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Reporting on Municipal Solid Waste

A Local Issue

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Reporting on Municipal Solid Waste: A Local Issue

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Preface

Ask any reporter who has ever covered the City Hall beat: The business of disposing of garbage is not only a big business, it's also a big story. One need only be reminded of the local headlines reporting a municipal sanitation workers' work stoppage or slow down to recognize that.

But waste generation, waste management, waste transport, and waste disposal go on year-round, 24 hours a day, strike or no strike. And waste itself is a big story, a continuing story in community after community.

Journalists need not be advocates to recognize that environmentally and economically sound and prudent waste management is in everyone's best interests. That's a point audiences inherently know and understand. But like other important environmental resource and management issues facing American citizens, there's more to the story than that.

Reporting effectively on the solid waste challenges and opportunities facing America as it moves toward the 21st Century will demand all the experience and traditional skills that the best professional journalism can offer. In that way, it's no different from most other challenging and stimulating stories environmental reporters face.

This guidebook is intended to be one more tool in the reporter's arsenal. If it helps pave the way toward better public understanding through better environmental journalism, it will have accomplished its sole objective.

Introduction

Reporters covering environmental issues see their share of end-of-the-earth doomsday predictions and "crises." They build their defense mechanisms early.

In the solid waste area, headlines using the words "garbage crisis," "garbage glut," and "solid waste dilemma" are illustrative. Wait there. The world isn't going to end next Tuesday. And the Statue of Liberty isn't *really* going to soon be up to her elbows in paper, corrugated boxes, or even discarded tires.

But does the U.S. face a mounting challenge to effectively manage its solid wastes? There's little doubt of that based on the increasing volumes of wastes being produced each year by a growing population and an expanding economy.

Covering local solid waste management issues involves the full range of public health, economic, social, legal, and scientific/technical issues that make environmental journalism so intriguing. But, go beyond the rhetoric in the choice of words to examine some of the real reasons behind this country's solid waste dilemma.

Behold ... the compact disc, a wafer-thin marvel of technology that long was packaged in three layers -- hard plastic, cardboard, and plastic shrink-wrap -- giving it an apparent bulk that belied its name "compact"

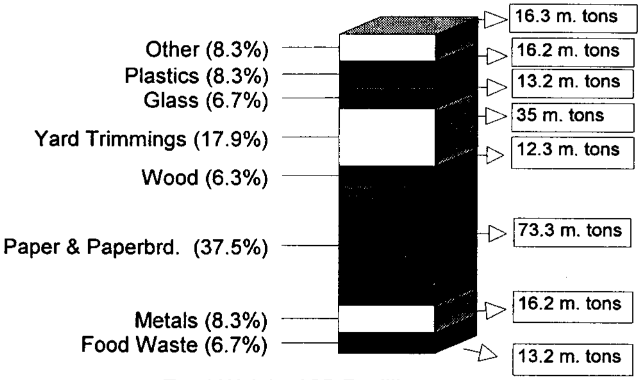
... the individualized, convenient drink container in a foil-lined box, decorated with a plastic-wrapped straw, and shrink-wrapped in plastic

... the single-portion, microwaveable meal on a plastic tray, inside a box, with microwaveable or oven-ready packaging

.... the fast-food container whose whole purpose for being is to keep the food hot for a few minutes from grill to table, only then to be discarded for what can be years and years in a landfill. Governments call it municipal solid waste. The person on the street calls it trash or garbage. Whatever you call it, each American now throws away 4.3 pounds of it per day. That represents a 37 percent increase from the 2.7 pounds we discarded each day in 1960.

The U.S. Environmental Protection Agency estimates that as a nation, we generate 195.7 million tons of solid waste per year, more than double the nation's 88-million-ton waste output in 1960. (Figure 1 shows what materials are in the municipal solid waste stream.)

Figure 1
Materials in the Municipal Solid Waste Stream, by Weight, 1990



Total Weight 195.7 million tons

Source: Characterization of Municipal Solid Waste in the United States: 1992 Update, *U.S. Environmental Protection Agency.*

That's a lot of trash. And the problem, at least in the absence of a refuse workers' strike, isn't so much in picking it up as in finding a good place to then put it back down.

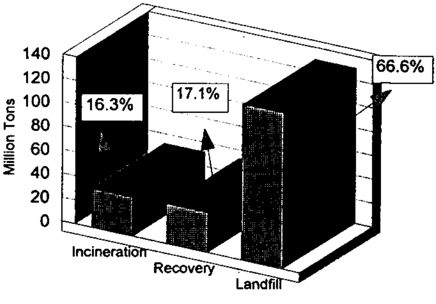
If there has *always* been a lot of solid waste, why has it suddenly emerged as a major environmental domestic issue for the 1990s? *Pogo* said it first: "We have met the enemy, and he is us." And there's no one to blame but ourselves.

One explanation is that as a society we're running out of landfill room. For instance, EPA estimates there were 6,034 operating landfills in the U.S. in 1986. A study conducted for the agency in 1992 estimates there were 5,345 active landfills in the U.S., an 11 percent decline from 1986.

Sweeping national statistics on their own can be misleading for individual regions. But the correlation between high population density and dwindling landfill capacity is clear-cut: heavily populated northeastern states are feeling more of a landfill crunch than those in other parts of the country, and landfills in cities such as Chicago, Los Angeles, New York City, and Philadelphia may be filled to capacity by the mid-1990s.

Figure 2 shows how we are managing our solid waste. About 67 percent of the waste ends up in landfills; about 16 percent is burned; and 17 percent is recovered for recycling or composting. Table 1 shows changes in management of municipal solid waste for 1960, 1975 and 1990.

Figure 2
Management of Municipal Solid Waste in the U.S., 1990



Total weight 195.7 million tons

Source: Characterization of Municipal Solid Waste in the United States: 1992 Update, *U.S. Environmental Protection Agency.*

Social forces to factor into the solid waste equation include shifts and growths in population in many areas of the country. Also contributing to the equation is the "throwaway mentality" of both manufacturers and consumers who contribute to overpackaging, "convenience" products, and a "don't fix it -- pitch it" attitude.

Another is the NIMBY -- Not In My Back Yard -- phenomenon that is responsible for the often emotional, but increasingly sophisticated, public opposition to both landfills and solid waste combustors, or incinerators as they are commonly called. This attitude is slowing the rate, and substantially increasing the building and operating costs, at which both are being built.

Adding to the public's disillusionment with landfills are recent findings that biodegradation doesn't occur as quickly and as

Table 1
Management of Muncipal Solid Waste, 1960-1975-1990

	1960 (million tons & % of total)		1975 (million tons & % of total)		1990 (million tons & % of total)	
Recovery for recycling	5.9	6.7%	9.9	7.7%	29.2	14.9%
Recovery for composting	0	0.0%	0	0.0%	4.2	2.1%
Combustion with energy	0	0.0%	0.7	0.5%	29.7	15.2%
Combustion without energy	27	30.8%	17.8	13.9%	2.2	1.1%
Discards to landfill/other disposals*	54.9	62.5%	99.7	77.8%	130.4	66.6%
Total	87.8	100.0%	128.1	99.9%	195.7	99.9%

**Does not include residues from recycling, composting or combustion processes.*
Source: Characterization of Municipal Solid Waste in the United States: 1992 Update, *U.S. Environmental Protection Agency.*

effectively as the public had come to believe.

Just as controversial with the public are incinerators. Also referred to as resource recovery or waste-to-energy plants, municipal waste incinerators can provide electricity from burning trash. There are 184 incinerators in operation, of which 147 recover energy and 37 do not. While there are facilities under construction, many additional incinerators have been blocked, canceled or delayed because of concerns in some cases over air emissions and the ash left from burning, however safe or unsafe it may be.

Economic factors also complicate consideration of waste-to-energy facilities. With construction costs potentially in the millions of dollars, the plants need a steady supply of trash for fuel and its' energy nonetheless needs to be competitive in the marketplace.

Given the state of solid waste, landfill space and public sentiment in the 1990s, how can the country and the mass media deal with all this trash?

If "all politics is local," as former House Speaker Tip O'Neil believes, so too is all solid waste management. Producers and users -- the manufacturing industry and the individual consumer -- are the hubs of the solid waste wheel; local municipalities and states are the spokes, the powers that control the directions in which solid waste management heads.

The environmental, economic and health implications of the solid waste story become more interesting and relevant as they become more local. Consider these examples:

At the state level: Under a statewide program in Rhode Island, residents recycle aluminum and tin cans, glass and plastic soda and milk bottles by placing them in a separate trash container at the curb. If the recycling bin isn't set out on the day the trash is collected, the household's regular garbage isn't picked up either.

In large cities: In a 420-page study of the economics and practicality of recycling, the Seattle Solid Waste Utility examined recycling programs that would divert between 50 and 76 percent of the city's waste. Based on this study, Seattle's city council voted for a plan that would reduce or recycle 60 percent of the city's waste by 1994.

In small localities: During the first three months of its recycling program, Takoma Park, Maryland, collected 603,000 pounds of newspaper, glass and aluminum. Despite paying to have the glass and aluminum processed and recycled, the town says that it saved $10,700 in three months because of reduced landfill tipping fees and because it could sell the recycled newspapers. Takoma Park has expanded the program to include the recycling of tin cans, corrugated and packaging cardboard, plastic bottles, office paper, junk mail, magazines, phone books, and catalogs, and the composting of leaves and grass clippings. Takoma Park estimates the net cost avoided between 1990, when the program was initiated, and June 1993, at about $125,000. The town also estimates that 53 percent of its municipal solid waste is recycled or composted.

There are standard options for localities faced with handling solid waste: reduce it, recycle it, burn it, or landfill it. And there are individual actions which are critical to journalists whose audiences are asking, "What can *I* do to help?": the "three R's" of reuse, reduce and recycle.

The national perspective on solid waste is important, but the local angle is the story.

Chapter 1
A Reporter's Roundtable

Sit a group of reporters around a table and the talk inevitably turns to their experiences in covering solid waste.

Well, not necessarily. It helps if they're environmental reporters.

It helps even more if the table is on a dias before an audience of the First U.S. Conference on Municipal Solid Waste Solutions for the 90s, which took place in June 1990. The reporters were brought together by the not-for-profit Environmental Health Center, author of this reporters' guide, for the explicit purpose of airing their laundry, clean and otherwise, on their experiences in covering municipal solid waste issues.

The plot thickens, and the plan worked. Reporters Mitchel Benson, of the *San Jose Mercury News*, Victor Cohn, of *The Washington Post*, Stuart Leavenworth, then with the Macon, Georgia, *Telegraph and News*, and now with the Raleigh, North Carolina, *News & Observer*, and Chuck Wolf, of KIKK-FM in Houston, took the bait. They gushed forth with a veritable textbook of tips for reporters covering the myriad issues that characterize solid waste policy and decisionmaking. Their talks, and the questions and answers that followed them, made writing this chapter a breeze.

Opening the plenary panel before an audience of several hundred gathered for the meeting in Washington, D.C., Mitchel Benson said he would resist the reporter's instinct for merely relating self-congratulatory "war stories" detailing their news-gathering conquests. Instead, he would discuss also the "pitfalls" environmental reporters encounter in coverage of issues such as solid waste.

Acknowledging that reporters share the same frailties and shortcomings as fellow human beings, Benson conceded that reporters occasionally may simply "screw up" in their coverage of complex and technical issues. "They're sometimes inexperienced or rushed: Reporters need to be given the benefit of the doubt that they can just make bone-headed mistakes, and not have some sort of conspiracy theory in their mind or some ulterior motive" in their reporting.

Beware: Don't Trust Superman.

Among "tips" to help reporters in their coverage, Benson said, "My first rule is: Don't trust Superman."

He cited an upper New York State newspaper headline to the effect that "Superman May Join Fight Against Interpower Plant."

"Actor Chris Reeves Wants the Facts," the newspaper reported in a second headline. He paraphrased the lead paragraph:

> Actor Chris Reeves is studying a proposed coal-burning power plant after environmentalists said the facility would contribute to acid rain in the Berkshires .... If he concludes that the plant would be an environmental threat, he would seek the help of the Creative Coalition, a group of about 500 actors and actresses and writers in New York State.

"Obviously a well-read, well-researched environmental lobbying group, the Creative Coalition," Benson teased. He warned that "too often reporters can get sucked-in by celebrities who all of a sudden are born-again environmentalists, or by politicians who, seeing a primary election coming up, or a general election, have a new-found concern or a new-found commitment to projects."

"If these people are brought into the political arena, you press them like you press anyone else," Benson advises other reporters. "You get their autograph, you get your picture taken with them," he joked. "Then you press them like you would anyone else, in terms of `Where's their scientific data coming from?' `Who are the experts they're relying on, ... either to knock down or to build up a project?'"

Beware: Limitations of scientific information

As for the kinds of questions reporters can ask to get to the bottom of an issue, *Washington Post* science writer Victor Cohn, author of the 1989 book *News and Numbers*, outlined a series of probing questions aimed at separating the statistical wheat and chaff. He outlined "five basic, bedrock concepts" reporters need to understand in their reporting:

- uncertainty,

- probability,
- power of the statistics,
- bias, and
- variation.

In covering technical and scientific issues such as those arising in solid waste reporting, Cohn reminds reporters that "science is almost always uncertain to some extent. Information is rarely complete."

At the same time, Cohn cautions that "uncertainty need not stand in the way of either good reporting or of sensible actions ... When action is required or involved, there still can be enough information for prudent steps."

Cohn suggests that science and environmental reporters become familiar with the world of statistics. "Scientists manage uncertainty by measuring probability with the numerical expression called the `P value,'" he says. That factor "takes into account the number of subjects or events with a given result that would occur just by chance, and not affected by other factors being examined .... The P value tells you whether or not something has statistical significance, whether it could or could not have been produced by some random process."

Statistical significance and even a high confidence level "does not necessarily mean biological or medical or practical significance, though these may be the case," Cohn says. "It just means that the numbers probably didn't occur by chance."

Nobody said environmental and health reporting should be easy.

Beware: `Association is not necessarily causation.'

Recalling the story of "the rooster who thought his crowing made the sun rise," Cohn cautions that "association is not necessarily causation."

"Laws of probability and chance also tell us to expect some unusual, even impossible-sounding events. A persistent coin tosser will occasionally toss heads or tails several times in a row ... It takes more than one study to make almost any case."

Reminding reporters that science "cannot prove a negative," Cohn cautions reporters that "no one can prove that little green men from Mars have not visited Earth. And no study can prove that something is not harmful or does not exist. The burden of proof is on those that say something does exist."

On "the power of numbers," Cohn cautions reporters to be mindful that "the size of the sample, the greater the number of subjects studied, the greater the power, the greater the probable truth of an effect or an association."

Beware: 'Bias in science doesn't mean prejudice.'

On the issue of statistical bias, Cohn emphasizes that "bias in science doesn't mean prejudice." Rather, bias involves "introducing false associations by failing to take into account other influential factors. Scientists call them confounding variables."

