	**0**	**0**	**0**	
35	FOOD MATERIALS	37,448	0	37,448	0.00
36	YARD TRIMMINGS	91,500	7,969	83,531	8.71
G	**TOTAL ORGANIC MATERIALS**	**128,948**	**7,969**	**120,979**	**6.18**
37	MAJOR APPLIANCES	1,060	931	129	87.83
38	SMALL APPLIANCES	2,090	121	1,969	5.79
H	**TOTAL APPLIANCES**	**3,150**	**1,052**	**2,098**	**33.40**
39	FURNITURE & FURNISHINGS	18,400	0	18,400	0.00
40	CARPETS & RUGS	5,120	67	5,053	1.31
41	TIRES	1,800	1,685	115	93.61

42	LEAD ACID BATTERIES	270	68	202	25.19
43	MISCELLANEOUS GOODS	39,760	6,362	33,398	16.00
NUM	**DISCARD ITEM**	**GENERATION[1]**	**RECOVERY[2]**	**DISCARDS[3]**	**% Recovered[4]**
I	**TOTAL DURABLE GOODS**	**65,350**	**8,182**	**57,168**	**12.52**
44	DISPOSAB;E DIAPERS	7,200	0	7,200	0.00
46	MISCELLANEOUS PACKAGING	280	0	280	0.00
47	INORGANIC MATERIALS	4,400	0	4,400	0.00
48	CLOTHING & FOOT WEAR	8,820	1,147	7,673	13.00
49	TOWELS,SHEETS,PILLOW CASES	1,890	320	1,570	16.93
50	MISCELLANEOUS NON DURABLES	4,750	0	4,750	0.00
J	**TOTAL MISCELLANEOUS**	**27,340**	**1,467**	**25,873**	**5.37**
K	**TOTAL RSW**	**372,195**	**51,036**	**321,159**	**13.71**

NOTES: This table was prepared by extracting information presented in Table 8 (Page 4-2 & 4-3) of the Franklin Associates Report, "Assessment of Solid Waste Discards in Delaware and the Potential for Recycling of Materials." commissioned by the DSWA, 1999.

[1]Column 3 provides an estimate of materials generated in Delaware
[2]Column 4 provides an estimate of the materials recovered in Delaware for recycling or diversion
[3]Column 5 provides an estimate of the discarded material in residential solid waste
[4]Column 6 shows the recycling or diversion percentage {(Col4/Col3)*100}

Not all materials are worth recovering because there may not be any buyers for such material. Mixed colored glass is a good example.

This table can be used to set priorities for additional materials recovery efforts. For example: yard waste diversion can be targeted as priority #1 because the current recovery rate is very low based on the information available. Corrugated paperboard could be targeted as priority #2 because there is a reasonable demand for it. Aluminum foil is another material, which has reasonable value in the market place. However, collection of such food contaminated material poses severe operating and separation problems.

Once priorities are set, one could examine collection options and costs for each material. Market conditions (specifications, demand, shipping etc) should be examined. Such information will yield better prospects for suggesting new programs to increase recycling/diversion rates.

Table 3 of this report complements Table 2. The practical diversion tons shown in Table 3 assumes 70% of the available recyclables in residential solid waste can be diverted under ideal conditions. If this is achievable, the additional tons which theoretically are available for recycling are shown in Table 3. The data in Table 3 have been rearranged to show the additional tons of recyclables by category in descending order. For example, it is apparent that yard trimmings have an additional 56,000 tons and total paper products have about 34,000 tons of recyclables which should be targeted in that order to increase Delaware's recycling/diversion rate. Yard trimmings alone account for approximately 55% of the additional total tonnage available for recycling. By targeting yard waste alone for greater recovery, Delaware could

possibly reach the 30% diversion goal although this approach would not make a contribution toward conserving finite resources. Diversion of yard waste as part of the equation to achieve the thirty percent diversion is being pursued by the RPAC.

Table 3. Residential Solid Waste in Delaware 1997
Additional Tons of Recyclables at 70% Diversion

NUM	DISCARD ITEM	PRACTICAL DIVERSION TONS	ADDITIONAL RECOVERABLE TONS
1	YARD TRIMMINGS	64,050	56,081
A	**TOTAL ORGANIC MATERIALS**	**64,050**	**56,081**
3	NEWSPAPERS	19,040	3,599
4	OTHER COMMERCIAL PRINTING	8,509	7,049
5	FOLDING CARTONS	6,258	6,258
6	THIRD CLASS MAIL	6,006	4,716
7	CORRUGATED BOXES	5,614	5,344
8	MAGAZINES	3,003	2,555
9	OFFICE PAPERS	2,117	2,117
10	BOOKS	1,624	1,508
11	TELEPHONE DIRECTORIES	546	508
B	**TOTAL PAPER PRODUCTS**	**52,717**	**33,654**
20	GLASS BOTTLES - FOOD & OTHER	6,367	4,882
21	GLASS BOTTLES - BEER & SOFT DRINK	5,600	0
22	GLASS BOTTLES - WINE & LIQUOR	3,528	2,830
C	**TOTAL GLASS PACKAGING**	**15,495**	**7,712**
23	STEEL CANS - FOOD & OTHER	4,641	2,613
24	OTHER STEEL PACKAGING	18	18
D	**TOTAL STEEL PACKAGING**	**4,659**	**2,631**
25	PLASTIC BOTTLES - SOFT DRINK	1,288	74
26	PLASTIC BOTTLES - HDPE	1,098	642

27	PLASTIC - OTHER CONTAINERS	225	0
28	PLASTIC - OTHER PACKAGING	189	189
29	PLASTIC WRAPS	136	136
E	**TOTAL PLASTIC PACKAGING**	**2,936**	**1,041**
33	ALUMINUM CANS - BEER & SOFT DRINK	1,722	148
34	ALUMINUM - FOIL & CLOSURES	630	607
35	ALUMINUM - OTHER CANS	35	35
F	**TOTAL ALUMINUM PACKAGING**	**2,387**	**790**
36	MISCELLANEOUS GOODS	6,362	0
37	TIRES	1,685	0
38	LEAD ACID BATTERIES	189	121
39	CARPETS & RUGS	67	0
G	**TOTAL DURABLE GOODS**	**8,303**	**121**
41	MAJOR APPLIANCES	931	0
42	SMALL APPLIANCES	121	0
H	**TOTAL APPLIANCES**	**1,052**	**0**
43	CLOTHING & FOOT WEAR	1,147	0
44	TOWELS,SHEETS,PILLOW CASES	320	0
I	**TOTAL MISCELLANEOUS**	**1,467**	**0**
K	**TOTAL MSW**	**153,065**	**102,029**

DSWA has commissioned Franklin Associates to perform an update of solid waste disposal and recovery in Delaware for calendar year 2000. This review will be very helpful in assessing changes in waste patterns and with defining areas for increased program activity. The report will be completed in 2002.

4.0 DSWA Activities

7 Delaware Code Chapter 64 created the Delaware Solid Waste Authority (DSWA) and gave DSWA its statutory authority to operate. It also gives DSWA the responsibility for recycling within the State of Delaware. The first 'RECYCLE DELAWARE' Center was placed at the Southern Solid Waste Management Center in 1990. The program has grown to 145 drop-off centers throughout the State. Each center is composed of several color-coded igloos. Standard color-coding improves the separation of recyclables and reduces contamination. A 'RECYCLE DELAWARE' center is located within a five-mile radius of most households so residents can easily drop off recyclables on the way to work or shopping. These recycling centers are made possible with the help of Delaware businesses and schools who donate a portion of their property. At no cost to taxpayers, DSWA operates the statewide program using money from its tipping fees and it averages about 1,500 tons of recyclables received each month. About five percent of the RSW is recycled through the 145 centers at a cost of about $0.75 per household per month. Despite the low diversion rate, 'RECYCLE DELAWARE' is a very successful voluntary drop-off program.

The DSWA supports waste oil, electronic goods, oil filter, Household Hazardous Waste, tire, white goods, yard waste and "RECYCLE DELAWARE" recycling programs as well as educational and public information programs. Information on all of DSWA's programs and cost as well as a copy of DSWA's 2000 annual report is available on DSWA's website at www.dswa.com.

Because of the loss of flow control, DSWA no longer "controls" the flow of Municipal Solid Waste within Delaware. DSWA receives no funding from the federal, state or local governments. Tipping fees and the sale of recycled material are DSWA's primary source of revenue. In order to ensure the majority of the waste generated within the State continues to be disposed of at a DSWA facility, DSWA has had to negotiate contracts with Delaware's waste haulers. As a result of the loss of flow control, DSWA may no longer have a guaranteed source of revenue to support programs such as those mentioned above.

A summary of the quantity of materials collected through the 'RECYCLE DELAWARE' program for FY 2001 and associated economics are contained in Appendix G. Appendix G also identifies the total quantity of materials recovered through private and commercial activities. For additional DSWA beneficial use activities see Appendix F.

5.0 Recycling Public Advisory Council Activities

5.1 Council Charge

Executive Order Number 82 (see Appendix A) primarily required the Department of Natural Resources and Environmental Control (DNREC), Division of Air and Waste Management (DAWM) to work in concert with the Delaware Solid Waste Authority (DSWA) and the Recycling Public Advisory Council (RPAC) to

- develop a method for measuring recycling,
- establish a recycling grant program,
- establish a public outreach and education program aimed at educating the general public and students on the value of recycling as well as to increase the recycling rate, and
- provide technical assistance to local entities to increase the recycling rate.

