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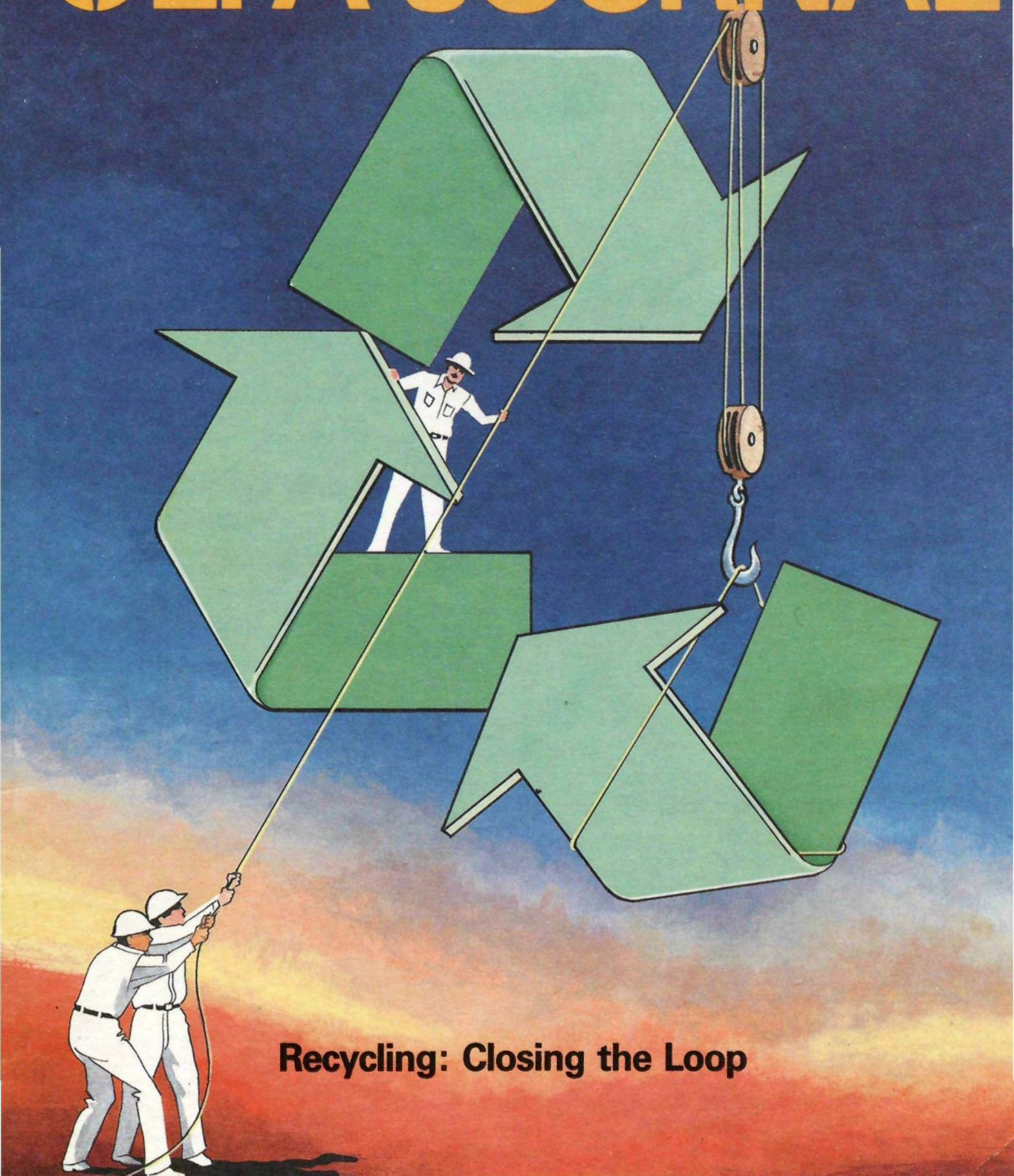

Recycling: Closing the Loop

EPA JOURNAL

A Magazine on National and Global Environmental Perspectives

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Front cover: Making the recycling process complete and effective is a contemporary environmental challenge. Illustration by Robert Flanagan.

From the Editor

Recycling. Millions of Americans are demonstrating their environmental concern by cooperating in recycling initiatives. Clearly, recycling has popular appeal as something real and relatively simple that individuals can do to help protect the environment.

But as is made clear in this issue of EPA Journal, recycling is a several-step process. It begins, of course, when a citizen separates out old newspapers for curbside pickup, takes bottles and plastic milk jugs to a community recycling bin, or puts empty soda cans into receptacles at work. But that is just the beginning. True recycling continues through processing collected items, finding markets, and reusing the materials in new products.

"Closing the loop," so to speak—proceeding full circle from collection to finding new, marketable uses for recyclables—is proving to be quite a challenge, and government agencies, legislatures, and companies are focusing a lot of attention on the matter. There are situations around the country where collected material has piled up, unprocessed, unused, because the recycling system has not yet fully developed—perhaps the plant is not there to process the material to the standards required; the market may not have developed for the product containing a certain recycled material; the price may not be right . . . .

Adding to the complexity is the question, Why is the United States relying so heavily on recycling when there is another approach that might alleviate a hefty portion of the municipal solid waste problem? The approach is source reduction, which means, for example, using reusable rather than throwaway cups, so that waste isn't produced in the first place.

It used to be said that the environment is a "mom and apple pie" issue, easy to support. But with recycling as an example, bridging the distance between great public concern and enthusiasm and actual, meaningful change—in place for the long run—takes some time and ingenuity.

John Heritage

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Contents





EPA is charged by Congress to protect the nation's land, air, and water systems. Under a mandate of national environmental laws, the Agency strives to formulate and implement actions which lead to a compatible balance between human activities and the ability of natural systems to support and nurture life.

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EPA Energy Star Logo Premieres

Several leading computer manufacturers have signed partnership agreements with EPA to promote energy-efficient personal computers (PCs). The new PCs could save enough electricity to power Vermont and New Hampshire each year and save ratepayers up to $1 billion in annual bills. The agreements are the first to be made under an EPA Energy Star program; the Agency expects to extend the program to manufacturers of other consumer appliances. Administrator Reilly said that the EPA Energy Star logo would make its debut on PCs within one year, by which time the Agency hopes to have signed on the entire industry. "Our partners in the computer world see energy efficiency as an opportunity to serve their customers, as well as the environment. Once again, they're on the cutting edge of a national trend."

The San Francisco Chronicle reported: " . . . Personal computer makers soon may get a star from the federal government—if their machines sip rather than guzzle electricity . . . . Participants in the program include such high-profile computer makers as Apple Computer, Hewlett-Packard, IBM, NCR, Compaq Computer, Zenith Data Systems, and Smith-Corona. Energy usage is a new issue in the PC world. Yet, according to studies cited by the EPA, PCs are the fastest-growing category of energy consumption, already accounting for about 5 percent of the energy used by businesses. One 1988 study predicted that electricity consumption by computer and office equipment would grow from 25 billion kilowatt-hours per year to 125 [billion] kilowatt-hours by 1996. Such figures mean that PCs could indirectly boost pollution caused by energy production—including the generation of carbon dioxide believed to contribute to a rise in the Earth's atmospheric temperature. But several energy-saving technologies have been developed by makers of laptop computers, and the EPA wants to encourage manufacturers to apply them to desktop models. One promising feature is a so-called 'sleep' mode, which turns off the display screen and reduces power to other key components until a user hits a key. 'There seem to be really dramatic possibilities here,' said Jeff Harris, a staff scientist at Lawrence Berkeley Laboratory that has studied the issue . . . . The EPA already has succeeded with a similar labeling approach in its so-called Green Light program aimed at encouraging use of energy-efficient bulbs."

The San Jose Mercury News commented: " . . . You probably shut off your office lights when you're not around. But energy-hogging personal computers are hardly ever turned off, even when they're not being used . . . . Starting next year, computers that automatically power down, or 'sleep' when unused for a period, could have an EPA 'Energy Star' logo affixed to them, and companies would be allowed to use the logo in their advertising. 'A lot of companies these days are interested in being "green," and we're building on that,' said Eileen Claussen, director of EPA's Office of Atmospheric Programs. If that isn't leverage enough, the EPA is hoping that the federal government, one of the nation's largest buyers of personal computers, will require that most of the machines it buys have the energy-saving feature, she said . . . . The 'power management' technology called for by the EPA consists of special computer chips and the software to control them and is used widely in portable notebook computers to conserve their batteries. But the technology is used little in standard desktop machines that run off wall current . . . . It is not clear how much the technology would add to the price tag of a personal computer, nor if consumers would be able to retrofit their current desktop machines to be more energy-efficient. But Apple spokeswoman Marianne Lettieri said, 'We plan to make the cost invisible to the customer' . . . ."

$4 Million Awarded in Environmental Education Grants

The first grants to be awarded under the 1990 National Environmental Education Act have been announced by EPA. A consortium of universities, businesses, and nonprofit organizations led by the University of Michigan received $1.6 million to assemble existing environmental education curricula and to develop additional materials. Five curriculum modules, each focusing on a different topic, will be assembled. They will incorporate different disciplinary approaches, so that teachers can apply them directly or integrate them into existing lesson plans. Smaller grants, totaling $2.4 million, were awarded to 219 schools, universities, and other non-profit organizations located in all 50 states and the District of Columbia. The purpose of these grants is to help improve environmental education teaching skills and curricula, promote teamwork to improve methods, and help the public in making decisions about environmental issues.

Mike Brisson photo, UW-Stevens Point.

Ongoing Enforcement Actions

Mack Trucks Penalty for Diesel Engine Violations Valued at $323,872

Mack Trucks, Inc., will pay a penalty valued at $323,872 for selling 177 new diesel truck engines that were not manufactured to the specifications listed in an application to EPA. Sixty-one of the engines also failed to meet the federal standard for smoke emissions. Under the Clean Air Act, prototype engines representative of a particular model must be tested and shown to conform to federal emissions standards before the model can be sold. The manufacturer submits test data to EPA to apply for a certificate of conformity for the model or models in question. In this case, models were sold that didn't match those listed on the application. EPA discovered the violations during an audit of Mack's assembly plant in Hagerstown, Maryland. Mack will pay a $174,863 cash penalty and will carry out an engine rebuild test program valued at $149,009.

Seven Indicted in Hazardous Waste Export

A grand jury in Charleston, South Carolina, has indicted four companies and three executives for conspiring to illegally treat, then export, more than 3,000 tons of hazardous waste to Bangladesh and Australia. According to the indictment, Gaston Copper Recycling of Gaston, South Carolina, paid Hy-Tex Marketing, located in Beaufort, South Carolina, to process baghouse dust from its smelting furnaces. The dust contained cadmium and lead. The processed dust was then shipped to a Stoller Chemical plant in Jericho, South Carolina, where it was mixed with other materials to make fertilizer. Stoller exported the fertilizer to Bangladesh and Australia without obtaining the consent of the governments of those countries.

Gaston Copper's parent, Southwire Corp., of Carrollton, Georgia, was also named in the indictment, as were three individuals: Bruce Bettenton, who participated in the management of baghouse dust at Gaston; Arthur Heinel, president of Hy-Tex; and Robert Weaver, general manager at the Stoller plant in Jericho during the period of the indictment. All defendants were charged with conspiring to violate the Resource Conservation and Recovery Act, as well as with the actual transportation of hazardous waste without a manifest. Stoller Chemical and Robert Weaver were also charged with treating hazardous waste without a permit and exporting it without consent of the receiving country. Weaver could face up to 20 years in prison and a fine of $1.75 million; Heinel and Betterton could face seven years in prison and $500,000 in fines. The corporations could face up to $500,000 in fines on each count of the indictment.

The case was investigated by agents of the South Carolina Department of Health and Environmental Control, the U.S. Customs Service, the Ninth Circuit Solicitor's Office, and the Charleston County Sheriff's Office, as well as by agents from EPA.

Chevron to Pay $8 Million for Violations of Clean Water Act

Chevron U.S.A., Inc., has agreed to plead guilty to 65 criminal violations of the Clean Water Act and to pay $6.5 million in criminal and $1.5 million in civil penalties. The crimes were committed on Platform Grace, an oil drilling rig in the Santa Barbara Channel off California. Chevron admitted to several kinds of violation of its permit issued under the National Pollution Discharge Elimination System. Between 1982 and 1987, samples of Platform Grace's wastewater, which contained chemicals toxic to marine life, were shown to exceed the permit limits approximately half the time. The company could have prevented the exceedances by operating a carbon filter system it had tested earlier but chose, instead, to use a less expensive, inadequate treatment method. The company then diluted samples of wastewater taken for testing, concealed test results, and, in certain instances, bypassed treatment altogether, allowing raw wastewater to discharge to the ocean. Additionally, Chevron admitted to dumping sandblast waste directly into the ocean on numerous occasions, rather than barging it to shore, as required. The waste contained old paint and rust removed from the platform prior to repainting.

The four-year investigation was overseen by the Department of Justice and carried out by special agents of EPA and the Inspector General's Office of the Department of Interior.

Cold Temperature Limits on Carbon Monoxide Set for Cars and Trucks

A new rule issued by EPA requires that car and truck prototypes tested for compliance with federal emissions standards for carbon monoxide (CO) be subjected to startup temperatures of 20 degrees Fahrenheit. Currently, CO is measured at temperatures between 68 and 86 °F. The new rule goes into effect with 1994 model year vehicles.

It is common knowledge that cars and trucks use more fuel and produce more CO during engine warm up. Further, a car started at 20 °F may emit more than 10 times as much CO as the same car started at 75 °F. In winter, when temperature inversions push cold air down and trap pollutants at the ground, levels of CO in the air increase dramatically. Currently, 39 metropolitan areas in the United States experience CO levels that exceed the federal health standard. More than half the violations occur at temperatures below 45 °F. When the new EPA rule is completely phased in, startup emissions of CO measured at 20 °F will be reduced 20 to 29 percent. In addition, the nation will conserve 43,000 barrels of oil each day by way of improved fuel combustion.

Draft Report on Health Effects of Passive Smoking Made Available

EPA has forwarded a revised draft report on passive smoking to its Scientific Advisory Board for review. At the same time, the Agency made the report available to the press and to the public. Entitled Respiratory Health Effects of Passive Smoking: Lung Cancer and Other Disorders, *the report incorporates important revisions to a draft published two years ago. In publishing the new draft, the Agency emphasized that the independent scientific review by the Board could result in substantial additional changes. A final report should be available by the end of the year.*

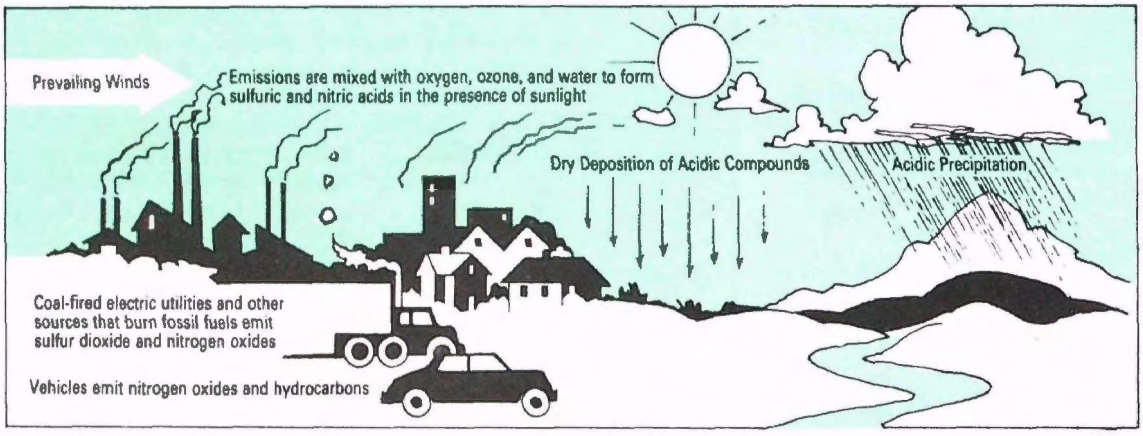
The Boston Globe commented: " . . . There is no longer a shadow of doubt that tobacco smoking is a major public health threat, worst for smokers but dangerous also for the family members, co-workers, and others with whom they share smoke-tainted space. Last week three national health organizations—the American Heart Association, the American Lung Association, and the American Cancer Society—declared that 'secondary smoke' should be treated as an 'environmental toxin' and banned from the workplace and public spaces. This week the Environmental Protection Agency issued a staff report concluding that each year, exposure to secondhand smoke causes between 150,000 and 300,000 acute lower respiratory infections, such as bronchitis and pneumonia, in children less than 18 months of age. These produce between 7,500 and 15,000 hospitalizations. The report also found that children who live with smokers are more likely to become asthmatic. Secondary tobacco smoke exacerbates asthmatic symptoms in approximately 20 percent of the country's 2 million to 5 million asthmatic children, and is a risk factor in triggering between 8,000 and 26,000 new cases of asthma per year. More generally, secondhand smoke increases the prevalence of coughing, wheezing, inner-ear infection, and reduced lung function among children. The report also suggests a link between secondary tobacco smoke and sudden infant death syndrome. Finally, it estimates that secondary smoke causes between 2,500 and 3,300 lung-cancer deaths per year. This report, focused solely on respiratory problems, leaves out heart disease, which other studies have estimated causes about half of the nation's tobacco-related deaths and 37,000 deaths per year among nonsmokers . . . . "

The Wall Street Journal reported: " . . . The report now goes to the agency's science advisory board, which can either accept it or send it back for modifications. Following the board's approval, the report will be sent to EPA Chief William Reilly, who may order further changes or release it. Agency officials predict the final report will

Acid Rain Emissions Limits Proposed for Over 900 Power Plants

Proposed plant-by-plant reductions in acid rain emissions have been listed by EPA for most of the electric-power generating plants in the United States. One hundred and ten of the largest plants, mostly coal burning utilities in 21 eastern and midwestern states, will have to make reductions beginning in 1995; at the turn of the century, over 800 smaller plants must also cut back on their emissions, and the larger plants must make further reductions. Electric power plants account for 70 percent of sulfur dioxide (SO_2) emissions in the United States; SO_2 is the chief contributor to acid rain.

Acid Rain Formation



Under the 1990 Clean Air Act, each power plant is to be issued emissions allowances. Each allowance equals one ton of SO_2 emissions per year. The number of allowances a plant gets is determined by formula and is based in large part on the plant's past consumption of fuel. As the program gets underway in 1995, each plant must hold enough allowances to cover its annual emissions. It can meet its requirement either by reducing emissions or by purchasing allowances from other utilities. For every ton of SO_2 a plant emits in excess of its allowances, it

be issued by year end. The EPA is barred by law from regulating smoking, but the report is expected to spur the Labor Department's Occupational Health and Safety Administration to act to restrict smoking in the nation's workplaces. Many employers and localities across the country have already banned or restricted smoking in offices and factories. Action on Smoking and Health, an anti-smoking organization, predicts the report will make 'Americans justifiably fearful of being in any enclosed area where smoking is permitted.' The study provides new support for the agency's earlier decision to declare secondhand smoke a known human carcinogen, putting it in the same category with such pollutants as asbestos . . . . "

will pay a penalty of $2,000 and will forfeit one allowance. This program of market-based trading in allowances, combined with tough monitoring and enforcement, is believed to have significant advantages over traditional "command and control" regulations. By allowing utilities that can reduce emissions cheaply to sell excess allowances to those whose control costs are high, total reductions can be achieved most cost effectively. As a safeguard, no utility—no matter how many allowances it holds—will be allowed to emit SO_2 in amounts that exceed federal health standards.

Sludge Dumping Finally Ends

New York City, the last of the cities to dump sewage sludge in the ocean, has met a court-ordered deadline to end the practice. Participating in ceremonies to mark the event, Administrator Reilly said: "The main objective of the federal Ocean Dumping Ban Act of 1988 has been realized—we have stopped dumping sewage sludge into the ocean. EPA will continue to enforce the consent decrees which require the establishment of long-term, land-based disposal alternatives. We will also continue to encourage solutions that have beneficial uses. Through these efforts, not only are we preventing pollution by protecting the ocean from use as a dump, we are now seeing sludge recognized more and more as a resource, not as a waste."

Marion Bernstein photo. New York City DEP.

The Tibbetts Brook, one of the barges used by New York City to transport sewage sludge for off-shore dumping. The practice has been stopped.

The New York Times commented: " . . . Late this afternoon the ocean barge Spring Brook will slip quietly into the East River and head to sea, carrying for the last time one of America's least loved cargoes: 400 tons of New York City's processed sewage. It has been four years since Congress voted to ban the common practice of using the ocean as a municipal chamber pot, and with the Federal deadline set for tomorrow, New York is the only city that still does it. For environmentalists and many politicians, the final barge journey will be a moment of triumph, one they say will make the planet a cleaner, healthier place. But behind the public celebrations lie a host of anxieties. For New York, the end of ocean dumping means the beginning of a new and troubling era: a city that is already struggling to recycle, burn, export, sell, and bury nearly 30,000 tons of garbage every day will have to find ways to handle some more. And despite plans, promises, and years of negotiations, it won't be easy or cheap . . . . 'This ban has been portrayed as an accomplishment that has no flaws,' said Representative Thomas J. Manton of Queens, whose district will be among those that will be forced to process the city's treated sewage, called sludge. 'But I worry whether this makes sense economically or environmentally. We rushed into this for political reasons and now we will have to deal with some harsh truths.' Perhaps the most painful of those truths is that while it will be nearly impossible to export, bury, or burn most of city's sludge, it is even harder to find a New Yorker eager to live near a plant designed to process it, either by turning that waste into useful compost or by baking it into fertilizer pellets at tremendous heat . . . . "

The Associated Press reported: " . . . New York and other cities began ocean dumping of sewage in the 1920s, and for many years used a site 12 miles off the New Jersey coast. In 1984, evidence of shoreline pollution and damage to marine life prompted a shift to the '106-mile site,' where the continental shelf drops from 600 feet deep to about 7,500 feet . . . . The halt to dumping compounds the problem of what to do with the daily production of some 2,000 tons of sludge, a byproduct of the 1.7 billion gallons of wastewater processed by 14 New York sewage treatment plants. Officials said the immediate solution is to ship it to landfills in other states. Estimates have put the cost of that at $250 million in the next fiscal year, compared with about $20 million a year for ocean dumping. Mayor David Dinkins, attending the ceremony, said out-of-state landfills were only a short-term answer while the city builds five new processing plants to turn it into commercially marketable fertilizer and dry compost . . . . " □

Recycling...

An old idea with enduring values

There is always the miracle of the by-products. Plane a board, the shavings accumulate around your toes ready to be chucked into the stove to kindle your fires (to warm your toes so that you can plane a board). Draw some milk from a creature to relieve her fullness, the milk goes to the little pig to relieve his emptiness. Drain some oil from a crankcase, and you smear it on the roosts to control the mites. The worm fattens on the apple, the young goose fattens on the wormy fruit, the man fattens on the young goose, the worm awaits the man. Clean up the barnyard, the pulverized dung from the sheep goes to improve the lawn (before a rain in autumn); mow the lawn next spring, the clippings go to the compost pile, with a few thrown to the baby chickens on the way; spread the compost on the garden and in the fall the original dung, after many vicissitudes, returns to the sheep in the form of an old squash. From the fireplace, at the end of a November afternoon, the ashes are carried to the feet of the lilac bush, guaranteeing the excellence of a June morning.

From *One Man's Meat*
by E.B. White, HarperCollins.

Putting the Crusade into Perspective

Recycling and waste generation both are on the rise

by William E. Franklin and Marjorie A. Franklin

Just about everyone in the United States seems to think that there is too much municipal solid waste (MSW). Newspaper articles and television programs bombard us with images of discards heaped up and overflowing. Schoolchildren are probably more aware than most; just visit a school and view the children's posters exhorting people to save the Earth by recycling.

There's no doubt that the problem is growing. EPA's most recent estimates are that in 1990 the United States generated over 195 million tons of MSW. That's up from about 88 million tons in 1960, and 151 million tons in 1980. EPA defines MSW as wastes from residences (such as houses, duplexes, apartments), from commercial establishments (such as office buildings, stores, hotels, airports, warehouses), from institutions (such as schools, prisons, hospitals), and from industries (such as packaging and office wastes from factories). MSW does *not* include industrial process wastes.

Of course, as the population increases, there are more people to generate waste. But even without the population increase, we would be generating more waste per person both at work and at home. EPA estimates the rate at 4.3 pounds of MSW per person per day in 1990, up from 2.7 pounds in 1960. These numbers are expected to increase over the next 10 years.

The approach that most government officials agree should be taken to the problem of MSW is integrated waste management. This means that, in most cases, no single alternative should be relied upon; each community should tailor a combination of methods to match its particular needs. However, there is a generally accepted hierarchy of waste management alternatives that goes like this:

- Source reduction—reducing wastes at their source and reusing products—is the best alternative because it means generating less waste in the first place. Very simply, waste that isn't generated never enters the waste stream.
- Recycling and composting are next best. Recycling is a process that begins with separation and collection of a product that otherwise would become waste and ends when the recovered material is processed into a new product. Closed loop recycling means that a recovered product (such as an aluminum can) is made into the same product again. Open loop recycling means that a product (such as a recovered plastic soft drink bottle) is made into a different product (such as fiber for carpeting). (See box on composting on page 14.)
- Incineration and landfilling are least desirable.

Unfortunately, endorsing this hierarchy is a little like saying you're going to lose weight; it's easier said than done. In the first place, no one has devised an acceptable way to measure source reduction on a nationwide basis, and it is difficult to estimate the effect that current efforts are having on the waste stream.