Variation is another factor complicating reporters' jobs in assessing potential risks, Cohn says. "Ask about a study's statistical strength, the odds against an association's being a matter of chance," he advises. "If someone says that something makes it 1.3 times as likely that an individual would get cancer, or even twice as likely, this could fall well into natural variability or variation. If a risk is 10 times stronger, that's strong .... That's a real association."

Beware: Inflated Claims for Recycling

"Tip number two" from Benson is that reporters covering solid waste issues should be dubious of claims that recycling alone is a panacea. Recycling "is a very valuable weapon in reducing the need for landfills and in slowing the filling-up of these landfills. However, I think that sometimes the public out there gets the wrong message: they think that if they stack up all their bottles of soda and all their newspapers every Tuesday night for Wednesday pick-up, they think that's it, and there'll never be a need for a landfill again. I think that's misleading," he said.

Benson cautioned that the public can develop unrealistic expectations for recycling as a result of overstatements by proponents or of inadequate reporting. He urged reporters to pose questions such as: "If this recycling program works as you plan it to work, for how many years will that extend the life of the landfill? If this recycling program works the way you expect it to work, how will this reduce the amount of waste going into that landfill?"

Beware: What your own paper, station is doing

Benson characterized the newspaper industry itself as being "schizophrenic" in its approach to solid waste management and recycling.

"Their editorial pages often preach the benefits of recycling, the need for recycling, the demand for recycling." But reporters approaching their editors with an idea for a story on the use of recycled newsprint frequently encounter resistance. While there are many reasons that recycling may not be easy, or economical, for papers, "it's definitely a worthwhile story for people to do," says Benson.

Beware: Told `State of the Art' ... Ask `What's Art?'

Told that projects are "state of the art," Benson said reporters should respond, "What is art?" He said many so-called state-of-the-art projects end up that way in name only. Warning of the "axe to grind" from unsuccessful bidders on a proposed project, he said reporters nonetheless should check with the losing bidders to try to verify state-of-the-art claims. "I don't think anybody knows more about their own industry than someone in the industry itself," he said.

He also encouraged reporters to seek outside experts, such as at local universities, to sort out claims on individual facilities. "Find someone who doesn't have a vested interest, and run the ideas by him or her," he encouraged. "Look for good sources of information who will not have a direct vested interest in the subjects you're writing about." In that way, reporters have a better chance of avoiding the "on-the-one-hand this, and on-the-other-hand that" kind of reporting which, he said, is not helpful to readers in understanding the pros and cons of a controversial issue.

Asked how he handles the common dilemma of experts' disagreeing on a particular issue, Benson suggested that reporters often can find a common trend or theme among the experts' views.

Beware: The politicians' or the public's health?

Stuart Leavenworth, then with the *Macon Telegraph*, said he is frustrated that so much coverage of solid waste issues involves "emotionalism" rather than serious consideration of potential public health issues. "The inevitable controversies over the original siting of those facilities" tend to dominate news coverage, he said, jesting that "the biggest health threat is to the political health of the politicians who support the facilities."

"It makes it real tough for us reporters sometimes, because we have to deal with a lot of emotional topics," he said. "As an environmental reporter, I would rather deal with the technical issues," but he acknowledged all the same that "these kinds of controversies are very important to local communities."

Beware: Big Outside Conglomerate, Local Citizens Dynamic

In his coverage of the issues in Georgia, Leavenworth said he found two "major forces" emerging: large corporations buying up smaller waste handling companies, and grassroots environmental interests. He pointed out that waste collection in the U.S. is a BIG business, increasingly dominated by fewer and fewer mega-corporations. He urged reporters to be sensitive to the dynamic between those large and often remote companies and local citizens.

In addition to merely reporting the predictable differences between those interests, Leavenworth encourages reporters to "go beyond competing claims and explain how local impacts sometimes are a reflection of what's going on nationally."

Beware: Grandiose economic projections

He said interests supportive of building a new waste management facility should be pressed to explain the professional qualifications of the people making their technical judgments. Reporters also should ask project proponents to document promises of new jobs to be generated and of economic development gains overall. Leavenworth said grandiose economic projections made during project planning and siting warrant a skeptical eye.

"Are they going to end up taking just the kinds of wastes they say they will?" Leavenworth asked. "Reporters really need to pin this down, and force interests to be honest from the start."

Speaking from the broadcast journalism perspective, KIKK-FM News Director Chuck Wolf cautioned that most TV and radio reporters "are general assignment reporters. They have no knowledge of RCRA, PURPA, or SARA Title III," [the Resource Conservation and Recovery Act, Public Utilities Regulatory and Policy Act, and the Superfund Amendments and Reauthorization Act's Emergency Planning and Community Right-to-Know Act (also referred to as SARA Title III)].

Wolf said broadcast media "don't try to tell the truth. It's not the media's job to tell the truth, who's lying and who's not. Instead, most stations go to the middle ground by presenting both sides of the story: We'll present the landfill operator, then we'll present the neighbor."

Citing strong competition among broadcast outlets, Wolf cautioned the audience that broadcast reporters' goals are to "be on the air fast and first." He lamented reporters' propensity to find certainty in inevitably uncertain situations, and he pointed out that in most cases "claims of safety are not newsworthy."

Reporting on solid waste won't be easy, and the best reporting, as is usually the case, may be the hardest work of all. Along with the tips and insights offered by the journalists above, the additional background material provided in this guidebook is aimed at helping reporters, and through them the citizens who are their readers and viewers, better understand the municipal solid waste issues likely to confront our society in coming years.

Chapter 2
Federal/State/Local Roles in Solid Waste Management

All levels of government -- federal, state and local -- play a role in managing the nation's solid waste and planning the mix of management options that will most effectively handle it.

The federal government establishes national goals and standards, develops education programs, provides technical assistance, and issues regulations applying to solid waste management. Six federal laws establish the primary role of the federal government in solid waste management.

Most programs for managing solid waste and handling hazardous waste, recycling and composting are implemented by states and localities. In the 1990s, solutions will also increasingly rely on initiatives from the private sector and on individual actions.

The primary federal law governing the federal government's role in handling and disposing of solid waste, setting standards for state and local waste management, and assisting the states with their solid waste programs is the Resource Conservation and Recovery Act. Other federal environmental laws affecting various aspects of municipal solid waste management include: the Clean Air Act, the Clean Water Act, the Safe Drinking Water Act, the Public Utilities Regulatory and Policy Act, and the Comprehensive Environmental Response, Compensation and Liability Act (or Superfund). The relevant sections are described in Appendix A of this guidebook.

The Federal Role

The funnel is a perfect metaphor.

Picture your city, any city, from the largest to the smallest, sitting atop the funnel.

Now picture its hourly, daily, weekly, annual solid waste stream, the detritus of modern society's cumulative activities.

Picture it accumulating over the years. Like a leaking faucet. Incessant. But more like a torrent than a drip.

For our purposes here, it's not especially important whether the total volume is the 195 million-plus tons of solid waste generated annually in the U.S. or the 222 million tons experts predict for the year 2000.

What does matter is what happens to the unending solid waste stream once it is in the funnel, once it is in the proverbial "pipeline."

It's the "Where" in the journalist's traditional "Five Ws" of "Who? Why? Where? What? And When?"

"Where does it go next?"

What happens to it depends on answers to those same "Five Ws." What is the specific waste? What option -- or, as is often the case, what combination of options -- makes the most sense in a particular instance and for a particular waste stream?

Even with a contentious issue such as solid waste management and environmental protection, most observers would find little argument with the "less is better than more" theory when it comes to the volumes of waste actually generated.

It's simple logic: When the volumes of solid waste can be reduced, issues arising from the need to treat and dispose of it can become more manageable. (Not easy, mind you, just easier.)

That reasoning helps explain the federal government's frequent emphasis on "source reduction" in its solid waste education programs: Reducing the amounts or toxicity of waste from products and packages *before* they enter the waste stream. Simply put, source reduction is waste *prevention*. This is not to be confused with recycling, which can be an effective way of managing waste after it is generated.

While there surely might be a point of diminishing returns from a financial standpoint -- no one seriously argues that we're anywhere close to it in terms of recycling and reuse potential! -- few would argue with the federal government's encouragement of product recycling and reuse as a second essential piece in the solid waste management puzzle. Seeing a nationwide increase in the amounts and percentages of solid waste recycled and reused is likely to be an important trend for the remainder of this century and well into the next.

At the same time, don't be confused if growth in recycling numbers isn't exactly a "bull market" from year-to-year. Changing well-ingrained life styles and consumer patterns takes time, and change will come only incrementally and over time.

In the "real world" scheme of things, no one yet has devised an even remotely feasible solid waste management strategy that does not in part also involve some continued reliance on incineration and/or landfilling.

Simply put, they're integral pieces of the solid waste management puzzle and key elements to finding the "solution" to the "garbage crisis" facing the country. Where well-engineered, well-constructed, and properly maintained and monitored, the federal government says both incinerators and landfilling can play important roles in managing the nation's solid waste today and tomorrow.

Working together and working cooperatively -- each doing what it does best and each contributing what it can, where it can, and when it can -- source reduction, recycling/reuse, controlled incineration, and effectively managed and monitored landfilling in the 1990s and for the foreseeable future comprise the practical arsenal in the nation's efforts to manage solid waste.

Solid waste management professionals have a name for it, "integrated waste management." The term gained currency as a result of the Environmental Protection Agency's 1989 report, *The Solid Waste Dilemma: An Agenda for Action*.

Government and private sector experts use "integrated waste management" as short-hand to describe the four-phase approach for managing solid waste through source reduction, recycling and reuse, incineration, and landfilling. The plan is that together, the four solid waste management options will create a comprehensive mosaic for solid waste management.

Integrated waste management. It's a term likely to become more familiar as society increasingly decides not to put "all its eggs in one basket," but rather to use its full arsenal of resources in managing solid wastes.

It's the federal government's primary responsibility to see that that arsenal -- those "arrows in the quiver," if you will -- are used effectively. And, to continue the metaphor, it's the federal government's responsibility to see that each arrow individually is as straight and true as possible.

Toward that end, the federal government encourages and prods source reduction and product recycling and reuse programs. It establishes uniform national goals, develops and carries out education programs, supports research and development, provides technical assistance, and issues regulations applying to solid waste management. It works with state and local governments to encourage practical planning at the local level, sets minimum standards for facilities, and encourages manufacturers to design products and packaging which help solve, rather than exacerbate, the long-run solid waste management challenge.

At the end of the day, the faucet still is leaking and the funnel still is filling up with trash. After all the source reduction and recycling efforts, the question for policy makers -- and for journalists -- remains: Where? If not here, then Where?

State/Local Role

Every state has at least one agency responsible for overseeing the state's solid waste management. Local authorities are generally responsible for the actual collection and disposal of the waste. The movement in state solid waste management programs is toward recycling, composting, materials recovery, and incineration, with reduced reliance on landfills to handle municipal solid wastes.

EPA estimated in 1992 there are approximately 5,342 landfills, although it says no one knows the exact number. *BioCycle* magazine, which periodically conducts surveys, estimates that 5,386 landfills were in operation in 1992 (see Table 2). Its 1992 survey also found that the numbers of curbside recycling and yard waste composting programs are increasing significantly.

States have passed legislation that addresses many aspects of solid waste management. These various state laws include:

- Setting statewide waste reduction goals;
- Requiring municipalities to pass recycling ordinances, develop recycling programs, reach specified waste reduction goals, or include recycling in solid waste plans;
- Banning disposal of certain products, such as recyclables, vehicle batteries, tires, motor oil, or yard waste;
- Setting packaging or product taxes or fees for products that commonly find their way into landfills or incinerators; and
- Raising funds for recycling programs, usually through a fee or tax at disposal sites, or a sales tax on garbage collection services.

Table 2
Trends in Municipal Solid Waste Management
1988 - 1992

	1988	1989	1990	1991	1992
Curbside recycling programs	1,050	1,515	2,711	3,912	5,404
Yard waste composting programs	651	986	1,407	2.201	2,981
Materials recovery facilities	16	41	92	191	191[1]
Number of Incinerators (Capacity in tons per day)	136 (59,000)	154 (69,000)	164 (82,000)	171 (100,000)	169 (90,000)[2]
Landfills	7,924	7,379	6,326	5,812	5,386

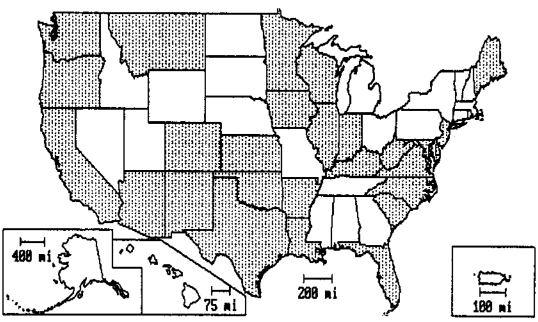
[1]*Differences in terminology used by state officials to define materials recovery facilities made it difficult to calculate the number of MRFs in operation in 1992,* BioCycle *says, although the total number most likely increased.*
[2]BioCycle *reports that the number of incinerators operating in 1992 remains fairly stable at 169. The reported capacity was 90,000 TPD, but CO, MI, NH, TX, VT and WA did not report a figure in that category.*
Source: BioCycle *magazine, March 1990, May 1991, April 1992, and May 1993.*

Appendix B is a state-by-state listing of state municipal solid waste management programs and activities. The success of many of these efforts depends a great deal on their economic viability. Many states are providing incentives to help stimulate the market for recycled materials.

More than half of the states which by 1990 had passed mandatory recycling laws had also passed some form of financial incentives to stimulate the marketplace. In March 1993, *Waste*

Age magazine reported that 13 states have some kind of minimum content law covering one or more materials, with newspaper the most common product subject to requirements. Additionally, *Waste Age* says, 11 states have voluntary agreements covering newspapers (11 states) and telephone directories (1 state) and 27 states now offer some type of recycling tax incentive (see Figure 3). Frequently used incentives are low-interest loans and grants targeted to the recycling industry. Other incentives include tax credit programs, requirements for newspaper publishers to purchase newsprint with recycled fiber content, and procurement provisions that encourage or give preference to the use of products made from recycled materials.

Figure 3
States Offering Recycling Tax Incentives



Source: "Recycling in the States: 1992 Update," National Solid Wastes Management Association, March 1993.

Private Sector Initiatives

Figures on industry's share of solid waste generated vary substantially. According to one estimate, industry generates between 55 and 400 million tons of solid waste a year. According to another estimate, the yearly total is 7.6 billion tons, which includes industrial nonhazardous waste, oil, natural gas and mining wastes, and trash. Numbers are hard to verify because industrial waste is disposed of primarily on-site, with

Publishers Join Recycling Efforts ... Voluntarily?

What is the publishing industry doing in terms of recycling? Should it be regulated to accomplish certain recycling goals in coming years, or are voluntary agreements between publishers and states working?