The RPAC formed three committees to help carry out its charge: the Measurement Committee, the Education Committee, and the Strategy Committee. The RPAC and Committee members are listed in Appendix B. For additional information on the committee reports see Appendices C, D, and E.

5.2 Method of Measuring

Before developing a methodology for measuring recycling in Delaware, it was necessary to define the scope of materials and activities that will be measured. As a starting point, the Measurement Committee considered the definitions and guidance contained in the USEPA report "*Characterization of Municipal Solid Waste in the United States: 1998 Update" (September 1999)* and "*Measuring Recycling: A Guide for State and Local Governments" (September 1997*).

The committee found it necessary to deviate from the EPA's guidance in order to best meet the intent of E.O. 82 in some instances. In addition, the committee found the guidance insufficient for defining the scope of what will be measured, since it does not make clear distinctions between *residential* solid waste and the other components of municipal solid waste – especially institutional and commercial solid wastes – whereas E.O. 82 is clearly focussed on residential solid waste. Therefore, the committee found it necessary to clarify exactly what wastes would be considered *residential* and what types of activities would count toward the "recycling" rate for measurement purposes. Ultimately, the committee proposed, and the Council agreed, that the methodology to be developed will be for the measurement of waste diversion (rather than "recycling") of solid waste generated within the residential sector (single-

and multi-family residences). Waste diversion will include recycling, reuse, and waste reduction. A glossary of terms and a detailed list of materials and activities that will be included for measurement purposes were developed by the Measurement Committee and accepted by the RPAC. This information can be found in Appendix J, Glossary of Waste Management Terms.

In order to determine how much waste is diverted, the Committee decided it must determine how much residential waste is generated in Delaware. The Committee prepared a survey to be completed by municipalities and waste haulers to collect this data. The questionnaires, requesting information on waste disposal for calendar year 2000, were mailed by DNREC to all Delaware municipalities (57 towns, cities and counties in all) and all haulers permitted to transport household waste in Delaware (100 haulers). DNREC requested that the questionnaires be completed and returned no later than October 1, 2001; however, as of the writing of this report, only Kent County, 29 municipalities (51%), and 42 haulers (42%) have returned the forms. Most of the questionnaires returned by haulers indicated that those haulers had not collected any residential solid waste in Delaware during the period of interest. Some haulers indicated that the requested information was proprietary and that they were not willing to reveal it. The Measurement Committee is currently in the process of considering whether there are alternative ways to obtain the required data. The RPAC has suggested submission of this information be legislated in recommendation number 5.

In 2002, the Measurement Committee will be gathering information on the diversion of residential solid waste and will work to streamline and institutionalize the process of gathering, compiling and analyzing residential waste disposal and diversion data. For the full Measurement Committee Report see Appendix C.

5.3 Recycling Grant Program

As its first order of business, the RPAC in conjunction with DNREC, developed the following documents necessary for program implementation:

a. Recycling Assistance Program Criteria – This is the grant guidance document that provides information on eligible applicants and activities, grant selection criteria, matching requirements and fiscal information. During this process the entities eligible to apply for grants were defined as follows: State of Delaware municipalities, schools, colleges and universities, not-for-profit organizations, civic groups and associations.
b. Estimated Project Budget – A worksheet designed to estimate all of the grant funding issues including matching funds.
c. Application for a Recycling Assistance Grant – The application requires detailed information about the applicant, recyclable materials targeted, the objectives of the proposed project and a description of the proposed project.

The initial Grant Program (FY2001) was publicly noticed (see Appendix H) on May 6, 2001 with grant applications due on June 25, 2001. In addition to the public notice, a press release announcing the grant program was issued and a short article appeared in the News Journal on May 10, 2001. A package containing the press release, Recycling Assistance Program Criteria, Estimated Project Budget worksheet, Application for a Recycling Assistance Grant and Executive Order 82 were mailed to 57 municipalities and approximately 30 different organizations. Four grant workshops were held statewide between May 8 and 14, 2001.

With very little direct outreach having been accomplished and despite the short turn around time for the grant applications**,** nine grant applications requesting a total of $122,000 in funding were received by DNREC to compete for the $46,000 available for grants. Based on the scoring criteria and a review of applications, the RPAC selected six grants to receive funding with five receiving total funding and the sixth receiving partial funding (see Table 4). These programs were initiated during the fall of 2001. The progress and success of these programs will be evaluated by the DNREC quarterly and the findings will be reported to the RPAC.

Table 4. Grant Summary

Grant Recipient	**Grant Amount**	**Brief Description**
Delaware City	$18,940	Curb Side & Yard Waste Collection
U of D	$15,000	Composting Education
Town of Camden	$6,400	Expanded Curbside Collection
City of New Castle	$3,750	Recycling Education & Containers
Town of Newport	$1,150	Recycling Education & Containers
Town of Laurel	$750	Recycling Education

The RPAC believes the Delaware City Grant exemplifies the intent and spirit of the Recycling Assistance Grant Program. The Delaware City program marks a milestone in the State of Delaware's recycling initiatives and efforts. The $18,940 grant award will allow Delaware City to implement the first stage of a sustainable recycling education, curbside recycling collection and yard waste composting program that otherwise may not have been possible.

Summarized below are highlights of the Delaware City Recycling Assistance Grant Program.

? Inform residents of the program with a target of 200 households for voluntary participation. Residents will be provided with two containers, one for newspapers and the other for all other recyclables.

? Weekly collection of newspapers, cardboard, glass (green, brown, clear), aluminum and steel cans, using a compartmentalized trailer. The DSWA will provide igloos for intermediate storage of the collected recyclables, and transport the recyclables to the

Delaware Recycling Center at no charge to the town. A storage pad will be constructed at the town's municipal works yard for placement of the igloos.

? Expand and improve the City's current yard waste collection program to include the collection of grass, leaves and small brush. The yard waste will be periodically chipped to prepare it for composting. Finished compost will be used by the town for grounds maintenance and will be available to residents for their own use.

? Installation of two "Envirodesign Recycling Centers" in the downtown area. The centers will provide recycling opportunities for tourists visiting the town and Fort Delaware State Park. Aluminum cans and narrow –neck plastic bottles will be collected initially.

? Development of a public education program to inform residents of the benefits of recycling, what materials will be collected and how it will help the town to reduce landfill disposal fees and conserve resources. Grant monies were used to contract professional services of a local environmental firm to design and produce educational literature. Door hangers, water utility bill inserts and letters were used to invite residents to participate in the program and to educate them on the types of recyclable materials that will be collected, the collection method and schedule.

? Development of a promotional program to encourage and build participation. Incentives including prizes and promotional items will be awarded to residents who participate in the program.

Paul Morrill, Jr., the town's City Manager, notes that the one-time and start up costs associated with the curbside recycling program would be difficult or impossible for a small town such as Delaware City to afford without the assistance of the Recycling Assistance Grant Program. Once the program is operating the town is confident that it can cover ongoing program costs and is therefore sustainable over the long term. Even though the program has just started, the town has enrolled 190 residents in the program. This almost immediate 95 percent success rate attest to the desire of Delaware residents to participate in comprehensive recycling programs. Delaware City is leading the way for other State of Delaware municipalities to establish their own successful recycling programs.

The University of Delaware Composting Education grant recognizes the widely held belief that education on the benefits and value of composting and recycling is critical to its wider acceptance and contributes tremendously to the success of recycling programs. The RPAC strongly endorses adoption of recycling related educational programs in our schools. Successful recycling education programs build upon the three cornerstones of environmental conservation – efficient use of non-renewable resources, energy conservation, and land preservation. Science curricula challenges students to think beyond the immediacy of their needs by considering the impacts of their actions upon others and the environment which sustains us. By endorsing and

supporting creative, involving educational programs, the RPAC hopes to increase awareness and acceptance of recycling and composting as a societal responsibility.

The University of Delaware, Cooperative Extension Service, Master Gardeners composting education grant "Composting in the Classroom" embodies such a purpose. Using the nationally recognized 4-H Back Yard Composting curriculum, an estimated 2500 students representing 25 elementary and middle schools in New Castle County and Kent County will participate in a comprehensive, hands-on compost education program. Under the guidance of a trained compost educator, students will learn the basics about backyard composting. Classroom teachers will receive 3-hours of in-service training on composting. A 3-section compost bin will be constructed from pallets in each school. Students will be encouraged to collect compostable materials (e.g. food waste, yard debris) to fill the bin. The program educator will communicate with teachers through e-mail and visit the compost sites to observe the progress of the composting project. Finished compost will be used on the school grounds and be given to students to take home.

An awards and recognition assembly will be held in each school with appropriate recognition for the classes that embraced composting best. By involving students in this interactive program, it is hoped that they will encourage their families to construct and maintain a compost bin to reduce the disposal of yard waste and recycle nutrients back into soils.

The remaining grants, while not on as large a scale as the Delaware City or University of Delaware Grants, are equally important in taking the necessary steps to substantially increase waste diversion within the State of Delaware.

The FY 2002 grant program has $75,000 in funding available and was publicly noticed on November 20, 2001. A total of 140 Grant applications were mailed to 57 municipalities, 56 organizations and 27 interested parties. Four grant workshops will be held statewide during the week of January 7, 2002. Grant applications are due March 29, 2002.

