Recycling can eliminate most of the garbage bound for dangerous incinerators and leaking landfills.

**Municipal Solid Waste Incinerators**

The U.S. Environmental Protection Agency (EPA) predicts that 25 percent of the nation's garbage—some 80 billion pounds per year—will be incinerated by 1990. United States citizens generate more garbage than any other nation—over 160 million tons of garbage each year or more than 1,200 pounds per person. EPA expects this to increase to more than 2,300 pounds of garbage per person each year within the next 12 years.

Whether it is recycled, buried or burned, the fate of this refuse has major impacts on public health, the environment and the economy.

**What's in Garbage?**

According to EPA, this is the general composition of household garbage:
- Paper and paperboard: 41.0%
- Yard wastes: 17.9%
- Metals: 8.7%
- Glass: 8.2%
- Rubber, leather, textiles, wood: 8.1%
- Food wastes: 7.9%
- Plastic: 6.5%
- Miscellaneous inorganic wastes: 1.6%

Most of these components are either fully or partially recyclable.

**Where Does Garbage Go?**

- Approximately 80 percent of U.S. garbage is currently buried in landfills. The groundwater pollution caused by landfills has fueled both public and regulatory opposition to new sites. Since existing landfills are reaching capacity, new methods of managing municipal waste are needed. Quickly.
- Approximately 10 percent of municipal solid waste is recycled. In recycling, wastes are separated at their sources, first in homes and businesses then further at recycling centers. The separated components—paper, glass, metal, etc.—are reintroduced into the marketplace as useful, salable raw materials.
- Approximately 10 percent of municipal solid waste is incinerated. In incinerators, wastes are burned and converted into gases and ashes. The gases are released into the air and the ashes are buried in landfills. Both the gases and ashes from municipal incinerators contain toxic chemicals and harmful heavy metals.

**About Incinerators**

In September, 1988, there were 161 municipal solid waste incinerators in
the U.S., according to the EPA. Another 322 incinerators are expected to be in operation or under construction by 1992.

Most of these incinerators are mass burn units, that is, they burn everything that rolls in. For refuse-derived incinerators, glass, metals and some other materials are separated out before burning. Increasingly, many incinerators are promoted as 'resource recovery' or 'waste-to-energy' systems since some of the heat produced by combustion is used to generate steam and/or electricity. By renaming the incineration process, the industry is trying to give the impression of greater efficiency, but producing minimal amounts of energy from incineration does not solve the problem of the toxic by-products created by incineration.

Even advocates admit that incineration is not a final disposal method: the primary waste, garbage, is converted into secondary wastes, gases and ashes. Additionally, the liquid and solid residues of any pollution-control devices require further treatment and final disposal.

Garbage incinerators perpetuate dependence on landfills. Incinerator gases, ashes and other residues are often more hazardous to public health and the environment than raw garbage.

When garbage is burned, the remaining ashes and materials are approximately 30 to 40 percent of the volume of the original garbage. Some advocates claim a 90 percent reduction in volume. This figure does not reflect other important factors such as:

- normal incineration commonly means inefficient and incomplete burning
- during shutdowns for repairs and maintenance, the garbage does not get incinerated, it gets by-passed and goes directly to the landfill
- tires, large appliances, mattresses, etc., must be removed before burning.

Many garbage components, such as paper, appear to be suitable candidates for incineration. Unfortunately, the inks, glues and other additives that are present in and on household paper products are not suitable for incineration. When burned, these substances, along with the plastics, solvents and numerous other complex chemical products found in U.S. consumer products, contribute to air pollution and incinerator ashes with concentrations of both heavy metals and toxic combustion products such as polychlorinated dioxins and furans.

Heavy Metals in Incinerator Gases and Ashes
Metals are not destroyed by incineration. Metals in cans, jar lids, batteries, inks, etc.—antimony, arsenic, beryllium, cadmium, chromium, copper, lead, manganese, mercury, molybdenum, nickel, selenium, tin, vanadium and zinc—are released in the stack gases and ashes of incinerators. For example, the Swedish government has estimated that 60 percent of the mercury emissions in their country comes from municipal incinerators.

Incinerators produce two forms of ash: bottom ash which accumulates in the burn chamber during combustion and fly ash which escapes with stack gases or is partially captured by pollution control devices. Tests have confirmed the presence of potentially hazardous concentrations of toxic metals in all incinerator ash tested.

Airborne metals are inhaled by people and animals. These metals also settle on soil and vegetation, which may be ingested. When incinerator ash is buried in landfills, the heavy metals can become groundwater contaminants.

The Washington State Department of Ecology tested both fly and bottom ash from five incinerators around the country. The study determined that four fly ash samples and one bottom ash sample were "extremely hazardous waste" and one fly ash and four bottom ash samples were "dangerous waste." The Environmental Defense Fund (a nonprofit organization) also tested ash from a number of incinerators and determined that every single fly ash sample, one-third of the bottom ash samples, and half of all combined ash samples were "hazardous" by EPA classification.