A December 1992 article in *Editor & Publisher* magazine discusses an ongoing debate on whether the publishing industry should be forced through federal legislation to use recycled fiber in printing newspapers.

The U.S. Public Interest Research Group says, for instance, that newspapers are using recycled fiber because -- at the time the article was published -- 11 states have laws requiring it. The Newspaper Association of America says the reason also is that there are about 14 voluntary agreements between state governments and publishers.

Editor & Publisher says "although reuse of newspapers in recycled newsprint has not kept up with the increased diversion of newsprint from the waste stream, its use by paper companies is governed not only by demand, but also by papermakers' de-inking capacity."

Newspapers in 1990 made up 6.6 percent (12.9 million tons) of the solid waste stream, according to the U.S. Environmental Protection Agency, and 42 percent of newspapers generated were recovered for recycling.

little public scrutiny, study or regulation.

The private sector also plays a significant role in managing solid waste -- private waste management companies handle 42 percent of the nation's solid waste. Many incinerators are privately owned and operated. Professional waste management companies, including processors and handlers of secondary materials, work with state and local officials to plan and implement integrated waste management and educate the public.

In addition to picking up and disposing of solid waste, the private sector has a significant financial stake in reducing waste, collecting recyclable solid waste and manufacturing marketable products from those recycled materials, and much is being done.

For example, the plastics industry formed the Partnership for

Plastics Progress to explore plastic recycling opportunities; it changed its name in October 1992 to the American Plastics Council.

In December 1989, New York announced a voluntary agreement between publishers and the state that publishers had set a goal to use 11 percent recycled fibers by 1992 (which the industry said it attained in 1991), 23 percent by 1995, and 40 percent by the year 2000.

McDonald's Corporation has undertaken a major effort, in cooperation with the Environmental Defense Fund, to reduce and recycle its waste, and other efforts by the private sector also are under way.

What You Can Do

With the increasing public support for environmental protection, reporters and editors have been finding high audience interest in specific actions they can take to help reduce the solid waste stream. For one thing, individuals help salve the feelings of frustration and powerlessness that much of the public feels in confronting seemingly formidable environmental problems. Some ideas for "What You Can Do" sidebars follow:

1. Recycle as much as possible: newspapers, magazines, catalogs, white paper, phone books, aluminum, tin, cardboard, glass, and plastic. Look for comparable products packaged in materials that your community recycles.
2. Select, if possible, products that are not overpackaged, packaged for individual servings, or packaged in non-recyclable materials.
3. Take a washable, reusable coffee cup to the office.
4. Recycle junk mail -- save the letters and envelopes for scratch paper, recycle the white paper, or use the envelopes that don't have a prepaid postage indicia on them.
5. Use reusable storage containers for food or look for items that are available in refillable containers.
6. Bring paper bags back to the store for the clerks to reuse or bring a reusable cloth bag for your next round of groceries.
7. Use rechargeable batteries.
8. Leave grass trimmings on the lawn or compost grass and leaves, or save them for local compost collections. Learn how to

start a compost pile in your yard; compost fruit and vegetable trimmings, egg shells, coffee grounds, and other compostible food waste.

9. Recycle at the office, home or school -- newspaper, office and computer paper, glass, and cans. Use both sides of a piece of paper, even just for scratch paper or casual notes or reminders to yourself and colleagues. *Then* recycle it.

10. Use cloth napkins, sponges or dishcloths that can be washed over and over again.

11. Try alternatives to gift wrap paper, such as newspaper comics (these can also be recycled), magazine covers, old maps, or other materials around the house that might otherwise be thrown out.

12. Select grocery, hardware and household items that are available in bulk.

13. Take used motor oil, used car batteries and antifreeze to participating auto service centers.

14. Maintain and repair durable appliances, electronic equipment, and other products.

15. Sell or donate unwanted goods rather than discarding them.

Chapter 3
Options for Municipal Solid Waste Management

Four major options are available for reducing and managing the volumes of the nation's solid waste:

- Source reduction -- producing less waste needing to be discarded in the first place.
- Recycling -- using in other forms materials that otherwise would be waste.
- Incineration -- burning solid waste usually to produce energy.
- Landfilling -- using an area of land to dispose of solid waste.

Each option has requirements or influencing factors to consider that are key to its becoming a viable option for individual communities.

Options: Source Reduction and Recycling

Source reduction and recycling are generally the preferred options for managing the nation's municipal solid waste output. They are separate but compatible waste management strategies and each should not be mistaken as a single approach to reducing the solid waste stream.

Source reduction means reducing the quantity and toxicity of waste. It involves reducing the waste content of products and packaging, reducing the volume of material and/or increasing the useful life of products to reduce the frequency of replacement. It can require changes in the way products are made, the raw materials used in their manufacture, and/or the ways the products are used.

Recycling involves separating, collecting, reprocessing, marketing, and ultimately reusing in other forms materials that otherwise would be waste materials.

While decreasing the volume of waste being discarded, these two options also can reduce the need for new raw materials, thereby conserving natural resources, and can cut down the environmental burden caused by mining, logging and manufacturing raw materials. They also can help reduce the amount of hazardous substances in the waste stream which eventually ends up in landfills or in ash that is left after burning solid waste.

Many factors influence the success of specific source reduction and recycling efforts:

- the specific products and materials affected;
- the viability of markets for the recycled goods;
- the price of virgin materials;
- public understanding of and support for, or opposition to, the effort; and
- economic incentives and government regulations.

The U.S. recycling rate is approximately 17 percent, according to EPA. This lags behind many other industrialized countries. In Japan, for instance, about 40 percent of solid waste is recycled, including about 55 percent of glass bottles and 66 percent of food and beverage cans. Depending on which region of the country they live in, Japanese households separate their garbage into seven to 21 different categories. Recycling rates in some western European countries are estimated at 25 to 30 percent.

Source Reduction

EPA defines source reduction as *the design, manufacture, and use of products to reduce the quantity and toxicity of waste produced when the products reach the end of their useful lives.* Preventing the pollution in the first place -- rather than cleaning it up later -- is the first step in an integrated waste management system.

The benefits of source reduction are fairly clear:

- the amount of waste to be handled is reduced, thus reducing disposal costs;
- energy and natural resources are saved in production and disposal processes;
- air, water and land pollution often are reduced; and
- the amount of hazardous substances in other parts of the disposal process (recycling, incineration and landfilling) is reduced.

Source reduction often carries its own economic incentives. Businesses and households can reduce costs by avoiding waste. Approaches can include product reuse, reduced amounts of material, reduced toxicity of products, increased product lifetime, or decreased consumption. The design and manufacturing

Source Reduction Activities

- Product reuse
- Reduced material volume
- Reduced toxicity of products
- Increased product lifetime
- Decreased consumption

Source: Decision-Maker's Guide to Solid Waste Management, *U.S. EPA, 1989.*

industries have a clear role in source reduction efforts. Source reduction can also be practiced at the individual and/or corporate level through reuse of products, selective buying patterns and decreased consumption of materials (e.g., packaging).

The publishing industry also can do its share in this regard: More and more newspapers have been getting excellent results by shifting from inks formulated from heavy metals to newer inks produced primarily from the ubiquitous soy bean.

Barriers, Obstacles. There are, however, many obstacles and complicating factors. Packaging contributes about half the volume of household waste, and some of the bulk associated with packaging of certain products is designed to prevent petty theft and shoplifting of those products from retail stores. One of the primary obstacles facing source reduction is the value consumers place on convenience, time savings and newness in products. A significant change in attitudes and lifestyles, therefore, will be required at the consumer level for some source reduction activities. Others, such as switching to reusable cups, are simple.

Some source reduction measures by manufacturers may require substantial initial costs for planning and capital investment. Others, such as internal policies to use both sides of a sheet of paper when making copies, can be easy to implement and may immediately reduce costs.

In the past, society and industry have focused on treatment technologies rather than on source reduction in response to regulation, in part because of costs and in part from lack of education on cost effectiveness.

There also is the potential that substituting one material at the source would have other negative environmental impacts and/or net result in overall reduction in the waste stream. This is not an issue if less of the *same* material is used, however. In addition, the benefits of source reduction are difficult to measure, making it more difficult to gain government and public support.

Source reduction as a means of waste management has practical limitations and can be only part of the means of dealing with the municipal solid waste problem.

Considerations in Assessing Source Reduction Options

- Social and economic return
- Feasibility, efficiency, and cost
- Useful life of the products
- Potential side effects of source reduction measures
- Impact on local waste management system, and
- Impact on waste generation by a facility or a product

Source: U.S. EPA.

Recycling

The basic steps to recycling include collecting and separating recyclables from other trash; preparing the material so it can be used in manufacturing or for some other use; and actually putting the recycled material to a commercial use.

The collection and separation of recyclables can be accomplished through curbside collection of separated materials, drop-off centers, or separation of mixed waste at materials recovery facilities. Curbside collection can range from simply separating out newspapers to separating waste into four or more individual components. Collection can be expensive -- ranging from $75 to $150 per ton in some areas -- depending on things such as the frequency of pick-ups and number of houses participating. Drop-off centers are less expensive and provide convenient central locations for processors or recyclers but require a more active role on the part of individuals.

Materials recovery facilities (MRFs) are processing plants which use a combination of manual and mechanical means of separating commingled materials into individual recyclable commodities. Individual households must separate out recyclable materials, such as paper, bottles and cans, which are collected and stored together (commingled.) At the MRF the materials are separated for recycling and processed to meet market specifications. By 1991, there were 191 MRFs operating in the U.S., up from 92 just one year earlier.

What is being done today? While the current national materials recovery rate for recycling and composting is about 17 percent, areas such as Seattle and San Francisco recycle 25 percent or more of their municipal waste streams. On the other hand, some areas recycle only about 5 percent.

Reporters in particular should beware of wildly ranging estimates on the proportion of U.S. garbage that overnight could be recycled using available technologies. Estimates of 75 to 80 percent are not uncommon, but reporters, upon hearing such estimates, should probe for substantiation from a technical, economic and practical perspective.

Practical rather than technical constraints in fact impede most recycling. However, the technical and economic feasibility of recycling varies greatly among various components of the waste stream. While markets for old newsprint are experiencing a glut as a result of increased municipal recycling efforts and a lack of capacity to process, there is unused capacity to recycle high-quality white paper like computer paper. American paper manufacturers have invested heavily in new mill capacity so they can recycle more paper in coming years.

The American Paper Institute estimates that by 1995 the recycling rate for all waste paper will be between 38.5 and 41.7 percent. It may reach 66 percent by the year 2000, according to a recent study for the National Solid Wastes Management Association.

Glass. Glass makes up about 6.7 percent of the waste stream, of which about 90 percent is glass containers. While recycling glass is more economical than using virgin materials, only about 20 percent is currently being recycled. Recycling efforts are complicated by having to separate differently colored glass in order to meet the needs of glass recyclers.

Aluminum. The aluminum industry has one of the highest recycling rates, primarily because a viable market exists for it. It is significantly more economical to recycle used cans than to create new aluminum. Unlike other materials, aluminum maintains much of its value through the recycling process and is marketable. EPA estimates that about 53 percent of all aluminum containers and packaging was recovered for recycling in 1990. According to the Can Manufacturers Institute, an industry trade group, 60.8 percent of aluminum cans were recycled in 1989, up from 55 percent in 1988.

Reynolds Aluminum, Inc., is experimenting with reverse vending machines where the customer feeds in empty cans and receives money in exchange. The steel and aluminum cans are automatically separated and then crushed.

Aluminum recycling saves 95 percent of the energy required to process bauxite ore, while recycling glass reduces energy costs by 30 percent. But even with half the nation's aluminum beverage cans being recycled, enough aluminum is thrown out every three months to rebuild the country's entire airline fleet.

Table 3
Recovery Rates for Selected Consumer Goods
(in percentages)

Type	1960	1975	1990
Beer, soft drink:			
Aluminum cans	--	20.0	63.2
Glass bottles	7.1	6.3	33.2
Corrigated boxes	34.2	26.7	48.0
Newspapers	25.4	27.3	42.5
Office paper	20.0	26.9	26.5
Rubber tires	36.4	8.0	11.6
Books, magazines	5.3	8.7	21.0

Source: Characterization of Municipal Solid Waste in the U.S.: 1992 Update, *U.S. Environmental Protection Agency.*

Yard and Food Waste. About 25 percent of the waste stream is made up of grass clippings, leaves, and yard and food wastes, much of which can be effectively composted, although little currently is. Proponents of increased composting argue that the potential environmental benefits go beyond merely reducing the amount of wastes having to be landfilled. They point out, for instance, that increased use of composted materials could help reduce reliance on manmade fertilizers dependent on petroleum products, thereby also helping to address energy conservation and groundwater pollution concerns.

Table 3 shows recovery rates (comparing rates from 1960, 1975 and 1990) for selected consumer goods.

Is what's being done working? Barriers to recycling take several forms including technical, economic and political. In many cases, recycling is simply not cost-effective, and it is cheaper and more efficient to use virgin materials than it is to collect, separate, transport, and reprocess used materials.

Much of the success of recycling efforts depends on the match of supply and demand and the overall economics of the effort for those involved. The recycled commodity must be able to be used profitably -- it must be competitive in terms of quality, price and reliability of supply. In some cases, the current recyclables collection system is inadequate to provide the steady, high-quality supply required by manufacturers.

In an April 1993, *Governing* magazine article Tom Arrandale wrote that government's role in managing solid waste may give communities "a chance to take mounting supplies of recyclable commodities and turn them into economic assets." But right now, Arrandale says, "nothing seems to hold more promise ... than old-fashioned regulatory mandates." Governments can require industries to use recycled feedstocks rather than virgin raw materials.

For instance, publishers in California and some northeastern states because of laws and voluntary agreements now have invested $42 million over three years to install de-inking plants for reprocessing used newsprint, reports Arrandale.

Supply and demand also varies from region to region of the country. Table 4 shows recycling revenues by region for several materials. Many states and localities are addressing the issue of markets in part by buying recycled commodities themselves or by providing incentives or requirements for private industry to use recycled materials.

Table 4
Recycling Revenues for Selected Consumer Goods, by Region
(in dollars per ton)

Region	Newspapers	Aluminum Cans	Clear Glass	Plastic	White Paper
Northeast	-30 to -15	27-33	0-22	8-12	65-75
Mid-Atlantic	-30-0	28-32	10-20	7-10	25-45
South	0-10	25-32	0-20	7-10	30-50
East Central	0-20	33-35	10-20	8-12	40-60
West Central	0-10	20-28	0-10	4-7	20-60
South Central	0-10	21-31	0-10	0-3	60-80
West	10-20	25-32	5-100	3-10	60-70

Northeast: CT MA ME NH NJ NY RI VT
Mid-Atlantic: DE MD PA VA WV
South: AL FL GA KY MS NC SC TN
East Central: IA IL IN OH MI MN MO WI
West Central: CO KS MT NE ND SD UT WY
South Central: AR AZ LA NM OK TX
West: CA ID NV OR WA
Source: Governing *magazine, August 1991.*

Steven Kraten in an April 1990 article in *Environmental Decisions*, published by the National League of Cities, calls collection the "major economic bottleneck in nearly all recycling systems." There are a number of direct and indirect costs associated with collection including fuel and wear-and-tear on collection vehicles, vehicle emissions into the air, and increased traffic congestion. Cleaning and sorting can also be expensive.