5.4 Public Education and Outreach

The Education Committee focused on three major activities in its first year: Kids for a Greener Delaware, Families for a Greener Delaware/America Recycles Day 2001, and civic association outreach.

The Kids for a Greener Delaware recycling contest consumed most of the committee's energy in 2001. Early in the year, DSWA and DNREC set up a Recycle Delaware Program (igloos) at eight competing schools where students, teachers, parents and neighbors would bring recyclable materials to the school. BFI, which collects materials from the igloos for DSWA, kept a monthly account of each school's total weight collected. The public schools that participated were: Jennie Smith Elementary, Gallagher Elementary, Bancroft Academy, Forest Oak Elementary,

Brandywine Springs Elementary, Redding Elementary in New Castle County and Towne Point Elementary and Booker T. Washington Elementary in Dover. The contest ended May 31, 2001. The first place winner was Towne Point was awarded $3,000, second place winner, Jennie Smith Elementary was awarded $2,000, and third place winner Gallagher Elementary was awarded $1,000. The other participating schools received $500 each. The prize money was awarded to each school's Parent/Teacher Association. Several of the schools will continue the program without the contest. Members of the Education Committee presented the awards at PTA meetings. The Dover Post covered the presentation to the winning school, Towne Point. DSWA invested approximately $70,000 to provide 'RECYCLE DELAWARE' centers to all participating schools. The DSWA's Public Information Group conducted several school assemblies where the benefits of recycling and the " Kids for Greener Delaware" kick-off celebration were discussed. Educational materials and 'RECYCLE DELAWARE' brochures were provided to most participating schools.

For the 2001/2002 school year, the Education Committee developed a new contest focused around the national America Recycles Day. Five schools signed up to participate in Families for a Greener Delaware/America Recycles Day 2001: Glasgow High School, Holy Spirit School, St. Peter's Cathedral, St. Elizabeth High School, in New Castle County and St. Thomas More Academy in Magnolia, Delaware. Schools were provided pledge cards asking students, parents, teachers, and neighbors to recycle and to buy recycled content goods. The school with highest percentage participation will be awarded $2,000 to be used to buy computer equipment. The second place school will be awarded $1,000, and the third place school will receive two heavy duty benches made from recycled plastics. The schools were awarded their prizes on America Recycles Day 2001, November 15, at Delaware City Town Hall. First prize went to St. Thomas More Academy; second prize to Holy Spirit School; and third prize to St. Peter's Cathedral.

Other activities for America Recycles Day 2001 (ARD): Governor Ruth Ann Minner signed a proclamation designating November 15 as America Recycles Day 2001 in the First State. Notification of the FY2002 Grant Program was announced on November 15 during the school awards. Environmental organizations and garden clubs were notified of ARD 2001 and suggested ways of celebrating the day were included in the announcement. The League of Women Voters handed out recycling pamphlets and pledge cards at seven Recycle Delaware sites in New Castle County as a thank you for using the igloos and provided information on where to take other recycled materials not collected at the sites. ARD Public Service Announcements were delivered to four radio stations. Later in November, a drawing of signed adult pledge cards would provide a winner for a Weekend at Rehoboth Beach for a Delaware family. All the pledge cards were sent to the ARD headquarters where there would be regional drawings for more prizes.

The Education Committee's full report can be found in Appendix D.

5.5 Technical Assistance

The DNREC is available to assist local entities with technical assistance in determining the best way to increase their recycling rate. This assistance will consist of providing guidance on what waste streams can be targeted for diversion and what methods of collection may work best for any given community.

6.0 Recommendations

Based on the information available to date the RPAC recommends the following actions be taken to achieve a 30 percent diversion rate:

1. Provide grant funding of $100,000 for 2003 and increase $25,000 per year through 2005.

   The grant program allows recycling programs to start where they otherwise would not. Increased funding is necessary to expand recycling throughout the State and in order to allow more and larger municipalities to obtain the funding necessary to start their own recycling programs. If the larger municipalities are able to start their own recycling programs, substantial increases in the recycling rate can be achieved. The current level of funding is insufficient to initiate recycling programs in the larger municipalities yet this is one area where it would be most beneficial to do so.

2. Maintain the DNREC's current recycling staff level of one Environmental Scientist and one Community Relations Officer and add a Planner position in Fiscal Year 2004.

   The Environmental Scientist position is required to address technical recycling issues such as measurement, processing and reuse. The Community Relations Officer position is required to address the many outreach and educational opportunities that exist to promote recycling throughout the State as well as to promote the Recycling Assistance Grant Program. Public education on the benefits and importance of recycling is critical to its success. If the State of Delaware is going to take a statewide comprehensive approach to recycling, it will eventually be necessary to hire a Planner to develop and implement a plan of action to enhance recycling throughout the state based on Delaware's demographics.

3. Enhance the 'RECYCLE DELAWARE' drop-off program by increasing awareness of the program, revising legislation allowing DSWA easier access to shopping centers to site new 'RECYCLE DELAWARE' centers, and by designing more aesthetic 'RECYCLE DELAWARE' centers to promote their acceptance during grant and educational outreach activities.

   'RECYCLE DELAWARE' centers consist of a combination of steel front-end containers and fiberglass igloos designed to accommodate the specific materials which they receive. In addition to lending to their attractiveness, the brightly colored igloos are color-coded for specific materials and to provide uniformity statewide with respect to recognition of specific containers for specific recyclables. For example, all blue containers are for old newspapers (including inserts), magazines, and telephone books. The specific types of containers being utilized are dictated by the existing available types of collection vehicles and requirements for the recyclable materials. The fiberglass igloos are required for glass, because a standard front-end steel container (8 cu. yd) if filled with glass would be too heavy to service. Correspondingly, the fiberglass containers must be emptied by a crane type of vehicle and only have a capacity of 4 cu. yd. to allow safe and easy unloading of glass. Although these containers are colorful and functional, it is recommended that DSWA continue to assess and develop even more aesthetically pleasing containers for receiving recyclables. Coupled with functionality, as new technology warrants, such containers hopefully would attract more sponsors and greater utilization. This should result in a higher number of 'RECYCLE DELAWARE' centers and correspondingly a greater quantity of recyclables collected.

4. Support and expand recycled materials markets through DEDO's Green Industries Program and DNREC's Recycling Assistance Grant Program.

   Integral to the success of collecting and recycling more materials are sustainable and diversified markets for the recyclable materials. Obviously, advances in technology will be required, but even more importantly ongoing support for recycled materials and their products is prerequisite. This support must come from the consumer and from the Federal, State, and local governments. Such public entities can require that a minimum percentage of materials purchased consist of products containing recycled materials and/or post consumer recyclables. As examples, copy paper, paper towels, and letterhead are available and easily obtainable. Support must also come for new products being developed that initially may demand a slight premium to be purchased. Public entities are expected to take the lead on supporting and expanding the markets for recyclable materials.

5. Through legislation provide DNREC with the authority to require waste collectors (municipal and private) to provide DNREC, on a confidential basis, information on the tons of trash and recyclable material collected in Delaware. This could be a requirement imposed as part of the transporter permitting process. It is proposed this legislation be effective July 2002.

   In order to accurately measure recycling this information is required. Without it there is no way to accurately measure the recycling rate and therefore no way of knowing if the diversion goal is being met. Since reporting is already required in the DNREC's transporter permit program this a logical place to impose this requirement.

6. Encourage municipal and home composting and divert yard waste from landfill disposal as follows:

   - ? Encourage municipal composting by state purchase (Parks and Recreation, Administrative Services, Del DOT) of composted material for use in landscaping and,
   - ? Provide a rebate for the purchase of mulching mowers; double if the mower is battery operated or electric or,
   - ? Ban yard trimmings from the active landfill and provide space at the landfill to collect the material for processing.

   Increased composting is one of the two keys to meeting the residential solid waste diversion rate goal of 30%; the other is curbside recycling.

   Delaware residents generated 372,000 tons of Residential Solid Waste (RSW) in 1997, according to a report issued by the Franklin Associates in 1999. Yard trimmings contributed 26% to the total RSW. Municipal composting of yard waste contributes significantly to the recycling rates of most states whereas in Delaware, it adds only 2-4% to the 14% recycling rate. In July, EPA released a report for 1999 showing a significant decrease in the generation of yard waste due to mulching and composting by homeowners. If we assume Delaware residents are equally aggressive in their use of mulching mowers and composting activities, the amount of yard waste entering the landfills should be dropping as a percent of RSW. These increases are the result of education programs and advertising on the benefits of mulching and composting. The State is increasing the education and application of the benefits through the grant program and Master Gardeners. While this will help increase composting, an aggressive approach to municipal and homeowner composting of yard waste is necessary to achieve the 30% diversion rate goal set for Delaware.

   Newark has had a composting program in place for several years. Until recent years, the avoidance of the landfill disposal fee has been sufficient to cover the collection cost. However, Newark is considering dropping the program because of increasing cost to the city. If state agencies were required to purchase the composted material for use in

landscaping operation and soil enrichment, Newark and other municipalities could compost more materials. The purchase program should only be required when the composted material can be substituted (equally useful) for the mulching materials currently used.

Many studies have shown that mulching yard waste and leaving it on the grass is beneficial to the grass as well as reducing landfill use. This practice needs to be accelerated. Rebates through the use of coupons or tax reductions for the purchase of mulching mowers and composting equipment as well as increased incentives for electric or battery run equipment would add to both recycling and reduced air emissions.