Nevertheless, there are many examples of source reduction currently in practice: Many offices are reducing waste by copying reports on both sides

(Bill Franklin, chairman of Franklin Associates, Ltd., has been a municipal solid waste consultant since 1968. Marge Franklin, president of Franklin Associates, has been a municipal solid waste consultant since 1975. Part of this article was based on a speech delivered at EPA's Municipal Solid Waste Source Reduction and Recycling Conference, Hot Springs, Virginia, March 1988. Most of the statistics in the article are from Characterization of Municipal Solid Waste in the United States: 1992 Update, *EPA Report No. 530-R-92-019.)*

The Situation Today

By weight, corrugated boxes are 12 percent of the municipal solid waste stream, the second largest component of MSW generation.

Mike Brisson photo. UW-Stevens Point.

of the paper; many marketers of consumer products are finding ways to reduce packaging.

Also, while efforts in recycling and composting have increased tremendously in the past few years, people wonder whether they're really making a difference. EPA's estimates of how MSW was managed in 1960 and in 1990 show that recovery for recycling and composting increased from almost 6 million tons in 1960 to over 33 million tons in 1990. At the same time, the amount of MSW burned increased only slightly. On the other hand, the United States landfilled about 130 million tons of MSW in 1990 compared to 55 million tons in 1960, an increase of 137 percent.

Looking at the recent past, the picture is a little brighter. MSW generation continued to increase steadily, but recovery for recycling and composting made a big increase—from more than 16 million tons (less than 10 percent of generation) in 1985 to over 33 million tons (17 percent) in 1990. This is an increase of 104 percent, not bad for starters. Incineration—also termed combustion—also increased in this period, so the best estimate is that less total MSW was landfilled in 1990 than in 1985.

If recycling is to be used as a genuine MSW management alternative, rather than just a "feel good" way to conserve resources, then materials must be recovered and made into new products in large quantities. Unfortunately, some of the products that are relatively easy to identify and recycle economically are not very big factors in the waste stream. To cite two examples:

- Lead-acid automotive batteries were recovered at a rate of over 96 percent in 1990. This is an impressive number, and keeping lead out of landfills and combustors is highly desirable from an environmental standpoint. However, these batteries would be less than 1 percent of all MSW even if they were not recovered at all.

- Recovery of aluminum beverage cans is one of the great success stories of recycling, perhaps the greatest. Their recovery rate was well over 60 percent in 1990, and, since they bring a good price, aluminum cans are an important economic factor in recycling programs. On the other hand, aluminum beverage cans would also be less than 1 percent of total MSW even if they were not recovered at all.

So what can be recycled that will have a real impact? By weight, the four largest components of MSW generation in 1990 were: yard trimmings (18 percent), corrugated boxes (12 percent), food wastes (7 percent), and newspapers (7 percent).

The yard trimmings and food wastes can be composted; the corrugated boxes and newspapers are highly recyclable. By going after these components, which really make a difference in the waste stream, communities can make some real reductions in what has to be disposed of. In fact, that is exactly what happened to achieve the 17 percent recovery rate in 1990. Paper products were nearly 63 percent of all recovery in 1990, and recovery of yard trimmings for composting made up nearly 13 percent. Recovery of glass, metals, plastics, rubber, and other materials made up the remaining 25 percent. What's been accomplished gives some guidance as to what must be done to increase recycling and composting in the future. That is,

concentrate first on the materials that make up the largest part of the municipal waste stream—paper and yard trimmings—then add other materials, such as plastics, metals, glass, and wood.

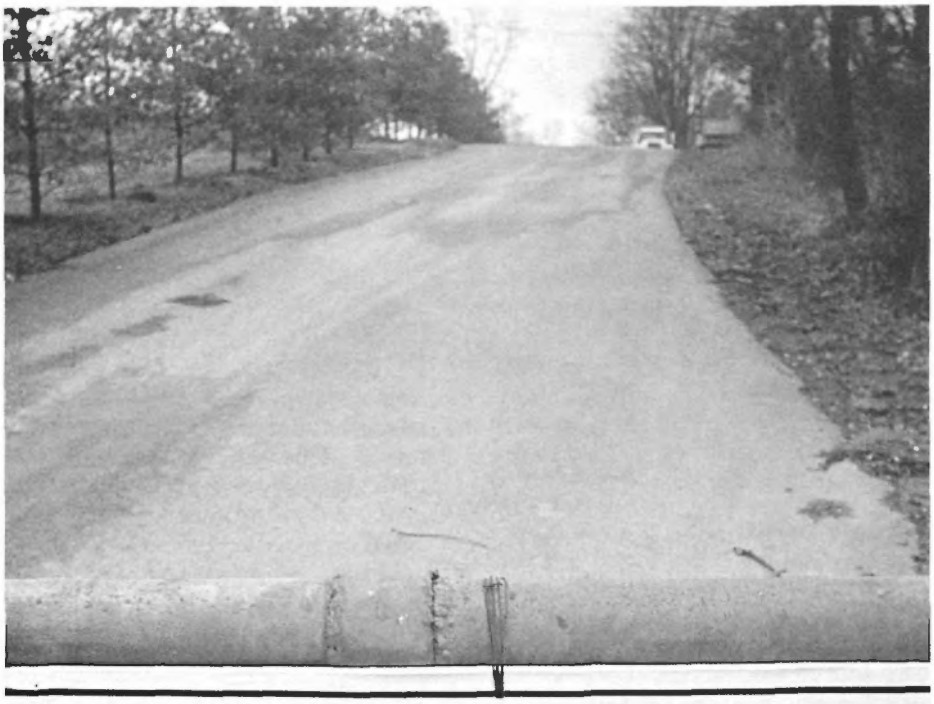
Behind all these numbers, what has been going on in the country that has affected attitudes toward the ways in which wastes are managed? Source reduction and recycling are certainly not new. People have always fed food scraps to livestock, made leftover fabrics into quilts, and used metal scraps to patch and reinforce everything from the roof to machinery. The use of recovered paper in paper manufacture was at a higher percentage 40 years ago than it is now. In years past, many an immigrant started a thriving family business as a "junkman" or scavenger. The private salvage industry has always recovered materials for recycling: metals, glass, paper, textiles, and rubber. This traditional salvage industry includes—in addition to junkmen or scavengers—dealers, secondary materials processors, brokers, and refuse haulers. In addition, there is a long tradition of recovered materials collected by social service and civic organizations, which earn money for their projects in this way.

In reviewing the subjects of source reduction and recycling for the last 20 years, it became obvious to the authors that the nation had been through several cycles.

The 1960s were an age of unrest, both politically and environmentally. Many people were influenced by Rachel Carson's *Silent Spring*. The gathering public indignation over environmental pollution became focused on the view that the United States was rapidly becoming a "throwaway" society. Nevertheless, most people loved the new products and the convenience they provided, and the decade set in motion a new wave of prosperity. In the 1960s:

- Environmental pollution came into focus as an issue
- Resource depletion also came into focus
- The simple life was contrasted with the throwaway society
- Packaging became the symbol of waste
- Prosperity meant more consumption and discards
- The marketplace rewarded consumption.

Outrage continued to mount over the country's wastefulness, especially over packaging. Material resource conservation was reborn, along with source reduction, as the way to get there. The simple life became the symbol of morality, and the throwaway



David Rogowski photo. Arlington Journal.

Overloaded landfills are a key factor in the nationwide interest in alternatives to traditional disposal of municipal solid waste.

beverage container became the symbol of the wasteful society. This era culminated in Earth Day 1970—the symbolic rejection of a materialistic society.

The forces set in motion in the 1960s continued into the 1970s. In 1970, EPA was established. In the waste arena, Congress passed the Resource Recovery Act, which amended the Solid Waste Disposal Act. An early study of recycling revealed that salvage markets were in decline, and use of virgin raw materials was on the rise. The trend was ominous. In combination with increasing disposables and throwaways and less recycling, the solid waste stream was a real growth item.

EPA sponsored many studies and initiatives to encourage recycling in this period, with industry and environmentalists usually at odds. Beverage-container deposit laws were often a focus. It was argued that such laws would save the refillable bottle, reduce litter, and achieve reuse and recycling. While a national deposit law was not enacted, 10 states did pass some form of this law, with Oregon leading the way in 1972, closely followed by Vermont. (The others were Michigan, Maine, Massachusetts, Delaware, Iowa, New York, Connecticut, and California.) In spite of these efforts, refillable bottles declined in use and, in many places, disappeared.

Another focus of attention for EPA and others in this era was the reduction of discards of consumer products and packaging. Packaging of all kinds, plus newsprint, tissue paper, and printing and writing paper, received most of the attention.

Many waste reduction proposals were put forth in the early 1970s. A few were successful; some were never put into action; others died, to be revived only recently. Here's what happened to some of the proposals:

- The 100,000 mile tire. Tire life increased to 40,000 miles, and tires got smaller. However, these developments were unrelated to source reduction efforts.

State Your Claim

On July 28th, the Federal Trade Commission (FTC) issued national guidelines for environmental claims on products. The guidelines, based on FTC investigations, hearings, and more than 100 written public comments, provide operating definitions of what is "recyclable" and what is not, as well as other environmental terms.

The following summary definitions are paraphrased from the new FTC guidelines:

Recyclable products or packaging must be able to be collected, separated, or otherwise recovered from the solid waste stream for use in the form of raw materials in the manufacture or assembly of a new product.

Recycled Content refers only to products made from materials that have been recovered or otherwise diverted from the solid waste stream, either during the manufacturing process (pre-consumer) or after consumer use (post-consumer).

Refillable packages should be labeled as such only if a system is provided for either the collection and return of the package for refill or the later refill of the package by consumers with product subsequently sold in another package. If it is up to the consumer to find new ways to refill the package, it should not carry a "refillable" claim.

Compostable products or packaging are comprised only of materials that will break down into, or otherwise become part of, usable compost (e.g., soil-conditioning material, mulch) in a safe and timely manner in an appropriate composting program or facility, or in a home compost pile or device.

Degradable/Biodegradable/Photodegradable product label claims should be substantiated by competent and reliable scientific evidence that the entire product or package will completely break down and return to nature—i.e., decompose into elements found in nature within a reasonable amount of time after customary disposal.

Ozone Safe and Ozone Friendly products cannot contain an ozone-depleting substance.

Source Reduction claims should be clear about the amount of waste reduction and the basis for any comparison asserted.

In general, the guidelines stress that: labeling should be clear and not deceptive; companies should delineate clearly whether claims apply to products, packaging, or just a portion of either; claims should not overstate environmental benefits of products, expressly or by implication; and if comparisons are used, they should be clear and the maker should be able to substantiate the comparison.

EPA estimates that in 1990 the United States generated more than 195 million tons of municipal solid waste, up from 151 million tons in 1980.

Waste Age photo.

- Elimination of excess packaging. Packaging proliferated but shifted to lighter materials.
- Package design to reduce waste. Efficiency in packaging is still increasing.
- Generic bottles and cans to encourage reuse. Brands and sizes of packaging proliferated.
- Buying in bulk. Smaller households, more working women led to more packaging and convenience foods.
- Backyard composting of yard wastes. Relatively little took place until recently.

The stage was set for a new era when the Middle Eastern nations embargoed oil exports to the United States for six months. Long lines at the filling station and instructions to turn down thermostats focused everyone's attention on energy.

In 1976, Congress passed the Resource Conservation and Recovery Act, better known as RCRA. This provided the seeds of what is now recognized as integrated solid waste management. RCRA addressed hazardous waste management, solid waste management, and procurement of products made from recovered materials. However, the overriding concern became safe disposal of hazardous wastes. The federal budget for nonhazardous wastes, including MSW, dried up, and MSW became firmly established as a local problem. Procurement guidelines, intended by the Act to encourage development of markets for recovered materials, were not forthcoming from EPA.

The limited waste reduction research that was sponsored by EPA was cast in terms of energy conservation. Most EPA grants to communities focused on recovery of energy from wastes through combustion, with recycling receiving secondary attention.

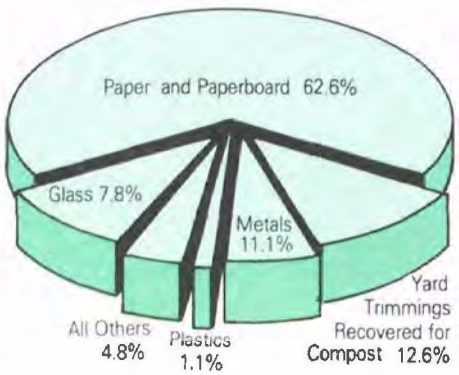
One reason why MSW took a back seat during this period was that landfill costs were still relatively low, and recycling programs were simply not cost effective at the community level. On the other hand, energy prices were escalating, and waste-to-energy projects could be shown to be cost effective within a few years of a plant's being put in operation.

Another important factor was that solid waste officials were facing increasing volumes of MSW, as urban areas grew and as material prosperity continued. It became expedient for these officials to seek "one step" solutions. Energy recovery, especially by burning, fit their criterion perfectly.

Recycling got some push in this era, but with no significant support from industry, except in the case of beverage containers, which were still under siege by bottle bills at the state level. Some faithful individuals and organizations kept their recycling goals alive, and the private recycling sector continued to function, but the white hat was hung up at EPA.

The early 1980s were quiet years for those interested in MSW management. Appropriations by Congress were all going to hazardous wastes, and EPA, along with most of the consultants that had been working on MSW, geared up accordingly. It is reported that EPA's technical nonhazardous waste staff declined from more than 150 employees in 1980 to fewer than 10 at one point. "Love Canal," "Times Beach," and dioxins were the buzzwords of the day. The missing

Recovery of Materials from the Municipal Solid Waste Stream, 1990 (By Weight)



Source: Franklin Associates (1992)

ingredient was building but had not surfaced in a big way yet—an honest-to-goodness crisis in solid waste disposal at landfills.

In November 1984, Congress enacted the Hazardous and Solid Waste Amendments (HSWA). These helped to revitalize MSW management by requiring EPA to revise solid-waste disposal criteria for facilities that received hazardous household waste or hazardous waste from small quantity generators. In other words, the criteria were to apply to nearly all landfills. States were given responsibility for permitting these facilities. The next era had begun.

Enter, then, some real landfill crises, and a new infrastructure to do something about it, especially in the Northeast, where states facing urgent disposal problems led the way. Integrated solid waste management was born in 1985 and is now a reality in many parts of the country. In large part, it is the extreme difficulty of siting new landfills and combustion units that now drives the need to reduce and recycle.

During this period, when EPA's MSW resources have been limited, a great many states have required local governments to prepare integrated solid-waste management plans, often with goals or requirements for reduction and recycling as part of the plans. The northeastern states have been particularly active, with the Coalition of Northeastern Governors (CONEG) taking the lead on many source reduction and recycling initiatives. Organizations such as the U.S. Conference of Mayors have also taken leadership roles.

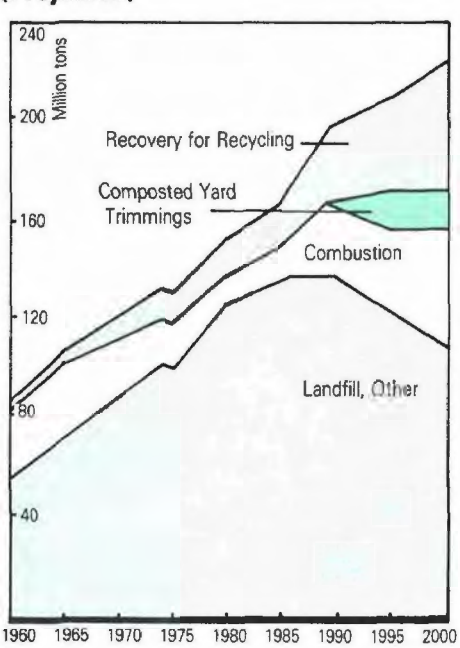
While increased recycling and composting have made a big difference, most of the country is still relying mainly on the combustion and landfill alternatives at the lower end of the hierarchy. Recycling experiences have shown that there are still some problems to be overcome, such as:

- Separating and collecting recyclables is proving to be quite expensive in many locations.
- Collected recyclables often need further processing to make them acceptable to those who manufacture a new product from them. This adds another layer of expense.
- There have been disparities between the amounts of recyclables collected and the amounts that can be used. There are reports of collected materials being landfilled or combusted, instead of recycled.
- The complete recycling and composting loop creates some unrecyclable residues that must themselves be disposed of. For example, deinking old newspapers to produce recycled newsprint creates a sludge.
- There has been some resistance to purchasing products containing recycled materials. Some people have the perception that recycled products are somehow inferior to products made of virgin materials. There have also been some real problems with recycled products. For example, many copy machines malfunctioned while using recycled paper, but these problems are now largely solved. Education of consumers is also beginning to overcome some of the image problems: For example, manufacturers that have avoided labeling their packaging as "recycled" now often display that information prominently.

What of the future? A number of trends are developing.

The *rate* of growth of municipal solid waste generation is slowing. Between 1960 and 1970, MSW grew at a rate of 3.5 percent per year, while population grew at a rate of 1.2 percent per year. Between 1980 and 1990, MSW grew at a rate of 2.8 percent per year, while population grew only 1.0 percent per year. While the reasons for this decline are not fully understood, use of lighter materials, such as plastics instead of glass, is almost certainly a factor. The decline in growth may stem from a sluggish economy, from people perhaps becoming less materialistic, or from serious public and private efforts to reduce materials at the source (especially in packaging, but also in some products). It is expected that this decline in *rate* of growth will continue, but growth will still exceed population increase.

Municipal Solid Waste Management, 1960 to 2000 (Projected)



Source: Franklin Associates (1992)

Despite the increased focus on recycling and composting, most of the country still relies on combustion and landfills.

The emphasis on recycling and composting is strong and will continue. Industry has gotten the word; the new capacity to absorb recovered materials is coming on-line. In particular, the paper industry has responded to increased collection of paper and to increased demand for paper with recycled content by committing the resources to build many new and expanded recycling paper mills. Some grades of recovered paper may actually be in short supply by 1995 or 1996. Industries using other recovered materials—plastics, glass, metals, and wood—have also stepped up their efforts to recycle more. An overall recovery rate of 30 percent of MSW generation seems within reach by the year 2000.

Finally, combustion with energy recovery struggles along, increasing slowly. This management alternative has been plagued with a legacy inherited from the earlier years of this century, when old fashioned incinerators belching smoke were a feature in many communities. New facilities are required to meet stringent air pollution regulations and to dispose of their ash properly, but this increases the cost of combustion. Further, the public often strenuously resists siting new facilities.

The picture that emerges is this. The country's generation of MSW continues to increase, although at a slower rate. Recovery for recycling and composting, which began to increase in the late 1980s, continues to grow. At the same time, combustion of MSW, which declined greatly when pollution controls became mandatory, is again on the increase. As a result of these changes, less MSW is projected to be landfilled in the year 2000 (about 109 million tons, or less than half of total generation) than was landfilled in 1980 (about 123 million tons, or 81 percent of total generation). Thus, changes in the way we manage our wastes—like increasing recycling—can make a dramatic difference over time.

The problems will not end—landfills will still fill up. But the country is already into a new era; the new landfills that are sited tend to be large, but there is a decreasing need for landfill capacity—thanks to all those efforts to reduce and recycle. □

Speaking of Composting

The heat builds: 100 degrees Fahrenheit; 110 °F; 120 °F. Oxygen molecules begin to break down, water molecules gather, and bacteria begin to multiply. Millions of microorganisms—mostly bacteria and fungi—metabolize grass clippings, dead leaves, and orange peels. More heat is released. The temperature climbs above 130 °F. Matter changes form. What was once tossed out as trash is turned into a rich, nutrient-laden mix called humus or compost.

This is not a description of a new technology developed to combat the United States' growing municipal solid waste problems. It is instead the eons-old process of composting: returning nutrients from yard waste and food scraps to the environment.

According to EPA data, nearly 18 percent (by weight) of the municipal solid waste stream is yard waste—grass clippings, leaves, tree trimmings, etc. During peak summer and fall months, yard waste can amount to between 25 and 50 percent of the solid waste stream. Collected and dumped into landfills, it adds up to some 35 million tons of material. That's second only to paper in landfill tonnage. The composting process can include food scraps (nearly 7 percent of the solid waste stream by weight) and even waste paper (weighing in at a whopping 38 percent); however, most municipal composting projects treat only yard waste. (One reason for this: Health laws governing food scraps and concerns about hazardous inks and other materials in paper complicate the process for municipalities.) EPA estimates that about one-third of yard waste can be diverted from landfills by 1995 if composting projects keep expanding at current rates.

Backyard composting piles have always been a boon to home gardeners. The rich humus generated from the piles of grass, carrot shavings, egg shells, and leaves helped many a garden grow. Composting has other benefits, too. Individual and community composting provides an alternative to leaf burning, a practice many areas have banned in the past decade due to air pollution, health, and fire safety concerns. Recent studies have shown that leaf and brush burning releases toxic, irritant, and carcinogenic compounds including carbon monoxide, hydrocarbons, and particulate matter—the "smoke" that's visible when leaves burn. These airborne particles are small enough to be breathed deep into the lungs and can remain there for months or even years, causing chronic irritation and other effects.

Composting also offers a partial solution to the problems of landfill closings and increased dumping fees, and the banning of yard wastes from many landfills beginning in the 1980s. Many local decision makers have opted for community composting programs. According to *Resource Recycling* magazine, at least 2,000 new yard-waste composting facilities will have begun operating between 1990 and 1995.

There are hurdles, though. Siting composting projects can be a problem due to the smell—which can range from disagreeable to downright intolerable—generated by some of the composting methods. Money is a problem as counties, cities, and towns cut back on services as budgets tighten. Many composting methods require investments for machinery and land and, at the very least, for a collection program. Finally, composting creates a product that needs to be used or sold. Many communities use the compost themselves for local groundskeeping or offer it free to residents. Savvy local officials have been able to sell the compost to nurseries or others. But that requires market knowledge and quality control—which can be difficult. (Bits of plastic from collection bags or bits of wood can result in unusable or unsaleable compost.)

Local planners can choose among many options for composting. For most methods, the material to be composted is formed into windrows—elongated piles or rows—up to 12 feet high and 24 feet wide. The piles are then left to decompose. The time required to effectively compost the material is anywhere from 4 to 18 months, depending upon the frequency of turning the material. Turning aerates the pile—a crucial element in composting. Forcing air through the piles using a blower and a network of pipes underneath the piles hastens the composting process: The compost is ready after only 2 to 10 weeks. Forced aeration methods require more energy, but also create less odor and can be done on a smaller scale than less-intensive windrow composting.

Composting can also be done "in-vessel." The material is composted within a chamber or vessel in which temperature, moisture, etc., can be carefully controlled. In-vessel composting requires little space, but is quite expensive to start-up and power. The compost, though, is ready in one to two weeks.

—Gregg Sekscienski, Assistant Editor

A Tale of One City

by Liz Chandler

Making recycling a top priority in Charlotte, North Carolina

Mecklenburg County photo.

1989's Hurricane Hugo created more waste in a night than Mecklenburg County, North Carolina, normally generates in a year. As part of the clean-up effort, the county ground 300,000 tons of trees into mulch.

On a fall night in 1989, Hurricane Hugo roared into Charlotte, North Carolina, turning this so-called "City of Trees" into a city of trash. The 90 mile per hour winds snapped trees and downed power lines to create more waste overnight than all of Mecklenburg County's 511,000 people generate in a year. By dawn, the city and county had launched a cleanup that would last 18 months, cost more than $27 million, and become the biggest test ever for the community's commitment to recycling.

To preserve landfill space, government officials decided to collect and grind 300,000 tons of trees into mulch. "The hurricane inundated us with waste—particularly yard waste," says Charlie Willis, chairman of the county's solid waste advisory board. "We couldn't bury it. We didn't have a place for it all. And we thought it would be a step backward from our commitment to recycling. So we had to go out and find places to stack thousands of tons of trees until we converted them to mulch."

The nation's 35th most populous city, Charlotte has become accustomed to adversity in waste disposal. The city, which spreads over 80 percent of Mecklenburg County, boomed during the 1980s, growing to the nation's third largest banking center, reaching the final cut for a new National Football League team, and landing on *Newsweek*'s Top 10 "hottest" cities list. And along with a 10-year growth spurt that added 25 percent more people, came tons more trash. Today, residents and businesses generate

(Chandler is a reporter for the Charlotte Observer.)

about 600,000 tons of garbage a year, and now the community is without a public landfill.

The 300-acre dump that served for 20 years hit capacity in April. Citizen lawsuits have blocked attempts to open a new one. Neighboring South Carolina, which borders Mecklenburg County, recently joined the fight to stop a planned 574-acre landfill on the South Carolina state line. The South Carolina legislature passed a law in June that would make that state's low-level radioactive waste dump off-limits to North Carolina if any North Carolina county builds a landfill within a mile of the South Carolina border. Lacking its own landfill, Mecklenburg County has contracted for space in a private dump—a move that has pushed up dump fees and sparked a new round of legal battles.

It is the constant struggle of siting new landfills that has propelled recycling from a modest experiment to a top priority in this community. Citizens have embraced recycling with 75 percent of eligible households participating at least once a month in Charlotte's voluntary curbside program. Seven local governments in Mecklenburg County, including Charlotte, have joined in a waste management plan that makes recycling the most favored disposal method.

The plan calls for reducing the amount of trash buried or burned by 25 percent per capita by next July. The goal jumps to 40 percent reduction by 2001. So far, the community has reduced disposal by 13 percent since 1990—a long way from next year's target.

To meet the goals, the city and county have set up aggressive recycling programs. This year, the two governments will spend $6.2 million on recycling collection and processing, up from $1.8 million three years ago. They also plan a $10 million recycling center for business waste. In January, curbside collection will be extended to 84,000 apartments and condominiums. And a new law requires all private haulers who serve businesses and citizens outside Charlotte to provide recycling to residential customers.

There's already an array of recycling programs in Charlotte: residential curbside pickup, yard waste pickup, dropoff centers, and a remove-and-resell operation for bulky appliances left at the landfill. The county mines and sells metals from ash at its incinerator. It also runs small recycling programs for cardboard, car batteries, and motor oil.