There are also technical difficulties with recycling certain materials, such as multi-layer and mixed plastics. Successful recycling also requires the capacity to process the recycled material into new products and a market for the end product.

Another obstacle to increased recycling is potential liability.

Several major recyclable materials -- such as used oil, autos, household hazardous waste, lead-acid batteries, and white goods -- may create potentially toxic byproducts during recycling processing, which is a disincentive for operating recycling facilities.

Several specific items create particular challenges for recycling. Tires, for instance, are virtually indestructible. Approximately 1.6 million tons of rubber tires were discarded in the U.S. in 1990, about 1 percent of the waste stream, according to EPA. Rubber tires in 1990 were recycled at a rate of 11.6 percent.

In addition to the problem of sheer volume, piles of discarded tires may catch on fire, posing serious fire-fighting challenges as hundreds of thousands of tires can burn uncontrollably for weeks at a time. Also, tires buried under ground may cause other problems. Some tires are recycled for use in asphalt in highway construction, but some methods for dealing with discarded tires long have been viewed as being prohibitively expensive or as showing adverse environmental effects. In recent years, use of used tires as fuel in electrical power plants has shown increasing promise, and chopped-up tires also are being used increasingly as fuel in cement plants, paper mills and other factories.

Another recycling challenge involves vehicle batteries. The concern focuses on lead from the batteries (about 20 pounds of lead per automobile battery) that contributes to the metals levels in incinerator air emissions and ash, and in landfills. Recovery of batteries for recycling has fluctuated between 60 and 90 percent, according to EPA.

Plastics Recycling. Plastics recycling also has received much attention, but it poses a number of logistical collection and preparation issues. According to EPA, plastics make up about 8.3 percent by weight of the materials discarded in the municipal solid waste stream (after composting, recycling and combustion) and an estimated 21 percent by volume. Plastics are the fastest growing component of the waste stream.

While virtually all plastics are technically recyclable -- meaning they can be remelted and formed into other items -- less than 2 percent is currently recovered for recycling. Soft drink bottles and milk jugs make up most of the plastic currently being recycled. According to a 1991 survey for American Plastics Council (formerly the Partnership for Plastics Progress), the

Table 5
Materials Recovery Rates for Municipal Solid Waste Stream Components, by Weight, 1990

	Percent of Waste Stream (millions of tons)	Percent Recovered (millions of tons)
Paper and paperboard	37.5 (73.3)	28.6 (20.9)
Yard trimmings	17.9 (35.0)	12.0 (4.2)
Metals	8.3 (16.2)	23.0 (3.7)
Plastics	8.3 (16.2)	2.2 (0.4)
Food wastes	6.7 (13.2)	- (-)
Glass	6.7 (13.2)	19.9 (2.6)
Wood	6.3 (12.3)	3.2 (0.4)
Textiles	2.9 (5.6)	4.3 (0.2)
Rubber and leather	2.4 (4.6)	4.4 (0.2)
Other nonfood	1.6 (3.2)	23.8 (0.8)
Miscellaneous inorganic	1.5 (2.9)	- (-)
Total	100.0 (195.7)	17.1 (33.4)

Source: Characterization of Municipal Solid Waste in the U.S.: Update 1992, *U.S. Environmental Protection Agency.*

recycling rate for PET (polyethylene terephthalate) plastic packaging used for soft drink bottles and base cups used with the bottles was about 36 percent in 1991, approximately 327 million pounds a year (see Table 5). The recycled plastic is used in a variety of products such as fiberfill for pillows, sleeping bags and jackets; bottles for household cleaners; flower pots; plastic for park benches; and even the "fuzz" on tennis balls.

Table 6
Estimates of Post-Consumer Plastic Packaging Recycled (1991)

Type	Percent Recycled	Percent of Sales	Virgin Plastic Sales*
LDPE/LLDPE: Low-linear/low-density polyethylene	46.9	1.0	4,678
PVC: Polyvinyl chloride	1.6	0.2	685
HDPE: High-density polyethylene	280.5	6.3	4,425
PP: Polypropylene	5.2	0.4	1,304
PS: Polystyrene	23.9	1.2	2,031
PET: Polyethylene terephthalate	326.8	35.8	912

Examples of Products:
LDPE/LLDPE: Film packaging, shrink/stretch wrap, retail bags.
PVC: Bottles for water, food, pharmaceuticals & cosmetics.
HDPE: Milk and water bottles, soft drink bottle base cups, film bags.
PP: Flexible plastic.
PS: Protective and food service packaging.
PET: Soft drink bottles and base cups.
* In millions of pounds.
Source: "Post-Consumer Plastics Recycling Rate Study," for The Partnership for Plastics Progress, 1990 and 1991.

A primary obstacle to increased recycling is that plastic recycling does not always save energy or money. The difficulties are in the collection, cleaning, separation, and marketing of the end products. Plastics include a wide variety of resins or polymers, with different characteristics and mixed plastics producing a lower quality end product (see Table 6). Multi-layer plastics, such as some squeezable mustard and catsup bottles, with up to six layers of polymers, are particularly difficult to separate for recycling.

Several joint ventures have been formed recently between chemical companies and the waste industry to address these obstacles. Procter & Gamble is marketing a cleaning product in a new container made completely with recycled PET. However, critics question whether recycling can be done on a sufficient scale to make a difference. They argue that reducing the use of wasteful plastics and packaging should be the priority.

Used Oil. Used oil also creates disposal problems. Approximately 58 percent (550 million gallons) of used oil is reprocessed annually into fuel, lubricant, and hydraulic oils, while 42 percent (400 million gallons) ends up in trash, in sewers or buried in the ground -- more than 30 times the amount spilled by the Exxon *Valdez* in the March 1989 spill in Alaska's Prince William Sound. The recycling rate for do-it-yourself oil changers is less than 10 percent. Concerns over the potential liability involved with used oil has been a major deterrent to increased recycling efforts. (Reporters should beware such *Valdez* comparisons, which often ignore that a major spill occurs in one place and at one time.)

Questions for Reporters to Keep in Mind

- What type of source reduction efforts are currently under way? Which industry is doing that? Is it economical?
- What are the possible negative environmental or economic impacts source reduction or recycling can have?
- What causes the difference of percentage of recycled waste in the country (e.g., in Seattle and San Francisco the rates are 25 percent or more, while in some areas it is only 5 percent)?
- In some areas, mixed household waste is sent to materials reclamation facilities. This option may save on collection costs, yet, is it feasible and beneficial in the long run? Can it become an effective alternative?
- It is obvious that source reduction and recycling are for the most part environmentally sound and save energy, but certain limitations exist in terms of cost effectiveness. How do these limitations impact potential options for a particular community?

Option: Solid Waste Incineration

Until the early 1970s, Americans routinely managed much of their trash by burning it. The scent of burning leaves was a harbinger of winter in parts of the country, and in many areas garbage was burned year-round. Individuals often burned practically anything burnable to help lighten their weekly garbage load. As concern about air pollution increased, local governments began to impose restrictions on burning trash in the open air.

The energy crisis in the 1970s also influenced changes in the handling of garbage, or solid waste, through development of a more sophisticated system of incineration that could recover energy as the garbage burned. This and other factors led to more and more stringent regulations, and today under the Clean Air Act and subsequent amendments, regulations require incinerators -- or municipal solid waste combustors, as they are formally called -- to meet specific air pollution control standards or to cease operations.

By the mid-1970s, waste-to-energy facilities became a viable component of an integrated waste management system. In 1992, 184 municipal waste incinerators were operating in the U.S., according to EPA.

In 1990, 16.3 percent (31.9 million tons) of America's 195.7 million tons of municipal waste was incinerated, and EPA estimated that about 15.2 percent (29.7 million tons) of that waste was incinerated with energy recovery.

EPA estimated that the 37 non-energy recovery facilities that were operating in 1992 had a combined capacity of 6,219 tons per day. The 147 operating energy recovery facilities had a combined capacity of 102,755 tons per day and a combined capability to produce 17 million megawatt-hours of electricity (net energy) per year.

Types of Incineration Facilities

There are three basic types of municipal waste incineration or solid waste combustion facilities operating in the U.S.: mass burn, modular, and refuse-derived fuel (RDF).

The *mass burn combustor* is designed to burn all municipal waste delivered to it en masse. Typically, a waste hauler dumps a truckload of solid waste into a holding pit at the facility. A

A Word About Words

It would be easier to write about incinerators, or municipal solid waste combustors, as many solid waste professionals prefer to call them, if everyone agreed on one term. But they don't, perhaps for good reason.

Reporters dealing with municipal solid waste issues should expect to hear many terms used to describe an incineration facility -- waste-to-energy, mass burn, refuse-derived fuel, combustor, resource recovery, and so forth.

Part of the reason is that there are important distinctions among the various types of incinerators. Another reason is that many professionals believe the word "incinerator" conjures up images only of the pre-controlled, belching smokestacks that were common years ago: The image is of urban apartment buildings in the 1950s randomly incinerating waste in an uncontrolled fashion.

In everyday language, the word "incinerator" is used interchangeably with the mix of terms that perhaps more precisely describe an incineration facility. But professionals will be loath to use the word incinerator because of the stigma that is attached to it in the eyes of the public.

The modern municipal solid waste incinerator, or combustor, is required by law to be equipped with pollution control equipment. Newer incinerators usually recover usable energy from solid waste. Older incinerators are required to use pollution control equipment or close.

It's important not to lose some of these distinctions in the shorthand of "incinerator."

crane lifts and places the solid waste into a combustion chamber or kiln, where it is burned.

The hot air generated from the burning process is funneled to boilers that create steam. In some cases, the steam is used on-site to operate turbines that generate electricity to sell to utilities. In other cases, the steam is sold directly to industries and institutions to power their own turbines. Hot exhaust gases pass through an air pollution control system designed to remove pollutants before the air is emitted from a smokestack.

Once the solid waste is burned, two types of ash remain. Smaller, lighter ash is caught by the air pollution control system as the exhaust gases pass though the hot air. This *fly ash* makes up about 10 percent of the incinerator's ash waste. The remaining ash, left at the bottom of the combustion chamber, is called *bottom ash*. The larger and heavier bottom ash includes chunks of unburnable material. The ash then is typically shipped from the facility to an ash monofill or it is co-disposed with municipal solid waste in a landfill.

A *modular combustor* works like a mass burn combustor but is physically smaller. Also, it is usually prefabricated so that it can be put in place fairly quickly.

The third type, the *refuse-derived fuel (RDF) combustor,* differs from the mass burn in two significant ways.

First, RDF facilities include a materials separation process. After the solid waste is dumped at the plant, it goes through a system of shredders, screens, and magnets to remove metals and other unburnable debris, such as rock and grit.

Second, the combustible solid waste is then further shredded or processed into pellets to form a uniform size fuel to feed the combustor.

Separating unburnable wastes and metals from other solid waste can reduce the toxicity of air pollutants and ash created by a combustor. It also increases the burning efficiency of waste, a key element in controlling resulting air pollution.

Why are there more mass burn and modular plants -- which don't routinely do separation -- than RDF facilities operating in the U.S.?

For one thing, in the early days of waste-to-energy incineration, RDF plants had more parts to break down. Experts say RDF plants are better built and more reliable than they used to be, but because they involve more steps and more equipment, they still tend to be more expensive than mass burn plants.

What Cost? Who Pays?

Waste-to-energy incinerators have two characteristics that distinguish them from most other energy-producing facilities: They get paid to take the fuel they use to generate energy, and the energy they generate has a guaranteed market.

The federal Public Utilities Regulatory and Policy Act (PURPA) requires investor-owned utilities to buy energy from waste-to-energy incinerators at a cost equal to what the utility saves by not having to build another power plant or operate existing plants at higher capacity. Some state laws similar to PURPA make it even more lucrative for waste-to-energy facilities to sell energy to utilities.

These incentives give municipal solid waste combustor facilities that recover energy an assured source of revenues. However, that does not mean that waste-to-energy facilities are the most efficient way to create energy. Alan Hershkowitz, of the Natural Resources Defense Council and who has written widely on this topic, cautions in the July 30, 1987, issue of *Technology Review* that "it would be a mistake for towns to regard their incinerators as energy-producing ventures. Rather, they are an important means of disposing of municipal waste."

They also can be one of the most expensive disposal means, a factor that helps elevate source reduction and recycling as priorities in solid waste management.

Typically, incineration proponents say a facility's initial costs -- construction and financing -- are estimated (in 1990) at $100,000 per ton of capacity per day. Plant sizes are usually described according to how many tons per day they are designed to burn. However, these figures are only estimates and may vary significantly in either direction for a particular type of facility.

Who foots the bill and assumes the risk for a facility depends on who will own it. There are two common ways to build and finance a facility.

The first is for a community to invite a vendor to design, build and operate the facility. In some cases, the community and vendor share costs. In other cases, either the community or the vendor can be the sole owner. In either case, the financing usually is obtained through bond sales, and the community, the vendor or both assume financial risk.

A second financing path is for a private vendor to do everything -- design, build, operate, and own the facility -- and then give a discount on the tipping fee (discussed below) to the host community or to certain customer communities. The vendor usually obtains financing through bond sales, just as in the first case. However, in this case, the community assumes no up-front financial risk. Nor, usually, does it have any say in the design of the facility.

The capitol cost of building the plant, though, is just one part of the costs involved with waste-to-energy facilities. In addition, operating costs include labor, repairs, maintenance, and utilities. In comparing landfill versus incineration costs, it's important that reporters, to develop a reasonable overview, keep in mind not only initial costs but also full life-cycle costs.

Tipping fees -- the amount the operator charges for each ton of waste delivered to the facility -- range widely from region to region. Incineration tipping fees initially are often higher than landfill tipping fees, but here too it's important to make comparisons over a long term and to keep in mind that comparative costs can vary from state to state and region to region, depending on factors such as regulatory and enforcement considerations and relative availability of landfill space.

Incineration facilities need a constant, predictable flow of solid waste to continue producing a constant, predictable flow of energy. To ensure that flow, vendors or investors often require communities to guarantee to deliver a specific amount of municipal solid waste to the plant each day or week. If for some reason the community cannot meet the quota, then under some contracts, it must pay a fee for the unmet quota. This sort of arrangement not only raises the price of disposal, but environmentalists and some solid waste management experts say that it also can create a disincentive for source reduction and recyling. These reasons help explain the importance of carefully planning plant size and capacity.

In the early "learning curve" years of U.S. operation of municipal solid waste combustors, plants in many cases demonstrated all the usual characteristics of a new and imperfect technology. Since the mid-1980s, some 130 combustors have gone on-line nationally, and the plants are on-line and fully operational far more than was true of the earliest combustors.