Banning yard waste from the landfill creates the problem of collection and potentially additional cost to the homeowner since these materials would have to be collected separately from the regular trash pickup. The cost of this type of program is a part of the proposed study recommended by the Council (see Recommendation Number 7).

7. Fund a study to determine the per-household cost of recycling/composting in different parts of the state. It is estimated that such a study would cost at least $50,000 and take several months to complete.

   One of the primary barriers to expanded recycling activities apparently is the cost to recycle. Proponents of recycling acknowledge that recycling may cost slightly more, but the long-term environmental benefits are worth the slightly higher cost and we have a responsibility to conserve these resources. However, what may appear to be a slightly higher cost to one person may in fact be a totally unacceptable cost to another. Therefore, it is recommended that a study be undertaken to determine such costs for households in different parts of the State. Such a study would determine the costs for recycling household recyclables and for composting yard wastes. The results of the study would define the benchmarks for determining the most effective recycling/composting alternatives available to households with respect to cost and diversion rates. Armed with factual and realistic cost information, Delawareans will be in a position to make better informed decisions regarding their recycling options as well as those which they deem affordable. A detailed scope of work outlining the specific recycling/composting technologies and/or programs to be studied will have to be developed. DSWA, DNREC and the RPAC will work together to develop this scope of work.

The remaining recommendations will require major action by the State of Delaware to achieve the thirty-percent diversion rate.

8. Provide franchise district capability to New Castle and Sussex County.

   Franchised trash collection districts take advantage of the economy of scale in providing consumers with cost-effective trash collection services. Currently, Kent County has franchised districts, which in fact result in lower costs to consumers for trash collection services. The citizens of Kent County must petition to the Kent County Levy Court to create such a franchise trash collection district and therefore such election is strictly voluntary. If the County approves the trash collection district, then it arranges through competitive solicitation to select a collector to service the established trash collection district. Accordingly, trash collection districts should likewise result in lower costs for curbside collection of recyclables. Therefore, it is recommended that the legislature provide New Castle and Sussex Counties the authority that would allow citizens to request the establishment of franchised trash collection districts in those counties. The Council believes that the statewide availability of franchised trash collection districts is key to the development and implementation of a curbside recycling program.

9. Collect a recycling fee from all waste haulers* on a per ton basis as a part of the permitting process to support the building and operation of a Materials Recovery Facility (MRF). A MRF is needed to process commingled recyclables and market recovered materials. The amount of the fee needed to support this recommendation could be determined as part of the study in Recommendation Number 7.

   If curbside collection is going to be used in Delaware to an extent that will contribute to achieving the 30% diversion rate goal, a means for separating the recycle materials must be available. Residents should not be expected to separate all of the recyclable materials that could be collected curbside and neither should the waste hauler. The best system is one that uses co-mingled collection of recyclables and a MRF capable of separating materials into saleable groups. The cost of a MRF varies with the degree of separation and materials collected and such a facility will easily cost several million dollars to construct.

   Currently, residents are separating their recyclable materials and depositing them in the 'RECYCLE DELAWARE' receptacles provided by the DSWA. These materials still need some processing, the cost of which is borne by DSWA. The return on the sale of the recycled materials only partially defrays the program cost so the losses are covered by DSWA waste disposal tipping fees.

   Waste disposal tipping fees are DSWA's primary source of revenue and are essential to their continued operation. Due to the loss of flow control, DSWA tipping fees must be competitive in order to ensure they continue to receive the majority of Delaware's waste. As such, increasing the landfill tipping fee to generate revenue to support recycling is not a viable option for Delaware.

Businesses collecting trash in Delaware have benefited from the 'RECYCLE DELAWARE' program by a reduction in the quantity of trash that they had to pay disposal fees on. In 1999, 20,000 tons of recycle material was removed from residential trash by the homeowners and taken to the 'RECYCLE DELAWARE' centers. This saved the waste haulers throughout the state an estimated $900,000 in tipping fees. Similar savings have occurred for the last several years and will in the future. As a result of the loss of flow control the DSWA has also had to provide Delaware's waste haulers a rebate on the tipping fee. This rebate equals approximately $8 million per year. Some of these monies should be encumbered by the State of Delaware to support recycling as it is in other states.

*Note – One of the nine RPAC members does not support collecting a fee from the waste haulers.

10. Build a Materials Recovery Facility (MRF) in New Castle County and adopt co-mingled curbside collection in the denser population areas.

    New Castle County generates approximately 60% (240,000 tons) of the residential solid waste generated in Delaware. Of this, about 60,000 tons could be collected as co-mingled waste for recycling. Therefore, New Castle County is a likely target for having a MRF to process recyclable materials. Such a MRF should have the capacity for 200 tons/day.

    The RPAC believes it is necessary to develop more accurate cost information to design, construct and operate a MRF in order to make an informed decision. The implementation of a curbside recycling program is integral to operating a MRF at commercial capacity.

    Incentives are needed to start a curbside program. These could be in the form of mandated recycling, tax incentives to private businesses to collect recyclables, tax relief to private enterprises to invest in greener industries, or providing jobs in New Castle County and markets for the recyclables.

    The study in Recommendation Number 7 can provide significant cost information to determine the feasibility of a MRF.

The Recycling Public Advisory Council offers these findings and recommendations to Governor Minner and the members of Delaware's 141st General Assembly. We invite and look forward to your guidance on which recommendations you would like the RPAC to actively pursue and promote. We further welcome any additional ideas that you would like us to explore.

Appendix A: Executive Order 82

Appendix B. Recycling Public Advisory Council and Committee Members

RECYCLING PUBLIC ADVISORY COUNCIL MEMBERS

Paul Wilkinson, RPAC Chairman
Del EASI

Patricia Todd
League of Women Voters

The Honorable Donald H. Mulrine
Mayor, Town of Newport

Richard C. Cecil
Delaware Association of Counties

Pasquale S. Canzano
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John Blevins
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Division of Air and Waste Management

Robert Propes
Delaware Economic Development Office

Paul R. Bickhart
Recycling Express of Delaware, Inc.

Kevin Shegog
Tri-State Waste Solutions

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James Short
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Division of Air and Waste Management

Danny Aguilar
Delaware Solid Waste Authority

Richard C. Cecil
Delaware Association of Counties

Alberta Melloy
Garden Club of Wilmington

Julia Morrill
Wik Associates, Inc.

Robert Chaddock
Del EASI

Deborah Heaton
Sierra Club of Delaware

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Mayor, Town of Newport

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Rich Von Stetten
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Joseph Davis
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Leo Sears
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Delaware Association of Counties

Robert Propes
Delaware Economic Development Office

First Annual Report of the
Recycling Public Advisory Council
January 2002

Appendix C. Measurement Committee Report

Introduction

Executive Order No. 82 establishes a recycling/diversion goal of 30 percent of the RSW generated in Delaware and directs the RPAC to "develop, in conjunction with the DNREC and the DSWA, a methodology for measuring recycling rates". Although the 'RECYCLE DELAWARE' data is readily accessible, the quantity of material being recycled outside of that system is unknown. The RPAC created a Measurement Committee to carry out the task of developing a measurement methodology that will enable the RPAC to track the state's progress toward achieving the goal of diverting 30% of the residential solid waste stream from disposal.

In 2001, the Measurement Committee undertook the following tasks:

- Establishing the committee's objectives;
- Identifying the scope of what will be measured (i.e., defining "recycling" and "waste diversion" for purposes of Executive Order No. 82);
- Devising means to collect and compile data on residential waste generation; and
- Beginning the process of collecting and compiling residential waste generation data.

Objectives

The committee has established the following three objectives:

Objective #1: Track progress statewide toward the 30% waste diversion goal.

In order to achieve this objective, the committee must accomplish several tasks:

- Define "waste diversion" and "recycling" for purposes of EO #82;
- Establish baseline waste generation and waste diversion rates on a statewide basis; and
- Develop a methodology for compiling data on residential recycling activities and measuring recycle rates on a periodic basis.

Objective #2: Evaluate the success of the Recycling Assistance Grants in increasing waste diversion rates in the grant recipients' target areas.

Accomplishing this objective will require that the committee:

? Establish baseline waste generation and diversion rates for each grant recipient's target area; and
? Develop a methodology for tracking changes in waste generation and diversion rates.