Toxic Chemicals in Incinerator Gases and Ashes
Incinerator gases and ashes also carry numerous organic chemicals which are formed during combustion. EPA cites municipal incinerators as sources of polychlorinated dioxins and furans—chemicals that include some of the most toxic substances known to modern science. Even equipped with pollution control devices, incinerator stacks let dioxins and furans escape at a rate two to seven times higher than the capture rate.

Pollution control devices are designed to capture acid-producing substances, such as hydrogen chloride, and particulate materials. Even with state-of-the-art pollution control equipment, metals and toxic chemicals are still released into the air.
EPA has estimated emissions from current and projected incinerators, even with good pollution control equipment, as follows:

<table>
<thead>
<tr>
<th>U.S. Municipal Waste Incinerators</th>
<th>Estimated Stack Emissions for Selected Pollutants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pollutant</td>
<td>Pounds per Year</td>
</tr>
<tr>
<td><em>Arsenic</em></td>
<td>5.940</td>
</tr>
<tr>
<td>Beryllium</td>
<td>0.220</td>
</tr>
<tr>
<td><em>Cadmium</em></td>
<td>22.800</td>
</tr>
<tr>
<td>Carbon monoxide</td>
<td>44,000,000</td>
</tr>
<tr>
<td>Chlorobenzenes</td>
<td>8,316</td>
</tr>
<tr>
<td>Chlorophenols</td>
<td>11,770</td>
</tr>
<tr>
<td><em>Chromium +6</em></td>
<td>1,320</td>
</tr>
<tr>
<td><em>Chlorinated dioxins and dibenzofurans</em></td>
<td>53</td>
</tr>
<tr>
<td><em>Formaldehyde</em></td>
<td>128,900</td>
</tr>
<tr>
<td>Hydrogen chloride</td>
<td>104,900,000</td>
</tr>
<tr>
<td>Lead</td>
<td>750,000</td>
</tr>
<tr>
<td>Mercury</td>
<td>149,000</td>
</tr>
<tr>
<td>Nitrogen oxides</td>
<td>67,100,000</td>
</tr>
<tr>
<td>Particulate matter</td>
<td>2,280,000</td>
</tr>
<tr>
<td><em>Polychlorinated biphenyls (PCBs)</em></td>
<td>10,934</td>
</tr>
<tr>
<td><em>Polycyclic aromatic hydrocarbons (PAHs)</em></td>
<td>2,101</td>
</tr>
<tr>
<td>Sulfur oxides</td>
<td>28,600,000</td>
</tr>
<tr>
<td>* Known or suspected carcinogens.</td>
<td></td>
</tr>
</tbody>
</table>

Scientists have identified over 200 toxic or potentially toxic chemicals in municipal waste incinerator emissions and ash residues. Many of these chemicals are known to cause cancer and all of them will eventually be released into the environment. Researchers at the Department of Energy found the following cancer-causing chemicals, besides dioxin, in incinerator ash:

**Carcinogenic Chemicals in Garbage Incinerator Flue Gas and Ash**

- acenaphthylene
- acrylonitrile
- aldrin
- aniline
- anthracene
- benz(a)anthracene
- benzene
- benz(a)anthracene
- benzo(a)pyrene
- benzo(b)fluoranthene
- benzo(b)pyrene
- benzo(e)pyrene
- benzo(g,h,i)perylene
- benzo(k)fluoranthene
- biphenyl
- chrysene
- corone
- diphenyldioxin
- dibenz(a,h)anthracene
- dibenz(o)pyrene
- dieldrin
- 9,10-dimethylanthracene
- 7,12-dimethylbenz(a)anthracene
- formaldehyde
- iden(1,2,3-c,d)pyrene
- methylene chloride
- p,p'-DDE
- 1,2,3,4-tetrahydronaphthalene
- phenol
- polychlorinated biphenyls
- propanol
- pyrene
- vinyl chloride

Municipal solid waste incinerators have been identified as the third largest category of point sources that are directly emitting airborne waste gases that contribute to acid rain.

**Dioxins and Furans**

Of all pollutants emitted by incinerators, polychlorinated dioxins and furans—formed during garbage incineration—may pose the greatest long-term threat to public health and the environment. They have been identified in incinerator ashes, gaseous emissions and even in the soils near incinerators. Dioxins are so toxic that a safe level of exposure cannot be determined.

Once released into the environment, polychlorinated dioxins and furans persist for years, selectively concentrating in the tissues of living creatures—fish, other animals and humans. The accumulation of dioxins and furans in the flesh and breast milk of humans is now a matter of global concern. These highly toxic chemicals have been linked to higher cancer rates, miscarriages, birth defects, liver disease, neurological damage and immune system disorders.