Public Confidence ... and Opposition

While the number of incinerators and the percentage of solid waste incinerated have increased in the United States, incinerators have not escaped from the public anxiety and concern -- the NIMBY, Not In My Back Yard, phenomenon -- that greets many types of industrial siting actions (see Table 7). Proponents of increased reliance on waste-to-energy incineration point out that the facilities require far less acreage than is required of landfills, thereby increasing the number of potentially

Table 7
Public Attitudes
Toward Garbage Disposal

	Yes	No	Not sure
Would you object to a new waste-to-energy plant in your community?	55%	37%	8%
Would you object to a new landfill in your community?	36%	59%	5%
Should federal and state officials override local opposition to a disposal facility?	44%	50%	6%

Source: National Solid Wastes Management Association, May 1990.

available siting locations.

All the same, reporters won't be surprised to learn there actually are more than two sides to the story.

"Since 1985, some 40 mass burn plants, valued at about $4 billion, have been canceled, most before reaching the construction stage," Neil Seldman, a vocal critic of mass-burn waste-to-energy incineration and advocate of recycling, wrote in *Environment* in September 1989. "In 1987, for the first time, more plant capacity was canceled than was ordered ... Of the 100 plants that remain in the planning stage, most face very stiff opposition and probably will not be built."

The process of incineration produces two byproducts: air emissions and ash. These byproducts are at the heart of environmental concerns about and community opposition to incinerators.

Some state and local agencies have imposed comprehensive air pollution regulations on incineration facilities. Under the Clean Air Act prior to passage of the 1990 Amendments, the U.S. Environmental Protection Agency was constrained in setting standards. With more stringent standards authorized under the 1990 Amendments -- and with coverage extended for the first time to include existing facilities and not just new ones -- the agency in 1992 was to strengthen its regulations and apply them also to smaller facilities.

Specifically, the Clean Air Act Amendments of 1990 required EPA to set standards for large capacity facilities by late 1991 and for small capacity facilities (less than 250 tons per day) by late 1992. The Act requires that emissions limitations be established for particulates, opacity, sulfur dioxide, hydrogen chloride, oxides of nitrogen, carbon monoxide, lead, cadmium, mercury, dioxins, and dibenzofurans (see Appendix A).

In February 1991, EPA set standards and guidelines for existing facilities with more than 250 tons per day capacity and mandated the following types of controls:

- good combustion practices;
- particulate emission limits;
- organic emission limits;
- acid gas controls; and
- nitrous oxide (NOx) emission limits (new sources only).

For ash, though, the regulatory status is less clear. While the 1990 Clean Air Act Amendments prevented EPA from addressing ash as a hazardous waste for two years, until November 1992, individual states for the most part have moved to regulate ash management in some way (see "Incinerator Ash" below).

Air Emissions. Municipal solid waste combustor facilities produce air emissions that contain four general types of pollutants that can pose a range of health effects depending on exposures, concentrations, and other factors:

- particulate matter;
- acid gases (including sulfur oxides, nitrogen oxides, hydrogen chloride, and hydrogen fluoride);
- trace metals; and
- dioxins and furans.

Specific pollutants identified by EPA as existing in incinerator stack emissions include arsenic, beryllium, cadmium, chlorobenzenes, chlorophenols, chromium, formaldehyde, lead, mercury, and polychorinated biphenyls. Again, if audiences are to draw informed judgments, reporters need to keep in mind not just whether a pollutant is in the emissions but also in what concentrations and amounts.

The amount of air pollution produced and then emitted can be reduced primarily by doing three things:

- controlling what goes into the incinerator;
- keeping the temperature in the combustor consistently high; and
- installing, operating and maintaining control equipment to effectively trap pollutants before they can be emitted into the atmosphere.

Three types of air pollution control equipment are typically used in waste-to-energy facility smokestacks. The most common is an electrostatic precipitator, which electrically charges particulate matter, then attracts and holds it like a magnet.

Another type of equipment is a scrubber, which uses an alkaline material to cool and neutralize acid gases. The third type is a baghouse or filter, which traps particulate matter through a system of tubular bags.

EPA has determined that the most effective control system for removing incineration air pollutants is one that combines a scrubber with a baghouse or filter. The agency found that this system "can reduce emissions by more than 95 percent, in most cases." However, these control systems are more expensive than electrostatic precipitators, and the increased costs have led to resistance to using the more effective technology, especially in retrofitting older incinerators whose remaining lifetime raises cost-efficiency questions.

The 1990 amendments to the Clean Air Act require that standards be set for the emissions of particular pollutants from solid waste combustion facilities, and that the emissions be monitored and the results made available to the public.

Incinerator Ash. Until the 1980s, most of the public concern -- and also most of the mass media attention -- about incineration facilities focused on air emissions. Current debate now also focuses on the resulting ash.

Inform, a nonprofit research organization, conducted a study of 15 waste-to-energy facilities that "mirror the diversity" of the 128 that were operating at the end of 1990. Making certain assumptions, Inform estimated that the nation's 128 waste-to-energy facilities were generating more than 5.5 million tons of ash requiring disposal per year. (There were no national statistics at the time of the study.)

Incineration facilities, as some scientists point out, are not waste disposal systems but waste reduction systems. Once the solid waste is burned, ash remains as waste.

Ironically, as air pollution control equipment has become more efficient and effective in containing the emissions, the ash that remains from burning has become a focus of debate because the once-airborne pollutants become trapped, particularly in the fly ash, inside the incinerator. And just how toxic and potentially hazardous the ash might be is in dispute, as is the regulatory status of ash.

Some challenge the laboratory testing and methods used to determine whether potentially toxic pollutants are present at certain levels in the ash. Some regulatory authorities use the outcome of a test to determine how the ash is to be managed.

U.S. EPA currently does not regulate municipal waste combustion ash as a hazardous waste, and therefore does not require that ash be tested (for example, through a leaching test) to determine whether metals concentrations exceed certain limits. The agency has performed leaching studies on ash using a variety of leaching tests (including the Extraction Procedure Toxicity, or EP Tox, test and the Toxic Characteristic Leaching Procedure, TCLP, test). Although the ash may sometimes fail these tests, studies have shown that these tests may not be realistic indicators of "toxicity"; i.e., they may not yield results that accurately predict actual leachate quality. For example, ash generated in modern combustion facilities equipped with lime injection to control acid gas emissions generally "pass" a leaching test because of buffering by the lime-laden ash.

At the federal level, the Resource Conservation and Recovery Act (RCRA) (see Appendix A) exempts the burning of municipal solid waste in waste-to-energy facilities from being regulated as a hazardous waste. But the law is unclear on whether the exemption applies to the resulting ash.

EPA has interpreted the RCRA statute as saying that municipal waste combustion ash generated by energy recovery facilities is exempt from hazardous waste regulation. The agency contends that this interpretation is consistent with the text and legislative history of the statute and that Congress intended that the ash be regulated as a non-hazardous waste. EPA's position is that the ash can be safely managed in a municipal solid waste landfill designed in accordance with the new landfill criteria in its regulations in 40 C.F.R. Part 258 (see end of Chapter 3).

Despite this regulatory interpretation by EPA, the final decision regarding the regulatory status of the ash remains somewhat unclear and ultimately will rest in either the federal courts and/or Congress.

Many states, seeing what they view as a regulatory void, have moved ahead to regulate ash on their own. As of 1991, according to EPA, 49 states regulated ash management, with 40 states requiring testing of the ash. Of the 40 states that require testing, 25 require that ash found to be hazardous according to state standards be managed as a hazardous waste. Forty-eight (48) states have some kind of requirements concerning ash disposal.

So, how should ash be treated? As a solid waste or as a hazardous waste? Should it be disposed of in a hazardous waste landfill or in a monofill (a landfill for a single commodity) designed for only ash? Or where?

Some suggest an untapped commercial value for incinerator ash to be used in cinder blocks or as artificial ocean reefs. In this process, called *solidification* or *stabilization*, the ash is mixed with cement and/or alkaline scrubber materials to form a hard mass with less leaching potential. Stability of the ash remains a question mark. Would concrete containing ash leach lead or cadmium over time, and in concentrations that could pose public health risks? Reuse of the ash and other treatment technologies are under research at the State University of New York, Stony Brook, and other places.

Questions for Reporters to Keep in Mind

- Does the community have a comprehensive solid waste management plan that includes source reduction, recycling and composting?
- If they are planning a new incinerator, have community leaders carefully sized the incinerator to handle only the amount of waste the community produces after recycling and source reduction?
- Who is building the plant? Does the builder have experience building incinerators that are up and operating? What is the

operation history of those other plants?

- What is the incinerator's basic cost? Who is financing it and how?
- How much does it cost to dump solid waste at the incinerator (i.e., what is its tipping fee -- fee for dumping at a landfill or other waste facility)? Is the community contractually obligated to provide a minimum amount of solid waste?
- Who owns the plant? Who operates it? Does the operator have experience operating incinerators?
- Are plant employees formally trained and certified? How and by whom?
- Does the incinerator use mass-burn or a refuse-derived fuel technology? Are certain types of waste banned from the incinerator to reduce ash and emissions toxicity?
- What type of air emission control devices are used? How efficient are those devices? Is a regular maintenance program built in to keep the devices operating at maximum efficiency?
- What happens to the ash? Is there a plan for safe and effective ash management? Is the more toxic fly ash combined with less toxic bottom ash? Does the ash go to a landfill, a monofill devoted to a specific waste, or a hazardous waste dump? How much does ash disposal cost?
- What state, local and federal regulations govern ash disposal and air pollution controls?
- What happens to the garbage during scheduled shutdowns of the incinerator for maintenance?
- How often are ash toxicity and air emission levels tested, by whom and with what equipment?
- Are necessary state, local and federal permits and testing reports up to date?
- Is the combustion chamber working at highest possible performance standards?
- Who is buying the energy created by the plant and for how much?

Note: An important point for reporters and editors to keep in mind: Much press coverage of incinerator controversies has centered around the trace air emissions. Are reporters in effect "missing the story" in perhaps over-playing air emissions ... and under-playing ash?

Option: Landfills

Landfills are another option for handling the nation's municipal solid wastes.

They are not necessarily a preferred option, but rather landfills are a fact of life. Ultimately, they are a necessity, for the most resourceful minds cannot conjure a near-term future when the U.S. will have no need for landfills anywhere.

"There's no scheme that eliminates them," Gregg Easterbrook, contributing editor for *Newsweek* and *The Atlantic,* wrote in the April 30, 1990, issue of *The New Republic.*

A Landfill Is Not A Dump

Webster's Unabridged Third New International Dictionary defines landfill as "disposal of trash and garbage by burying it under layers of earth in low ground." The American Society of Civil Engineers takes the definition further, saying a sanitary landfill is:

> a method of disposing of refuse on land without creating nuisances or hazards to public health or safety, by utilizing the principles of engineering to confine the refuse to the smallest practical area, to reduce it to the smallest practical volume, and to cover it with a layer of earth at the conclusion of each day's operation or at such more frequent intervals as may be necessary.

Webster's defines dump as "an accumulation of refuse or other discarded materials" or "a place where such materials are dumped."

It comes down to this: A landfill is not, should not be, a dump. In its November 1989, *Decision-Makers Guide to Solid Waste Management,* EPA makes the distinction neatly: "The technologies used at modern landfills are more sophisticated than the open dump methods of the past," it says.

When is the last time your newspaper used "Sanitary Landfill" in a headline? Or the last time you saw the term used anywhere in a headline? Don't hold your breath. "Dump" is a headline writer's delight: Short, one-syllable, pithy, and at the same time graphic. Ideal. But perhaps inaccurate.

We've all seen "No dumping" signs along the highway. A dump is someplace where people wantonly pull up, discard something, usually in a random heap, and drive off. No advance planning, no design aspects to it all, no continued maintenance, and certainly no thought to quality control or long-term care. That's about it.

There's no analysis. There's no follow-up, no systematic intervention or monitoring.

Living Down the Reputation of a Legacy of 'Dumps'

Some of those same characteristics that give dumps their bad name could be said to apply to what were intended to have been landfills, not dumps. That's a past, and a painful reality, that well-engineered landfills are having a tough time putting behind them when it comes to popular perceptions.

Unlike the "spontaneous and unrehearsed" nature of a dump, a modern landfill is no accident. The best ones are carefully planned and meticulously sited from the start. New and existing landfills are subject to an array of federal, state, and local restrictions:

- siting standards;
- design and operating criteria;
- groundwater monitoring requirements;
- corrective action provisions;
- closure and post-closure care and financial assurance provisions; and
- landfill bans for particular wastes such as oil, batteries, household hazardous wastes, tires, and yard wastes.

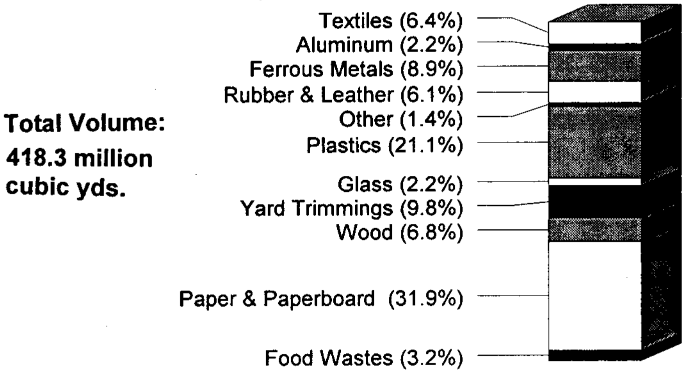
EPA says that in 1990, landfills were used to accommodate 66.6 percent of the nation's 195.7 million tons of municipal waste, with recovery for recycling and composting at 17.1 percent and solid waste combustion the remaining 16.3 percent.

In its *Characterization of Municipal Solid Waste in the U.S.: 1992 Update*, EPA predicts recovery for recycling and composting to increase from 17.1 percent to 25 and 30 percent in the years 1995 and 2000, respectively. It expects solid waste combustion to increase from 16.3 percent to 17 and 20.8 percent in 1995 and 2000, respectively. Also, EPA predicts the percentage remaining for landfill disposal to decrease to 58 percent in 1995 and to 49.2 percent in the year 2000.

Can Landfills Measure Up?

With a growing population and expanding U.S. economy generating more and more waste each year -- at a rate that exceeds the overall rates of both economic and population growth -- are landfills up to the task? Reporters are well-familiar with reports of a landfill "capacity crisis," and many experts have come to accept, albeit reluctantly, that all landfills leak ... eventually. How do those factors enter the solid waste equation, and how can reporters responsibly deal with them?