Curbside collection in Charlotte reaches 110,000 single family homes and is nationally recognized for its high participation. Residents toss glass bottles, aluminum and steel cans, newspapers, and milk containers and other plastics into bright red "Curb it" bins and place the bins at the curb. City collectors carry the material to recycling headquarters, where glass is smashed, cans are crushed, and plastic and newspaper are baled for sale.

Recycling coordinators won't accept new materials until they are certain they have buyers.

Recycling headquarters is a converted warehouse about twice the size of a high school gym. Recyclables are dumped on the floor, pushed by tractors onto conveyor belts, and separated by workers into bins. Loads are then baled for sale to buyers. A private company runs the processing center at no cost to the county. In return, the company keeps whatever profits it makes.

Charlotte took a big step in recycling in 1991 when it cranked up yard waste collection. Residents place tree limbs and brush at the curb. Grass clippings and leaves must go in clear plastic bags, so workers can see what's inside. City haulers drop the materials at two sites, where county workers take over.

With a shredder and three giant machines called tub grinders, county workers grind scrap wood and limbs into mulch. Other yard waste is composted: It's laid out in long rows, watered, turned frequently to aerate, and sometimes has nitrogen added to it. Within six months, the waste becomes a black humus, which is used to enhance soil.

Both products are sold to residents and landscapers. The county last year made $100,000, an amount expected to jump this year because of a new state law that prohibits putting yard waste in landfills. Mulch goes for about $1 for a 20-pound bag; compost sells for $3.50 for a 40-pound bag. The county has a revenue sharing deal with a private company to sell compost at local retail stores.

Recycling coordinators won't accept new materials until they are certain they have buyers. Charlotte, for example, claims to be the first city to accept spiral paper cans—from products like frozen juice—for recycling. Officials added the cylindrical cardboard cans only because they struck a deal with a nearby company that converts the cans into low-grade paper for cones that are used for textile yarn, carpet, and tape. "We would never have picked up spiral cans unless the market had approached us," says Cary Saul, the county's deputy engineering director. "We know markets have been a problem. We're cautious. You have to know your market before you get into

Mecklenburg County photo.

Charlotte recycling organizers say they have strong markets for their recyclables because their supply is clean and thoroughly sorted.

something."

As competition for buyers heats up across the country, Charlotte recycling organizers say they've maintained strong markets because they supply a clean, thoroughly sorted product. "We're going after the best quality paper we can get to supply our plants," says Kenny King, a buyer who has a contract for Charlotte's newspaper. "We've got to have a large quantity. We want it source-separated .... They do an excellent job at it."

Says the county's Saul: "When things get tight, buyers are going to want the best material. They don't want a bunch of newspaper with broken glass mixed in."

Despite everything that Charlotte is doing, city and county leaders admit they probably won't make the 25-percent reduction goal next July. More likely, it will be 1994, after a new commercial recycling center opens. The center is the city's first significant venture into attacking the business waste stream, which accounts for 55 percent of all trash.

The success of the center is not guaranteed. County leaders last year took steps to ensure a steady supply of recyclables with a "flow control" ordinance. It required that all waste generated in Mecklenburg County be dumped at a county disposal facility, and it gave county officials power to dictate which facility haulers used. The plan was to direct commercial waste rich with paper, cardboard, and other recyclables to the new recycling center. But one Mecklenburg County company, wanting to use its own landfill outside the county, sued and blocked the new law.

Now the county has turned to old-fashioned competition to lure haulers. Officials are devising strategies, such as cut-rate dump fees and tax incentives, to lure haulers to use county facilities. "We can't go too far, because it could backfire," says Saul. "If we make disposal too cheap, there's no incentive for companies to cut the amount they produce."

Despite recycling's popularity, nobody believes it's a cure-all. The county's waste management strategy also relies heavily on incineration. Landfilling is the least-favored option.

"Recycling is one of the options we've chosen to manage a portion of our waste," says Saul. "It's part of the answer .... We want to recycle everything we can, then incinerate the rest. We only want to put things that won't burn in the landfill."

Mecklenburg County's incinerator opened in 1989; it burns 200 tons of refuse daily. Steam generated from incineration heats buildings at the University of North Carolina-Charlotte in the winter. And the electricity produced is sold to the Duke Power Company. The plant burns about 11 percent of the county's waste; energy sales help defray about half the $2 million annual operating costs. The rest of the money comes from dump fees charged at county disposal sites.

The county plans a second incinerator that will burn 600 tons daily. Set to open in 1996, the $90 million burner is to be paid for through revenue bonds and energy sales. All told, the two incinerators are projected to burn 26 percent of the county's waste in 1996.

So far, the incinerators have dodged the kind of citizen's legal challenges that stalled a new landfill. Officials have calmed neighbors' fears by monitoring air quality around its current burner and publicizing the results. The county pledges similar tests around the new incinerator and will build in anti-pollution devices, such as stack scrubbers and a bag house.

Mecklenburg County has spent more than $100,000 to study a myriad of waste disposal options, including such obscure methods as refuse-derived fuel and bioconversion. Officials say they're confident the recycle-burn-bury combination is best. Still, it's going to take more than a disposal plan to reach the 40-percent reduction goal by 2001. "The real key is reducing waste at the source," says Saul. "That takes time. That means plants have to change processes, and people have to change habits."

Board chairman Willis says people are beginning to do that. "There's a tremendous intangible benefit derived from curbside recycling. Those red boxes are like advertisements. Public awareness is so great that it filters into everything people do. They buy smarter. They think greener. They are more aware of their impact on the environment." □

Into the Loop

Waste Management photo.

Collection: The First Step

Recovery rates have been a success

by Bruce R. Weddle

In 1990, the United States generated over 195 million tons of municipal solid waste, approximately 4.3 pounds per person per day. This exceeds the generation rate in every other industrialized nation. The good news is that Americans recognize the problems associated with municipal solid waste and are responding by separating and collecting many types of material for recycling.

Just take a look around. Supermarkets are accepting used plastic grocery bags for recycling, employees are collecting office paper at the workplace, local gas stations are taking used oil back from their customers, and schools are recycling everything from notebook paper to plastic food trays. Where once we may have been content to return aluminum cans to central collection centers, or contribute the occasional stack of newspapers to a paper drive, materials of all kinds are finding their way into a variety of public and private collection programs.

Of course, separating and collecting recyclable goods is just the beginning; recycling isn't complete until the materials have been reprocessed, marketed, and reused. Nonetheless, progress has been substantial over the last several years as the foundations of a comprehensive, nationwide recycling system are being laid. In 1990, we recovered 17 percent of our waste stream for recycling and composting, compared to just 10 percent in 1985. This means that in 1990, because of our higher generation rate, we recovered over 33 million tons of materials, which is more than twice the 16 million tons recovered in 1986.

While federal, state, and local governments, industry, and private organizations have all contributed to the rapid growth in the collection of recyclable materials, the real heroes are ordinary citizens. Individuals of all ages are not only collecting more materials for recycling, but they're volunteering at collection sites, promoting programs, and more. Perhaps we as a nation have embraced recycling because it allows us as individuals to do something that has an immediate and measurable impact on a problem to which we all contribute. Considering the diversity and complexity of today's environmental challenges, separating recyclables from our trash reminds us that we really can make a difference.

In many areas of the country, municipal governments have led the way. Encouraged by the support of local civic groups, volunteer recycling committees, and other concerned citizens, these communities have designed and implemented recycling programs that reduced their reliance on landfills and incinerators and provided considerable savings in tipping—or dumping—fees. These communities also earned revenues from the sale of recyclable materials that helped offset the cost of the recycling program.

Community recycling programs are typically organized around curbside or dropoff collections. In a curbside program, local haulers or recycling companies pick up sorted or mixed recyclable materials directly from residents. Characteristically, curbside programs result in a high participation rate, successfully diverting a significant percentage of the waste stream. The number of curbside collection programs has quadrupled since 1988; today, some 65 million Americans are served by these programs. Lexington, Massachusetts, for example, established its curbside recycling program in 1988, distributing recycling bins to area residents to be filled with mixed recyclables and placed at the curb for collection by a private contractor. The city reported in 1991 that over 80 percent of its residents participated, diverting 30 percent of the city's waste stream.

Dropoff collection programs require the individuals to bring their separated materials to a central site. These programs range in scope from newspaper collections sponsored by scouting organizations to industry-sponsored buy-back projects to fully staffed multi-material collection centers. Operating dropoff sites is less expensive than managing curbside collection programs, though lower participation and collection rates usually result. In some communities, vending machines are being used for

(Weddle is Director of EPA's Municipal and Industrial Solid Waste Division.)

Seventeen percent of municipal solid waste is now recovered for recycling, up from 10 percent in 1985.

Steve Delaney photo. EPA.

consumer convenience. Individuals simply deposit their aluminum and plastic beverage containers into the machines and receive cash in return.

To encourage recycling by residents, some communities are using economic incentives, such as "variable rate" programs in which residents are billed for waste collection based on the weight or volume of waste they place at the curb for disposal. Material set out for recycling is collected without charge. One of the most successful programs began in Seattle, Washington, in the early 1980s. The program significantly increased the amount of material diverted from the waste stream. In 1991, approximately 40 percent of the city's waste (about 50,000 tons of material) was collected for recycling.

To learn more about such successful collection efforts, EPA is funding a study by the Institute for Local Self-Reliance, a nonprofit research and educational group dedicated to supporting independent communities. The institute is developing case studies on 30 community-based recycling programs. It is compiling and comparing such data as costs, participation levels, and recovery rates. The idea is to provide reliable information that other communities can use to plan for and evaluate their own programs. The information will be made available in a three-volume report this fall.

Regional approaches are also being undertaken. A coalition of 20 southwestern cities created the Southwest Public Recycling Association, which is examining collection and marketing issues. The cities discovered in 1991 that each used different methods to compile and calculate recycling and participation rates. They are now working to develop uniform measurement methods to enable them to gauge the success of their efforts more accurately. Because of low landfill costs and high transportation costs, caused by long distances to markets for their collected recyclables, these cities also face special recycling challenges, which they are working to overcome. Additionally, the coalition is working cooperatively to market recyclables, thereby ensuring a steady supply of materials on which recycling industries can rely. This will make the recovered materials more valuable and easier to sell.

State governments have been instrumental in providing a boost for

recycling; today, virtually every state in the country has enacted some type of recycling legislation. In 1986, Rhode Island instituted the country's first state-wide regulations mandating recycling, requiring the participation of both households and businesses. The state initially concentrated on residential collection. A list of materials to be collected from the curb was compiled, and residents were asked to separate these materials from their household waste. The participation rate by households reached 80 percent this year. Businesses were asked to prepare recycling plans, focusing their efforts on those materials that appear in the largest quantities in their waste stream. To date, over 90 percent of the companies have submitted their plans and report an average reduction in the amount of waste requiring disposal of 20 percent. In Pennsylvania, where over two million residents in 200 communities are participating in community recycling programs, a state recycling program is being developed that will eventually involve over eight million of its citizens.

The federal government has introduced a large-scale recycling effort, In 1991, President Bush signed an Executive Order requiring, among other things, that every federal agency and department formulate a plan to recycle usable materials, from paper and plastic to used oil and automobile tires. Through this effort, the federal government will soon become one of the largest recyclers in the world. The General Services Administration is helping many federal agencies get their programs off the ground and has established collection programs in federally owned office buildings.

EPA launched its own recycling program in 1975. Program organizers educate employees about recycling, track the amounts and types of waste diverted, and direct purchasing decisions toward products with recycled content. While collection efforts were initially focused on high-grade white office paper, the program now includes newsprint, mixed waste paper, aluminum cans, and glass bottles. Last year, EPA diverted over 2,400 tons of recyclables from its waste stream.

Numerous interagency recycling partnerships have been established as well. Just this year the U.S. Postal Service joined forces with EPA to design an educational poster on recycling that will be displayed in post offices across the nation. The Postal Service itself has implemented its own comprehensive recycling program, collecting such diverse materials as paper and cardboard from its offices and waste oil, lead-acid batteries, and antifreeze from its vehicle maintenance operations. In 1990, the Department of the Interior, along with Dow Chemical and Huntsman Chemical, formed a partnership to sponsor major recycling programs for glass, aluminum, and plastics in several national parks.

Another cross-agency effort is helping to provide guidance to manufacturers and consumers on the use of marketing claims like "recycled" and "recyclable." Many consumers want to purchase products that have recycled content or other environmental attributes but have been confused by the inconsistent and sometimes misleading use of environmental marketing claims.

To address these issues, EPA initiated an Interagency Task Force with the Federal Trade Commission (FTC) and the U.S. Office of Consumer Affairs to develop a comprehensive national response to the problems posed by the inconsistent use of claims. A major goal of the task force is to prepare consistent national guidelines for the use of environmental claims. On July 28, the FTC made a

Many community groups, such as these Virginia scouts, recycle aluminum cans for fundraising.

Aluminum Company of America photo.

major contribution to this goal by announcing the release of voluntary industry guidelines. EPA was pleased to assist the FTC by providing technical input to the guidelines. They will help provide consumers with reliable information, discouraging the use of vague claims like "recyclable where facilities exist" and encouraging specific claims like "contains 50 percent recycled material." (See box on page 10.)

Private groups, from national environmental organizations to local civic groups, have also done their part to mobilize recycling in the nation. The Environmental Defense Fund (EDF), working with the Advertising Council, launched a pair of nationwide advertising campaigns in 1988 and 1990 to stimulate people's interest in recycling. The first recycling campaign, using the slogan "If you're not recycling, you're throwing it all away," generated over 120,000 calls from people requesting more information. The follow-up campaign targeted nonrecyclers, conveying a message that recycling not only lets individuals make a difference, but that it's easy. Other groups, such as the Natural Resources Defense Council, have initiated research projects to quantify the effectiveness of recycling, and many community organizations, such as the League of Women Voters and Keep America Beautiful, are working to increase participation by residents in local recycling programs.

The foundations of a comprehensive, nationwide recycling system are being laid.

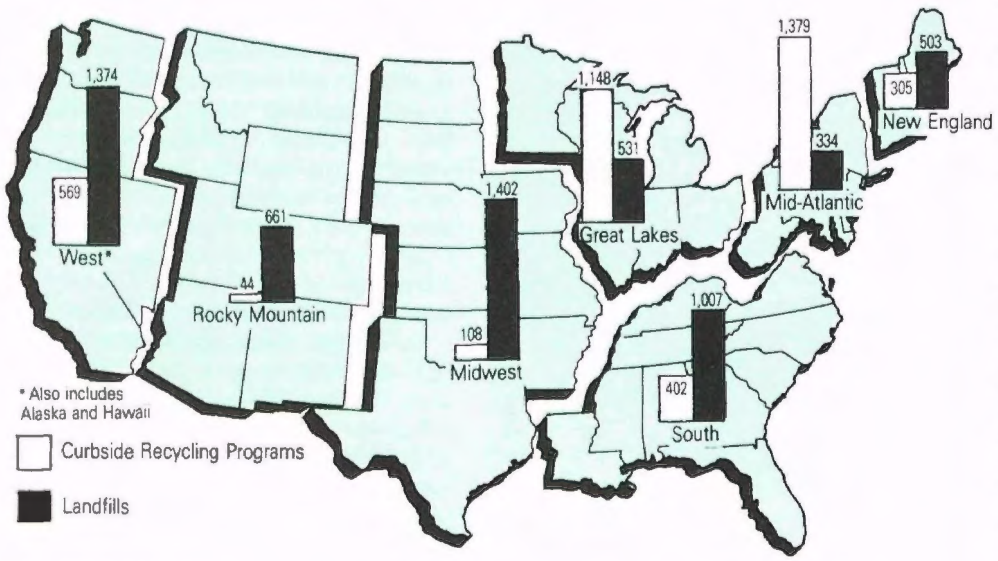
Partnerships between industry and environmental groups have been especially successful at increasing the amount of waste being collected for recycling. In 1990, EDF and the McDonald's Corporation formed a task force to study how waste could be effectively reduced and recycled in the company's franchises. Among the actions McDonald's decided to implement was collecting corrugated boxes (which comprise over one-third of its waste) for recycling. Facts about the company's efforts also are printed on bags and posters to help promote recycling among the restaurant's many customers.

Schools also have been active in the recycling arena. From kindergarten to college, students are championing recycling—and taking the message home to their friends and families. In Newark, New Jersey, for example, hundreds of children from kindergarten through the sixth grade have been sworn in as "Recycling Rangers." Their job: to "tell my family and friends why recycling is a good thing to do and help them to recycle." At the University of Wisconsin-Stevens Point, students and faculty instituted a collection program for paper, aluminum and other metals, and yard trimmings. The program recovered almost 45 percent of the university's waste stream in the first full year of operation.

The tremendous surge in collection programs in recent years reflects a growing concern with solid waste management in the United States. It also demonstrates a concerted effort by numerous individuals to take responsibility for the waste they generate. This willingness to make changes in our lifestyles is a necessary first step toward developing even more innovative solutions in the years to come. □

Regional Refuse Breakdown

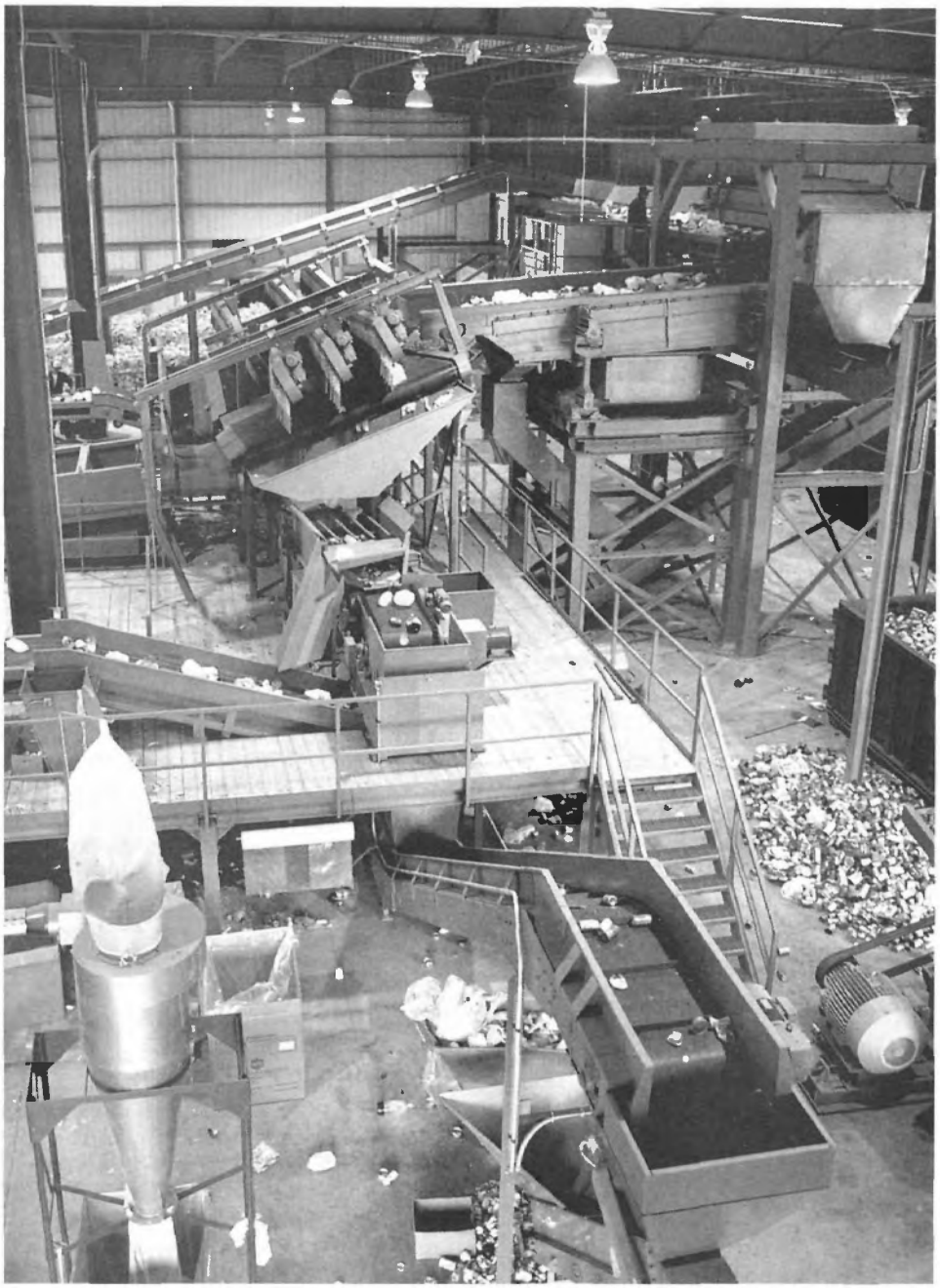
Number of curbside recycling programs vs. number of landfills by U.S. region



Source: *BioCycle* Magazine

Processing: The Unheralded Middleman

by Jerry Powell



In 1991, recycling processors handled more than 75 million tons of post-consumer scrap materials.

Recycling's universally recognized symbol is truly representative of this thriving environmental industry. The symbol's chasing arrows perfectly connote the sequential, full circle nature of materials recovery and use.

As a beginning, residents, businesses, and institutions must prepare discards for recycling collection. These materials must then be sorted, processed, and transported. Mills and factories must convert these recovered commodities into new goods and products for sale to and use by consumers, thus rounding out the circle. It is important to note that the recycling logo has three equally sized arrows. Should any of the activities involved fall behind their counterparts, the resulting imbalance will cause the system to falter.

This article outlines the activities involved under the second arrow: the conversion of collected materials into commodities desired by industry here and abroad. In a sense, this article is about that quiet and unknown element of recycling—the processor.

As well, this article describes a growing industry, an industry that operates in nearly every American town and city. In the United States, there are nearly 2,000 sites where recovered paper is received, sorted, and packed for shipment to paper and paperboard mills. Last year, these processors handled over 30 million tons of recyclable fiber.

More than 5,000 facilities in the United States process scrap metals before the material is sent to mills and foundries. Over 100 processing locations turn glass bottles into cullet—small bits of glass that can be easily melted—for use by container manufacturers. Similarly, some 300 scrap plastic processors now operate in

(Powell is Editor-in-Chief of Resource Recycling Magazine *based in Portland, Oregon.)*

The processor turns "trash" into commodities that are ready for sale.

the United States. In total, recycling processors in 1991 handled more than 75 million tons of post-consumer scrap materials and sold these commodities to end users at a combined value of $14 billion.

This is an historic industry, for recycling processing has occurred ever since we began to use paper and metals. Much of the paper made in the 1700s and 1800s in the United States contained high levels of post-consumer fiber, primarily old paper and rags. Similarly, we've always collected scrap metals for recycling. For example, George Washington owned several scrap metal processing sites.

To portray how collected materials are converted into industrial commodities by the recycling industry, let me summarize how some specific materials are handled.

- **Paper.** As with other recyclables, there is little demand for a mixture of all types of used paper and paperboard. Recycling mills want specific grades of paper, not a combined mess. In fact, recovered paper is sold in more than 50 different grades. Thus, the paper processor's principal role is to make sure the mill receives the grade of paper desired. This entails assuring that a bale of paper doesn't include other types of paper or nonpaper items, such as plastic or metal. For instance, a bale of computer paper cannot include a significant amount of newspaper.

The second principal function of the paper processor, as with processors of other recyclables, is to package recovered paper in a manner desired by the paper mill. This generally entails the production of a dense, wire-bound bale, which is the easiest package to store and ship.

- **Metals.** The scrap metal processor performs similar tasks. For example, loads of post-consumer aluminum cans are sorted magnetically and manually to assure that other metals and other materials are eliminated. The cans are then packaged, commonly into a dense briquette.

- **Plastics.** Just as there are many kinds of paper, plastic products are made from numerous resins. Each has unique features in terms of rigidity, density, strength, etc. Thus, a mixed lot of scrap plastics is relatively useless. The scrap plastic processor employs mechanical and manual techniques to assure that a load of old milk jugs, for instance, contains only these containers and no other plastics or other materials. Sorted plastics are then shredded, washed, and pelletized before shipment to a recycled plastic user.

- **Glass.** Glass containers are commonly sorted by color before shipment to a processor. The processor uses mechanical techniques to remove metal lids and caps and to remove paper labels. The glass is then crushed before it is introduced into the glassmaker's furnace.

The only constant element of today's recycling industry is change. The domestic processing industry in 1992 is far different from that of just 10 years ago.

Considerable investment has been made in new recycling processing systems. A few examples are offered:

- In recent months a number of firms, with financial assistance from the plastics industry, have developed highly automated machines that use x-ray and infra-red detection systems to sort plastic containers by resin type and color.

- Researchers at several universities, including Carnegie Mellon and the University of Illinois, are developing techniques to automatically sort glass containers by color.

- In the last decade, new scrap metal and paper processing systems have been introduced to the market.

- Major European and American manufacturers have developed highly sophisticated plastics processing lines.

A second trend is the entry into the processing industry of "Fortune 500" firms. Processing of recyclables is no longer dominated by small entrepreneurs. Major makers of recycled products have integrated downward to acquire recycling processing operations. For instance, Wellman, the nation's largest plastics recycler, acquired CRInc., an operator of processing plants nationwide. This gives the recycled product maker access to an adequate supply of material at the lowest cost and highest quality. This trend also includes the involvement of all the major publicly traded waste management firms, such as Browning-Ferris, Waste Management, Laidlaw Waste Systems, and others. These firms have invested substantially in establishing and operating processing plants.

A third trend is the entry in recent years of local government. Cities and counties face rising costs for solid waste collection and disposal and are now, more than ever, looking to recycling and composting to reduce the burden on landfills. In addition, nearly every state has adopted a waste management law that places recycling collection requirements on local governments. In order to market the recyclables now being collected in their communities, many local governments have established new processing centers.

Many of these centers are owned by the city or county and operated by a private contractor. Many are called MRFs, or materials recovery facilities. In these plants, source-separated paper and commingled bottles and cans are sorted and processed, much in the manner described earlier.