Objective #3: Compile data in ways that are designed to assist the Strategy and Education Committees in achieving their goals

Designing a methodology that will provide useful data in a useful format will be crucial to helping the other committees, and the RPAC, achieve their objectives.

a. Identifying the scope of what will be measured

Before developing a methodology for measuring recycling in Delaware, it was necessary to define the scope of materials and activities that will be measured. As a starting point, the committee considered the definitions and guidance contained in the USEPA documents *"Characterization of Municipal Solid Waste in the United States: 1998 Update" (September 1999)* and *"Measuring Recycling: A Guide for State and Local Governments" (September 1997).*

In some instances, the committee found it necessary to deviate from the EPA's guidance in order to best meet the intent of E.O. 82 as the committee members understood it. In addition, the committee found the guidance insufficient for defining the scope of what will be measured, since it does not make clear distinctions between *residential* solid waste and the other components of municipal solid waste – especially institutional and commercial solid wastes – whereas E.O. 82 is clearly focussed on residential solid waste. Therefore, the committee found it necessary to clarify exactly what wastes would be considered *residential* and what types of activities would count toward the "recycling" rate for measurement purposes. Ultimately, the committee proposed, and the RPAC agreed, that the methodology to be developed will be for the measurement of waste diversion (rather than "recycling") of solid waste generated within the residential sector (single- and multi-family residences). Waste diversion will include recycling, reuse, and waste reduction. A glossary of terms and a detailed list of materials and activities that will be included for measurement purposes were developed by the Measurement Committee and accepted by the RPAC. This information is incorporated into this report as Appendix J, Glossary of Waste Management Terms.

b. Devising means to collect and compile data on residential waste generation and waste diversion

Waste generation consists of two components: the quantity of waste generated and disposed of, and the quantity of recyclable materials diverted from disposal. The

committee decided to first attempt to establish data on the quantity of residential solid waste being collected for disposal. The committee developed questionnaires designed to solicit information from the two best potential sources of data on residential solid waste disposal: municipal governments and haulers of residential solid waste. Municipalities that provide trash removal services for their residents know how much solid waste the residents have disposed of through their services. Waste haulers who provide residential trash removal either through single subscription or under contract with a municipality also know how much residential solid waste has been disposed of through their services.

The committee reasoned that the data provided by the questionnaires could be compared with DSWA's estimates of residential waste delivered to its landfills and to waste generation rates for 1997 reported by Franklin Associates in its report, "Assessment of Solid Waste Discards in Delaware and the Potential for Sustained Recycling of Materials – January 1999." If there are significant discrepancies among the figures provided by these various sources, the committee will attempt to determine the reasons for the discrepancies and to devise methods for more accurate data collection.

c. Beginning the process of data collection and compilation.

The questionnaires, requesting information on waste disposal for calendar year 2000, were mailed by DNREC to all Delaware municipalities (57 towns, cities and counties in all) and all haulers permitted to transport household waste in Delaware (100 haulers). DNREC requested that the questionnaires be completed and returned no later than October 1, 2001; however, as of the writing of this report, only Kent County, 29 municipalities (51%), and 42 haulers (42%) have returned the forms. Most of the questionnaires returned by haulers indicated that those haulers had not collected any residential solid waste in Delaware during the period of interest. Some haulers indicated that the requested information was proprietary and that they were not willing to reveal it.

The Measurement Committee is in the process of considering whether there are alternative ways to obtain the required data.

Next Steps

The committee has identified the following next steps:

? Gather data on diversion of residential solid waste (the committee has begun to strategize how this information will be obtained).
? Streamline and institutionalize the process of gathering, compiling, and analyzing the information.

Appendix D. Education Committee Report

Introduction

Executive Order No. 82 also directs the RPAC to "advise the DNREC and the DSWA on possible outreach activities designed to achieve greater recycle rates" in Delaware. The Council created the Education Committee to design and implement public educational efforts aimed at increasing public awareness of recycling opportunities. The Education Committee also assists in implementing school recycling initiatives and programs.

Objectives

1. Assist DNREC with public notification regarding the Recycling Assistance Grant Program and in publicizing grant awards.

2. Assist DNREC and DSWA with aggressive programs and incentives for public and private schools.

3. Assist DSWA and DNREC in continuing education and outreach to state residents, civic associations, civic groups and municipalities on the benefits, whys and how-tos of recycling, reducing and reusing, particularly on new initiatives for the state.

   With training by the DNREC/RPAC, members of the education committee may also assist in presenting new initiatives such as the grant program.

4. Provide information to the public and businesses about available recycling programs.

5. Assist the RPAC in informing residents, civic associations, civic groups and municipalities on the status of state efforts with the goal of increasing participation in existing and new programs.

Outreach Activities

a. Kids for a Greener Delaware

Early in 2001, DSWA and DNREC set up 'RECYCLE DELAWARE' centers at eight competing schools where students, teachers, parents and neighbors would bring

recyclable materials to the school. The schools that participated were: Jennie Smith Elementary, Gallagher Elementary, Bancroft Academy, Forest Oak Elementary, Brandywine Springs Elementary, and Redding Elementary (all in New Castle County), and Towne Point Elementary and Booker T. Washington Elementary in Dover. The DSWA's Public Information Group conducted several school assemblies where the benefits of recycling and the " Kids for Greener Delaware" kick-off celebration were discussed. Educational materials and 'RECYCLE DELAWARE' brochures were provided to most participating schools. BFI, the hauler that collects materials from the igloos for DSWA, kept a monthly account of the weight of recyclables collected at each school. The contest ended May 31, with the following results: the first place winner was Towne Point Elementary, which was awarded $3,000; the second place winner was Jennie Smith Elementary, which received $2,000; and the remaining participants received $500 each. Members of the Education Committee presented the awards at PTA meetings. The Dover Post covered the presentation to the winning school, Towne Point Elementary.

DSWA invested approximately $70,000 to provide 'RECYCLE DELAWARE' centers to all participating schools. Several of the schools decided to continue to host their 'RECYCLE DELAWARE' sites after the contest ended.

b. Families for a Greener Delaware/America Recycles Day 2001

For the 2001/2002 school year, the Education Committee developed a new contest focused around the national America Recycles Day. Five schools signed up to participate in Families for a Greener Delaware/America Recycles Day 2001: Glasgow High School, Holy Spirit School, St. Peter's Cathedral, St. Elizabeth High School, in New Castle County and St. Thomas More Academy in Magnolia, Delaware. Schools were provided pledge cards asking students, parents, teachers, and neighbors to recycle and to buy recycled content goods. The school with highest percentage participation will be awarded $2,000 to be used to buy computer equipment. The second place school will be awarded $1,000, and the third place school will receive two heavy duty benches made from recycled plastics. The schools were awarded their prizes on America Recycles Day 2001, November 15, at Delaware City Town Hall. First prize went to St. Thomas More Academy; second prize to Holy Spirit School; and third prize to St. Peter's Cathedral.

Other activities for America Recycles Day (ARD) 2001:

? Governor Ruth Ann Minner signed a proclamation designating November 15 as America Recycles Day 2001 in the First State.

- ? The FY2002 Recycling Assistance Grant Program was announced on November 15 during the school awards.
- ? Environmental organizations and garden clubs were notified of ARD 2001 and suggested ways of celebrating the day were included in the grant announcement.
- ? The League of Women Voters handed out recycling pamphlets and pledge cards at seven 'RECYCLE DELAWARE' sites in New Castle County as a thank you for using the igloos and provided information on where to take other recycled materials not collected at the sites.
- ? ARD Public Service Announcements were delivered to four radio stations.
- ? In late November, a drawing of signed adult pledge cards was held, with the prize being a Weekend at Rehoboth Beach for a Delaware family. All the pledge cards were sent to the ARD headquarters where there would be regional drawings for more prizes.

c. Fenwick Island Lions Club Outreach

At the request of the Fenwick Island Lions Club, DNREC attended a club meeting on November 19, 2001, and presented information about the Recycling Assistance Grant Program. Recognizing a need for more individual civic group outreach and education of this nature, members of the committee will make themselves available to explain the Grant Program to civic associations and other groups.

Appendix E. Strategy Committee Report

Introduction

Steps that the Citizens' Work Group on Recycling recommended but that have not been implemented are:

? Legislation to make it easier for the DSWA to site 'RECYCLE DELAWARE' centers;
? A legislatively mandated diversion rate;
? The establishment of waste franchise districts; and
? Construction of a MRF.

The Strategy Committee has accepted these recommendations as a continuing need to meet the diversion rate goal of 30%.

The Citizens' Work Group recommended also that the results of Executive Order No.82, signed in 1990 by former Governor Castle to encourage waste reduction, recycling and waste utilization, be reviewed to determine the degree to which state agencies have implemented the Executive Order. The Strategy Committee accepts this recommendation also.

The primary objective of the RPAC is to increase the RSW diversion rate through recycling and composting. It is assumed that Executive Order No.82 (signed by Governor Carper) intended to limit diversion to those practices of waste management that involve recovery of materials by recycling and not burning or other landfill avoidance methods. The Measurement Committee has adopted the following equation for calculating RSW diversion in Delaware:

$$\text{RSW Diversion Rate (\%)} = \frac{\text{Total RSW Diverted}}{\text{Total RSW Discards + Total RSW Diverted}} \times 100$$

$$\text{Example Calculation: } \frac{\text{120,000 tons RSW Diverted}}{\text{280,000 tons RSW discarded + 120,000 tons RSW diverted}} \times 100 = 30\ \%$$

Therefore, the Strategy Committee will also pursue source reduction of the waste generated as an important element to increasing the diversion rate. Reducing the generation of yard trimmings reaching the landfills by grasscycling and composting by residents on their own land could increase diversion significantly. Source reduction programs will become a part of the strategy objectives.

The Strategy Committee was formed in June 2001. The main emphasis has been:

? Identifying committee objectives;
? Reviewing information collected by the Citizens' Work Group;
? Meeting with representatives of the Retired Senior Volunteer Program (RSVP) to encourage senior recycling programs;
? Identifying barriers to recycling and composting; and
? Identifying waste reduction opportunities to remove solid waste from the residential stream.

Objectives

The committee has established the following five objectives:

1. Identify and analyze recycling and yard waste programs that have been used to divert recyclable material from the residential solid waste stream.