Figure 4
Types of Materials Discarded in Landfills, by Volume, 1990
(Percent of total)



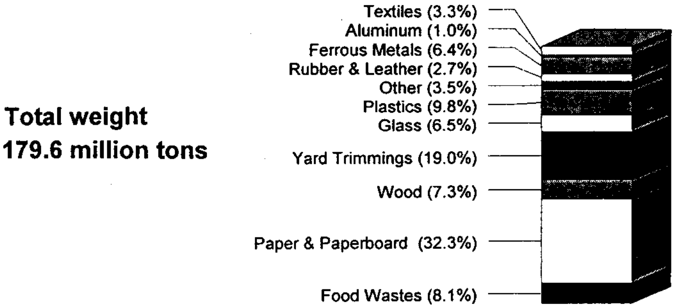
Source: Characterization of Municipal Solid Waste in the U.S.: Update 1992, *U.S. Environmental Protection Agency.*

Writing in *The New Republic* in April 1990, Gregg Easterbrook said, "Except in a few densely populated cities, it's nutty to maintain that a country as vast as America is `running out' of space for landfills. There is room to landfill our trash till the Lord's return. What we are running out of is willingness to tolerate landfills."

Easterbrook says that although landfills "can be built with reasonable environmental safety, they are fundamentally bad ideas: enablers of an irresponsible attitude toward resource consumption."

Given that source reduction and recycling "won't ever solve

Figure 5
Types of Materials Discarded in Landfills, by Weight, 1990
(Percent of total)



Source: Characterization of Municipal Solid Waste in the U.S.: Update 1992, *U.S. Environmental Protection Agency.*

all disposal problems," Easterbrook concludes that municipal solid waste "is probably best managed with a combination of moderate recycling, waste-to-energy plants burning the bulk of the trash, and some landfills (there's no scheme that eliminates them) for ash from the burners."

Figures 4 and 5 show, by volume and weight respectively, the percentage by types of materials discarded in the municipal solid waste stream (after composting, recycling and combustion).

Landfill regulations adopted in October 1991 are summarized at the end of this chapter.

Public Confidence ... and Opposition

Resolving the issue of public opposition to siting will be difficult, unless citizens are confident of the engineering design of the landfills and environmental integrity of whoever manages them.

Several factors should be kept in mind when reporting on municipalities' efforts to cope with their solid waste challenges:

Location restrictions should be applied and enforced so that they forbid siting of landfills at, on, or near airports; floodplains; wetlands; fault areas; seismic impact zones; and geologically unstable areas.

To help protect groundwater resources, new landfills should be designed with effective low-permeability membranes or soil liners to minimize the movement of leachates from the landfill to groundwater. In some cases, more than one liner, or a mix of different kinds of liners, may be needed.

Another important design element in new landfills is that they incorporate effective groundwater monitoring and sampling techniques to ensure that any contamination is detected early. Groundwater around existing landfills should be monitored to ensure adequate protection.

Even the presumed truism that "all landfills leak" might in the end merely raise other important follow-up questions: "Eventually," but when? And how much before the leak can be detected and stopped? What is the effect of the leak? Does monitoring detect the leak before important groundwater resources are affected?

Releases of leachates to ground and surface waters are not the only obstacle facing landfills when it comes to public opposition and anxieties. Air emissions from landfills, including odor problems, also are a concern.

Methane gas in particular is a problem, since methane is a highly combustible byproduct of the decomposition of organic refuse in the absence of air.

"Landfill gas emissions are comprised of a mixture of carbon dioxide and methane, of which methane comprises 50 to 60 percent," EPA says in its *Decision-Makers Guide.* "At and around municipal solid waste landfills, methane can migrate through soil and accumulate in closed areas (e.g., building basements) where it can present significant explosion dangers if not properly controlled. A normal landfill will generate methane at these concentrations for 10 to 20 years as waste decomposition takes place, although methane generation can continue for over 100 years."

"A system that recovers methane -- the volatile gas given off by decomposition within the landfill -- should be installed after closure of the landfill to minimize air pollution and recover a valuable fuel," writes Ford Fessenden of *Newsday* in the newspaper's 1989 book *Rush to Burn: Solving America's Garbage Crisis?,* a paperback that reprints a 10-part, 55,000-word series done for the paper by more than two-dozen staffers in what became known as "The Garbage Project."

Table 8
Municipal Solid Waste Landfill Tipping Fees by Region, 1990

Region	Average	Minimum	Maximum
Northeast	64.76	12.00	120.00
Mid-Atlantic	40.75	6.00	89.00
South	16.92	5.25	40.00
Midwest	23.15	5.65	50.00
West Central	11.06	8.88	13.50
South Central	12.50	6.75	26.25
West	25.63	14.75	55.00
National	26.56	5.25	120.00

Northeast: CT MA ME NH NY RI VT
Mid-Atlantic: DE MD NJ PA VA WV
South: AL FL GA KY MS NC SC TN
East Central: IA IL IN OH MI MN MO WI
West Central: CO KS MT NE ND SD UT WY
South Central: AR AZ LA NM OK TX
West: CA ID NV OR WA
Source: National Solid Wastes Management Association, 1990.

Such a methane recovery effort might consist of a passive system of trenches housing gravel and perforated piping and circumventing the landfill's perimeter. With such a system, methane from the landfill moves to the perimeter trenches and through the piping system until it is vented or flared. With an active methane control system, blowers would help to extract the gas from the landfill.

EPA cites 1989 data indicating that 155 landfills in the U.S. were recovering methane gas, or planning to do so. "Methane recovery is expected to become an important aspect of municipal solid waste landfill operation in the future," the agency says, explaining that when impurities are removed from the methane it can be used as a low-grade fuel or upgraded to pipeline-quality methane.

Table 9
Municipal Solid Waste Landfill Rankings: Tipping Fees, Environmental Protection Features, and Capacity, 1990

Rank	Highest Average Tipping Fee	Most Environmental Protection Features	Least Average Remaining Capacity
1	Northeast	Northeast	Northeast
2	Mid-Atlantic	Mid-Atlantic	South
3	West	Midwest	West
4	Midwest	West	Midwest
5	South	South	Mid-Atlantic
6	South Central	West Central	South Central
7	West Central	South Central	West Central

Source: National Solid Wastes Management Association, 1990.

One ironic effect of the increasingly stringent landfill siting and operation requirements over the past several years has been to increase the waste "capacity crisis," as higher design and operating costs and tougher regulatory thresholds have driven some low-end landfills out of existence, unable to compete financially and unable to survive environmentally. From an environmental standpoint, such a "loss" may not be much of a loss after all, though the capacity challenges it presents are no less significant. The likelihood over the near term is for a trend toward fewer but larger regional landfills -- properly sited, designed, built and maintained, and serving a larger geographical area.

Citizen concerns and more stringent environmental requirements are among the factors which have led to significantly

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increased costs for using landfills. The National Solid Wastes Management Association (NSWMA) conducted a survey of 219 municipal solid waste landfills owned predominantly by NSWMA members but also nonmembers, for their disposal tipping fees. Northeast facilities averaged the highest fee at $64.26 per ton and West Central facilities averaged the lowest at $11.06 per ton (see Table 8).

In its survey report, NSWMA said the "tip fees in all regions were related to the level of environmental protection afforded by the facilities," with the Northeast and Mid-Atlantic reporting the most widespread use of environmental protection features.

Tipping fees also were inversely related to capacity, said NSWMA, with the Northeast reporting the highest fee ($64.26) and the least remaining capacity (see Table 9).

Questions for Reporters to Keep in Mind

- What are the technical criteria that went into the siting of a new landfill? What was the environmental and economic basis for selecting a particular site? What other sites were judged less well-suited to siting a landfill? What is the company's track record? Is the site in a watershed? a flood plain? upstream from a water supply reservoir? Will less safe "dumps" be closed when this new landfill is opened? What other options are available?
- What measures and what technologies are being used to ensure that groundwater resources are adequately protected? What monitoring protocols and techniques are being used to minimize migration of leachates?
- What is being done to control releases of methane gas and other air pollutants from the landfill? Are methane recovery techniques being planned or used?
- What is the protocol for day-to-day effective operation and maintenance, and what steps are taken to make sure that the protocol is followed? Are operators certified? How? What criteria are used in certification?
- What are the options to landfilling in particular instances? What are the "tradeoffs" involved with those options, both from a financial and from an environmental standpoint? What steps are being taken to reduce, where possible, over-reliance

on landfilling? What steps are taken to ensure that banned wastes do not nonetheless end up in the landfill?

- If the landfill is private, how much is the community being compensated (fees or other) and how does this compare to other communities with similar projects?
- Is the company new in the business? If not, what is their environmental compliance track record with other landfills or incinerators?
- Will the waste operation actually provide the economic development and jobs it promises? What has been the economic impact on communities with similar projects?
- What is the life expectancy of the landfill? What if any wastes will be prohibited from being disposed of there? Was it the low bid? If not, why was low bid rejected?

Outlook

Even the most successful source reduction and recycling initiatives inevitably will leave some wastes to be managed through efficient and environmentally protective combustion and landfilling. In the case of landfilling, the prospects for building and maintaining public confidence essential to their operation will rest heavily with restricting from landfills those special wastes unsuited to landfilling, and ensuring effective siting, design, and opera-tion and maintenance practices for those wastes that are landfilled.

Effective reporting on municipal landfills will help flag environmental and public health shortcomings where they exist, and help allay unfounded public anxieties when they are truly unfounded.

The increased environmental awareness of Americans in the early 1990s is likely to lead to increased recycling and reuse, and source reduction increasingly is becoming a part of the American "corporate environmental ethic," in part because of cost savings and fears of liability associated with waste disposal.

As mentioned earlier, however, source reduction and recycling in themselves are no panacea. After they have accomplished what they realistically can, the challenge to environmental journalists will remain: how best to help the lay public reach informed decisions on the optimum handling of the remaining waste stream.

Municipal Solid Waste Landfill Regulations (RCRA, Subtitle D)

EPA on October 9, 1991, adopted regulations affecting about 6,000 municipal solid waste landfills nationwide. The regulations establish minimum federal criteria for municipal landfills, including those used for co-disposal of sewage sludge and disposal of nonhazardous municipal waste combustion ash. The rules set standards for location, operation and maintenance, design, closure and post-closure care, and for financial assurance for municipal solid waste landfills. The rules were adopted under the authority of the Resource Conservation and Recovery Act, Subtitle D, as amended in 1984.

The regulations are intended to give states flexibility to meet state-specific conditions. To be implemented by states, the rules are expected to lead to the closure of many smaller community landfills and development of fewer, larger regional landfills. The new federal standards are described below.

Location requirements: Restrictions apply to siting new or existing landfills near airports and in ecologically valuable wetlands or areas subject to natural disasters, such as floodplains, fault areas, seismic zones, or unstable areas.

Airport safety: Any new or existing landfill within 10,000 feet of a runway used by turbojet aircraft or within 5,000 feet of a runway used only by piston-type aircraft must demonstrate that the unit does not pose a bird hazard to aircraft. Any new owner/operator proposing a unit or lateral expansion within a five-mile radius of an airport runway must notify the airport and the Federal Aviation Administration.

Floodplains: Any new or existing landfill located in a 100-year floodplain may not restrict the flow of the 100-year flood, reduce the temporary water storage capacity of the floodplain, or result in the washout of solid waste.

Wetlands: New units or lateral expansions are forbidden in wetlands unless the owner/operator can demonstrate to the director of the approved state: that there is no practical alternative; that it will not contribute to violation of water quality or marine sanctuary standards or degradation of wetlands; that it will not jeopardize endangered species or critical habitats; that ecological resources are protected; and that steps have been taken to achieve no net loss of wetlands.

Fault areas: In general, new units or lateral expansions are banned within 200 feet of faults and within seismic impact zones. The director of the approved state may establish alternative setback of less than 200 feet.

Seismic impact zones: New and lateral expansions are prohibited unless demonstrated to the director of the approved state that all containment structures are designed to resist the maximum horizontal acceleration in lithified earth material.

Unstable areas: New or existing landfills located in unstable areas must demonstrate that the structural components will not be disrupted by events such as landslides.

All the restrictions apply to new units and expansions, while existing units must only comply with the airports, floodplains and unstable areas restrictions. Existing landfills that cannot meet the criteria must close within five years (by 1996). An extension for up to two years is allowed by the director of the approved state if there is a showing that no alternative treatment capacity is available and that human health and the environment will not be threatened as the result of an extension.

Operation and maintenance standards:

1) A cover of at least six inches of earthen materials must be applied at the end of each operating day. Alternative materials and thicknesses are allowed by the director of the approved state.

2) Regulated quantities of hazardous waste and polychlorinated biphenyl (PCB) wastes must be kept out (for instance, through use of random inspections of incoming loads).

3) Methane gas must be monitored at least quarterly to ensure that concentration does not exceed 25 percent of the lower explosive limit (LEL) in on-site buildings and does not exceed the LEL itself at the facility property boundary. "Lower explosive limit" means *the lowest percent by volume of a mixture of explosive gases in air that will propagate a flame at 25 degrees Centigrade and atmospheric pressure.*

4) To control illegal dumping and public exposure to hazards, public access must be restricted.

5) Except in limited circumstances, open burning must be eliminated.

6) Stormwater run-on and run-off must be controlled.

7) Surface water must be protected from pollutants to comply with the Clean Water Act.

8) The disposal of bulk liquid waste must be restricted. Leachate or gas condensate recirculation is allowed under limited circumstances.

9) Disease vector populations (rodents, flies, mosquitoes, etc.) must be controlled.

10) Appropriate operating records must be kept and made available to the state agency upon request (see Table 10).

Table 10
Recordkeeping Requirements

- Any location restriction demonstration required;
- Inspection records, training procedures and notification procedures;
- Gas monitoring results from monitoring and any remediation plans;
- Any municipal solid waste landfill (MSWLF) unit design documentation for placement of leachate or gas condensate in a MSWLF unit;
- Any demonstration, certification, finding, monitoring, testing, or analytical data required by the groundwater monitoring requirements;
- Closure and post-closure care plans and any monitoring, testing, or analytical data required under the closure and post-closure care requirements;
- Any cost estimates and financial assurance documentation; and
- Any information demonstrating compliance with small community exemption.

The owner/operator must notify the state when any of these documents have been placed or added to the operating record, and all information contained in the operating record must be furnished upon request to the state agency or be made available at all reasonable times for inspection. Also, the state agency can set alternative schedules for recordkeeping and notification requirements except for the notification requirements in Sections 258.10 (airport safety) and 258.55(g)(1)(iii) (a particular requirement for assessment monitoring programs).

Design standards: In states that specified Maximum Contaminant Levels (MCLs) with EPA-approved permitting programs, landfills must be designed to ensure standards are not exceeded in groundwater. Certain values cannot be exceeded in the upper-most aquifer at a point specified by the state agency (see Table 11). That "point" must be on the facility property and be no more than 150 meters from the waste management unit boundary.

In states without EPA-approved programs, landfills must be designed with a composite liner system which includes a flexible membrane liner, a layer of compacted soil, and a leachate collection and removal system (see Figure 6).