Processors of mixed waste often call their plants "dirty" MRFs. These facilities take loads of mixed solid waste and use mechanical and manual techniques, such as magnetic separation and hand picking, to remove selected types of paper, metals, glass, and plastics.

According to Governmental Advisory Associates of New York City, the number of these commingled recyclable and mixed waste sorting plants nearly doubled in just the last two years.

Mike Brisson photo.

Currently, some 116 of these facilities operate in the United States and have these features:

- More MRFs are in the Northeast than any other region.
- MRFs are becoming far more mechanized than in past years.
- New plants are about twice as large as the average MRF now operating.
- The average MRF processes about 130 tons of material per day and costs about $3 million to construct and startup.

A fourth trend is the increasing emphasis on material quality. This means that manufacturers can accommodate higher percentages of recycled materials in their feedstock (see article on Rhode Island's experience on page 26).

A fifth trend is the growing number of new recycling grades handled by processors. With consumers demanding recycled products and with industry responding, processors are being asked to supply many new types of recyclables.

Hundreds of communities now collect magazines separately in curbside recycling collection programs. This fiber is used, along with old newspapers, to make deinked newsprint. Several market analysts predict that a shortage of old magazines will occur before 1995 unless collections grow as fast as the number of new deinking systems coming on-line in the United States and Canada.

Another recyclable that is being handled by more and more processors is plastic film—items like plastic shopping bags, trash bags, and plastic wrap for food. The United States uses three times as much plastic film as soft drink bottles, milk jugs, and water bottles combined. There are a number of high volume uses for reclaimed film, including the manufacture of trash bags.

And there is considerable attention nationwide on recovering and using construction and demolition wastes. New facilities are opening daily that sort and crush these wastes to produce new materials for use in construction and other applications. Of particular note are the growing number of wood waste processing plants and facilities that process scrap gypsum wallboard.

Some emerging trends for processing recyclables bear watching. Transportation of recyclables, especially paper, by railroads is becoming increasingly common. For example, state legislation requiring recycled newsprint has caused many Canadian newsprint mills to bring back old newspapers from the United States in the empty box cars returning to the mill.

Another issue is the health and safety concerns from processing recyclable materials, especially manual sorting of these materials from mixed waste. Worker exposure to high levels of microorganisms and the poor design of the working environment in many processing facilities have been documented in Denmark.

Recycling cannot occur without collected materials being processed. The processing industry—the quiet giant of recycling—has undergone significant changes in the past decade. Even so, tomorrow's processor will be different from the processor of today. □

Steve Delaney photo, EPA.

Too much broken glass makes it hard to sort out glass by color, as the market demands.

When It Doesn't Make the Grade

Quality control is crucial

by Edward F. Connelly

"Garbage in; garbage out." The expression wasn't meant to describe the solid waste industry, but it is very applicable to the collection and processing of recyclables. Recycling programs are businesses that market commodities. If the commodities are being treated like trash, that is what they become.

Quality control is essential to ensure that recyclables can be marketed. This does not mean producing the cleanest stream of recyclables no matter what the cost, but striking a balance between the needs of the market and the cost of producing recyclables to meet those needs. To achieve this balance, recyclers must combine a clear understanding of the market, the nature of the waste that is to be

(Connelly is the Recycling Program Manager for the Rhode Island Solid Waste Management Corporation.)

recycled, and the capabilities and operating cost of the collection and processing system.

Markets for recyclable materials are constantly changing in response to traditional market forces and to the expansion of recycling programs. Recycling managers must regularly review and adjust their collection and processing operations to account for increases or decreases in the amount the markets pay for material, changes in minimum quality, or technological advances in manufacturing. Several years ago, when the economy was booming and there were fewer recycling programs, it was relatively easy to market newspaper that contained up to 5 percent other paper. Today, markets demand 100 percent newsprint.

Similarly, in the past, it was not difficult to sell mixed plastic bottles. Today, however, manufacturers take only sorted material, and they pay less for it. Recycling programs that collect and market glass must now ensure that the product is free of ceramics, like coffee mugs and dishes, because ceramics can explode in glass furnaces. Programs that cannot deliver ceramic-free glass will lose their markets. On the positive side, new markets are developing for material such as magazines and textiles, and technological advances in plastics manufacturing promise to allow recycling programs to market mixed materials.

The key to success is understanding what the recycling program has to produce in order to sell products every day. Knowledge of the market tells the manager what has to be produced, but it does not tell him or her how to consistently produce quality products. This requires monitoring at all three major steps: at the source, during collection, and during processing. Quality control at these points is necessary whether the program is designed to collect industrial scrap or paper from classrooms.

As the source of the material to be recycled, generators—residents, businesses, etc.—must understand exactly what materials are to be separated from the waste stream, the condition they must be in, and the contaminants that are not allowed. A thorough, initial training must be followed up with reference materials and periodic reminders.

In Rhode Island's municipal collection program, residents are informed of a program start by postcard. They are invited to attend public meetings or call special phone lines to get answers to questions about recycling. Newspaper advertisements also explain the program. A flier with a list of materials to be recycled is delivered to each residence. All this is done so that participants will know exactly what can be collected for recycling and what can not. The approach applies to any type of recycling; time and money are well spent on education because education results in a cleaner stream of recyclables and thereby reduces the cost of removing contaminants before marketing.

The collector is the only regular link between market and source and plays a major role in maintaining quality. All collectors must understand the nature of materials that are acceptable and should be instructed to reject materials that do not meet specifications. There is no better way to convince a generator to improve quality than to reject an unacceptable load. Warnings are useful, but they must contain instructions on how to improve. If a generator needs help, the collector can provide educational material or can arrange for a site visit by his home office.

In Rhode Island's residential recycling program, truck drivers play a major role in reducing contamination by monitoring the materials they collect. When the drivers spot unacceptable material, they place brightly colored stickers on the contaminant to notify the resident. This system has proved effective in reducing contamination and improving quality.

After collection, most recyclables are processed before they are marketed. The processor's knowledge of the market tells him how much processing is necessary, but worker training determines how effective the process will be. Some processing facilities use bonuses as a means of encouraging workers to improve quality and keep vigilant for contamination.

The importance of the worker's contribution to quality control can be illustrated in the following anecdote. Rhode Island's material recovery facility operator learned that the processing and sorting equipment was breaking significant amounts of glass, making it difficult to separate by color and causing a large percentage of it to be lost because the pieces were too small to sort. By cushioning the fall of the glass, the operator reduced breakage; more material was recovered; and contamination by small pieces of glass was reduced.

Recycling programs must be prepared to pass up markets if the needs of the market cannot be met efficiently by the program. Rhode Island's residential recycling program produces large amounts of high-quality newsprint. Metal, glass, and plastic are collected with the newspaper, and some metal cans get mixed in with the paper. Not all the cans are removed, because the cost of removing them is high, and most markets can live with a small percentage of the combination. An offer from a local building-products manufacturer to purchase large amounts of metal-free newsprint had to be rejected, because the price the company was willing to pay would not have justified the cost of the equipment and labor to remove the metal.

Even the best quality control system cannot protect against every mishap when the raw material of the business is trash. Early in Rhode Island's municipal collection program, an entire load of newspapers was contaminated because of a promotional vinyl record that was included in a Sunday newspaper. That time, it was recyclables in, garbage out. □

Coming Full Circle

At least seven different types of plastic resins are found in the municipal solid waste stream, making it difficult to process the plastics to specifications.

Douglas Dalton photo.

The Challenge of Markets

The supply of recyclables is larger than the demand

by Michael Alexander

"Markets, markets, markets," the recycling buzzword for the 1990s, has become all too familiar to those responsible for moving materials through the recycling process. Why are markets so vital to the success of recycling? How do they behave under the current recycling fervor? What forces lie behind their development?

Traditionally, a market is created when the available supply of a product is matched by a corresponding demand. Usually, supply and demand follow each other closely, as markets evolve over time. In the rush to recycle, however, the demand for recyclable material has not always kept pace with burgeoning supplies. While state and local governments have proved effective in implementing programs to recover materials, they have had less success in finding markets for them.

Several factors contribute to this problem. The lag time between the availability of large quantities of recyclable materials and the development of manufacturing capacity to convert these materials into finished products creates supply and demand imbalances. This is especially true during the current economic recession. Also, geographic distances between the sources of recovered material and industrial consumers frequently fuel regional marketing problems, and hard-to-anticipate international economic forces further impact domestic markets. Finally, policies originally intended to aid in the development of this country's natural resources, such as energy subsidies, timber supports, and certain federal tax codes, encourage manufacturers to use raw, virgin materials rather than material recovered from the waste stream. To illustrate how these forces affect the recyclables marketplace, three materials that are currently experiencing marketing problems are examined here.

(Alexander is a Policy Analyst with the Northeast Recycling Council.)

Green Glass

Generally speaking, recovered glass is used to produce new glass containers of the same color: Brown glass goes into new brown containers, green glass into new green containers, and so on. A number of furnaces in the United States are dedicated to clear and brown glass production, and recyclers enjoy a relatively stable market for these colors. However, only a few furnaces are dedicated to green glass production, and recyclers throughout the country report difficulty in finding markets for green cullet.

The imbalance is created largely by the import of green bottles from sources outside the United States. While only a few domestic beverage companies choose to package their products in green bottles, several foreign companies do. As a result, the amount of green glass collected by recyclers exceeds the capacity of domestic bottlers to use it. Domestically, green glass bottle production represents about 13 percent of dedicated furnace capacity, while green containers average 23 percent of the glass-container waste stream. This difference is estimated to translate into a production capacity shortfall for green bottles of one million tons per year.

This imbalance is exacerbated in some regions of the country by market dislocation: For instance, while recyclers in the Midwest may not have difficulty securing markets because of their proximity to green glass furnaces, others, particularly in the Northeast and Northwest, are forced to either landfill or stockpile the material because of the costs associated with shipping to distant markets.

Post-Consumer Plastic Resins

Similar marketing problems currently face those recovering various post-consumer plastic resins (PCR).

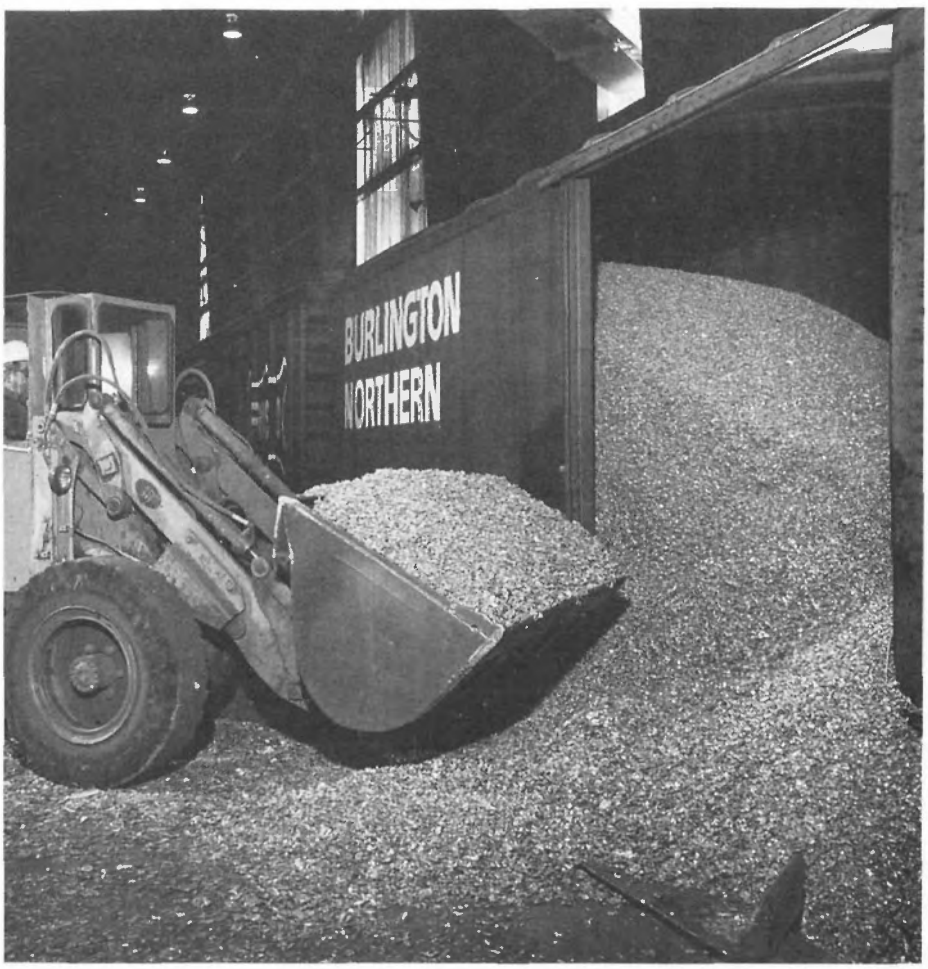
Continued on next page

PCR includes items such as shampoo and laundry detergent bottles and milk jugs. The price paid to processors of these materials has been steadily declining over the past few years; a number of factors have contributed.

At least seven different plastic resins are found in the residential waste stream. Collecting, separating, bailing, and processing these resins to meet market specifications is difficult because of cross contamination of resins and the consequent contamination of the end product. Once processed, the recovered plastics have limited applications. Yet, these problems can be managed through improved public education programs, more efficient handling and processing systems, and advances in technology. The most pressing problem facing plastic recyclers is a decline in the price of virgin resin, the material that PCR must compete with for market share.

Since 1989, the price of virgin polyethylene resin, which is used to package a range of consumer products, has been decreasing, and many analysts predict that the trend will continue for several more years. Even as the recession dampened demand for plastic resins, production capacity expanded significantly in the United States. A tremendous amount of additional capacity is also planned, or under development, around the world, most notably in Saudi Arabia, the Far East, and Indonesia.

These foreign capacity expansions are hurting U.S. resin producers who have traditionally relied on overseas markets to absorb their excess supplies. In the absence of these markets, U.S. producers must either reduce production or sell their resins in the already saturated North American market. This has resulted in lower virgin resin prices and has led to the inability of PCR to compete in a number of plastics markets.



Reynolds Aluminum Recycling Company photo.

Markets for scrap aluminum are strong. Here shredded aluminum cans arrive by rail at a Reynolds Aluminum reclamation plant. The cans will be off-loaded and fed into a furnace for melting.

Over time, virgin resin capacity may diminish. Low prices may force some producers out of business, leading to a balance of supply and demand and to higher and more stable prices for virgin polyethylene. However, this cannot come soon enough for recycling programs that are recovering PCR. Weak PCR markets are straining municipal recycling budgets and challenging officials to find more cost-effective collection and processing systems. Some industry analysts predict that it could be several years before the price cycles of PCR and virgin plastic reverse themselves.

Old Newspapers

Despite being a principal target of market development efforts, even old newspapers cannot seem to clear their market impasse. There has been a notable time lag in some regions of the country between market demand and the growing supply of recovered newspapers.

Since 1988, when recycling began to take hold as a primary solid waste

management strategy, the recovery rate for newspapers has increased by nearly 50 percent nationally. Although some markets, such as recycled newsprint mills, exports, and animal bedding, did emerge in response to this additional supply, the price of recyclable newspapers bottomed out in 1989. As is common in the recyclables marketplace, some regions have fared better than others. (See graph.)

West Coast processors of recovered newspaper receive, on average, $30 to $40 per ton more for their material than their counterparts in the Northeast. Due to their shipping proximity to markets in the Far East, where fiber supplies are sometimes short, West Coast suppliers benefit from a relatively stable export market. More importantly, newsprint mills in the Northwestern United States and in Western Canada have recently added significant processing capacity for old newspapers, creating a strong market for wastepaper. Eight deinking facilities, capable of removing ink and other contaminants and converting the paper to pulp for use in making new newsprint, are now operating in the region.

These investments in recycling capacity were spurred by two factors. First, federal regulations protecting spotted owl habitat in the Northwest restricted logging and increased the price of wood chips, causing paper mills to consider recycled production inputs as a way to contain raw material costs. Second, in 1989, California enacted legislation requiring all state newspapers to incorporate increasing levels of recycled content; newsprint producers who wanted to sell their product in the biggest market in the region had to have access to deinking capability.

Similar laws and voluntary agreements encouraging the purchase of recycled newsprint are in existence in 21 other states and the District of Columbia. Nevertheless, while these policies are having a significant impact on recycled newsprint investment decisions, regional market gaps continue to exist between deinking facilities coming on-line and the growing supply of recovered newspapers.

State governments in the Northeast and Midwest, for example, facing a possible shortage of disposal capacity, used aggressive solid waste legislation to stimulate the recovery of old newspapers. However, the majority of this originated from Canadian sources, and the Canadian companies are just now beginning to bring the capacity on-line that will allow them to take back their used product. As a result, the market is currently so saturated with recovered newspapers in some parts of the Northeast that suppliers are having to pay to move their material. On the bright side, the market for old newspapers seems poised to turn around even in these troubled regions.

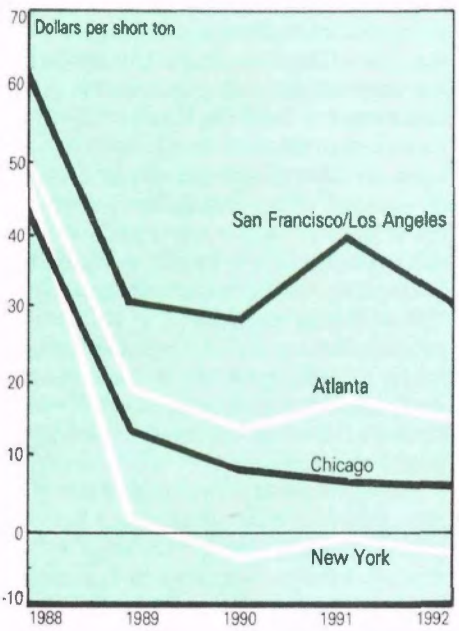
In order for a market to exist for recyclables, a number of ingredients must be present . . . .

Over the next four years, significant growth is projected in the capacity of newsprint manufacturers to consume old newspapers. Seven new deinking facilities that could potentially take recovered newspapers from the Midwest and Northeast are scheduled to be in operation by 1996, bringing the total number in Eastern North America to 20. If all these planned facilities begin operation, they will increase the current demand by over one million tons. Some analysts predict that this new demand will drive up the price of high quality recovered newspapers to as much as $60 a ton by 1994.

Ingredients for a Recyclables Market

These three examples illustrate the interaction of a number of forces that shape the market for recyclables. One obvious commonality is the impact of international market dynamics on the demand for domestically generated recyclables. Developments abroad, such as low prices for materials that recyclables compete with (virgin plastics) and the packaging choices of foreign importers (green bottles), influence domestic markets. Reciprocally, large increases in the

Pricing for Old Newspapers 1988 - 1992



Source: Northeast Recycling Council. Prices for 1992 represent first quarter prices only.

supply of recovered material in this country, often exceeding domestic demand, fuel increases in the export of recyclables, as seen by the growth of recovered newspaper shipments from the West Coast to markets in the Far East.

Also common to the examples cited above are supply and demand dislocations that lead to notable differences in the market status for some recyclables in different geographic areas of the country. Each region has a unique demographic and industrial makeup. For some, large markets exist virtually in the backyard (recycled newsprint mills in the Northwest); for others, supply consistently outstrips demand. Frequently, shipping materials to where they are needed is the biggest obstacle facing recyclable suppliers.

These examples provide a useful framework for understanding how markets are created. In order for a market to exist for recyclables, a number of ingredients must be present; however, there is no prescribed sequence for blending these ingredients. For one thing, there needs to be an identifiable source and supply of material. Then, systems to extract materials from the waste stream and deliver them in a specified quantity and quality will be required. A facility that is able to accept and re-manufacture the recovered material into a saleable form is also necessary. And, there must be an existing or potential demand for the finished product.

For some recyclables, markets emerge because of signals from the pricing system. Companies benefit directly from reduced production costs by recycling used materials into new products. The supply of material is pulled from the waste stream and delivered to production facilities through an existing pricing structure that provides an economic incentive to do so. For instance, using recovered glass to make new containers saves glass manufacturers in raw material, energy, and equipment replacement costs.

Experts predict that the next four years will bring significant growth in the capacity of newsprint manufacturers to consume old newspapers.

Similar market forces are set into motion by consumer demand for products manufactured with recovered materials. By exercising a preference for recycled goods, consumers can provide the economic impetus for companies to seek supplies of recyclable material. In response to consumer demand for recycled packaging, two major soft drink companies are now using recovered plastic in the production of their bottles.

The creation of other markets is supply driven. Significant financial and policy commitment to the development of infrastructures with the capability to recover materials from the waste stream is often matched by capital investment in the manufacturing capacity needed to convert those materials into new products. One element that stimulated growth in the market for recovered newspapers in many areas was the existence of a well-developed collection and processing system. Manufacturers are more willing to invest in recycling capabilities once recovery programs have developed a track record for meeting quantity and quality requirements.

In the absence of traditional marketplace incentives, government can intervene to encourage firms to use more recovered materials in their production processes. The California recycled content law for newsprint was a significant force behind the

Mike Brisson photo.

development of strong markets for old newspapers in the region.

Current Marketplace Distortions

Clearly, recycling has had many success stories. Genuine long-term commitments are being made by governments and businesses alike. Unprecedented quantities of materials are completing the recycling "loop," conserving valuable resources, and enhancing the quality of the environment. Given the relative inexperience of many markets for recyclables, especially in handling the tremendous supply of materials now being generated, volatilities are to be expected. Evolution takes time. Yet, despite the concerted efforts of both public and private sectors, there remain some basic distortions that need to be addressed by policy makers.

The way in which costs are allocated in the current economic system makes it difficult for most firms to realize monetary benefits by using recyclable (instead of virgin) materials, or by ensuring that their products can be recovered and recycled at high rates. A number of factors contribute to these inconsistent signals from the marketplace; they include a set of market flaws and policies that, in effect, fail to hold companies and consumers accountable for the financial and social costs of packaging and products once they have been discarded as waste.

Two primary factors lead to these distortions. First, the current price system fails to internalize waste management costs in a product's price, thus passing the costs to society as a whole. Second, public finance practices consistently undervalue the price of waste disposal, limiting the ability of recycling programs to realize the full savings associated with diverting waste from disposal.

One approach currently being explored by a number of state legislatures to internalize solid waste management costs is to attach advanced disposal fees to packages and products based on their impact on the environment and on the cost of managing them after they have been discarded. Volume-based garbage collection fees and virgin material fees are two other methods being suggested. The former attempts to charge individuals on the basis of the amount of garbage they set out for collection. By making individuals directly responsible for the amount of garbage they generate, these fees encourage recycling and source reduction. Conversely, the latter is a fee imposed on all materials at the level of primary processing.

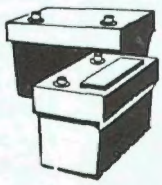
Under one approach being considered, the fee would be paid directly by the processor on the basis of tons of virgin materials used as a percentage of finished products shipped. Products imported into the United States would be charged a similar fee at the point of introduction into the economy. Monies generated from the fee could be reallocated to states for their use in developing solid-waste-management infrastructure, including recycling facilities.

Addressing the second market distortion, the underpricing of waste disposal, will necessitate a similar reflection of costs in public finance decisions. One possible way of adjusting disposal charges to more accurately reflect their true costs to society is to levy a tipping fee surcharge on the amount of waste disposed of at a landfill, transfer station, mass burn incinerator (where undifferentiated, unprocessed garbage is burned), or other waste management facility. This fee could be assessed not only to generate revenue for operating recycling and source reduction programs, but also to increase the cost of least preferred methods of waste management, thereby encouraging the use of preferred methods.

Some forces that are creating bottlenecks in the recycling loop cannot be easily controlled using traditional policy tools. Influencing the international marketplace and altering the regional industrial makeup of this country are, for the most part, unrealistic options. But recycling can succeed on the grand scale envisioned by many if the two market distortions addressed above are corrected. The playing field on which recyclable materials vie for market share with virgin materials must be leveled. Recycling must be allowed to compete on equal footing with other solid waste management options. Only then will recycling reach its full potential. □

Recyclables Market Basket

Fifty-four percent of all *aluminum* containers and packaging are recovered for recycling. The overall recovery rate for aluminum is 38.1 percent. The markets for scrap aluminum are strong. Almost all the aluminum collected is used to make new cans.



About 96 percent of automotive batteries are recovered each year. Although these lead-acid batteries constitute a small portion of the MSW stream, they contain metals that may be a concern when disposed of in landfills and combustors. All three components of automotive batteries are recyclable: the lead, the acid, and the plastic casing.

About 22 percent of all *glass* beverage containers are recovered. Glass has an overall recovery rate of 19.9 percent. Glass manufacturers typically use 30 percent of crushed glass (known as "cullet") along with raw materials to make new glass. Cullet also can be used as an aggregate in road building.

Paper has an overall recovery rate of 28.6 percent. About 48 percent of corrugated boxes, 42.5 percent of newspapers, 10.3 percent of books, 10.7 percent of magazines, and 26.5 percent of office papers are currently recovered for recycling. At times, market supply for some recovered paper products, such as newsprint, has exceeded the capacity of mills to use the materials. Markets for recycled paper products, however, are generally stable and expanding as more mills build new deinking facilities to process waste paper and as the demand for recycled paper products grows. Significant new capacity will be on line by 1994. Paper is recycled into paper products, paperboard products, and construction products.

Source: U.S. EPA's Characterization of Municipal Solid Waste in the United States: 1992 Update. *Office of Solid Waste and Emergency Response. Data are from 1990.*

About 2.2 percent of all *plastics* are currently recovered for recycling. Plastics' share of the waste stream is growing by weight and volume. Most plastics that end up in the waste stream are from packaging and containers. Plastics recycling has increased dramatically over the past two years. Products made from recycled plastic include drainage pipes, toys, carpet, filler for pillows and sleeping bags, and cassette casings.