   To achieve this objective, the committee:
   ? Reviewed the Citizens' Work Group results and extracted pertinent data,
   ? Reviewed data from other states and the Franklin Associates Report of 1999,
   ? Arranged with the RPAC to have a review of the DSWA 'RECYCLE DELAWARE' program,
   ? Arranged with the RPAC to invite representatives of surrounding states for a "recycling panel" meeting in January 2002, and
   ? Developed a map showing housing densities, municipal boundaries and franchise districts (in Kent County) to better understand state demographics. This map is attached as Appendix I.

2. Develop a plan to achieve the 30% goal specified in Executive Order No.82.

   To achieve this goal, the committee needs to:

   ? Convince municipalities to collect yard trimmings for composting.
   ? Develop a strategy to separate co-mingled recyclables collected in Delaware.
   ? Develop costs for proposed systems of recycling, composting, source reduction.
   ? Overcome the barriers identified in objective 3.

3. Identify barriers to achieving the 30% diversion rate and ways to overcome them.

   Accomplishing this goal will require the committee to:
   ? Define the requirements of each successful recycling, composting and waste reduction program and compare the requirements to the resources in Delaware,

- ? Find sources to separate recyclable materials for sale, and
- ? Find ways to encourage curbside recycling, at least in New Castle County.

4. Identify which elements of the plan can be implemented within set timeframes.

   This objective will require a timeline showing programs to be implemented in 2002 and each year thereafter.

5. Coordinate the efforts of the committee with the Education and Measurement Committees.

Actions Taken

a. Identification of Recycling Variables

The Committee reviewed information from the Work Group report, US EPA publications, and other state programs, and compared the elements for residential solid waste systems to those in Delaware.

Five variables were used to compare the residential systems; population, collection, processing, management, and markets.

1. **Population** – Population affects the type and quantity of waste that is created as well as where it is created.

   Municipal solid waste generated nationally per person per day was 2.7 lbs. in 1960. By 1999, the quantity had increased to 4.6 lbs. per day, a 70% increase. The rate slowed in the 1990's due to waste reduction efforts by manufacturers and to increased composting by residents. Sixty percent (60%) of municipal solid waste is from households, the remainder from business. According to a study conducted by Franklin Associates for the DSWA, Delaware residents generated 372,000 tons of solid waste in 1997. Adjusting for the 2000 census, residential solid waste was 399,000 tons in 2000 and is still growing. Yard trimmings (grass, leaves, and limbs) accounts for 25 percent of the RSW in Delaware, almost twice the national average. On the other hand, paper seems to be lower as a percent of generated waste in Delaware than other locations.

   The state's population is concentrated in New Castle County. Recycling programs that would be most cost effective for New Castle County would not necessarily be cost effective in the rural areas of the state. Demographic differences must be taken into consideration in any plans for increasing recycling.

2. **Collection** – Trash is generally collected at curbside, and curbside recycling is often considered the best recycling system by residents since it is the most widely used and requires the least effort on the part of the resident. US EPA reports that 54% of the US

population had access to curbside recycling in 1998. Access is the highest in the Northeast (83%) and lowest in the South (39%). Curbside recycling has been tested in several Delaware communities, but very few households are currently served by a curbside program.

Recyclable materials can be collected co-mingled, partly separated or separated. Nationwide, co-mingled collection with separation in a Material Recovery Facility (MRF) is the most widely used method of curbside collection. If the resident has to separate the materials, participation typically drops off rapidly after two or three containers are required. The survey commissioned by the Work Group indicated that this would likely be the case in Delaware. An alternative to residents separating materials is to have the waste haulers separate materials at curbside. This system is expensive but is used in some states. Because of population density, curbside collection of co-mingled material or minimally separated waste would be the most productive collection system for New Castle County and those municipalities with several thousand households, assuming the availability of a MRF.

In states with strong curbside programs, counties generally have franchise responsibility. This allows the county or a part of the county to contract for collection of waste and recyclables and to control costs. Only Kent County has franchise authority in Delaware. This limits the ability to control curbside recycling in the suburban areas (but not incorporated areas) of New Castle and Sussex Counties.

Curbside pick-up of grass and leaves is provided in Newark, Dover, and other locations, but the programs are small (2% of RSW) compared to the results from other areas of the country (10-15%). Franklin Associates estimated that twenty five percent (25%) of Delaware's RSW consists of yard trimmings. A significant increase in the collection of this component of the waste stream would greatly increase the state diversion rate. RPAC is focusing on this composting potential.

Monthly costs for trash removal is quite variable in Delaware from a low of the mid teens per month in parts of Kent County to a high in the mid twenties per month in suburban New Castle County. The lower cost, which is substantial on a percentage basis, is a result of Kent County's ability to contract with the waste haulers on a bid basis. This is one advantage to franchise districts.

3. **Processing** – To be marketable, collected recyclables must be clean and must be separated. Delaware has only limited separating capability; therefore, Delaware is limited currently to programs where the materials are separated by the residents at drop-off centers or at curbside or the materials are separated by the haulers at curbside. Separating at curbside is costly but has been done in other states.

The cost to build one or more MRFs in Delaware was estimated by the Work Group at $6-10 million. An alternative to building a MRF may be to contract with one in a nearby state, although hauling distances make this unlikely.

There are other ways to process RSW: it can be burned for energy recovery, used to replace other more expensive materials (a beneficial use), or disposed by burning or landfilling. All of these options, except burning, are being used currently for Delaware RSW material.

4. **Markets** – A major barrier to recycling is market demand. Markets have always lagged behind the public's desire to recycle, and that is the case today. With insufficient markets to maintain volume and price, prices fluctuate widely; and this has to be factored into the design of any recycling system.

   Most of the recyclable material collected in Delaware is shipped out of state for sale. Delaware has limited markets for recyclable materials and those markets consist of those companies that repair and/or refurbish items for sale and scrap metal. An effort is needed to create new business using recyclable materials.

   There are two approaches that will help: increase the use of materials made from recyclables by getting government and industry to buy products made from recycled materials, and increase composting. Composting of yard trimmings is less costly than recycling, and the compost that is produced can be used beneficially as a replacement for other material. US EPA reported nationally a 45% recovery of yard trimmings in 1998 through composting programs. Delaware's rate is slightly more than 2%, if estimates made of the generation rate are correct.

5. **Management** – The most successful diversion programs appear to be those that have the control of all elements of the waste management system in the hands of one organization (i.e., a state, county, city, agency, authority, or private company). With this type of control, cost savings at one point can be used to offset higher costs in another operation. A good example is the 'RECYCLE DELAWARE' program run by and controlled by the DSWA.

   In Delaware, control of the waste management system is spread among several organizations. DSWA controls the landfills (including disposal fees) and the licensing of haulers that use DSWA facilities. DNREC controls permitting of waste haulers. The DSWA owns and operates a facility to process and market source-separated recyclable materials from residential solid waste (primarily materials from the 'RECYCLE DELAWARE' drop off centers). Collection of waste is controlled in the incorporated areas by the municipalities and in the unincorporated area by the waste haulers. Implementation of a statewide recycling plan will require the joint cooperation of all of

these organizations. The state could act as the controlling entity if appropriate legislation were enacted.

b. Cost and Control as a Deterrent to Recycling

Recycling typically results in some increase in the cost of waste management. The need for separate collection and processing of recyclables makes recycling more costly than disposal alone. Costs can potentially be offset by the return from the sale of the recyclables, the avoidance of the disposal cost of the recycled material, and the long-term benefits of resource conservation. In those areas where recycling is the highest and the cost the lowest, control of all the cost (collection, processing, disposal and sale of both trash and recyclables) is under one agency or municipality either by direct management or by contracts. In Delaware, control is spread over several entities, so cost increases in one area can not be offset by savings in another. Only by agreement by all parties to share the cost and profit could this be achieved.

c. Identification of Recycling Programs

The DSWA runs the 'RECYCLE DELAWARE' program. They collect the recycled materials, process them and sell them. Their cost for collection and processing is offset by a combination of a recycling fee of $5.83 per ton for FY '02 (included in its user fee of $58.50 per ton) and revenues from the sale of the recyclables. The 'RECYCLE DELAWARE' budget is predicated on DSWA's receiving 760,900 tons to generate sufficient recycling fees to support the program. Fortunately, DSWA has been able to support the 'RECYCLE DELAWARE' program primarily through the revenues obtained from the user fees collected at its facilities. DSWA's user fee has remained unchanged at $58.50 per ton for the last nine (9) years.

Several municipalities have started recycling programs to reduce the cost of disposal fees. These programs are profitable to the communities because the DSWA collects and processes the recyclable material free of charge, allowing the communities to use the disposal avoidance fees to pay for the collection. This would not be an acceptable system for a large community because of the increased cost to the DSWA.

Work is continuing to identify all of the existing recycling programs in Delaware. The following programs have been identified to date:

? 'RECYCLE DELAWARE' collection program.
? Current programs in Delaware other than those of the DSWA are as follows:
    1. Recycling Express of Delaware – A business venture to contract with households to collect recyclables. Materials are either sold or turned over to the DSWA.
    2. Camden – Town collects newspaper curbside.

3. Dover and Newark – Cities collect grass and/or leaves for composting.
4. The Ardens – Contract with Waste Management to collect recyclables and trash.
5. Wilmington – City collects newspaper.

d. Volunteer Programs

Resources within the RPAC, DNREC, and DSWA to take advantage of the many educational and recycling opportunities are limited. As such, efforts are being made by the Committee to enlist the help of other groups to promote recycling throughout the state.