Closure and post closure care: When a landfill stops accepting waste, it must be covered with a minimum of two feet of earthen material (six-inch erosion layer, plus 18-inch infiltration layer) to keep liquids out and prevent erosion. Once the landfill is closed, the owner/operator is responsible for maintaining the integrity and effectiveness of the final cover, monitoring groundwater and methane gas, and continuing leachate management (if applicable) for 30 years. The state may decrease the post-closure period if doing so does not threaten human health or the environment. Closure operations must begin within 30 days of final receipt of waste and must be completed within the succeeding 180 days. Approved states have the flexibility to extend these deadlines. Also, after the unit is closed, the owner/operator must record a notation in the property deed indicating the property had been used as a landfill and that its use is restricted.

Owners/operators are required to prepare closure and post-closure plans by October 9, 1993, or by their initial receipt of waste, whichever is later. Plans must describe the steps necessary to close the landfill and the maintenance and monitoring activities that will be performed after closure.

Financial assurance: Landfill owners/operators by April 1994 must demonstrate their financial ability to cover costs of closure, post-closure care and any known corrective actions. The cost estimates must be updated annually. The financial assurance may be in the form of a trust fund with a pay-in period, surety bond, letter of credit, insurance, state-approved mechanism, or

Table 11
Maximum Contaminant Levels (MCLs)
Under the Safe Drinking Water Act

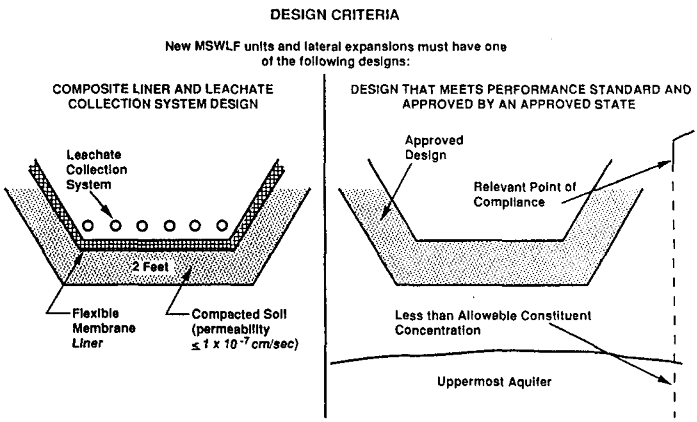
CAS No.	Chemical	MCL (mg/l)
7440-38-2	Arsenic	0.05
7440-39-3	Barium	1.0
71-343-2	Benzene	0.005
7440-43-9	Cadmium	0.01
56-23-5	Carbon tetrachloride	0.005
7440-47-3	Chromium (hexavalent)	0.05
94-75-7	2,4-Dichlorophenoxy acetic acid	0.1
106-46-7	1,4-Dichlorobenzene	0.075
107-06-2	1,2-Dichloroethane	0.005
75-35-4	1,1-Dichloroethylene	0.007
75-20-8	Endrin	0.0002
7 --	Fluoride	4.0
58-89-9	Lindane	0.004
7439-92-1	Lead	0.05
7439-97-6	Mercury	0.002
72-43-5	Methoxychlor	0.1
--	Nitrate	10.0
7782-49-2	Selenium	0.01
7440-22-4	Silver	0.05
8001-35-2	Toxaphene	0.005
71-55-6	1,1,1-Trichloroethane	0.2
79-01-6	Trichloroethylene	0.005
93-76-5	2,4,5-Trichlorophenoxy acetic acid	0.01
75-01-4	Vinyl chloride	0.002

state assumption of responsibility, or a combination of mechanisms. (The U.S. Environmental Protection Agency expects in 1993 to propose a local government financial test that will allow financially strong municipalities to demonstrate financial assurance.)

Groundwater monitoring: The regulations require a system of monitoring wells to be installed at existing landfills and new units.

New units must have monitoring systems in place before they

Figure 6
Design Criteria for New Landfill Units



Source: Solid Waste Disposal Facility Criteria (40 CFR Parts 257 and 258), Final Rule.

can accept waste. Existing landfill units and expansions must install systems on a schedule determined by proximity to nearest drinking water intake (see Table 12). States may establish an alternate schedule whereby all existing facilities install monitoring systems by 1996. Each groundwater monitoring system must be certified as adequate by a qualified groundwater scientist or approved by the director of the approved state.

Closure and post-closure periods are exempt from the groundwater monitoring requirements if owners/operators can demonstrate to the state that the landfill unit is located above a hydrogeologic setting that will prevent hazardous constituent migration to groundwater during the active life.

The regulations include specific procedures for sampling monitoring wells and methods for statistical analysis and determination of groundwater elevations and background groundwater quality. Samples must be taken at least semi-

Table 12
Effective Dates for Landfill Regulations

Date	Provision
OCT 1991	Final cover requirements (for facilities receiving wastes after that date).
OCT 1993	Location restrictions. Design criteria. Operating criteria. Groundwater monitoring and corrective action (new units). Closure and post-closure care.
APR 1994	Financial assurance.
OCT 1994	Groundwater monitoring and corrective action (existing units or lateral expansions less than one mile from drinking water intake).
OCT 1995	Groundwater monitoring and corrective action (existing units or lateral expansions greater than one mile but less than two miles from drinking water intakes).
OCT 1996	Groundwater monitoring and corrective action (existing units or lateral expansions greater than two miles from drinking water intakes).

annually during a facility's active life and during the closure and post-closure periods. Approved states can specify an alternative monitoring frequency, but no less than annual for detection monitoring.

If any of the constituents listed in Appendix C (which includes 47 volatile organic compounds and 15 metals) is detected at statistically significant levels above background, then the owner/operator must: establish an assessment monitoring program within 90 days. The assessment monitoring program includes sampling of all the constituents listed in Appendix D, and if any constituent is detected at statistically significant levels above an established groundwater protection standard then an assessment of correction action remedies and the selection of a corrective action must be undertaken.

Chapter 4
Information Sources

Aluminum Association
900 19th St., NW
Washington, DC 20006
(202) 862-5100

Aluminum Recycling
Association
1000 16th St., NW, Suite 603
Washington, DC 20036
(202) 785-0951

American Paper Institute
260 Madison Ave.
New York, NY 10016
(212) 340-0654

American Paper Institute
1250 Conn. Ave., NW
Suite 210
Washington, DC 20036
(202) 463-2420

AM Iron & Steel Institute
1133 15th St., NW, Suite 300
Washington, DC 20005
(202) 452-7100

American Plastics Council
1275 K St., NW, Suite 400
Washington, DC 20005
(202) 371-5319

American Recovery
Corporation
900 19th St., NW, Suite 600
Washington, DC 20006
(202) 775-5150

Association of
Petroleum Refiners
P.O. Box 427
Buffalo, NY 14205
(716) 855-2212

Association of State and
Territorial Solid Waste
Management Officials
444 N. Capitol St., Suite 388
Washington, DC 20001
(202) 624-5828

Biocycle Magazine
Box 351
Emmaus, PA 18049
(717) 957-4195

Center for Plastics Recycling
Research, Rutgers University
Bldg. 3529-Busch Campus
Piscataway, NJ 08855
(201) 932-4402

Citizen's Clearinghouse for
Hazardous Waste
P.O. Box 926
Arlington, VA 22216
(703) 276-7070

Can Manufacturers Institute
821 15th St., NW
Washington, DC 20005
(202) 232-4677

Clean Water Fund
317 Penn. Ave., SE, 3rd Fl.
Washington, DC 20005
(202) 547-2312

Coalition for Recyclable Waste
17 E. Church St.
Absecon, NJ 08201
(609) 641-2197

Concern, Inc.
1794 Columbia Rd., NW
Washington, DC 20009
(202) 328-8160

Cook College
Department of Environmental Science
P.O. Box 231
New Brunswick, NJ 08903
(201) 932-9571

Council of State Governments
Iron Works Pike
P.O. Box 11910
Lexington, KY 40578-1910
(606) 231-1866

Council on Packaging in the Environment (COPE)
1275 K St., NW, Suite 300
Washington, DC 20005
(202) 789-1310

Environmental Action
1525 New Hampshire Ave.
NW
Washington, DC 20036
(202) 745-4870

Environmental Defense Fund
257 Park Ave., South
New York, NY 10010
(212) 505-2100

Environmental Defense Fund
1875 Connecticut Ave., NW
Washington, DC 20009
(202) 387-3500

Environmental Institute for International Research
331 Madison Ave., 6th Floor
New York, NY 10017
(212) 883-1770

Food Service and Packaging Institute
1025 Conn. Ave., NW
Suite 513
Washington, DC 20036
(202) 347-3756

Garbage Magazine
435 Ninth St.
Brooklyn, NY 11215
(718) 788-1700

Glass Packaging Institute
1801 K St., NW, Suite 1105-L
Washington, DC 20006
(202) 887-4850

Inform
381 Park Ave., S.
New York, NY 10016
(212) 689-4040

Institute for Local
Self-Reliance
2425 18th St., NW
Washington, DC 20009
(202) 232-4108

Institute of Resource Recovery
1730 Rhode Island Ave., NW
Suite 1000
Washington, DC 20036
(202) 659-4613

Institute of Scrap
Recycling Industries Inc.
1627 K St., NW
Washington, DC 20006
(202) 466-4050

Integrated Waste
Services Assoc.
1133 21st St., NW
Washington, DC 20036
(202) 467-6240

International City Management Association
777 N. Capitol St., NE
Suite 500
Washington, DC 20002
(202)289-4262

Keep America Beautiful Inc.
Mill River Plaza
9 West Broad St.
Stamford, CT 06902
(203) 323-8987

Municipal Waste Management Association
1620 I St., NW, 4th Floor
Washington, DC 20006
(202) 293-7330

National Association for Plastic
Container Recovery
5024 Parkway Plaza Blvd.
Suite 200
Charlotte, NC 28217
(704) 357-3250

National Association
of Counties
440 First St., NW
Washington, DC 20001
(202) 393-6226

National Association of
Recycling Industries, Inc.
330 Madison Ave.
New York, NY 10017
(212)

National Association of
Solvent Recyclers
1333 New Hampshire Ave.,
NW, Suite 1100
Washington, DC 20036
(202) 463-6956

National Association of Towns
and Townships
1522 K St., NW, Suite 730
Washington, DC 20005
(202) 737-5200

National Container
Recycling Coalition
712 G St., SE, Suite 1
Washington, DC 20003
(202) 543-9449

National League of Cities
1301 Penn. Ave., NW
Washington, DC 20004
(202) 626-3000

National Oil
Recyclers Association
2600 Virginia Ave., NW
Suite 1000
Washington, DC 20037
(202) 333-8800

National Recycling
Coalition, Inc.
1101 30th St., NW, Suite 305
Washington, DC 20007
(202) 625-6406

National Resource
Recovery Association
1620 I St., NW
Washington, DC 20006
(202) 659-4613

National Soft
Drink Association
Solid Waste Manage-
ment Department
1101 16th St., NW
Washington, DC 20036
(202) 463-6740

National Solid Waste Institute
10928 North 56th St.
Tampa, FL 33617
(813) 985-3208

National Solid Wastes
Management Association
1730 Rhode Island Ave., NW
Suite 100
Washington, DC 20036
(202) 659-4613

National Tire Dealers and
Retreaders Association
1250 I St., NW, Suite 4000
Washington, DC 20005
(202) 789-2300

National Wildlife Federation
1400 16th St., NW
Washington, DC 20036-6800
(202) 797-6800

Natural Resources
Defense Council
40 W. 20th St.
New York, NY 10011
(212) 727-2700

North American Water Office
15119 E. Franklin Ave.
Minneapolis, MN 55404
(612) 872-1097

Organic Gardening Magazine
Rodale Press, Inc.
Emmaus, PA 18098

Plastic Bottle
Information Bureau
1275 K St., NW, Suite 400
Washington, DC 20005
(202) 371-5244

Polystyrene Packaging
Council, Inc.
1025 Connecticut Ave., NW
Washington, DC 20036
(202) 822-6424

Resource Recovery Institute
2045 N. 15th St., Suite 310
Arlington, VA 22201
(703) 528-5756

Solid Waste
Information Clearinghouse
P.O. Box 7219
8750 Georgia Ave., Ste. 140
Silver Spring, MD 20910
(301) 67-SWICH

RCRA/Superfund Hotline
(800) 424-9346
(703) 920-9810

Renew America
1400 16th St., NW, Suite 710
Washington, DC 20036
(202) 232-2252

Rubber Manufacturers Assoc.
1400 K St., NW, Suite 900
Washington, DC 20005
(202) 682-4800

Society of Plastics
Industry, Inc.
1275 K St., NW, Suite 400
Washington, DC 20005
(202) 371-5200

Solid Waste Association of
North America
P.O. Box 6126
Silver Spring, MD 20916
(301) 585-2898

Steel Can Recycling Institute
680 Andersen Dr.
Pittsburgh, PA 15220
(800) 876-SCRI

U.S. Conference of Mayors
Institute for
Resource Recovery
1620 I St., NW, 4th Floor
Washington, DC 20006
(202) 293-7330

U.S. Department of Agriculture
Agricultural Research Service
Soil Microbial Systems Lab
Building 318, Barc-E
Beltsville, MD 200705
(301) 344-3327

U.S. Environmental Protection Agency Regional Offices:

Region 1 -- (617) 565-3715:
CT ME MA NH RI VT
Region 2 -- (212) 264-2657:
NJ NY PR VI
Region 3 -- (215) 597-9800:
DE DC MD PA VA WV

Region 4 -- (404) 347-4727:
AL FL GA KY MS NC SC TN
Region 5 -- (312) 353-2000:
IL IN MI MN OH WI
Region 6 -- (214) 655-6444:
AR LA NM OK TX
Region 7 -- (913) 551-7000:
IA KS MO NE
Region 8 -- (303) 293-1603:
CO MT ND SD UT WY
Region 9 -- (415) 556-6322:
AZ CA HA NV AS GU
Region 10 -- (206) 442-1200:
AK ID OR WA

U.S. Public Interest Research Group
215 Penn. Ave., SE
Washington, DC 20003
(202) 546-9707

Vinyl Institute
155 Route 46W.
Wayne, NJ 07470
(201) 890-9299

Worldwatch Institute
1776 Mass. Ave., NW
Washington, DC 20036
(202) 452-1999

North American Waste Exchanges

Some of the exchanges below may operate nationally, while others are limited to one or two regions. Reprinted with permission from *The Green Business Letter.*

U.S. Exchanges:

California Waste Exchange, Toxic Substances Control Div.
P.O. Box 806
Sacramento, CA 95812
(916) 324-1807

Indiana Waste Exchange
2129 Civil Engineering Bldg.
Purdue University
W. Lafayette, IN 47907
(317) 494-5038

Industrial Materials Exchange
172 20th Ave.
Seattle, WA 98122
(206) 296-4633

Industrial Materials Exchange Service
P.O. Box 19276
Springfield, IL 62794
(217) 782-0540

Industrial Waste
Information Exchange
NJ Chamber of Commerce
50 West St., Ste. 1110
Trenton, NJ 08608
(609) 989-7888

Montana Industrial
Waste Exchange
Chamber of Commerce
P.O. Box 1730
Helena, MT 59624
(406) 442-2405

Northeast Industrial
Waste Exchange
90 Presidential Plaza, Ste. 122
Syracuse, NY 13202
(315) 422-6572

Pacific Materials Exchange
South 3707 Godfrey Blvd.
Spokane, WA 99204
(509) 623-4244

RENEW
Texas Water Commission
P.O. Box 13087
Austin, TX 78711
(512) 463-7773

Resource Exchange & News
3250 Townsend NE
Grand Rapids, MI 49505
(616) 363-3262

Southeast Recycling
Market Council
P.O. Box 11468
Montgomery, AL 36111
(205) 277-7050

Southeast Waste Exchange
Urban Institute, UNCC Station
Charlotte, NC 28223
(704) 547-2307

Southern Waste
Information Exchange
P.O. Box 960
Tallahassee, FL 32302
(800) 441-SWIX
(904) 644-5516

Canadian Exchanges:

Alberta Waste
Materials Exchange
Alberta Research Council
P.O. Box 8330, Postal Station
F, Edmonton, Atla T6H 5X2
(403) 450-5408

British Columbia
Waste Exchange
1525 West 8th Ave.
Vancouver, BC V6J 1T5
(604) 731-7222

Canadian Chemical Exchange
P.O. Box 1135
Ste. Adele, Que 1LO
(514) 229-6511

Canadian Waste
Materials Exchange
ORTECH Intl, 2935 Speakman
Dr, Mississauga, Ont. L5K 1B3
(416) 822-4111 x265

Manitoba Waste Exchange
c/o Biomass Energy Institite
1329 Niakwa Rd E.
Winnipeg, MB R2J 3T4
(204) 257-3891

Peel Regional Waste Exchange
Regional Municipality of Peel
10 Peel Dr.
Brampton, Ont L6T 4B9
(416) 791-9400

Appendix A
Major Laws Affecting Municipal Solid Waste Management

Resource Conservation and Recovery Act (RCRA): In 1965, the Solid Waste Disposal Act was passed to improve solid waste disposal methods. It was amended in 1970 by the Resource Conservation and Recovery Act (RCRA), which itself was amended in 1980 and 1984.