Annually, 11.6 percent of scrap *tires* are recovered. Scrap used tires are difficult to dispose of in landfills and waste combustors. An estimated 2 billion to 3 billion are currently stockpiled. These stockpiles can provide convenient habitats for rodents, serve as breeding grounds for mosquitos, and pose fire hazards. Of the scrap tires that are used, most are burned for energy. Scrap tires also are used for rubberized asphalt paving, molded rubber products, and athletic surfaces.

Sixty-seven percent of all *used oil* is recovered (900 million gallons). Only 10 percent of the amount generated by people who change their own motor oil is returned to collection programs. If disposed of improperly (i.e., poured down sewage drains), used oil can contaminate soil, ground water, and surface water. In some communities, used motor oil is collected at service stations, corporate or municipal collection sites, or at the curbside.

Each year, 4.2 percent of *yard trimmings* are composted. Yard trimmings can be transformed into compost for homeowners, farmers, public agencies, landscapers, and nurseries. Grass clippings can be beneficial when left on the lawn.

A "Cradle to Cradle" Debate in Congress

Recycling is high on the agenda

by Julie C. Becker

When the Resource Conservation and Recovery Act (RCRA) was first enacted in 1976, it was hailed as a "cradle to grave" program—a means of controlling wastes from generation to disposal. The Act prohibited indiscriminate dumping of hazardous wastes and directed EPA to regulate their generation, transportation, and disposal. Eight years later, recognizing that there were gaps in this "cradle to grave" scheme, Congress returned to the drawing board. The Hazardous and Solid Waste Amendments of 1984 added new programs to the RCRA agenda: underground storage tanks, "corrective action" to clean up RCRA-regulated facilities, tighter control of small quantity generators, and a ban on land disposal of certain wastes, to name a few.

Now RCRA is due to be reauthorized, giving Congress yet another bite at the apple. This time recycling is high on the agenda, as Congress strives to shift the focus of RCRA from disposal to recycling and waste reduction. On the floor of the House and Senate, recycling has been discussed over 600 times since the beginning of 1991. The issues are simple, yet challenging.

Making Space In Local Landfills

Currently, only 17 percent of municipal solid waste is recovered for recycling. Most of the remaining waste is sent to landfills. However, landfills in many communities are closing down because they cannot meet federal or state environmental standards. In most cases this means sending wastes to a larger regional landfill at another location, often in the face of opposition from the receiving community (recall the "garbage barge" fiasco and the more recent story of the "poo-poo choo-choo"). In turn, sanitation costs rise as local governments strive to pay for shipping municipal wastes to regional disposal facilities.

One proposal aimed at preserving landfill space and reducing sanitation fees is a nationwide "bottle bill" requiring bottlers to establish deposit-refund systems for bottles and cans, which make up about 4 percent of household waste. The plan would be similar to the deposit-refund programs now in effect in New Hampshire, Vermont, and eight other states. Also up for discussion is a bill that would put states, rather than bottlers, in charge: Each state would be required to assure, through any means it selected, that a set percentage of its beverage containers were recycled. States failing to meet the recycling goal would then be required to impose a 10-cents-per-bottle deposit.

Bottle bill proponents, including the National Association of Counties and the National League of Cities, argue that a bottle bill would substantially reduce the cost of waste management to municipalities. Opponents, led by the bottling industry, claim that a national bottle bill would harm local curbside recycling programs while addressing only a small fraction of the problem.

Creating Markets

It doesn't do any good to collect newspapers, glass, plastic, and aluminum for recycling unless someone is willing to purchase these materials. Today's lack of demand for recycled products is clearly a problem.

In Congressional hearings, recycling industry representatives have warned that the market for recycled products will hit a "brick wall" unless demand improves and prices rise. They have

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urged Congress to "close the loop" by taking action to boost the market for these products. Proposals include:

- *Requiring the manufacturers of paper, glass, plastic, and aluminum to replace a portion of the virgin materials they use with recycled materials.* This would shift some of the burden of recycling from the municipalities, which claim to have been saddled with the cost and burden of recycling, back "upstream" to the manufacturing sector.

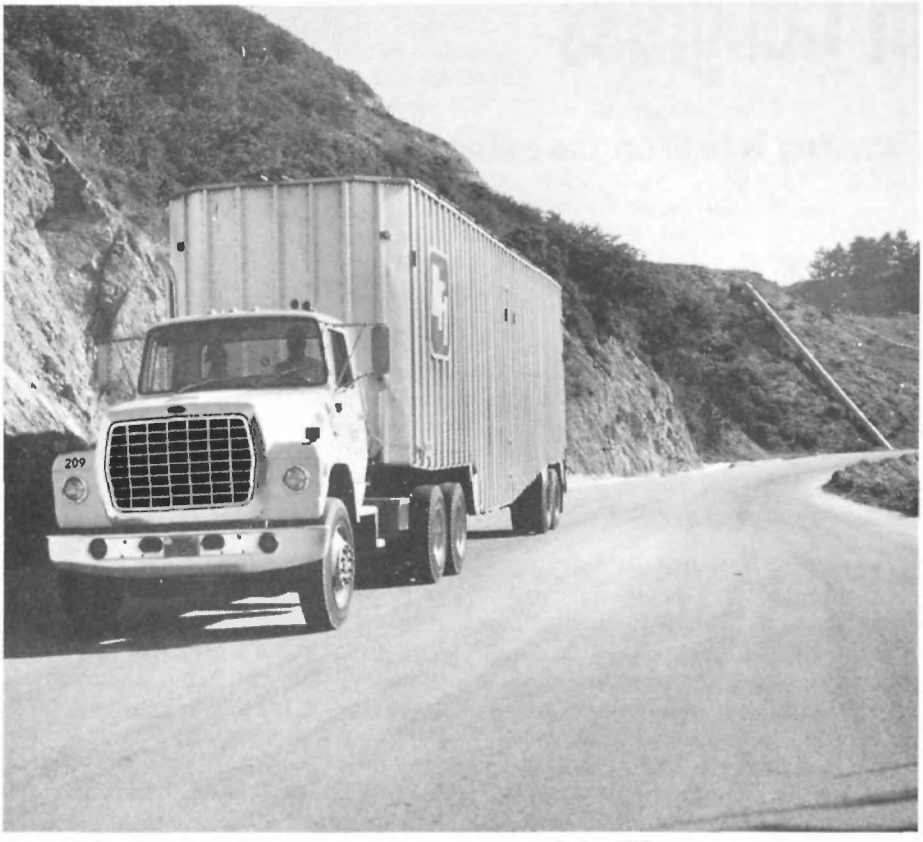
One version of this proposal that is popular among packaging manufacturers is to allow companies several options to what is traditionally considered recycling. For instance, rather than setting up a recycling program, the manufacturer could make reusable or refillable containers or redesign its containers to reduce their volume and weight.

Another approach supported by packaging manufacturers is to create a system of marketable recycling and waste reduction "credits." Under the "credit" scheme, a company that does more than is required by law would receive marketable recycling "credits." Companies that do not meet federal recycling and waste minimization standards would be required to purchase enough "credits" from their competitors to make up the difference.

- *Changing federal procurement standards.* With 7,000 buildings under its jurisdiction, the General Services Administration (GSA) is one of the country's largest paper consumers. However, current federal government specifications favor the use of virgin materials. Proposed RCRA amendments would direct EPA to work with other federal agencies, including the GSA, to draft new purchasing standards which favor the purchase of recycled paper and other office products, as well as plastics and rubber products (including asphalt pavement containing rubber derived from waste tires). These new standards would assure that the federal government becomes a major consumer of recycled goods.

- *Establishing a national recycling clearinghouse to provide information on recycling technologies and regulations.* The clearinghouse would also maintain a database designed to match those who generate recycled materials with manufacturers who can use the materials.

Already, private industry throughout the United States and Canada has established regional networks for exchanging industrial wastes such as scrap metals and spent solvents. These "waste exchanges" could serve as a model for EPA in designing a national waste exchange network which would include municipal waste.



Browning-Ferris Industries photo.

Many federal proposals are aimed at conserving room in landfills. Scarce landfill space has left some communities no option but to transport their wastes to other regions—often incurring steep transport costs and the ire of people in the receiving communities.

"Green" Advertising

A trip to the grocery store shows why advertising has become a hot issue in the RCRA debate. The labels may claim that the plastic, cardboard, or other packaging on the products we buy, as well as the products themselves, are "recyclable," "environmentally friendly," "ozone safe," or "biodegradable." However, until recently, there were no federal guidelines for this type of labeling, making it difficult to tell whether products lived up to their marketing claims.

One result of the RCRA debate has been to focus national attention on the need to regulate environmental advertising. In late July 1992, the

Federal Trade Commission, with the help of EPA, announced new guidelines to prevent the use of misleading environmental marketing claims. These new guidelines define a number of "green" terms—"recyclable," "refillable," "biodegradable," etc.—and are intended to discourage companies from using these terms in a misleading or deceptive way (see box on page 10).

Sham Recycling

Although recycling is on the upswing, recyclers claim that even more recovery of recyclable materials would take place if the regulations governing these activities were simplified. One of the trickiest issues facing Congress is how to encourage valid recycling efforts while preventing "sham" recyclers from polluting the soil and ground water. This is no small concern. In the past, many companies which called themselves "recyclers" indiscriminately dumped the wastes they collected—and then went out of business, leaving behind scores of severely contaminated sites.

One proposal for keeping an eye on recyclers (while reducing the regulatory burden) is to develop a tiered permit program. Construction and operating standards, reporting requirements, and government inspections would be based on the types of materials being recycled and the risk of environmental damage if these materials are managed incorrectly.

Batteries, Tires, Oil, and Appliances

Some specific waste disposal problems are serious enough to merit special consideration on Capitol Hill. This year, "top billing" has gone to four types of wastes generated in virtually every household: lead-acid batteries, used tires, used oil, and old appliances.

Indeed, these four wastes alone have the potential to do substantial damage to our surroundings. Many of the 70 million used lead-acid batteries disposed of each year contaminate ground water. Most of the 250 million scrap tires generated each year end up in local tire piles, where they become fire hazards, threats to the air and ground water, and vectors for the spread of disease. Forty percent of the one billion gallons of used oil generated each year goes into landfills, sewers, and storm drains, threatening water supplies: A single quart of used oil can contaminate 250,000 gallons of drinking water. Used appliances leak ozone-depleting refrigerants into the atmosphere and fill up valuable landfill space.

Recognizing that municipal governments are often ill-equipped to deal with these wastes, Congress has considered several ways of shifting responsibility. One idea, for instance, is to require businesses to establish "take-it-back" programs to assure that these products do not end up in landfills or incinerators. Recycling may also be encouraged by an outright ban on the incineration or land disposal of tires and lead-acid batteries, and by developing a less burdensome regulatory program than currently exists for the recyclers of used oil.

Whether or not RCRA is amended in 1992, the trend is clear: Congress will eventually pass a bill that includes a comprehensive federal program to encourage recycling, sets standards for "green" advertising, and protects against "sham" recyclers. We will all be encouraged to recycle problematic household wastes such as used oil and tires, spent batteries, and old appliances. Municipal governments, states, recyclers, the packaging and bottling industries, and others will be watching closely to see who bears the cost and responsibility for making all of this happen.

Even after it is finally reauthorized, the new RCRA bill will take years to implement. Nevertheless, when RCRA becomes a "cradle-to-cradle" law, with programs for the reuse of waste materials, our chances for successful and long-term recycling will be much improved. □

Cartoon by Schwadron. Reprinted with permission.

Urgent Responses by the States

by Eugene J. Wingerter

Legislatures try demand-oriented initiatives

Over the past few years, states have legislated recycling goals as high as 50 percent of their waste stream. The clock is ticking toward those statutory deadlines, and most states aren't even close. The question is, How do we get there from here?

As discussed elsewhere in this issue of *EPA Journal*, recycling does not happen—the loop is not closed—until collected material is processed, manufactured into a new product, and sold. Without this sequence of steps, recyclables can sit in warehouses or find their way to landfills. Mandatory curbside collection programs across the United States have flooded the newspaper market. Many communities have had to pay to have the material taken away. The nation also faces gluts of green glass, plastics, and office paper.

Many state and municipal recycling authorities are searching for the same thing: markets for the recyclable material they are collecting. Small wonder that state legislatures are now stressing market development in their recycling laws.

State laws to help develop markets take several approaches:

- Minimum levels of recycled content in newsprint and other products
- Requirements that the state buy recycled products, even if they are more expensive than comparable products of virgin material
- Tax credits/incentives and grants
- Recycling market development boards or offices.

In 1991, seven states passed minimum content legislation. North Carolina, Oregon, Rhode Island, and Texas passed laws requiring post-consumer content in newsprint at levels ranging from 7.5 to 40 percent; West Virginia required "the highest practicable content." The year before, seven states had passed recycled content laws for newsprint. In addition, Maryland and Oregon passed minimum recycled content requirements for telephone directories in 1991.

Oregon imposed a minimum content requirement on glass containers; California, on fiberglass insulation. Both states set recycled content requirements on rigid plastic as one of four options available to plastics packagers to achieve waste reduction goals.

While Oregon's law encourages the use of recycled plastic, it also recognizes that sometimes recycling is just not economically feasible. The law requires that, by 1995, all rigid plastic packaging must either be reusable five times, 10-percent source reduced, recycled at a 25-percent rate, or contain 25 percent post-consumer content. Some of these options could develop recycling markets. However, the law also says that counties have to pick up plastic only if markets are "stable" and are paying at least 75 percent of collection costs. In other words, the statute recognizes that supply could outstrip demand, and, with no takers, there's no point in spending money to collect the material. Also, Oregon is paying attention to collection, processing, and transportation costs, stipulating that recyclers should not be forced to collect something that is not cost-effective.

This feasibility threshold is important, because today's sorely stretched state and municipal budgets cannot afford a hemorrhage from recycling losses.

Another way to develop a market is to become a customer. States are legislating themselves into becoming larger purchasers of recycled-content goods. Every state now has legislation encouraging state agencies to buy paper with recycled content. Twenty-seven states apply a price preference to paper with secondary content; the preference usually amounts to 5 to 10 percent more than the price of competing virgin paper. Fourteen states require "set-asides": In other words, a certain percentage of their paper purchases must be paper with recycled content. One of the most ambitious laws is a new Arkansas statute setting a 60-percent set-aside for paper by the year 2000. Twelve states have both price preferences and set-asides. Scores of city and county governments have set their own "buy recycled" policies as well.

In addition to paper, states are increasingly looking at procurement requirements for other products. For example, California extends price preferences to compost, glass, oil, solvent, paint, tires, and glass products. Maine requires compost to be used on all public land maintenance and landfill closure projects that use state funds. Several states are using—or studying the use of—recycled materials in road maintenance: crushed glass to make "glasphalt" or scrap tires to make rubberized asphalt.

Other state aids to recycling include tax credits and grants to support the use of recycled materials. In 1991, seven states—Arkansas, Colorado,

(Wingerter is the Executive Director/CEO of the National Solid Wastes Management Association. The association, with over 2,500 members, serves the private-sector waste management industry in North America.)

Maine Waste Management Agency photo.

Washington County, Maine, composts blueberry waste, horse bedding, and wood ash. Maine requires that compost be used for all public land maintenance.

Illinois, Louisiana, Montana, New Mexico, and Oklahoma—passed laws allowing tax credits for the use of post-consumer materials in manufacturing. In addition, Montana's law allows an additional tax deduction of up to 5 percent from taxable income for the purchase of recycled material that is a business-related expense. A total of 21 states now offer tax incentives for recycling.

Also, some state recycling grants can be applied to the demand side of the equation. In at least 17 states, grants may be used to invest in the manufacture of recycled products. Arkansas, California, Illinois, Michigan, Missouri, Nebraska, and Oregon offer grants that can be used for market development.

To supply more direct assistance, Arkansas, Illinois, Mississippi, Oregon, South Carolina, Tennessee, Washington, and West Virginia passed laws last year creating advisory councils to aid in market development. The scope of the mandates varies widely. West Virginia's council deals only with recycled newsprint; Washington's targets mixed paper, glass, tires, compost, and plastics. The Clean Washington Center represents a legislative upgrading of the previously created Washington Committee for Recycling Markets. Its activities include funding demonstration projects and providing technical assistance and feasibility studies.

Market development initiatives can come from state governors as well as from legislatures. For example, Florida Governor Lawton Chiles recently created a recycling plan with a unique closed-loop marketing strategy. Under this plan, the state would buy certain products only from designated recycling business ventures. These groups, comprising haulers, processors, and manufacturers of recycled goods, would bid competitively both to remove specific recyclables from state institutions and to sell the recycled products back to the state.

States are also demonstrating how cooperative purchases can increase their recycled buying power. Banding together to boost demand for recycled paper, the Council of Great Lakes Governors, through its Great Lakes Recycling program, will acquire 30 million pounds of recycled copy paper at an estimated cost of $13 million. According to a spokesman for the council, the program, which was announced this summer, "shows business that government can be a serious consumer." At the same time, the scale of this cooperative effort will realize significant savings for the individual states: Indiana, Minnesota, Pennsylvania, New York, Illinois, Michigan, Wisconsin, Ohio, and South Dakota.

Finally, new and substantial recycling markets are likely to develop as new uses for recyclables are sanctioned by standards-setting industry groups. This year, at the urging of the New Jersey Department of Environmental Protection (DEP), the National Association of Plumbing-Heating-Cooling Contractors changed its widely used National Standard Plumbing Code to permit the use of 3/4-inch crushed glass as fill in laying French drains around perimeter walls of buildings. (Mixed-color crushed glass is otherwise of no value and has to be landfilled in many cases.) Because scores of federal agencies, states, and localities use this code or model their own codes on it, the change could soon have a widespread effect.

According to a spokesman for the New Jersey DEP, the code change will create an important market for the 45,000 tons of crushed mixed-color glass generated in the state each year. Other changes in construction codes could further expand the use of crushed glass as an aggregate fill around subsoil culverts, pipes, and drains.

These demand-oriented initiatives are just in their early stages; it's too soon to see results. As state and municipal officials gain more experience with recycling, the economic and feasibility challenges become clearer. Market demand and cost effectiveness are major requirements. State laws and executive programs keyed to these concerns will help recycling succeed. □

From Lumber to Lampshades

Young businesses put recyclables to new uses

by Kathrin Day Lassila

Will they sell? Eco Sneaks, made by Deja, Inc., are made from used textiles, rubber products, and other post-consumer waste.

Deja, Inc. photo.

The Daily Planet, a mail-order catalog company targeting the young and progressive, used to sell papier-mache bracelets sculpted from wastepaper and earrings made out of fishing line collected on the beach. Unfortunately, the bracelets tended to lumpiness and the earrings looked like nothing so much as coils of fishing line, and the overall effect was more environmental than ornamental. "We haven't sold them for two years now," says the company's manager.

Wastepaper bracelets and fishing-line earrings epitomize a concern felt by some seasoned recycling advocates: Americans will judge the potential of recycling by a few creative but economically insignificant products, dismiss the entire concept as a fad, and continue burying and burning valuable materials as if there were no tomorrow.

"The key to ending the solid waste glut isn't innovation," says Allen Hershkowitz, a senior scientist at the Natural Resources Defense Council. "It's mainstreaming. What we need are federal standards for post-consumer content in high-volume products like paper and packaging."

But if innovation is only a supporting player on the national recycling stage, it plays a starring role in dozens, or perhaps hundreds, of small-scale operations springing up all over the country. These young businesses—which run the gamut from light industry to cottage industry—are putting recyclables to new and sometimes unusual uses. An Oregon woman founded Deja Inc., to manufacture Deja Shoes from used textiles, rubber products, and other post-consumer waste. Turtle Plastics in Cleveland, Ohio, turns used swimming pool liners and scrap automobile trim into industrial floor matting and urinal screens. Earth Partners, based in Oregon, plans to make newsprint into floor paneling material and molded panels for hollow-core doors.

None of these entrepreneurs, or their fellow venturers around the United States, is likely to take issue with the need for mainstreaming. But they are seeing concrete local benefits from the innovative use of recyclables: small but tangible quantities of material kept out of landfills; new economic niches that create jobs in their communities.

One organization, Bronx 2000 of New York City, has turned to recycling and recyclables specifically as a means of furthering its community development mission. The 12-year-old nonprofit group has set up 10 recycling companies around the country, and is now launching a new venture to recycle wooden pallets and skids used to stack shipped goods for storage and transportation. According to president David Muchnick, half the hardwood used in the United States (including a generous proportion of oak) goes into pallets, and half of these in turn are destined for one-way trips that generally end in a landfill or incinerator.

Bronx 2000 will have a prototype factory on line by early fall to grade pallet wood, turn the best grades into high-quality butcher-block furniture, and sell the rest back to pallet manufacturers and to deforested tropical countries. Within two years, Muchnick plans to train 100 inner-city youths, and to spin off the factory as an independent commercial venture and a model to be replicated in other communities.

But it is as economic ventures that recyclable-based businesses are most vulnerable. Innovation in business invariably involves risk, and entrepreneurs who use recyclables

(Lassila is Director of Publications at the Natural Resources Defense Council (NRDC). This article represents her own views and not necessarily those of the NRDC.)

have more to contend with than most. To the usual list of startup hurdles they must add the uncertainties and flaws still impeding the supply of recycled materials.

U-Save Tire Recyclers, for example, proved to be an environmental idea whose time had not yet come. U-Save was established in Massachusetts to manufacture "Flash," a children's playground swing in the shape of a horse. Flash was "very successful as a product," its founder says, generating inquiries every week and ultimately selling about 10,000 copies over the year and a half of U-Save's life. But with no uniformity or standards governing the quality of the raw material, Flash's production was impossible to automate and too labor-intensive to yield a workable profit margin.

Chicago Art Glass and Jewels, Inc., in Plymouth, Wisconsin, is dealing with problems in its own post-consumer supply by developing a new product tailored to the material. The company currently sells over 600 products, from faceted glass "jewels" used in stained-glass windows to vases and lily-shaped lampshades. Although it reuses all its own industrial scrap and uses post-consumer bottle glass in several items, most of its products are too delicate to tolerate a sizable proportion of the lower-quality post-consumer glass. However, owners Debra and Ray Selk recently developed a glass tile that can incorporate a much higher post-consumer percentage. Theirs was the only glass exhibit out of 500 entries in a major international tile show this summer, and the interest it received has encouraged the Selks to move ahead with a second line in glass tile that will likely expand their workforce from 12 to 18. "Everybody in business knows there's always a problem with post-consumer waste," says Ray, "and if you're working in that direction, you'd better make some commitments to be innovative."

Both Bronx 2000 and Chicago Art Glass have put substantial energies into careful product development. Sometimes, a handy supply of recyclables can lure a company into skipping this step. Mary Kohrell, who helps put recyclers in touch with potential buyers through the Wisconsin Cooperative Extension Service, has seen it happen several times. "For a couple of months last year," she says, "I was getting a call once a week from some company saying, 'I want to make plastic lumber because I know I can get a supply.' They were putting their marketing principles backwards. Success depends on planning."

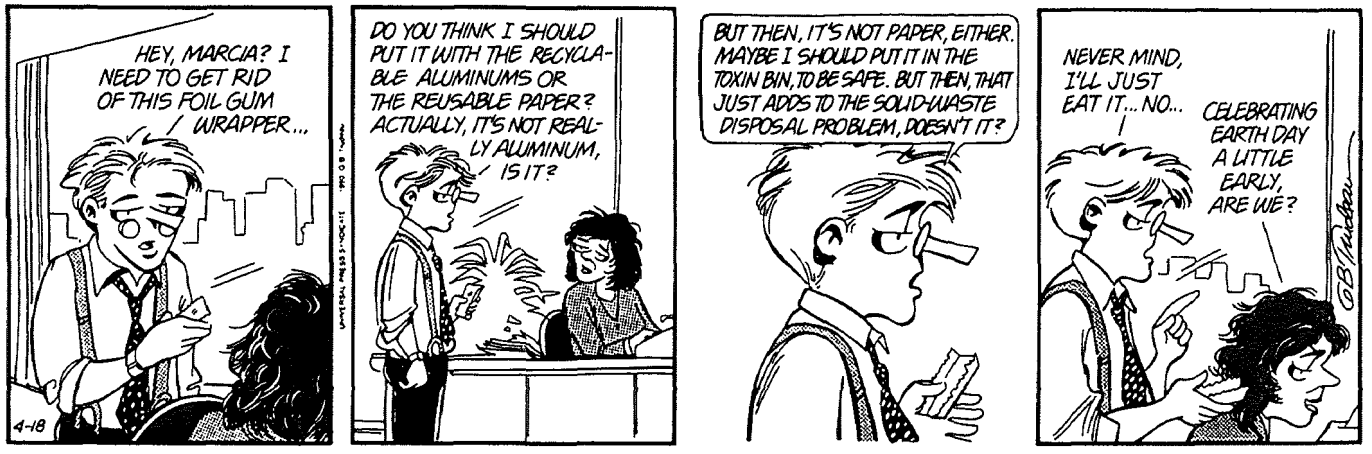
One company that Kohrell believes has done its planning homework well enough to succeed with plastic lumber is the three-year-old Recycled Plastics Industries in Green Bay, Wisconsin. Its president, Lee Anderson, states the company's guiding principle this way: "The trick is to not let the variables control the show. You have to control the variables to the best of your ability." There are several dozen plastic lumber facilities in the country that use a random mix of plastics in their product, but Recycled Plastics is one of a handful that restrict their raw materials to the high-density polyethylene used in milk jugs, bleach bottles, soap bottles, and similar containers. The result, Anderson claims, is a more homogeneous, high-performance product, tougher than wood and bacteria-resistant. The result of a more dependable product is a more dependable demand. Recycled Plastics is still a small operation, but it sells to food warehouses, paper mills, park and recreation departments, and manufacturers of reusable pallets, and demand is growing constantly.