? Retired Senior Volunteer Program – A meeting was held with the program directors of the three counties to discuss various opportunities available to seniors in the field of recycling. Interest in setting up programs is high. Some of the potential objectives are:

1. Organize a group of seniors to pick up recyclable material from households of seniors and physically disadvantaged people who are not able to take the materials to DSWA sites.
2. Set up a program for seniors to oversee recycling containers at public events and to provide educational opportunities for the public to learn about recycling.
3. Train seniors to collect household hazardous waste from other seniors and physically disadvantaged people.
4. Organize seniors to collect recyclable materials from senior multi-family locations.
5. Train seniors to provide outreach programs to schools and civic groups.
6. Enlist the help of young people for intergenerational projects.

? AmeriCorps – Grants are available through AmeriCorps, a National Service Corporation organization, for assistance with programs that provide direct services to communities. The committee is pursuing such help for the coming year to assist DNREC with its recycling responsibilities.

Appendix F. DSWA Beneficial Use/Waste Diversion Programs

DSWA consistently strives to design innovative internal solutions to help create a safe environment for our future. Many items accepted at its landfills or transfer stations are recycled as well.

"Electronic Goods"

Effective July 1, 2001, DSWA implemented an Electronic Goods Recycling Program on a statewide basis. DSWA's landfill locations in Kent and Sussex County, and Pine Tree Corners Transfer Station accept electronic goods for delivery to the Delaware Recycling Center located at Pigeon Point. Truckload quantities of electronic goods are accepted directly at the Delaware Recycling Center where they are sorted and packaged in preparation for recycling. To date approximately 300 tons of electronic goods, consisting primarily of computers, monitors and accessories, have been recycled.

"White Goods"

Appliances such as air conditioners, refrigerators and freezers, called "white goods," that contain chlorofluorocarbons (CFCs) are first drained of CFCs for reuse. Then, they are sold with non-CFC white goods such as washers, dryers and hot water heaters for scrap metal recycling.

"Yard Waste"

At SSWMC, DSWA shreds yard waste into mulch and gives it away periodically to homeowners. At NSWMC and CSWMC, DSWA uses shredded yard waste as ground cover, wet weather pad construction and for making topsoil.

"Tires"

Tires are kept separate from other solid waste and transferred to various mid-Atlantic regional facilities for energy recovery which uses tires as alternative fuels.

"Landfill Gas"

By collecting landfill gas at our Northern facility and pumping it to the Conectiv Power Plant in Edgemoor, where it is burned with conventional fossil fuels, we help generate more electricity while using fewer natural resources. Using methane from landfills for power production will help reduce global warming. DSWA can produce up to 5 mw of electric power for use in Delaware if Conectiv or the Electric Coop can pay at least 5¢/kw per hour. The current average prices is 2.8¢/kw per hour.

"Construction & Demolition" (C&D)

Through contractual agreements DSWA recycles metals found in construction and demolition (C&D) material and grinds the remaining waste for beneficial use as an alternate daily cover and road building material at its Central and Southern Landfills. The DSWA has an attractive program that provides incentives to separate construction and demolition materials for recycling and beneficial use by DSWA.

"Stabilized Sludge"

Even sludge can be used beneficially. DSWA's Cherry Island Landfill and the closed Pigeon Point Landfill accept stabilized processed sludge from the City of Wilmington for use as an alternative daily cover soil and as fill material. DSWA currently receives over 216,000 tons of stabilized sludge for beneficial use.

"Leachate"

When rain falls on the landfill, it mixes with the trash as it seeps through soil and garbage, picking up lots of chemicals along the way. This liquid is called leachate. DSWA circulates leachate through some of its landfill cells to accelerate waste decomposition before collecting it through a series of collection pipes that pump the leachate to holding tanks. The leachate is then hauled away by truck to be treated at a special wastewater treatment facility and released into the environment.

Appendix G. 'RECYCLE DELAWARE' 2001 Report of Recyclable and Reusable Materials Collected

'RECYCLE DELAWARE' material collected FY 01

TABLE I

'RD' MATERIAL COLLECTED FY '01'	POUNDS COLLECTED	POUNDS PER CAPITA	KG per Capita
Newspaper	26,004,000	33.34	15.14
Plastic	1,750,000	2.24	1.02
Glass	4,426,000	5.67	2.57
Cans	1,484,000	1.90	0.86
Cardboard	3,226,000	4.14	1.88
Batteries	114,000	0.15	0.07
TOTAL	37,004,000	47.44[1]	21.8
Oil	2,302,000	2.95	1.34

[1] The total is divided by the population of 780,000 to reflect per capita rate.

Basic materials collected for recycling through the 'RECYCLE DELAWARE' program

TABLE II

ITEM	TONS	METRIC TONS
Paper (ONP) (Includes newspaper, magazines and phone books)	13,002	11,793
Plastic Bottles	875	794
Clear Glass	1,195	1,084
Brown Glass	338	307
Green Glass	680	617
Cans	742	673
Cardboard	1,613	1,463
Batteries	57[2]	52
TOTAL	18,502	16,783

SPECIAL MATERIALS COLLECTED AT 'RECYCLE DELAWARE' LOCATIONS

TABLE III

MATERIALS	TONS	METRIC TONS
Used Motor Oil	1,151	1,044
Used Oil Filters	494	448
Textiles	24	22
TOTALS	**1,669**	**1,514**

[2] 24 tons (22 metric tons) of used household batteries were collected through the 'RD' program for separate storage in landfills.

BULKY MATERIALS AND SPECIAL WASTE COLLECTED AT DSWA LANDFILLS

TABLE IV

BULKY MATERIALS	TONS	METRIC TONS
Tires	1,676	1,520
White Goods	1,870	1,696
Yard Waste	3,434	3,115
Chlorofluorocarbons (CFCs)	1	1
TOTALS	**6,981**	**6,332**

BENEFICIAL USE OF SPECIAL WASTE MATERIALS

TABLE V

BENEFICIAL USE	TONS	METRIC TONS
Stabilized sludge used at Cherry Island Landfill and Pigeon Point Landfill	**216,421**	**196,294**

TOTAL STATEWIDE MATERIALS RECOVERED OR REUSED IN FY 01

TABLE VI

ITEM	TONS	METRIC TONS
'RECYCLE DELAWARE' base materials (Paper, plastic, cans, glass, cardboard, household batteries)	18,502	16,781
'RECYCLE DELAWARE' special materials (Used oil, oil filters and textiles)	1,669	1,514
BULKY MATERIALS RECYCLING AT DSWA LANDFILLS (Tires, white goods, yard wastes, and CFCs)	6,981	6,332
BENEFICIAL USE OF SPECIALIZED WASTE (Stabilized sludge used at Cherry Island Landfill and Pigeon Point Landfill)	216,421	196,294
PRIVATE/COMMERCIAL RECYCLING (Estimate based on Jan. 2000 – June 2001 reported tonnage)	1,507,653	1,367,441
INDEPENDENT RECYCLERS THAT DELIVERED RECYCLABLES TO THE IPF	5,843	5,300
TOTAL RECYCLED OR REUSED	**1,757,069**	**1,593,662**
MATERIALS NOT GENERATED IN DELAWARE (Materials were delivered to the IPF)	149	135

Delaware generated a total of 2,612,469 tons (2,369,509 metric tons) of materials to be managed. A total of 1,757,069 tons (1,593,662 metric tons) of the materials or about 67% were recycled or reused. A total of 855,400 tons (775,848 metric tons) of materials were disposed in DSWA landfills.

TABLE VII

MATERIAL COLLECTED IN DELAWARE FROM BUSINESSES	**TOTAL TONS OF MATERIAL RECYCLED (Jan. 2000 – JUNE 2001)**	**METRIC TONS**
All Aluminum	5,274	4,784
All Other Non-Ferrous	3,876	3,516
All Ferrous	257,765	233,793
Scrap Cars	715	649
Automotive Batteries	1,535	1,392
Household Batteries	118	107
Newspaper	3,512	3,185
All Office Paper	13,528	12,270
Junk Mail	119	108
Corrugated Cardboard	38,930	35,310
Plastic	25,178	22,836
Polystyrene	818	742
Glass	1,072	972
Concrete	337,975	306,543
Asphalt	383,148	347,515
Wood	70,988	64,386
Yard Waste	35,478	32,179
Tires	86,668	78,608
White Goods	11,523	10,451
Used Motor Oil	10,702	9,707
Textiles	2,911	2,640
Anti-Freeze	118	107
Other (vegetable oil, ink, soil, etc.)	215,702	195,642
TOTAL MATERIALS	**1,507,653**	**1,367,442**

TABLE VIII

MATERIALS	VALUE REVENUE PER TON[3]	AVERAGE PROCESSING COSTS PER TON[4]	COLLECTION COSTS PER TON[5]
ONP (newspaper)	$28	$73	$90
OCC (cardboard)	$33	$73	$173
OMG (magazines)	$65	$73	$90
Plastic Bottles	$109	$73	$372
Clear Glass	$26	$73	$172
Brown Glass	$22	$73	$171
Green Glass	$4	$73	$174
Aluminum	$960	$73	$237
Steel Cans	$43	$73	$237
Oil Filters	$4	$73	$48
Textiles	$25	n/a	$48

[3] Value after deduction of transportation costs.
[4] Processing cost has been averaged for all commodities.
[5] Collection Cost based on per truck load delivered to DRC.