Subtitle D of RCRA is for the environmentally safe operation of solid waste management facilities. At a minimum, state waste disposal facilities must comply with federal standards, although states may adopt more stringent standards.

Subtitle D also established a program under which states may develop and implement solid waste management plans. Because this portion of the law is voluntary, EPA's role has been limited to setting the minimum regulatory requirements that states must follow in designing their plans, and approving plans that comply with these requirements. Responsibility for developing and implementing the plan lies with each state.

Subtitle F of RCRA, also known as Section 6002, requires the federal government to participate actively in procurement programs fostering the recovery and use of recycled materials and energy. It requires federal agencies and other groups receiving federal funds to procure items composed of the highest percentage of recovered materials practicable and to delete requirements that products be made from virgin materials.

Subtitle C of RCRA regulates the generation, transportation, and treatment, storage, or disposal of hazardous wastes. Wastes designated by RCRA as hazardous are excluded from Subtitle D incinerator and landfill facilities and must be discarded at facilities permitted under the Subtitle C regulations.

Clean Air Act of 1970: Under the Clean Air Act, incinerators must meet performance standards that limit emissions of individual pollutants to the air. Facilities must meet these standards by using the best available technology.

Clean Water Act (1972): The Clean Water Act applies to waste disposal facilities generating ash-quench water, landfill leachate, and surface water discharges. Disposal of ash-quench water and landfill leachate can present problems for solid waste facilities because many wastewater treatment plants cannot accept these discharges. Facilities generating surface water discharges must use best available technology to control these discharges and must obtain a discharge permit.

The 1987 reauthorization of the Clean Water Act, called the Water Quality Act, mandates site-specific requirements for facilities that discharge to streams where the best available technology still fails to meet water quality standards. It also requires storm water management plans for facilities whose storm runoff volume exceeds specified limits. A facility within a wetlands area needs a Section 404 permit under the Clean Water Act.

Safe Drinking Water Act (1984): The protection of water wellhead areas, the sources of springs or streams, as defined in the Safe Drinking Water Act may affect municipal waste disposal facilities. Facilities located in wellhead areas must comply with state and local restrictions on their activities, including design specifications that may add significantly to the cost of the facility.

Public Utilities Regulatory and Policy Act (PURPA) (1978): Developed to encourage cogeneration and small power producers to supplement existing electrical capacity, PURPA requires investor-owned utilities to purchase electrical power from cogenerators or small producers, such as municipal incinerators, at rates developed by state public utilities boards and overseen by the Federal Energy Regulatory Commission. PURPA therefore guarantees a market and a fair price for the energy produced, to control project risk.

Comprehensive Environmental Response, Compensation and Liability Act (Superfund) (1980): Under Superfund, municipalities can be held liable for current and past waste disposal practices. Superfund applies to any environmental cleanup, and a substantial number of the sites currently listed as Superfund sites are municipal landfills.

Appendix B
Municipal Solid Waste Management: State-by-State

State	Total Municipal Solid Waste (MSW) Generated (Tons/Year)	Percent Recycled	Percent Incinerated	Percent Landfilled
Alabama	5,200,000	12	8	80
Alaska	500,000	6	15	79
Arizona[1]	4,147,000	7	0	93
Arkansas[1]	2,154,000	10	5	85
California[2]	44,535,000	11	2	87
Colorado	3,500,000	26	1	73
Connecticut	2,900,000	19	57	24
Delaware[1]	790,000	16	19	65
D.C.[3]	919,000	30	59	11
Florida[4]	19,400,000	27	23	49
Georgia	6,000,000	12	3	85
Hawaii[1]	1,300,000	4	42	54
Idaho	850,000	10	0	90
Illinois[2]	14,140,000	11	2	87
Indiana[5]	8,400,000	8	17	75
Iowa	2,088,000	23	2	75
Kansas	2,400,000	5	0	95
Kentucky	4,650,000	15	0	85
Louisiana	3,484,000	10[6]	0	90[6]
Maine[3]	1,246,000	30	37	33
Maryland	5,000,000	15	17	68
Massachusetts	6,600,000	30	47	23

Michigan[1]	13,000,000	26	17	57
Minnesota	4,270,000	38	35	27
Mississippi	1,400,000	8	3	89
Missouri	7,500,000	13	0	87
Montana	744,000	5	2	93
Nebraska	1,400,000	10[6]	0	90[6]
Nevada	2,300,000	10	0	90
New Hampshire[1,3]	1,138,000	10	26	64
New Jersey[3]	7,513,000	34	21	45
New Mexico	1,487,000	6	0	94
New York[3,4]	22,800,000	21	17	62
North Carolina[2]	7,788,000	4	1	95
North Dakota	466,000	17	0	83
Ohio[2]	16,400,000	19	6	75
Oklahoma	3,000,000	10	8	82
Oregon[1]	3,350,000	23	6	71
Pennsylvania	8,984,000	11	30	59
Rhode Island	1,200,000	15	0	85
South Carolina[1]	5,000,000	10	5	85
South Dakota[1,6]	800,000	10	0	90
Tennessee[2]	5,800,000	10	8	82
Texas	14,469,000	11	1	88
Utah	1,500,000	13	7	80
Vermont	550,000	25	3	72
Virginia	7,600,000	24	18	58

Washington[3]	**5,708,000**	**33**	**2**	**65**
West Virginia	**1,700,000**	**10**	**0**	**90**
Wisconsin	**3,352,000**	**24**	**4**	**72**
Wyoming	**320,000**	**4**	**0**	**96**
Total	**291,742,000**	**17**	**11**	**72**

[1]Includes some industrial waste.
[2]Includes significant industrial waste.
[3]Includes out of state disposal.
[4]Includes construction and demolition waste.
[5]Includes construction and demolition, and sewage sludge.
[6]Data from *BioCycle's* 1992 "State of Garbage in America" survey.
Source: "1993 Nationwide Survey: The State of Garbage in America,: BioCycle, *May 1993.*

Municipal Solid Waste Management: State-by-State

State	Statewide MSW Management Goals	Disposal Bans						Mandatory Deposit Laws	Recycling Tax Incentives	Minimum-Content Recycling Laws
		Vehicle batteries	Tires	Yard Waste	Motor Oil	White Goods	Other			
Alabama	Mandated 1991									
Alaska										
Arizona		X	X					X	X	X
Arkansas	Mandated 2000	X	X	X				X	X	
California	Mandated 2000	X	X		X	X			X	X
Colorado									X	
Connecticut	Mandated 1991						X[1]	X		X
Delaware	Not M'd 2000							X	X	
D.C.	Mandated 1995									
Florida	Mandated 1995	X	X	X	X	X	X[2]		X	X
Georgia	Mandated 1996	X	X	X[3]						
Hawaii	Mandated 2000	X								
Idaho		X	X					X		
Illinois	Mandated 2000	X	X	X		X[4]		X	X	X
Indiana	Mandated 2000			X					X	
Iowa	Mandated 2000	X	X	X	X		X[5]	X	X	
Kansas			X					X	X	

Kentucky	Mandated 1997								X	
Louisiana	Mandated 1992	X	X			X		X	X	
Maine	Not M'd 1994			X			X[6]	X	X	
Maryland	Mandated 1994		X	X					X	X
Massachusetts	Mandated 2000	X	X	X		X	X[7]	X		
Michigan	Not M'd 2005	X		X				X		
Minnesota	Mandated 1996	X	X	X	X	X	X[8]	X	X	
Mississippi	Mandated 1996	X						X		
Missouri	Mandated 1998	X	X	X	X	X		X		X
Montana	Not M'd 1996								X	
Nebraska	Mandated 2002	X	X	X	X	X				
Nevada	Mandated 1994	X			X			X		
New Hampshire	Mandated 2000	X		X			X[1]			
New Jersey	Mandated 1995	X		X[9]				X	X	
New Mexico	Mandated 2000	X			X				X	
New York	Not M'd 2000	X						X		
North Carolina	Mandated 1993	X	X	X	X	X		X	X	X
North Dakota	Mandated 2000	X			X	X		X		
Ohio	Mandated 1994	X	X	X						
Oklahoma			X						X	
Oregon	Mandated 2000	X	X		X	X	X[10]	X	X	X
Pennsylvania	Mandated 1997	X		X[11]				X		

Rhode Island	Mandated	X						X		X
South Carolina	Mandated 1997	X	X	X	X	X		X	X	
South Dakota	Mandated 2001	X	X	X	X	X	X[12]			
Tennessee	Mandated 1996	X	X	X						
Texas	Mandated 1994	X	X		X			X	X	X
Utah		X						X		
Vermont	Not M'd 2000	X	X		X	X	X[13]	X		
Virginia	Mandated 1995	X							X	
Washington	Mandated 1995	X			X			X	X	
West Virginia	Mandated 2010	X	X	X					X	X
Wisconsin		X	X	X	X	X	X[7]	X	X	X
Wyoming								X		

[1]Mercury oxide batteries; [2]Demolition debris; [3]Yard trimmings ban passed in 1993 legislative session; [4]White goods containing CFC gases, mercury switches and PCBs; [5]Nondegradable grocery bags, carbonated beverage containers, and liquor bottles with deposits; [6]Household batteries; [7] Glass and metal containers, recyclable paper and single polymer plastics; [8]NiCd batteries, telephone books and sources of mercury; [9]Leaves; [10]Discarded vehicles; [11]Leaves and brush; [12]Office and computer paper, newsprint, corrugated and paperboard; glass, plastic, steel and aluminum containers; [13]Various dry cell batteries.

Source: BioCycle, *May 1993 and June 1993, and* Waste Age *magazine, March 1993.*

Appendix C
Compounds and Metals for Groundwater Detection Monitoring

CAS No.*	Common Name**
	Inorganic constituents:
(Total)	Antimony
(Total)	Arsenic
(Total)	Barium
(Total)	Beryllium
(Total)	Cadmium
(Total)	Chromium
(Total)	Cobalt
(Total)	Copper
(Total)	Lead
(Total)	Nickel
(Total)	Selenium
(Total)	Silver
(Total)	Thallium
(Total)	Vanadium
(Total)	Zinc
	Organic constituents:
67-64-1	Acetone
107-13-1	Acrylonitrile
71-43-2	Benzene
74-97-5	Bromochloromethane
75-27-4	Bromodichloromethane
75-25-2	Bromoform; Tribromomethane
75-15-0	Carbon disulfide
56-23-5	Carbon tetrachloride
108-90-7	Chlorobenzene
75-00-3	Chloroethane; Ethyl chloride
67-66-3	Chloroform; Trichloromethane
124-48-1	Dibromochloromethane; Chlorodibromomethane
96-12-8	1,2-Dibromo-3-chloropropane; DBCP
106-93-4	1,2-Dibromoethane; Ethylene dibromide; EDB
95-50-1	o-Dichlorobenzene; 1,2-Dichlorobenzene
106-46-7	p-Dichlorobenzene; 1,4-Dichlorobenzene
110-57-6	trans-1,4-Dichloro-2-butene
75-34-3	1,1-Dichloroethane; Ethylidene chloride

107-06-2	1,2-Dichloroethane; Ethylene dichloride
75-35-4	1,1-Dichloroethylene; 1,1-Dichloroethene; Vinylidene chloride
156-59-2	cis-1,2-Dichloroethylene; cis-1,2-Dichloroethene
156-60-5	trans-1,2-Dichloroethylene; trans-1,2-Dichloroethane
78-87-5	1,2-Dichloropropane; Propylene dichloride
10061-01-5	cis-1,3-Dichloropropene
10061-02-6	trans-1,3-Dichloropropene
100-41-4	Ethylbenzene
591-78-6	2-Hexanone; Methyl butyl ketone
74-83-9	Methyl bromide; Bromomethane
74-87-3	Methyl chloride; Chloromethane
74-95-3	Methylene bromide; Dibromomethane
75-09-2	Methylene chloride; Dichloromethane
78-93-3	Methyl ethyl ketone; MEK; 2-Butanone
74-88-4	Methyl iodide; Iodomethane
108-10-1	4-Methyl-2-pentanone; Methyl isobutyl ketone
100-42-5	Styrene
630-20-6	1,1,1,2-Tetrachloroethane
79-34-5	1,1,2,2-Tetrachloroethane
127-18-4	Tetrachloroethylene; Tetrachloroethene; Perchloroethylene
108-88-3	Toluene
71-55-6	1,1,1-Trichloroethane; Methylchloroform
79-00-5	1,1,2-Trichloroethane
79-01-6	Trichloroethylene; Trichlroethene
75-69-4	Trichlorofluoromethane; CFC-11
96-18-4	1,2,3-Trichloropropane
108-05-4	Vinyl acetate
75-01-4	Vinyl chloride
1330-20-7	Xylenes

**Chemical Abstract Service registry number. Where "Total" is entered, all species in the ground water that contain this element are included.*
***Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals.*

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