If these companies are any indication, entrepreneurs in recyclables have healthy ambitions. Chicago Art Glass has doubled its sales every year over its three-year life. Recycled Plastics Industries recently turned down a bid to produce a million pallets a month for 36 months, simply because it could not yet handle the volume. Earth Partners aims eventually to have 50 plants, each handling 100 tons of newsprint a day.

Clearly, these fledgling entrepreneurs don't divert a large part of the waste stream. But perhaps the trick may be to last long enough and do well enough to graduate from "innovative" to "mainstream." After all, even the horseless carriage and the electric candle were innovations in their day. □

Doonesbury

BY GARRY TRUDEAU



A Forum: Will the U.S. Recycling Approach

Is the nation on the right track in its approach to recycling? EPA Journal posed this question to two observers who have been actively involved in municipal solid waste issues. The question is wide open to controversy, as their commentaries, printed below, indicate:

Lynn Scarlett

(Scarlett is Vice President of Research for the Reason Foundation, a nonprofit public-policy think tank in Los Angeles, California.)

No doubt about it, Americans throw out a lot of stuff—about 4.3 pounds per person each day of what we call municipal solid waste.

Five years ago, watching the peripatetic garbage barge from Islip, New York, search in vain for a destination—a place to offload its dubious cargo—Americans abruptly began worrying about trash. Would we soon be buried in waste? And how could we stem the tide?

Recycling, long practiced to a modest extent, loomed large as an answer—a way of turning trash into treasure, diverting discards away from disposal facilities, and averting a crisis. By 1992, at least 38 states had established recycling goals or mandates. Local governments had set up over 4,000 curbside recycling programs. And recycling collection programs were diverting some 17 percent of the municipal waste stream, up from barely 10 percent just a few years earlier.

A success story? Partly. Can we reach even higher levels of recycling? Probably. But are we on the right track? Will mandated recycling and prescriptive packaging regulations designed to "create markets" for recyclables serve us well? Specifically, will the current legislative push to enshrine recycling as the preferred approach (apart from source reduction) to handling discards improve our environment? Will it save resources or improve waste management? And at what cost?

Some recycling makes sense. And in some locations—those close to recyclable markets, or where disposal costs are high—a lot of recycling makes sense.

Take aluminum cans. Making new cans from recycled aluminum takes 95 percent less energy than fashioning aluminum out of bauxite. And the cans are light, easily crushed, and, thus, easily transported—even long distances—to smelters. In short, the collection and transportation process consumes fewer resources than are saved in energy and raw materials consumption at the smelter. This means aluminum recycling makes economic (and, not incidentally) environmental sense.

The same can be said of some glass, plastic, wastepaper, and other metal recycling. But the critical word is "some." Whether such efforts make sense depends, critically, on location and on comparative costs of available alternatives for waste disposal.

As with aluminum, it generally takes less energy to make glass or newsprint using recycled materials than using virgin materials. But for glass and newsprint these energy savings are more modest—sometimes so modest that collecting and transporting the recycled material actually consumes more energy than can be conserved in the manufacturing process. And, in the case of paper, recycling can involve shifts away from renewable (wood residue) fuel to fossil fuels, with important cost implications.

One European study of wastepaper recycling, looking at total energy consumption under three scenarios—maximum recycling, selective recycling, and zero recycling with wastepaper incineration—concluded that overall fuel inputs were actually greater in the maximum recycling case than in the zero recycling case.

Mandated by law, recycling becomes an end in itself. It should, however, be viewed as a means to a broader end—the efficient use of resources, including labor, energy, capital, and raw materials. Sometimes—with some materials and in some locations—recycling achieves this end; other times not.

One-size-fits-all legislation ignores this caution. And mandatory use of recyclables—an effort to artificially "create markets"—limits the ability of

manufacturers to respond flexibly to particular costs and constraints. Ignoring these constraints, through prescriptive packaging regulations, results in unintended consequences. And that can mean higher costs to consumers and greater resource consumption.

The devil, as the saying goes, is in the details. Consider a few examples. Increasing recycled content in paperboard from 10 or 15 percent to over 30 percent will reduce the container's strength. Achieving similar strength requires additional inputs of total fiber. In fact, the container with less recycled content uses 20 percent less total fiber than a comparable container with high recycled fiber content. The same tradeoff occurs with plastic bags: More recycled plastic content means less bag strength, thus requiring a thicker bag to achieve similar strength characteristics.

But resource conservation in manufacturing processes is not the only justification for recycling. Indeed, much recent recycling was pursued, primarily, to conserve landfill space, reduce waste management costs, and avoid the perceived harms associated with landfilling and incineration.

Here the case for mandating recycling has been overstated—and waste management needs have been misperceived. The United States is not "running out of landfill space." Though the total number of municipal landfills has declined from over 18,000 to less than 6,000, two points are worth noting.

First, new landfills are on average four times larger than those they are replacing, so we should expect total absolute numbers of landfills to decline. Second, Gonzaga University economist Clark Wiseman has calculated that all of the municipal waste produced in the United States over the next 1,000 years could fit into a space covering less than 0.1 percent of the continental United States. No, we wouldn't site such a mega-landfill. But Wiseman's calculation puts into perspective the fear that we will soon be overrun by landfills.

Moreover, notwithstanding cost increases in the 1980s for most U.S. regions, traditional waste collection and landfilling remains less costly than recycling—even taking into account avoided landfill costs. Though recycling costs vary by program design, most local programs cost between $100 and $200 per ton of materials collected. By contrast, total traditional disposal costs—including collection and landfill costs—fall somewhere between $60 and $100 per ton of disposed material. In a few areas, especially in the Northeast, costs are considerably higher. There, recycling can reduce total waste management costs. But for most U.S. cities and counties, mandated recycling means higher costs. And higher costs are a signal that we may be consuming more, not fewer, total resources to accomplish our ends.

Mandated by law, recycling becomes an end in itself.

Public sentiment, which cannot and should not be ignored, does deter the siting of some landfills (and incinerators). Often, however, this opposition results from misperceptions about the health and environmental problems associated with these facilities. Old-fashioned dumps and belching incinerators did pose potential hazards. Some municipal landfills, in fact, are now Superfund sites. But modern, state-of-the-art facilities—both landfills and incinerators—pose small, even insignificant, harm to public health, according to EPA's own risk assessments.

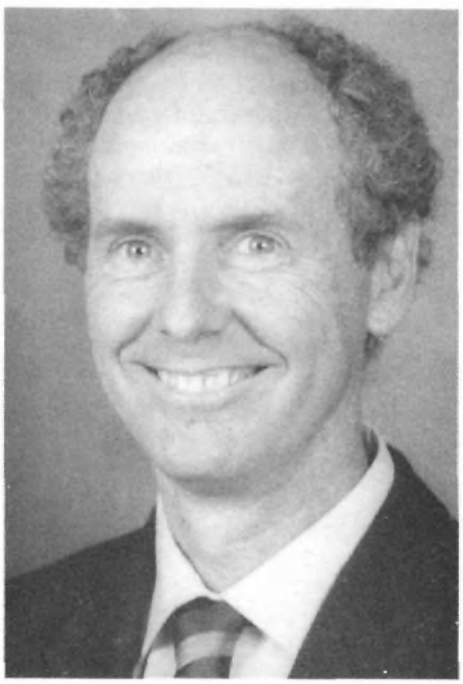
Simply mandating recycling does little to educate the general public about waste management options and comparative costs. Indeed, such mandates often perpetuate misconceptions and further undermine efforts to site needed waste management facilities. Much of the public now assumes, for example, that most of the municipal waste stream can be recycled—at a savings to local governments. Yet garbologist William Rathje and U.S. Chamber of Commerce researcher Harvey Alter estimate, by contrast, that even vigorous recycling efforts are unlikely to divert more than 20 to 35 percent of the waste stream. Household recycling now typically diverts less than 7 percent of the waste stream. And at least some of this recycling may bring us few, if any, real environmental benefits.

We need to recast the discussion about solid waste management. Yes, recycling has a role to play. But such efforts need to be market-driven.

This does not imply a do-nothing policy. Many local governments still fail to charge households directly for waste management service. Consumers, therefore, have little incentive to reduce the amount of waste they generate—by recycling, composting, or altering purchasing habits. We need to introduce user fees. And we need to ensure that waste disposal fees fully reflect total costs of operating such systems. E. S. Savas at State University, New York, notes that many local governments understate waste management costs by 25 to 30 percent—in effect, subsidizing such programs.

Introducing these two measures—user fees and business-based accounting practices—would give consumers and local decision makers the necessary information with which to decide how to handle their discards. This, not mandates, will result in sustainable recycling and integrated waste management systems that meet local needs. □

Peter L. Grogan



(Grogan is a partner in the national consulting engineering firm of R.W. Beck and Associates, and the president of the National Recycling Coalition (NRC). The views expressed in this commentary are those of the author and do not represent the positions of the NRC, the Recycling Advisory Council, or R.W. Beck and Associates.)

The United States does not have a comprehensive solid waste recycling strategy. Since the action on waste reduction has been at the state and local levels, it would be more accurate to ask if we are on the right track in our approaches (plural).

The 42 states that have recycling laws each have a different approach, but most involve target waste reduction goals that will be met primarily by source reduction, recycling, and composting.

We can analyze those recycling approaches in general terms by looking at their three common components: the collection of recyclable materials, the processing of recyclable materials, and the marketing of recyclable commodities.

Are our collections approaches on the right track? Some of the evidence is optimistic. More than 4,000 local governments now provide residential collection of recyclable materials, and that number grows by nearly 1,000 each year. That means we are providing waste recycling collection services to about a quarter of the population. This is a good start, but we have generally under-invested in recyclables collection programs and over-invested in collection designed for disposal.

Other elements of our collections approaches are definitely on track. For example, many of the trial-and-error practices of the recycling collection systems of the 1980s will be replaced in the 1990s with surer methods. The emergence of cost-based rates, which work much like utilities' charges for water and electrical services, is a good trend. Charges for solid waste services are thus correlated to the volume generated.

Seattle and Portland are two of the first large cities to experiment with variable-rate systems at the residential level, with notable success. In these cities the more waste you generate, the more you pay. The outcome, especially in Seattle, has been reduced waste generation, increased recycling and composting, and resultant financial savings for the ratepayer.

Another positive direction for residential collections involves the demise of the single-collection vehicles, which some cities now use to provide services for trash, recyclable materials, and organics. The next generation of collection systems—often referred to as "2-sort" or "4-sort" programs—will radically change waste collection and processing beginning in the mid-1990s.

As the standard trash-compactor truck goes the way of the rotary dial phone, the goal will become to collect all of the materials, with maximum waste recovery, in one or two vehicles. Residential and commercial sectors will participate in these collection programs, and rural areas will be served by a truck that is part compactor, part recycling truck. These vehicles are already serving communities like Telluride, Colorado. The result: higher waste recovery and lower collection expense. As this shift takes place, it will represent the first step towards appropriate capitalization of hardware.

Are we on track to providing the appropriate infrastructure for processing recyclable materials? Here, again, the nation is off to a good start, but a lot of work lies ahead.

The system of choice for processing recyclable materials at the local government level is the material recovery facility, or MRF. Approximately 250 MRFs are now recovering recyclable materials from local governmental programs. The primary role of these facilities is to remove materials from the waste stream and return them to the stream of commerce.

The trend in MRFs represents an under-invested but appropriate direction that needs bolstering in two areas. First, we need to build a national MRF infrastructure, just as we have for other governmental services, such as fire protection.

The second problem area is design. Most of today's facilities were designed to process only residentially collected recyclable materials. If future facilities are set up for 2-sort and 4-sort collection programs, they will be designed to process most of the entire

waste stream. Economics will be improved by the larger mission of future MRFs through economies of scale.

Recycling costs cannot be aptly compared to the costs of traditional solid waste collection and disposal simply by comparing the cost per ton of each service. A true comparative analysis must take into account, on the side of traditional disposal practices, such factors as hidden tax supports; economic impacts from environmental degradation; the costs of proper landfill closure and post-closure procedures such as those spelled out in EPA's 1991 regulations setting the first comprehensive federal standards for municipal landfills; and liability considerations.

EPA's 1991 regulations, issued under the Resource Conservation and Recovery Act (RCRA), set location, design, operating, and closure standards, as well as clean-up requirements for existing contamination. Importantly, the new regulations also set financial assurance criteria, requiring owners/operators of landfills to demonstrate their ability to finance required monitoring and other follow-up activities for 30 years following closure of a landfill.

Given the realities of state-of-the-art landfilling and the new federal requirements governing municipal landfills, urban areas have a compelling opportunity to bring down their total solid waste management costs with aggressive recycling and composting. In fact, some cities have already accomplished this goal.

Opponents of recycling claim that recycling services drive up costs. This is not necessarily the case. The value of recyclable commodities will improve with increased demand brought about primarily by content legislation and progressive industry target recovery goals. Consequently, when the recession ends, the market value for commodities will be improved.

It comes down to this: All the best collection and processing strategies in the world are useless without comparable success in developing the end-use markets for recyclable commodities.

Are we on track toward creating viable markets that will support aggressive waste recovery? This, unfortunately, is where we are having the most trouble getting a foothold. For solid waste recycling to succeed as a national strategy, a decade of market development infrastructure work lies ahead, and we have three major hurdles to clear.

First, we have neither a national strategy nor enough federal governmental leadership on this issue. Second, some states, like Washington and New York, have developed successful market development programs, but most have not. And third, while some industries are actively stimulating the recovery of their products, other industries are not.

A decade of market development infrastructure work lies ahead . . . .

Because of slow progress at the federal level, the mantle of leadership falls on state governments. They have a unique opportunity to include market development for recyclable commodities as part of their ongoing commerce development role.

State governments do an effective job of marketing everything from tourism to produce, and Washington and New York have demonstrated that by making market development for recyclable commodities a priority, they can attract major new recycling industries. These industries offer new economic development opportunities and employment opportunities in addition to end-use markets for local government's recyclable commodities. Washington, for example, now has enough mill capacity for all waste newspaper generated in the state, and a brand new recycled content phone-directory paper mill.

The states that effectively staff and fund recyclable commodity market activities and aggressively market the availability of recyclable commodities to industry will be big winners.

Private industry can also continue to expand its leadership role. More than 95 million tons of recyclable commodities were recovered in 1991, and almost every community experienced record recovery. U.S. paper mills have already spent $42 billion in the past three years re-tooling to manufacture recycled content paper. These actions on the part of major newsprint manufacturers demonstrated that recycled-content legislation has worked effectively in the interest of creating significant new demand for waste newsprint and magazines.

Most of the major commodity groups with consumer products including plastic, metals, and glass have set target recovery goals for this decade. Those are positive steps in the right direction, and most of the goals are likely to be achieved.

Industry must also dedicate itself to manufacturing recycled content products. At least 11 states now have recycled-content laws that require the manufacturers of specific products to use recycled-content material in their products. Overall, the commodity marketing job is progressing on the right track.

We are beginning to change America's behavior from a throwaway society to a conserving society. State-mandated recycling goals have encouraged millions of Americans to voluntarily participate in solid waste recycling. More sophisticated collection systems will improve recovery and cost efficiency. Giving future MRFs a larger mission in life will help us process additional waste streams.

If, over the next decade, we can make enough progress in developing markets in recyclable commodities, the end results of this nation's integrated solid waste management approaches that include recycling will be as other industrialized nations have demonstrated: enhanced resource conservation, an improved gross national product, increased trade exports, and a reduction in solid waste and environmental degradation. □

Source Reduction

In 1987, the vagabond "Islip garbage barge" became a symbol for a nation producing too much trash.

Slowing the Waste Behemoth

by Bette Fishbein and David Saphire

Source reduction is overshadowed by recycling's success

Herman Miller, a Michigan-based furniture manufacturer, saves more than $1 million each year since the company changed from single-use cardboard packaging to reusable blankets for protecting furniture during shipping. Pepsi Cola has reduced the amount of corrugated cardboard it uses to deliver two-liter bottles to market by 80,000 tons per year since it switched to reusable plastic shipping crates. And, each day in New York City, 10,000 pounds of food that restaurants, corporations, and cafeterias would otherwise throw away is brought to homeless shelters, daycare centers, and other social service facilities by City Harvest.

What do these examples have in common? They are just a few illustrations of initiatives to reduce solid waste "at the source."

Source reduction, reducing the amount or toxicity of garbage, tops the now widely accepted national solid waste hierarchy, which places recycling and composting second and disposal options, such as incineration or landfilling, last. Making less garbage not only decreases the amount of waste that must be managed, but also preserves natural resources and reduces pollution generated during manufacturing and disposal. Source reduction is the most cost effective solid waste strategy, because garbage that is not produced does not have to be collected, let alone recycled or sent to the landfill.

Four converging trends over the past several decades have contributed to the garbage crisis in the United States. The population has increased; per capita waste generation has soared; the waste has become increasingly toxic; and landfills—the country's primary means of waste disposal—have been filling up while, at the same time, new ones have been increasingly difficult to site and construct.

Recycling has emerged as the number one solution to the crisis. Nevertheless, there is a growing recognition that recycling is not a panacea. Major obstacles remain to be overcome: shortage of markets, absence of processing infrastructure, and the costs of starting and operating a program.

With these problems in mind, some communities are beginning to ask, why dispose of or recycle something that is not needed in the first place? Yet, despite this recognition, despite source reduction's position atop the garbage management hierarchy, currently it receives the least attention. Thirty-eight states and the District of Columbia have recycling goals; only seven have source reduction goals.

Why? The answer lies in the nature of source reduction itself. There appears to be a parallel with health care: As a country, we find it easier to treat than to prevent.

At the local government level, planners, engineers, and managers are familiar with the steps involved in the collection, separation, processing, and marketing of materials for recycling. However, most have only a vague idea of how to encourage businesses and citizens to produce less waste. Many municipal planners are not aware of the variety of source reduction strategies they could adopt.

Source reduction also has not yet received the widespread media attention that recycling has. This may be due, in part, to public policy debate, which often pits recycling against incineration. For the individual, source reduction requires changes in behavior—what we buy and how we operate at work—which are more difficult to accomplish than simply separating wastes that have already been generated.

Further, there is concern that source reduction may be anti-prosperity: If we consumed less, we would generate less waste. The challenge is to sustain economic growth while still being less wasteful. It can be done: other industrialized countries enjoy the same standard of living that we do, but they generate less waste per capita.

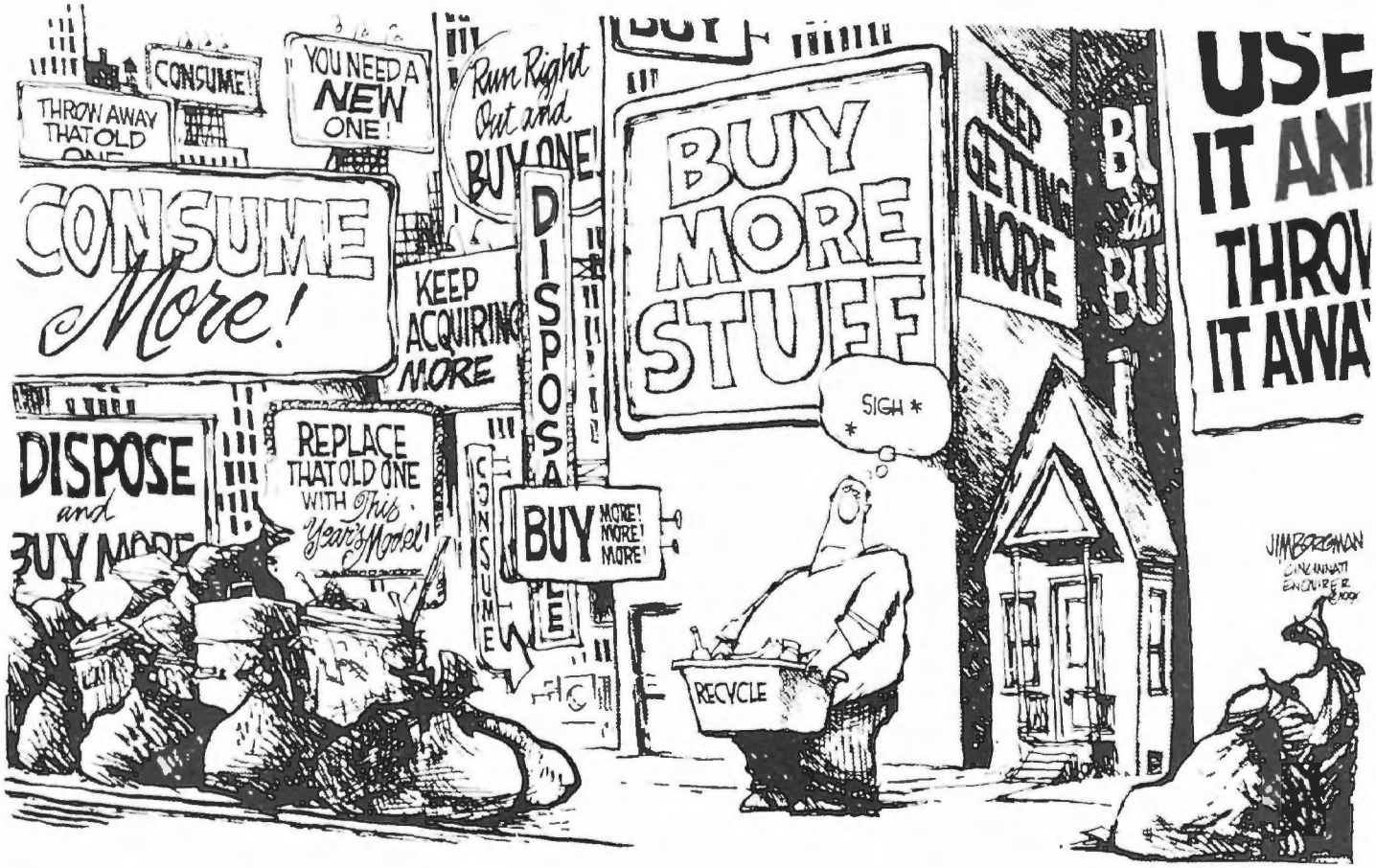
Business as role model

Source reduction initiatives can have a major impact in the commercial sector, which generates about 40 percent of the country's waste. Many companies have taken such initiatives as a way to improve operating efficiency and cut costs, as well as to reduce waste.

AT&T recognized the potential of reducing the use of office paper to save money. Nationally, the use of office paper has soared from 1.5 million tons in 1960 to 7.3 million tons in 1988, making it one of the fastest growing segments of the waste stream. AT&T set a goal of reducing office paper waste 15 percent by 1994 from a 1990 baseline. A key strategy is promoting double-sided copying. The company estimates that annual savings, if double-sided copying is increased to 50 percent, will be 77 million sheets, which would reduce paper purchasing costs by $385,000.

The Rainier Brewing Company, a Seattle-based maker of beer, has been

(Fishbein is director of the Municipal Solid Waste Program at INFORM, Inc., and Saphire is a research associate. *Funding for INFORM's source reduction research has been provided, in part, by EPA Region 2 and the Risk Reduction Engineering Laboratory.* *INFORM's forthcoming report,* Making Less Garbage: A Planning Guide for Communities, *documents successful source reduction strategies.)*



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buying back and refilling all of its single-serve bottles since 1990. After the first year of the program, Rainier estimated that it had refilled 20 million bottles, saving enough landfill space to fill the Seattle Kingdome—a 60,000-plus seat stadium—three feet deep and enough energy to serve 1,434 homes for a year.

For Rainier, buying back its old bottles and refilling them means a savings in new bottle costs. Local recyclers also benefit, since selling intact Rainier bottles back to the brewery pays more than selling cullet to area glass processors.

Refilling bottles, a once common practice in this country, has virtually disappeared. In the early 1960s, 89 percent of all packaged soft drinks, and nearly 50 percent of all packaged beer was sold in refillable bottles. Today, only about 6 percent of packaged beer and soft drinks, combined, is sold in refillables. In comparison, German legislation passed in May 1991, mandates that 72 percent of beverages must be sold in refillable containers.

Nationwide, corrugated cardboard is the largest component of the waste stream, accounting for nearly 13 percent of the total by weight. Ninety to 95 percent of all U.S. manufactured goods are shipped in corrugated boxes, which are typically used only once.

Many manufacturers and suppliers have realized the benefits to be reaped from switching to reusable shipping containers made from plastic or corrugated cardboard. A rigid plastic container may make 250 trips or more in its lifetime. Besides reducing wastes, these containers may also cut operating costs, including packaging, transportation, warehousing, and waste disposal.

Toyota Motor Manufacturing, USA, Inc., in Georgetown, Kentucky, has saved $3.6 million per year in the cost of transporting materials from suppliers since it adopted a modular reusable system. Because the containers are designed to better fill a standard trailer, Toyota can receive more parts per delivery. For the suppliers, switching from one-way to reusable containers means a long term savings in packaging costs.

Government Programs That Work

Successful source reduction programs are emerging in the public sector as well. Seattle officials estimate a reduction of 12 percent in the amount of yard waste collected since instituting a backyard composting program that includes free bins and in-home instruction. The New York State prison system has embarked on a program that replaces disposable food trays with reusable ones, composts food wastes and cotton mattress filling, and reuses paper.

Over 200 communities in 19 states are now charging residents for waste pickup based on the amount of waste they generate. These programs, however, are primarily directed at promoting recycling (recyclables are picked up free), and it is not known

whether reductions are due to increased recycling or source reduction. Variable rate systems that charge something for recyclables but more for trash could provide the incentive for residents to adopt source reduction practices. Such programs have not yet been implemented.