BREAK DOWN OF COSTS TO COLLECT MATERIALS FOR RECYCLING IN THE 'RECYCLE DELAWARE' PROGRAM

TABLE IX

Employee Costs (wages)	**$234,014**
Contractor's Operating Costs (contract DSWA-422)	**$1,449,596**
Contractual Services (temporary services, insurance, …)	**$160,776**
Professional Service (legal & auditing services)	**$789**
Travel	**$416**
Utilities	**$5,513**
Supplies and Materials	**$49,476**
Depreciation (land, site, equipment, vehicle depreciation)	**$290,921**
G & A Distribution (overhead, accounting fees)	**$201,665**
TOTAL	**$2,393,166**

BREAK DOWN OF COSTS TO PROCESS MATERIALS AT THE INTERMEDIATE PROCESSING FACILITY

TABLE X

Employee Costs (wages)	**$362,885**
Contractual Services (temporary services, insurance, …)	**$588,250**
Professional Services (legal & auditing services)	**$4,479**
Travel	**$605**
Depreciation (land, site, equipment, vehicle depreciation)	**$241,937**
G &A Distribution (overhead, accounting fees)	**$302,497**
Utilities	**$154,628**
Supplies and Materials	**$85,493**
Bond Interest	**$42,261**
TOTAL	**$1,783,035**

TOTAL 'RD' COLLECTION AND IPF PROCESSING COSTS = $4,176,201

Collection costs	$2,393,166
Processing costs	$1,783,035
TOTAL COST:	**$4,176,201**
Less Revenues from sale of recyclable materials	($914,488)

TOTAL COST OF PROGRAM AFTER REVENUES: $3,261,713

THE FOLLOWING COMPANIES PURCHASED RECYCLABLE MATERIALS FROM THE INTERMEDIATE PROCESSING FACILITY IN 2001

COMPANY	TONS	COMMODITY
Fibre Marketing Group – Stevensville, MD	17	Plastic
Pacific Forest Resources – South Norwalk, CT	23	
Evergreen (Pete Processors) – Clyde, OH	83	
PREI – Recycle America – Youngsville, NC	659	
Conti Group – Brooklyn, NY	20	
United States Recycling – Philadelphia, PA	84	
Partners Recycling – Baltimore, MD	43	
CitiSteel, USA – Claymont, DE	384	Steel Cans
Waste Management – Cherry Hill, NJ	20	
Diamond State Recycling – Wilmington, DE	20	Aluminum Cans
Terrapin Recycling – Baltimore, MD	50	
Waste Management – Cherry Hill, NJ	19	
Wise Recycling – Joppa, MD	68	
Ace Waste Services – Chester, PA	651	Cardboard
American Independent Paper – Tarrytown, NY	86	
Butler Paper Recycling – Suffolk, VA	1,093	
Chesapeake Fiber Resources – Urbanna, VA	66	
Euro-Fibers, Inc. – Glen Mills, PA	871	
Fibre Marketing Group – Stevensville, MD	66	
Lasensky Paper Stock – Lansdowne, PA	218	
Millenium Fibers, Inc. – Valley Stream, NY	1,859	
Newman & Co. – Philadelphia, PA	116	
Pacific Forest Resources – South Norwalk, CT	108	
United States Recycling – Philadelphia, PA	87	
Waste Management (ConfiShred) – Wilmington, DE	1,187	
Partners Recycling – Baltimore, MD	1,414	Glass
Todd Heller Inc. – Northampton, PA	868	
CitiSteel, USA – Claymont, DE	308	Oil Filters
American Independent Paper – Tarrytown, NY	202	Paper
Garden State Paper – Elmwood Park, NJ	13,021	
United States Recycling – Philadelphia, PA	20	
Waste Management – Baltimore, MD	22	
Waste Management (ConfiShred) – Wilm., DE	34	

Appendix H. Public Notice for the 2001 Recycling Assistance Grant Announcement

Appendix I. State of Delaware Housing Density Map

Appendix J. Glossary of Waste Management Terms

Combustion means the burning of waste material.

Composting means the process by which organic material is decomposed to a stable point so that it can be safely used as a soil amendment, conditioner, or additive.

Discards include the solid waste remaining after recycling and composting. These discards are mainly disposed of in landfills or combusted, although some waste is littered, stored, or disposed on site, particularly in rural areas.

Diversion of materials from disposal may be accomplished through source reduction and recycling (including composting). *(Note: this term is synonymous with **waste reduction**.)*

Generation refers to the amount of materials and products that enter the waste stream before recycling (including composting), landfilling, or combustion takes place. *(Note: MSW is considered to have been generated if it is placed at curbside or in a receptacle such as a dumpster for pickup, or if it is taken by the generator to another site for recycling or disposal.)*

Landfill Avoidance refers to those activities (i.e., resource recovery and combustion) that reduce the amount of waste generated that ultimately gets landfilled.

Materials Recovery Facility (MRF) means a facility in which recyclable and reusable materials are recovered, by either hand sorting, mechanical processing, or a combination thereof.

Municipal solid waste (MSW) includes durable goods (excluding vehicles and other moving equipment), nondurable goods, containers and packaging, food scraps, yard trimmings and miscellaneous inorganic waste from residential (single- and multi-family households) and non-residential (commercial, institutional and industrial) sources. MSW does not include construction and demolition debris, vehicle bodies, municipal sludges, combustion ash, industrial process wastes, and trees and brush from parks, streets or power line trimmings that might also be disposed in municipal solid waste landfills

Recovery of materials means removing certain materials/products from the waste stream for the purpose of recycling (including composting).

Recyclable materials refers to the portion of the waste stream that can be separated from the waste stream and managed through the process of recycling.

Recycling refers to materials that would otherwise be discarded and includes any of the activities necessary for a recovered material to be used in a new product. Recycling involves any and all of the

following steps: separating, collection, processing, market or free distribution, remanufacturing (if done), and purchase/use by a consumer. Excludes the use of these materials as a fuel substitute or for energy production.

Residential solid waste (RSW) consists of wastes that fall within the following categories and that are generated by the residential sector (single- and multi-family dwellings).

- Durable goods
  - Major appliances
  - Furniture and furnishings
  - Small appliances and carpets and rugs
  - Rubber tires
  - Lead-acid batteries
  - Miscellaneous durables (e.g., consumer electronics, luggage, sporting equipment)

- Nondurable goods
  - Old newpapers
  - Old magazines
  - Office papers
  - Disposable diapers
  - Clothing and footwear
  - Other nondurable goods (e.g., books, junk mail, tissue paper and paper towels, paper and plastic plates and cups, other nonpackaging paper, trash bags, sheets, and towels)

- Containers and Packaging
  - Glass packaging
  - Metal packaging
  - Paper and paperboard packaging
  - Plastics packaging
  - Wood packaging
  - Other miscellaneous packaging (e.g., cloth, leather)

- Other Wastes
  - Food waste
  - Yard trimmings
  - Miscellaneous inorganic wastes

Resource Recovery means removing certain materials/products from the waste stream for the purpose of recycling (including composting), reuse, or energy production.

Reuse refers to the use of a product or component of MSW in its original form more than once. Examples include refilling glass or plastic bottles, using corrugated or plastic containers for storage, and returning milk crates.

Source reduction refers to those activities that reduce the amount or toxicity of wastes that enter the municipal solid waste management system. Reuse of products such as refillable glass bottles, reusable plastic food storage containers, or refurbished wood pallets are examples of source reduction. Management of yard trimmings at home is another example of source reduction.

Waste-to-Energy means the combustion of solid waste to produce energy in the form of electricity and/or steam.

Equations

Example Inputs: Ourtown generates 60,000 tons of RSW per year.
5,000 tons is source reduced through homeowner composting.
10,000 tons is recovered for reuse, recycling, and/or municipal composting.
40,000 is combusted, leaving 10,000 tons of ash that must be landfilled.
10,000 tons of RSW is sent directly to the landfill.
Total tonnage landfilled is 20,000. Total tonnage avoided is 40,000.

1. Equation for calculating residential recycling rate:

$$\text{RSW Recycling Rate (\%)} = \frac{\text{(Total RSW Recycled)}}{\text{(Total RSW Generated*)}} \times 100$$

Using Ourtown example: $\frac{10{,}000}{60{,}000} \times 100 = 16$ percent

*Total RSW Generated = Total RSW Recycled + Total RSW Discards

2. Equation for calculating residential waste diversion rate:

$$\text{RSW Diversion Rate (\%)} = \frac{\text{(Total RSW Diverted)}}{\text{(Total RSW Discards + Total RSW Diverted)}} \times 100$$

Using Ourtown example: $\frac{10{,}000 + 5{,}000}{50{,}000 + 15{,}000} \times 100 = 23.1$ percent

3. Equation for calculating landfill avoidance percentage:

$$\text{LAP} = \frac{\text{(Tons Removed Through Resource Recovery)}}{\text{Tons Generated}} \times 100$$

LAP is $\frac{30{,}000 \text{ combusted} + 10{,}000 \text{ recyled}}{60{,}000} \times 100 =$ or 67%

Note: If any residue from Resource Recovery (e.g., ash from waste-to-energy) must be landfilled, the tonnage of that residue must be subtracted from the numerator.

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