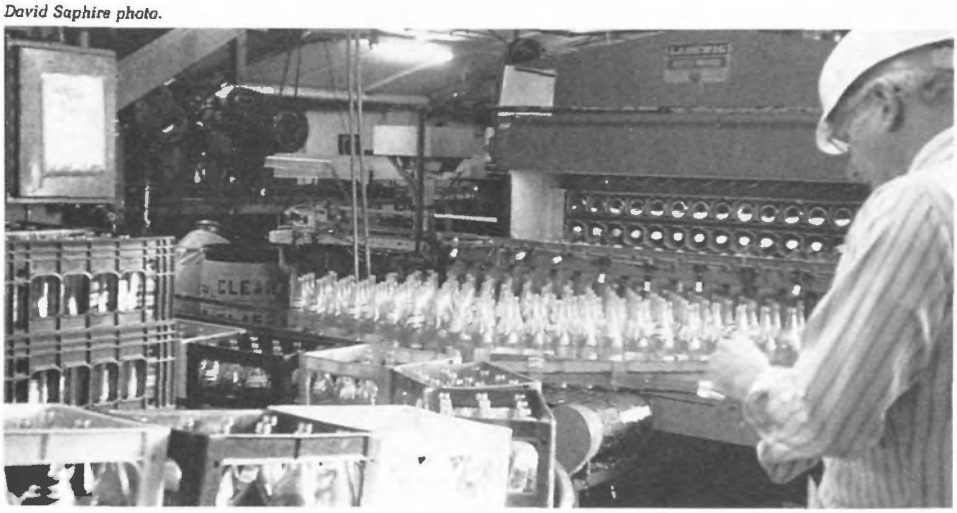
Government is our country's biggest customer, accounting for 20 percent of our gross national product and employing one in six workers. While procurement guidelines have been used to promote recycling, they are rarely used to promote source reduction. Only Connecticut has passed legislation promoting the purchase of reusables over disposables. Wisconsin is working on a life-cycle costing system that bases purchasing decisions on the average cost of a product over its useful life, thereby recognizing the cost savings of purchasing more durable products. Purchasing policies could also require suppliers to ship in reusable packaging, require longer warranties, and specify products with fewer toxic constituents.

The Future is Now

Over the past 40 years, the United States has come to symbolize the "throwaway society." Pressed for time and seduced by convenience, we have seen products that formerly lasted a lifetime re-emerge as single-use items—the throwaway camera, for example. Increasing concerns about our environment may reverse the trend. Industry is responding to growing "green consumerism." The CD long box will soon be a relic of the past, and McDonald's, a company that epitomizes convenience, is working with environmentalists to reduce its wastes.

As knowledge of these and other successful efforts spread, source reduction may truly become top priority. □

David Saphire photo.



Empty soda bottles are loaded for washing at Stewart's Bottling Plant in Saratoga Springs, New York. Refilling bottles, once common practice in the United States, is rare today.

David Saphire photo.

These standardized, reusable shipping containers are used by automotive parts suppliers for deliveries to Toyota Motor Manufacturing, U.S.A., in Georgetown, Kentucky.

Getting Serious in Germany

Germans are reducing their output of household waste

by Cynthia Pollock Shea

For most Americans, walking into a German grocery store is a shocking experience. The products not only have funny names, many are not even wrapped. Meat and cheese are cut to order, and if you're lucky, the bakery clerk will hand you warm rolls.

The biggest surprise comes at the checkout counter. There are no bags, or baggers, waiting at the cash register. Plastic bags may be purchased for seven cents apiece, and sometimes there are extra packing boxes available, but most consumers bring their own bags or baskets to tote groceries. Older patrons often use "bags on wheels" to make the walk home less strenuous.

Because of a wide and growing variety of such source reduction measures, Germany is the only member of the 24-nation Organization for Economic Cooperation and Development that reduced its household waste output during the 1980s. Household waste production per person fell 9.3 percent from 1980 to 1989 to 318 kilograms (700 pounds) a year. The average German produces one-third as much household waste as the average American.

A close look at the products available in German stores reveals numerous differences. Yogurt and refills of wet wipes for babies come in containers covered solely with aluminum foil. A first purchase of wet wipes means having to buy the package with a dispenser top for a higher price. Tubes of aluminum-foil refills are also less expensive than their boxed counterparts. A toothbrush with three snap-in brushes costs the same as one traditional model.

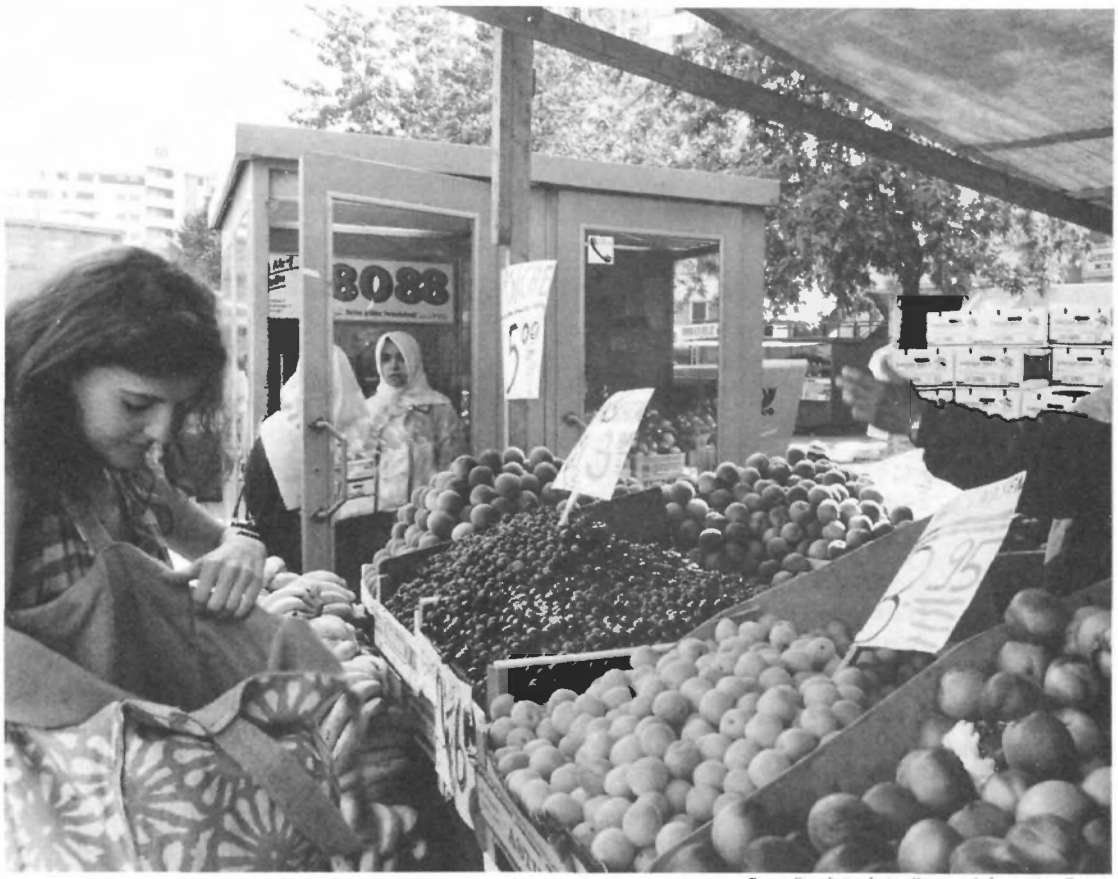
Laundry detergent, in recycled paper boxes, is widely sold in a concentrated form that packs the same punch into two-thirds the powder. The first boxes on the market included a measuring cup and a mesh sack. (The sack is refilled with detergent for each load and helps distribute the soap evenly in Germany's front-loading washing machines.) Today most boxes are labeled as refills and forego the extras. A purchaser of a concentrated bag of fabric softener mixes the contents of the bag with three parts water in the empty bottle at home. The practice reduces packaging waste by 85 percent.

Fresh produce is generally loose, except for onions packaged in net bags and potatoes, in plastic. Selected fruits and vegetables are placed in thin polyethylene sacks and weighed by the customer on electronic scales. German scientists have found the plastic bags less environmentally damaging than paper when the overall life cycle of the bags are compared. Many Germans, however, still buy their produce at outdoor markets or directly from the grower.

Most beverages come in refillable glass or plastic bottles and require a deposit of 20 to 50 cents per bottle, plus more for the case itself. Throughout Germany, 75 percent of the beer, water, soft drinks, fruit juice, and domestic wine is sold in refillable bottles, a share that is rising as disposable containers become more expensive and less popular among environmentally aware shoppers. Milk is also available in refillable bottles, but because of the higher price only 17 percent is sold this way.

Coca-Cola, with 60 percent of the German soft drink market, packages 65 percent of its retail sales in refillables. The container of choice is refillable glass bottles, followed by steel cans; refillable PET plastic bottles; one-use, recyclable bottles; and FANTA juice boxes. The refillable 1.5 liter plastic bottle, introduced in 1989, accounted for 90 percent of Coke's growth in Germany last year. Lightweight and

(Pollock Shea is a freelance writer living in Bonn, Germany. She was formerly a senior researcher with the Worldwatch Institute in Washington, DC.)



Most German shoppers bring their own bags to carry groceries. Household waste production per person in Germany fell 9.3 percent from 1980 to 1989.

Owen Franken photo. German Information Center.

unbreakable, the containers will be refilled at least 25 times at one of 15 bottling plants around the country before rejects are sent to the Netherlands for recycling.

Despite the diversity of source reduction activities, Germans are still not satisfied with their performance. When asked why the country produces so little waste, Germans immediately set you straight and describe a huge waste management problem they say has only begun to be tackled. Many of the problems are universal: diminishing landfill space, political opposition to incinerators—even the technologically advanced and well-monitored German variety—and popular recycling programs that are overwhelming secondary materials markets.

Mounting concern over these problems resulted in a new national packaging ordinance in the spring of 1991. The law requires private collection and recycling of all types of household product packaging. By July 1, 1995, 72 percent of glass, tinplate, and aluminum must be recycled and 64 percent of cardboard, paper, plastic, and composites, such as drink boxes. If industry fails to achieve these targets, government will require hefty deposits on virtually all packaging.

Six hundred retailers, packagers, and consumer products are scrambling to meet the law's interim deadlines and hope to offer private collection service to 90 percent of German households by the end of the year. Glass containers will continue to be collected through dropoff programs. The new industry network, known as the Duales System Deutschland, has given households yellow bins and bags to store the remainder of the discarded packaging. To be eligible for private collection, packages must carry the "green dot," a symbol developed by Duales. After paying a licensing fee to Duales that averages one cent per package, companies may place the green dot on their product. As of April 1992, domestic and foreign-based firms had purchased 5,000 licenses, covering 40 billion packaging units, through this privately managed and funded program.

The new law also encourages source reduction. Since December 1, 1991, product distributors have been forced to take back their boxes and pallets for reuse or recycling. Before that time, only 13 percent of the 2.3 million metric tons of distribution packaging used annually was considered reusable. Most containers were made of recycled paper or cardboard, but the use of plastic shrink wrap was growing. Now reusable plastics and wood are increasingly used to deliver foods, pharmaceuticals, furniture, and biking supplies.

Schoeller International, based in Munich, invented the plastic beverage case 50 years ago. It is now working on a collapsible polypropylene crate designed for packing and display. After the sides are removed, the tray is placed directly on store shelves, eliminating the job of unpacking. Uniform, interchangeable parts and removable labels mean that after washing, the same crate can be circulated among cookie makers, cosmetic manufacturers, and pasta producers. Dubbed the Multi-Transport System, or MTS, the system is being tested by 14 retail chains and 25 consumer product companies. Schoeller hopes the MTS will become a European standard.

On April 1, 1992, the second part of the packaging ordinance came into effect, permitting customers to leave excess packaging in specially provided

bins next to the checkout counter. Boxes surrounding toothpaste tubes, cellophane wraps around cardboard boxes, and plastic blister packs all fall into this category. Retailers, unwilling to become garbage dumps, pressured their suppliers to eliminate any excess, and it seems to be working. A recent survey designed to detect altered behavior among 400 Duales members found that a quarter of previously packaged products are now sold *au naturel*. Polyvinyl chloride and plastic foams were abandoned completely. Of the 146 companies that formerly used plastic blister packs, only one still does.

The German tradition of conserving resources is largely a result of the devastating scarcities suffered during and after World War II. Though rich in technical expertise, Germany is a densely populated country with a miserly endowment of natural wealth, and societal pressure to behave responsibly and consume frugally remains strong.

As a result, German companies frequently view environmentally friendly products and production processes as market opportunities, not government punishments. Indeed, market response often exceeds company expectations.

Thirty months after introducing a concentrated laundry detergent designed to reduce packaging and water pollution, Procter and Gamble's innovation had captured 30 percent of the powdered detergent market. Sixty percent of the company's fabric softener is sold in refill bags. Six months after introducing mercury- and cadmium-free batteries in 1989, the German company Varta saw its share of grocery-store battery sales more than double, from 7 to 17 percent.

German companies frequently view environmentally friendly products and production processes as market opportunities.

Source reduction efforts in Germany extend far beyond the grocery store and factory floor. Dehoga, a major hotel and restaurant association, urges members to reduce energy, water, and waste; limit use of harmful cleaning products; and recycle garbage generated by employees and guests. Long a feature of hotel breakfasts, individually packaged servings of coffee creamer, butter, jam, and honey are being replaced with cream pitchers and jam pots. The association assures members that reducing waste cuts costs; bulk purchases trim the cream bill 70 percent and jam and honey bills 50 percent.

Outdoor festivals—focal points of summer weekends, Octoberfest celebrations, and pre-Christmas activities—increasingly use washable plates, glasses, and cutlery. Dishwashing trailers, owned jointly by neighboring counties or communities, clean continuously during the event. At festivals still dependent on paper and plastic, redemption stands are starting to pay seven cents apiece for empty plastic cups.

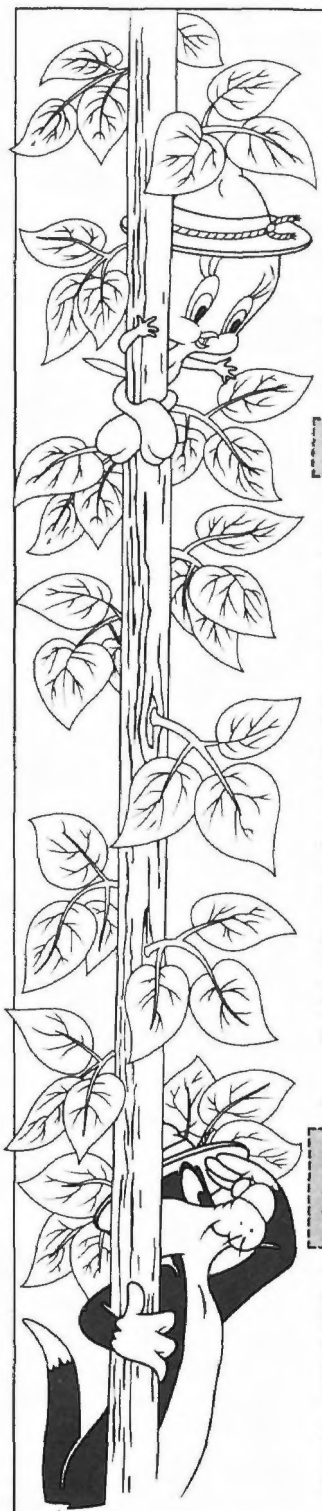
The smattering of source reduction activities cited in this article stem from an environmentally aware and concerned public, companies responsive to consumer demands, and government bodies willing to take bold actions to steer behavior. The Federal Environment Ministry in Bonn intends to give ever more responsibility for source reduction and recycling to private companies. Automobile manufacturers, computer suppliers, battery makers, and magazine publishers are all being told to develop more environmentally sound products and take-back systems. But shifting the responsibility to the private sector is not enough.

Germans view their current source reduction efforts as the first step toward a more fundamental economic restructuring. At one of the country's newest government-sponsored research institutes, in Wuppertal, Dr. Frederich Schmidt-Bleek is investigating strategies to drastically reduce overall materials use and waste. He believes that resources should be valued as highly as labor and capital, a change that would foster more efficient food and transportation systems. Just as Germans have learned not to waste recycled materials, he hopes they will learn not to waste any natural resources. □

For its German market, Coca-Cola uses lightweight, refillable bottles that can be reused at least 25 times before being sent to the Netherlands for recycling.

Coca-Cola G.m.b.H. photo.

"Tweety and the Beanstalk" is taken from Tweety's Global Patrol, a series of teacher-friendly activities that are designed for third and fourth grades. Tweety's Global Patrol is a joint effort of EPA, the Alliance for Environmental Education, and Warner Brothers. For more information, please contact the Alliance for Environmental Education, 51 Main Street, The Plains, VA 22171, (703) 253-5812.



Tweety and the Beanstalk

Nature's Original Recycling Program

In nature, there is no waste. Everything is fed back into the system! Imagine a world without waste! We can learn from nature's recycling program: the world of cycles. But, how can we feed *everything* back into the system? Well, that's pretty difficult, but Tweety has some IDEA STARTERS!

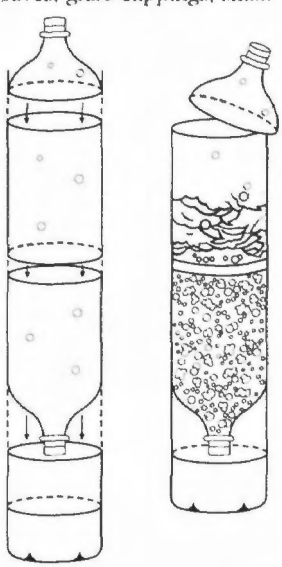
Think Cycle.

Key words: cycle, recycle, compost, decomposers

Tweety's Idea Starter
The end is the beginning.

You will need as many 2 liter recyclable plastic bottles as you want to use with your class, leaves that have fallen or grass clippings, soil, scissors, and a source of water.

Unlike nature, we try to get rid of as much yard waste (leaves, grass clippings, small branches, etc.) and food scraps as possible. But guess what! What we think is the end of their usefulness can actually be the beginning of something wonderful! Let's watch it happen!



- Cut 2 bottles and tape pieces together as shown. Many different arrangements can be made, but this one is for compost columns.
- Make air holes in cylinder with heated paper clip, scissors, or cold needle. The decomposers (living things that assist in the natural process of decay) need oxygen.
- Fill columns with small pieces of leaves or other organic material, with and without soil. (You may want to start one ahead of time so "before and after" comparisons can be made without waiting so long.)
- Schedule for it to "rain" periodically. Watch! As the organic material decays, it turns into compost.

Idea 1 — Can each student make a compost column? Can they be set up differently and results compared?
Idea 2 — What will we do with the compost? Grow a giant beanstalk, what else?

Tweety's Idea Starter
A Giant Beanstalk or a "Giant" Anything Else

For giant beanstalks — use Scarlet Runner bean seeds. For giant anything else — try seeds of marigolds, coleus, sunflowers, or Fast Plants from Carolina Biological Supply. You'll also need soil and "pots", such as cardboard egg cartons, small plastic containers or milk cartons with holes in the bottom — all with a waterproof protective layer underneath.

This can be fun — and messy! A **Mathstarter**➡ We'll need to mix some compost material with the soil (1 part compost to 3 parts soil), and put some into each "pot." Follow directions for planting seeds and keep soil moist. When the seeds start to sprout, **it is very important to keep them in a sunny window** — south or west direction. If it's possible to move the seedlings into a garden outside, we will have a beautiful school garden, or a garden at home! Stake beanstalks so they will grow tall.

Idea 1 — Compare seeds grown in soil only and in soil with compost. What do you think we will find out? Make a graph of results. **Idea 2** — Write a poem, song, or story about this experience and the things you have observed.

A Lesson Plan on Recycling

(For Junior and Senior High School Students)

What Is Municipal Solid Waste?

Municipal Solid Waste (MSW) is the garbage that Americans produce in their homes and where they work. The word "municipal" means anything that is operated and controlled by elected local officials, such as city or county governments. MSW refers to what we throw away each day, including newspapers, yard waste, old appliances, household garbage, and just about anything else you can think of that ends up in the garbage or trash.

Americans generate more than 195 million tons of MSW each year. This means that, on average, each of us creates over 4 pounds of garbage every day.

What goes into our nation's MSW? The figures below show you the components of what we throw away by weight.

Together, these components create a lot of trash, and more will be created in the years ahead. According to the Environmental Protection Agency (EPA), Americans will be throwing away over 25 million more tons of garbage every year by the year 2000.

Disposing of MSW

Where does all the garbage go? Over 66 percent of MSW goes into the ground in landfills. About 16 percent is burned, and 17 percent is recovered for recycling or composting.

Landfills have been the method most societies have used to get rid of garbage. A landfill is a special pit that has been dug in the ground to hold garbage. Once the pit is full, dirt is used to cover the trash.

For many reasons, fewer landfills are

Paper Paperboard 37.5%

Yard Wastes 17.9%

Miscellaneous 8.3%

Acknowledgement: Teachers Sue Rafferty and Fran Earle of Yorktown High School in Arlington, Virginia, worked with EPA Journal staff to prepare this feature.

being built today, as older landfills close. There are about 5,000 landfills left in the United States, and half of these will be closed by the year 2000.

Population growth has had the largest impact on the solid waste stream. Since 1865, when the population was 35 million, the number of people living in the United States has grown to 250 million. As the number of people has grown, so has the total amount of trash produced.

What Is Recycling?

Although the best answer to the MSW problem is to reduce the amount of waste we create in the first place, some waste will probably always be produced. Many waste materials, however, can be remade into useful products, and this process is called *recycling*. Glass, for example, can be crushed into small pieces called cullet, melted down, and made into new bottles. Every time we remove materials from our garbage and trash to recycle it, less garbage and trash have to be trucked to the landfill.

The three arrows in the recycling symbol represent basic steps in the recycling process: *collect*, *reprocess*, and *reuse*. All three steps must occur before we can say that recycling has taken place. It is not enough, for example, to collect old bottles and crush them into cullet. Someone has to buy the cullet and use it to make new bottles.

What Can We Recycle?

Besides glass, the following materials commonly found in our garbage and trash can be recycled.

Aluminum cans—melted down and made into new cans.

Tin-plated steel cans—the tin is dissolved off and sold separately as ingots; the steel cans are washed and sold as high grade steel.

Paper—shredded, mixed with water, and beaten into pulp. The pulp is screened to get rid of most of the water; the remaining fibers are pressed and dried into recycled paper.

Plastics—soft drink and milk containers, the two items most commonly found, are made of different kinds of plastic. Separated or mixed, they are melted down to be reshaped into recycled products. If they are separated, they can be remade into higher quality products.

Yard waste—grass, leaves, and shrub and tree clippings can be ground up, then composted into mulch.

Continued on next page

Plastics 8.3% Metals 8.3% Glass 6.7% Food Wastes 6.7% Wood 6.3%

For the Teacher

- Explain the recycling symbol. Make an overhead transparency from an enlargement of the illustration and explain what each arrow means.

- Have each student carry a grocery bag for a day to collect all trash (anything that would be thrown away) he or she generates during a 24-hour period. The next day in class, sort and classify the components (such as paper, plastics, and aluminum) of each person's trash and weigh the components.

  Calculate component percentages both for individuals and for the class as a whole. Discuss differences between individuals.

  Using the total weight calculated for the class and using published population figures, calculate the amount of trash produced each day by the school, the city or county, the state, and the nation.

- Divide the students into groups to research and prepare reports on the following (this issue of *EPA Journal* provides source information):

  How do government regulations and policies affect recycling?

  How can plastics, metals, glass, and paper be recycled?

  (One report for each type of material.)

Conclusion. Students have collected and separated their personal trash, the first arrow of the recycling symbol. Their reports should give insight on the second (remake) and third (reuse) arrows. End this unit in a class discussion on how the recycling loop can be closed in your community.

Additional Activities

- Have the students examine the trash collected during the above activity to determine the recyclable materials not collected by your community. Have them write a letter to the local county board or city council apprising officials of the results of your study and urging them to expand their recycling efforts.

- Organize a trip to tour a recycling plant.

- Imagine that you have been told that your school's supply budget for the rest of this year has been eliminated. Have your students design new uses for materials, remaking and reusing them. Create a display of these materials.

- Stage a class debate, after providing time for researching the issue. The debate question could be: "Is recycling worthwhile?"

- Have the students choose a product that seems to have excess packaging and write to the manufacturer urging that the package be streamlined. Have them ask that recycled materials be used whenever possible.

- Have the students create an art display using trash as "found objects."

- Using archaeological techniques, the Garbage Project at the University of Arizona has sorted, catalogued, and evaluated more than a quarter million pounds of garbage since 1973. Have your students try their hand by using the trash they have collected. Ask the question: "What does this trash tell us about the people who threw it away?" Look for clues such as the amount of processed foods, microwave foods, brand name or gourmet foods, generic or in-house brands, etc. Can you form a profile of this group? What is missing from this trash? Is it possible to form an accurate picture from this collection?

Sources

"Let's Reduce and Recycle: Curriculum for Solid Waste Awareness," presents lessons and activities to teach students in grades K-12. (EPA/530-SW-90-005)

"School Recycling Programs: A Handbook For Educators," presents step-by-step instructions on how to set up a school recycling program. (EPA/530-SW-90-023)

"Environmental Education Materials For Teachers and Young People" (Grades K-12). Annotated compendium of educational materials on environmental issues. (EPA/OCEPA-21K-1009)

Call the EPA Solid Waste Hotline at 1-800-424-9346 (in Washington, DC 382-3000) or write to: RCRA Information Center (OS-305), U.S. EPA, 401 M Street, SW., Washington, DC 20460 for copies of all EPA publications and for information on how to contact recycling coordinators in your area.

Also Available

"The Consumer's Handbook for Reducing Solid Waste," a practical guide suitable for junior and senior high school students (EPA530-K-92-003).

A Meeting with the Dynamometer

Cars must pass the scrutiny of EPA's emissions laboratory

by Lily Whiteman

A typical car rolling off the assembly line today emits only about 5 percent as much pollution as did the typical new car in 1972. The fuel economy of 1992 models, twice as efficient as typical 1972 models, averages about 28 miles per gallon. The average car on the road today is about 80 percent cleaner than 20 years ago.

Where do these high-tech facts come from? Answer: EPA's National Vehicle and Fuels Emissions Laboratory (NVFEL) in Ann Arbor, Michigan. It is here—a stone's throw from the motor city of Detroit—that EPA scrutinizes the emissions and fuel consumption patterns of real-life automobiles. As sample vehicles are tested at NVFEL, their inputs and outputs are measured much as human responses are monitored during stress tests.

The heart of NVFEL vehicle tests is the dynamometer. Just as a treadmill allows a human patient to exercise in place, a dynamometer allows the test vehicle to simulate driving on the road without leaving the test lab. Immobile though a test vehicle may be, it nevertheless pumps out as much pollution as if driven under comparable conditions on the road. And as the test vehicle runs on the dynamometer, its tailpipe exhaust emissions are routed to precise laboratory equipment for measurement.

NVFEL is one place where the principles of equality prevail; no favoritism here. Elite Lamborghinis complete the very same test schedule—a triathalon of sorts known as the Federal Test Procedure (FTP)—as do everyday Ford Escorts. The main part of the FTP consists of a 43-minute dynamometer test run that simulates an 11-mile urban commute. In this fast-changing sequence, short periods of idling punctuate stretches of stop-and-go city driving and short sprints. A second 13-minute dynamometer test mimics 10 miles of free-wheeling highway driving. During

Test vehicles spin their wheels and the engines rev at programmed speeds while being checked on the EPA dynamometer.

Latime photo.

(Whiteman is a policy analyst with EPA's Office of Mobile Sources.)

these dynamometer runs, fuel economy is also measured.

Two additional tests were added to the FTP after NVFEL scientists found pollutants were released from areas other than tailpipes. Surprisingly large amounts of pollutants, NVFEL experiments reveal, evaporate directly from fuel systems that are heated even just slightly—even when they are parked.

NVFEL scientists collect and measure evaporative emissions with the help of a Sealed Housing for Evaporative Determination (SHED). In order to estimate emissions released during heating caused simply by high afternoon temperatures, emissions from a test vehicle in the SHED are monitored as the temperature of its fuel system is slowly raised from 60 to 84 degrees Fahrenheit. Another SHED test, conducted on a recently revved vehicle, is designed to gauge evaporative emissions generated by a parked car that is cooling down from a recent run.

It is the acute sensitivity of NVFEL's analysis equipment to exhaust emissions levels that makes the FTP much more accurate than neighborhood inspection and maintenance (I/M) tests used today. While both the FTP and I/M tests measure hydrocarbon and carbon monoxide emissions, the majority of I/M tests do not measure nitrogen oxide levels as the FTP does. The FTP test also accounts for many factors influencing emissions—such as cargo weights and wind resistance—that current I/M tests ignore. Moreover, the specificity of the FTP facilitates comparisons between emissions test results and federal standards.

Any prototype vehicle that produces pollution excesses either on the dynamometer or in the SHED gets two more tries. However, if the test vehicle belongs to the 1 percent of engine families that fail the additional tests, the manufacturer may be fined. A second failure also gets the engine family scrapped or sent back to the drawing board—only to confront another judgement day at NVFEL down the road.

Failures are infrequent, because, as required by law, manufacturers engage in extensive tests on their home turf before sending prototype vehicles to EPA for review. These analyses, which last about six months, put prototype vehicles through grueling tests equivalent to covering about 50,000 miles. Emissions are sampled every 5,000 miles. As a general practice, only when a new engine family is deemed durable and clean enough to pass federal standards is the data submitted to EPA.

Even after EPA releases an engine family to the mean streets, emissions surveillance continues.

EPA usually considers the manufacturer's home-turf test results sufficient evidence of compliance with federal standards to approve an engine family for mass production. Nevertheless, the Agency selects prototype vehicles representing 30 percent of new engine families to strut their stuff at NVFEL. Some engine families are randomly selected for these tests. Others are picked because their design is significantly different from previously tested vehicles. And sometimes EPA needs to view FTP results to determine whether an engine family deserves to be taxed as a gas guzzler.

Exotic, low-production vehicles are more likely to fail the FTP than are more ordinary models with longer histories and larger total production. For example, the Dodge Viper, which sells for between $60,000 and $100,000, took many tries over several months and several rounds of improvements to earn a thumbs-up from EPA.

Even after EPA releases an engine family to the mean streets, emissions surveillance continues. The Agency may run surprise checks at auto assembly lines to ensure that mass produced cars are at least as clean as their tested prototypes. Sometimes, the widespread popularity of an engine family focuses EPA attention on certain models. Consistent failures on I/M tests may suggest to EPA that the emissions performance of certain road warriors is not holding up under real-world driving conditions.

Once EPA identifies suspect models, the Agency—relying on the kindness of strangers—borrows privately owned vehicles for testing at NVFEL or other test labs around the country. Poor emissions grades on extensive EPA tests yield expensive recalls, an option that manufacturers consider too costly to let happen often. Indeed, the industry's relatively high pass rate at NVFEL shows that EPA's policing system does keep automakers honest and on their toes. But recalls do occur.

Despite the success of the current program, EPA's test procedures are not written in stone, so to speak. EPA is currently reevaluating its testing procedures to reflect insights into typical real-world driving patterns gained through driver surveys and the lab's own testing. In addition, EPA's current deliberations over whether to regulate "nonroad" mobile pollution sources, such as locomotives, motor boats, and chainsaws, may mean new moving targets for NVFEL testing. □

Thinking about the Conservative Thinkers

A Book Review by E. Donald Elliott

Look out, EPA! Just when you thought you'd survived the conservative onslaught, here comes Fred L. Smith, Jr., and friends.

The environmental policies of Bush-Quayle/Reilly-Habicht have emphasized reforming EPA's programs to incorporate market incentives, risk-based priorities, cost-effectiveness, and voluntary cooperation from industry to prevent pollution. According to the Smiths of the world, these reforms are mere halfway measures. They amount to "the ecological equivalent of ... market socialism," the failed policy of former Communist countries in which goals were set politically but implemented through markets. They may even be dangerous, because they "make it [regulation] *easier*" (horror of horrors), not to mention cheaper and more efficient.

The real target, argues Smith and a growing segment of the conservative intelligentsia, should be the entire concept of centralized regulation of the environment by the government. Not only is centralized, bureaucratic regulation inherently subject to self-serving manipulation by "special interest groups," including environmental groups and bureaucrats, but, more fundamentally, the concept of centralized regulation protecting the environment is wrong.

Environmental Politics: Public Costs, Private Rewards, edited by Michael S. Greve and Fred L. Smith, Jr. (Praeger, 1992; 209 pp.), consists of nine chapters. Seven are case studies by authors of particular environmental decisions, from the Clean Fuels Program (under the 1990 Clean Air Act), to Superfund, and the controversy over the use of the synthetic hormone bovine somatotropin to increase milk production in dairy cows. The common theme is "rents," the argument popularized by University of Chicago economists that government regulation provides a ready political lever that special interests can use for their own purposes. This is not a new idea, but the case studies are interesting and useful in that they illustrate how the process works in environmental regulation.

The intellectual core of the book, however, is in the introductory and concluding essays by editors Greve and Smith. Greve summarizes the arguments about what is wrong with the present system. Curiously absent from his summary is the criticism that regulation does too little, that the present system requires huge volumes of information and, therefore, is slow and cumbersome, and leaves some problems unaddressed. In the final chapter, Smith develops his provocative theoretical argument that private remedies should replace the

(Elliott is Julian and Virginia Cornell Professor of Environmental Law and Litigation, Yale Law School, and is affiliated with Fried, Frank, Harris, Shriver and Jacobsen, New York City and Washington, DC, as a consultant. During 1989 to 1991, he served as EPA Assistant Administrator and General Counsel.)

present system of government regulation.

Market Failure Re-Examined

For decades, the standard theoretical justification for public environmental regulation has been the concept of "market failure": Unregulated markets fail to internalize the true social costs of pollution because polluters can "externalize" the costs of their pollution onto others as damages that go uncompensated. Thus, government should step in to regulate.

This "market failure" argument is useful as far as it goes; however, a number of academics have criticized it for failing to consider the moral—if not outright religious—dimension that underlies our attitudes about the environment; among other things, the conventional economic argument for regulating pollution implies that not having *enough* pollution is bad (because the money spent could produce greater benefit elsewhere), an idea that many find strange.

Smith attacks the market failure justification for public regulation from a totally different perspective. The best way to protect the environment, perhaps the only way, he says, is not through government regulation, but through expanding private markets to include environmental quality: "Rather than viewing the world in terms of market failure, we should view the problem of externalities as a *failure to permit markets* and create markets where they do not yet—or no longer—exist." This has some force in areas such as municipal solid waste, where government monopoly on trash collection hides the true costs of waste disposal from consumers.

Private Environmental Law

In emphasizing private alternatives to government regulation of the environment, Smith is part of a growing chorus of free-market thinkers, as illustrated by the recent books of Richard Stroup and John Barden, and Terry Anderson and Donald Leal. While this literature is long on criticism of the present system and on theoretical arguments for "private environmental law," it is very short on the practical details of how private property and litigation rights would actually replace public regulation in protecting the environment.

The standard view, which Smith discounts, holds that private nuisance or damage suits by individuals harmed by pollution, while useful in some cases, cannot be relied on to regulate pollution because of the problem of "transaction costs": The costs of developing information about the harm caused by pollution are too large, and the provable damages that could be recovered by individuals are too small to make it worthwhile for many lawsuits to be brought, particularly since case-by-case litigation is very expensive and time-consuming.

I doubt that "private environmental law" will ever replace government regulation.

Smith acknowledges that these problems are "real" but argues that moving the issue into the public sector doesn't make the problems less difficult: "Under a private regime, proof problems and the like will sometimes cause a failure to abate pollution. The political manager, in contrast, can limit pollution even without proof of damage."

Smith's arguments are interesting and provocative, but a bit Utopian. I doubt that "private environmental law" will ever replace government regulation. History never repeats itself exactly, and the 19th century's approach to regulating pollution is unlikely to be reinstated. A more likely future is a "hybrid" system, in which both private rights and governmental regulation work together.

Elements of public/private hybrid systems already exist: for example, in Superfund, which consists of a strange amalgam of government regulation and private litigation; and in the Toxic Release Inventory, in which government regulation requires the compilation and disclosure of information, but private, local action then "enforces" pollution prevention based on this information. The record of such systems is mixed, but the high costs and long delays in the Superfund program do not inspire confidence that case-by-case litigation in the courts is a cure-all for the problems of public environmental law.

Most conservative thinkers complain bitterly about private lawsuits as a regulatory device where they currently exist—product liability, medical malpractice, toxic torts. It is a strange anomaly that they have such faith in private lawsuits to take on the much larger, and more difficult task of environmental regulation. □

A Conservationist in the Wings

My friend Ramsay fancies himself a real bass man. We met when we were at business school. That was back in the late sixties, at the University of Virginia. Ramsay fished all the time. He had married a local girl whose father had a bass pond right behind the house. Her old man kept it filled with largemouth bass, big lazy lunkers that just lay there waiting to be fed . . . . Ramsay loved to catch bass.

After graduation, I had gone to work for a developer of vacation homes. I spent most of my time touring the most beautiful parts of New England, figuring out how to chop them up into lots for A-frames. Business school had warped my values. I'd become consumed with making money. Ramsay had taken a prestigious job with the Boston Consulting Group. Unfortunately for Ramsay, Boston was a long way from his father-in-law's bass pond. When he called me one day, he was desperate . . . .

I thought back to Jordan's Camps* and remembered how much I loved to fish. Every night, if it wasn't raining or too windy, we'd row out and try our luck . . . . We always caught a bundle of fish: hornpout, white perch, yellow perch, and even an occasional smallmouth bass. Catching a bass in Lovewell Pond was a big deal. Real bass men didn't fish Lovewell. They went to a secret pond, up toward North Fryeburg . . . .

Then I got the call from Ramsay . . . . I told him not to worry, that there was a secret pond just north of Fryeburg that supposedly was loaded with smallmouth bass . . . . Meanwhile, I was thinking to myself that this pond might give me a chance to make some money. Given the growth that had taken place around Fryeburg, it must just be ripe for development.

A campsite just outside Fryeburg, Maine, on the south side of Lovewell Pond, where the author had vacationed as a child.

Mike Brisson photo

Ramsay was parked outside my door at noon the very next Saturday. He had his canoe tied onto the top of his car and the back was loaded with all kinds of camping and fishing equipment . . . . Ramsay made me read aloud from *McLane's Standard Fishing Encyclopedia* as we headed for Fryeburg. The chapter on bass was dogeared and thoroughly annotated . . . . "The smallmouth bass is widely acclaimed as the top trophy of the bass family. The fish is extremely active and usually jumps when hooked. The average smallmouth is not nearly as large as many freshwater fish, but the capture of a four-to-five pounder requires more skill and more patience than the taking of many species of comparable size." Ramsay had me read that part several times . . . .

When I finally found the pond, Ramsay insisted that we launch the canoe immediately . . . . Except for one new cabin down at the far end, nothing had changed. The pond was still natural and wild. It reminded me of what Lovewell used to be like when I was a kid. It was a developer's dream . . . .

Ramsay took complete command. He put me in the bow and told me that we would paddle about thirty yards from shore, trolling a line on each side of the canoe. I tied on a Rapala, an underwater lure that looks like a minnow. Ramsay scoffed at my Rapala. "Overrated," he said. He chose a Tony Accetta Jelly Belly with the Glow Eyes . . . .

Within ten minutes I felt a strong jerk on my line. I looked back and saw a smallmouth leap out of the water.

Ramsay was ecstatic . . . . [He] carefully photographed it from several angles before releasing it. He was sure that in a matter of minutes he would be posing with one of his own.

Only it didn't happen. My Rapala hooked another beauty, which Ramsay didn't bother to photograph. He was too busy changing lures. His second selection was Bagley's Famous Mud Bug . . . .

By nine o'clock, the Rapala had scored again, but the Mud Bug had lured only one fish, and it got away . . . . He rummaged through several layers of his tackle box and finally settled upon Fred Arbogast's classic Double-Lobed Lip Jitterbug. This particular model had the markings of a green frog and two sets of treble hooks.

It was totally dark by the time we started back to camp. We were each trailing about twenty-five yards of line when Ramsay announced he had a strike . . . .

Ramsay was positive he had a big one. "Let's hear it for Fred Arbogast! This could be a new school and pool! This mother's really jumping!" Then there was a dramatic change in his voice. "Hey," he said anxiously, "something's wrong here."

"Ramsay! Get your rod down! You're going to lose him if he comes up!" . . .

At that moment, a large white object came soaring over the canoe and slammed into the water. "Get the light!" Ramsay screamed . . . .

"What light?"

"The one in my tackle box!"

I leaned back, but I couldn't reach his tackle box. By this time, Ramsay's "fish" had taken off again. It circled the canoe and crashed into the woods.

"Ramsay," I said, "you must have caught a bird. Hold the line, and I'll paddle us to shore."

"The hell with that. I'm cutting this line, before whatever it is comes back."

I started to protest, but Ramsay cut the line . . . . We could hear the bird in the woods, trying to shake the Jitterbug. "Let's get back to camp," Ramsay said. He was not pleased . . . .

"Wait a minute," I said. "We can't leave that bird. It might be an eagle." . . .

We heard the tinkle of hooks as the bird continued to try to free itself. It was only a few hundred feet away. "I'll tell you what," I said. Let's go down to that cabin and see if they have some flashlights . . . ."

We paddled down and introduced ourselves to Dick and Pat de La Chapelle and their four children. The de La Chapelles couldn't believe that Ramsay had caught a bird. The kids quickly ran off to find it . . . . After half an hour, we had found nothing. We were just about to give up when we heard the sound of hooks tinkling under a bush. I turned the light toward the sound and saw two huge brown eyes glaring at me. The bird was a barred owl. Its beak and talons were locked together by the treble hooks . . . .

I took off my jacket, one of those heavy, red-and-black Woolrich shirts, and threw it over the owl.

Back at the cabin, I placed the bird on the picnic table, next to Dick de La Chapelle's big kerosene lantern. I gingerly removed the jacket. The bird lay there, studying me with its huge brown eyes . . . .

"Ramsay," I said. "Get in here and help me clean your fish."

"You've got to be kidding," Ramsay said.

"Come on, it's just a bird."

"That's not just a bird; that's a big bird, with a big beak, big talons, and big hooks."

I knew he was right, but I had to try to free this bird . . . . "Come on. All you have to do is hold the wings and consult. I'll do the cutting."

The idea of consulting must have appealed to Ramsay. He stepped forward and grabbed the owl by both wings. I took a pair of pliers and went to work. I had no idea what the owl might do when I freed its beak and talons. "Ramsay," I said, "if he starts to attack me, let him go."

"Don't worry" was all Ramsay said. I could see the sweat on his brow and felt a bead trickling down my own nose.

Remarkably, the bird just lay there. It must have been in shock. As I removed the final hook, I no longer felt like a developer. I felt like John J. Audubon, Izaak Walton, and Aldo Leopold all rolled into one.

"Okay, Ramsay, nice going," I told him. "Your consulting job is over."

Ramsay looked very relieved . . . . I wrapped the bird back into my jacket, picked it up, and laid it on the dock. Swaddled in my Woolrich with only its head showing, it looked like a baby with extra big eyes and a funny haircut. "Ramsay, quick, take a picture," I said. "You can send it to your father-in-law. Show him what a real smallmouth looks like." Ramsay got one shot of his owl before it wriggled itself free, defecated on my jacket, and flew into the night.

We fished again the next morning. Instead of thinking about ways to develop the pond, I found myself thinking about ways to protect it. All Ramsay was thinking about was fish. My Rapala caught one more nice bass, but [his] Sidewinder came up empty. No fish, no birds, no nothing.

I was in high spirits during the drive back to Boston. This trip had convinced me that I was not cut out to be a developer. I didn't want to exploit these beautiful places. What I really wanted to do was protect them . . . .

I called Ramsay at his office a few days later. I wanted to see if we were going fishing and tell him that I was looking for a job in conservation. I planned to give his owl full credit. Ramsay's secretary told me that he was out of town and wouldn't be back until the following week. He was on some personal business. He had gone to see his father-in-law in Virginia. □

ON THE MOVE

G. Tracy Mehan III is a new Associate Deputy Administrator. Mehan's responsibilities will include coordination of policy and regulatory issues on behalf of the Deputy Administrator.

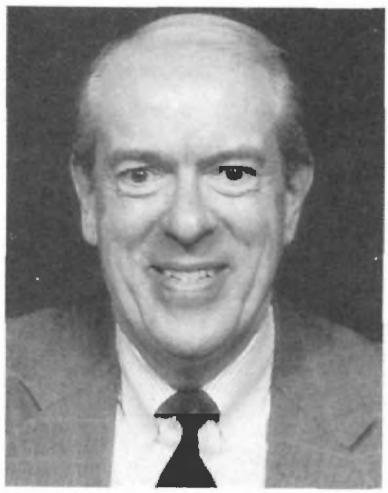
Mehan was the director of the Missouri Department of Natural Resources (DNR) from 1989 until August of this year. In that capacity he managed the state's environmental, energy, and parks programs. Before his stint at the Missouri DNR, he was a partner in the St. Louis law firm of Anderson, Gilbert & Garvin. From 1978 to 1979, Mehan served as staff attorney in the St. Louis County Counselor's Office. He also served as a law clerk for Judge John J. Kelley, Missouri Court of Appeals, Eastern District.

Mehan earned his undergraduate and law degrees from St. Louis University. He has served as chairman of the Upper Mississippi River Basin Association, Commissioner to the Midwest Interstate Low-Level Radioactive Waste Compact, Vice-Chairman for the Missouri Basin States Association, and as a member of the State/EPA Operations Committee, which seeks to create better working relationships between states and EPA.

Nancy B. Firestone has been appointed as an EPA Environmental Appeals Judge. The Environmental Appeals Board consists of three judges—Ronald L. McCallum and Edward E. Reich have already been named and were profiled in the March/April issue of *EPA Journal*—called from the ranks of senior Agency attorneys. The board will make final Agency decisions in appeal cases contesting the adjudicatory decisions of Administrative Law Judges and Regional Administrators.

Firestone previously served as an Associate Deputy Administrator. She has also served as the Deputy Chief of the Environmental Enforcement section at the U.S. Department of Justice. In addition to her duties at EPA, Firestone is currently an Adjunct Professor at the Georgetown University Law Center, where she teaches environmental law.

She earned her bachelor's degree from Washington University in St. Louis and her law degree from the University of Missouri—Kansas City Law School.



The new Director of the Environmental Monitoring Systems Laboratory in Las Vegas, Nevada, is **Wayne N. Marchant**. The lab develops, evaluates, and applies methods and systems for monitoring the environment. It also develops monitoring techniques for a variety of environmental pollutants and conducts environmental studies nationwide.

Marchant has previous experience in managing research programs. From 1988 until July of this year, he served as Chief of Research and Laboratory Services in the Bureau of Reclamation. He also served as Deputy Assistant Secretary for Water and Science in the Department of the Interior from 1986 until 1988. Previously, Marchant served as program manager and scientist at the U.S. Bureau of Mines in Washington, DC, and at Salt Lake City Research Center.

Marchant earned a bachelor's degree in chemistry at the University of Nevada and a doctorate in chemistry at the University of California. □

Acid Rain Damage?

The May/June issue of *EPA Journal* contains a photograph of a seriously damaged forest. The caption [which reads, "Dealing with modern environmental problems, such as acid rain, requires ingenuity and new approaches."] implies that acid rain caused the injury and death of the trees shown in the picture [p.6]. This implication is not correct. Acid rain (more accurately called acid deposition because of its many physical and chemical forms) has not been proven to be the primary cause of tree injury and death in any natural forest that I know of in North America.

A call to the Editor confirmed my suspicion that the forest shown in the photo was part of the mixed Fraser fir/red spruce forest near the summit of Mt. Mitchell in my home state of North Carolina. From 1985 to 1989, I was the Mount Mitchell Site Director for an EPA-sponsored research program called the Mountain Cloud Chemistry project. (See article in the May/June 1989 issue of *EPA Journal* entitled "There's More Than Poetry in the Clouds.") The purpose of this program was to measure the deposition of airborne pollutant chemicals and some other stress factors that occur at this high-mountain location.

At this site, the primary cause of injury and death of Fraser firs in this mixed conifer forest is not acid deposition, but rather an insect called the Balsam Woolly Adelgid. Acid rain, acid snow, acid cloudwater, and phytotoxic concentrations of ozone all occur frequently at this site. It is possible that these pollutant chemicals predisposed the trees to attack by this insect. But the insect itself is capable of causing injury and death to Fraser fir trees.

Although the implication of this picture and caption is not correct, their publication in the *EPA Journal* provides stimulus for some readers who may wish to continue their education about how acid deposition affects various types of forests in North America:

- In some forests with minimal supplies of available sulfur and nitrogen, acid deposition adds to the supply of these essential nutrients and thus helps the forest grow.

- In some forests where the trees grow in acid soils with low buffering capacity, the cumulative deposition of acidic and acidifying substances over many decades induces further acidification. This leads to eventual impoverishment of the soil caused by depletion of available calcium, magnesium, and/or other nutrients that are essential for normal growth and development of trees.

- In some forests receiving large cumulative deposition of acidifying nitrogen compounds, the soil eventually becomes nitrogen saturated. This sometimes leads to surface-water and ground-water accumulations of nitrate that exceed safe drinking water standards.

- In high-elevation red spruce forests in the northern United States, acid cloudwater sometimes predisposes the trees to damaging or killing frost. This effect has not been noted at Mt. Mitchell and other high-elevation locations in the southern United States, probably because injurious cold occurs here less frequently than in northern parts of our country.

- In some other forests (including the spruce fir forest at Mt. Mitchell), we do not yet know if, when, where, or to what extent, acid deposition is causing changes (directly or indirectly through interactions with other factors) in forest growth, health, productivity, species composition, genetic stability, aesthetic quality, wildlife habitat, water quality, or other aspects of the forest environment.

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Skeptical of the Skeptic

The Congress and the President have not been drawing much praise these days, but fortunately they were not nearly as dumb as Michael Gartner thinks they were when they enacted the 1990 Clean Air Act Amendments ["A Skeptic Speaks," EPA Journal, May/June 1992]. Among other things, the Act requires the nation's utilities to cut by nearly half, or 10 million tons, their sulfur dioxide (SO_2) emissions, a crucial precursor of acid rain, and cap total emissions at the reduced level. To make sure that utilities and their rate payers do not have to pay more than necessary to meet this ambitious mandate, the Act permits a utility that has trouble meeting its requirements to offset its extra emissions if another utility cuts its emissions more than required. The nation still gets the total reductions as bargained for, but at a lower cost—up to $1 billion a year lower—than if every utility had to make the same reductions no matter what the cost. Without that cost savings, Congress probably would not have passed, nor the President signed, such a tough acid rain program. Instead, fewer reductions would have been required and total emissions would not have been capped.

Mr. Gartner worries that this cost savings might come at the expense of the people living near the utilities that use this system to emit more SO_2 than otherwise allowed. Fortunately, the President and Congress worried about exactly the same thing. That is why the law says that no matter how many extra emissions offsets a utility buys from others that make extra reductions, it can never increase its emissions above the standards set by other provisions of the Clean Air Act to protect public health. In addition, all utilities will be making an overall reduction of 10 million tons.

That is also why comparing the Clean Air Act's acid rain emissions trading system to trading off "No Smoking" sections in restaurants, as Mr. Gartner does, misses the point entirely. Emissions trading under the acid rain program allows us to get the most reductions for every dollar spent without sacrificing public health or environmental protection. In view of the urgency of our nation's environmental and other social challenges, we cannot afford to pay more and get less emissions control.

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Steve Delaney photo. EPA.

Youthful enthusiasm is one of the driving forces behind recycling.

Back cover: "Honey, did you put out the recyclables?"

Photo by Art Stein for Folio, Inc.


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