In assessments of health risks from incinerators, inhalation has been presumed to be the primary route of exposure. However, one recent study of a community located near a municipal incinerator revealed that consuming their local dairy products posed risks 481 times greater than respiratory exposure. Another study indicated that consuming produce grown near incinerators exposes people to 451 times more dioxin than breathing air contaminated by the stack gases.

Incinerator advocates claim that the production of dioxins and furans can be reduced by maintaining constantly high temperatures and carefully monitoring oxygen levels in the combustion chamber. Since the composition of garbage is so variable, finely-tuned control of combustion conditions is difficult, if not impossible. Despite several studies, scientists still disagree on the relationship between burn temperature and dioxin formation.

Although the factors controlling dioxin and furan formation are not fully understood, one thing is certain—incineration creates and releases these hazardous chemicals. A 1983 study by the Canadian government determined that, among known sources of dioxins, municipal and industrial incinerators are the largest contributors of dioxins to the environment. Landfills containing incinerator ash were the third largest dioxin source. The same study concluded, "It is . . . imperative to reduce dioxin exposure to the absolute minimum."

**Regulating Incinerator Ash Disposal**

The EPA has interpreted the Resource Conservation and Recovery Act (RCRA) to mean that all household waste, whether it meets the criteria for hazardous waste or not, is exempt from the disposal standards required for hazardous waste. EPA's attorneys contend that this same supposed exemption extends to the ash remaining after household waste is incinerated, even when that ash meets the criteria for hazardous waste.

In reality, nearly all municipal incinerators burn mixed wastes—refuse not only from households but also from businesses and industries. EPA's position on disposal standards for this ash has been neither clear nor constant. However, the regulations are clear that, if ash from mixed waste meets hazardous waste criteria, the disposal of that ash must meet hazardous waste disposal standards. Incinerator ash samples are routinely found to contain lead, cadmium and other toxic substances at concentrations that meet EPA criteria for haz-
ardous waste. For example, the state of Michigan has determined that ash from Detroit's incinerator must be handled as hazardous waste. Meanwhile, EPA has not taken any enforcement actions against facilities, and the agency has not insisted that states do so. Instead, EPA has decided to create a new waste category (they're calling it "special") for incinerator ash. Disposal standards for "special" waste will not have to meet those required for hazardous waste.

The Real Solution to the Garbage Crisis—Recycling and Reduction

According to EPA, recycling is "a technology that can prevent depletion of valuable landfill space, save energy and natural resources, provide useful products from discarded material, and even make a profit (especially when the avoided costs of incineration or landfilling are taken into account)."

Recycling also avoids much of the pollution associated with the use of non-renewable resources and leaves fewer, less toxic residues than incineration.

Environmental Benefits from Substituting Secondary Materials for Virgin Resources

<table>
<thead>
<tr>
<th>Reduction of</th>
<th>Aluminum</th>
<th>Steel</th>
<th>Paper</th>
<th>Glass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy use</td>
<td>90-97%</td>
<td>47-74%</td>
<td>23-74%</td>
<td>4-32%</td>
</tr>
<tr>
<td>Air pollution</td>
<td>95%</td>
<td>85%</td>
<td>74%</td>
<td>20%</td>
</tr>
<tr>
<td>Water pollution</td>
<td>97%</td>
<td>76%</td>
<td>35%</td>
<td>-</td>
</tr>
<tr>
<td>Mining wastes</td>
<td>97%</td>
<td>97%</td>
<td>80%</td>
<td>-</td>
</tr>
<tr>
<td>Water use</td>
<td>49%</td>
<td>58%</td>
<td>50%</td>
<td>-</td>
</tr>
</tbody>
</table>

Once built, incinerators cripple efforts to reduce or recycle wastes since they create their own demand for garbage. Many municipalities sign contracts guaranteeing garbage supplies to insure a steady supply for incineration, stipulating fees to be paid to operators if garbage levels fall below projections. Since they are so capital intensive, incinerators have a much greater advantage over recycling centers in competing for the same resource—garbage.

In addition to recycling, communities must reduce municipal waste at its sources. The highest priority for such source reduction goes to packaging and household hazardous wastes. Manufacturers who overpackage their products reinforce this wastefulness. Packaging accounts for as much as half the volume of household wastes. By changing habits—carrying reusable bags to the grocery store and refusing to purchase items with excessive, non-biodegradable and/or toxics-related wrappers, consumers can reduce their own wasteloads to the environment and show their preference for recyclable and safe products.

Wastes from many cleaning agents, lawn and garden additives, paints, batteries, and auto supplies release toxics during incineration. They contaminate air and groundwater when landfilled. And some of these items create special recycling problems. Non-toxic alternatives are available for many of these toxic household products. Refusing to purchase, and thereby refusing to discard, hazardous materials is another essential step in solving the garbage crisis.

What You Can Do

Begin at home.
- Buy recyclable, non-toxic products.
- Avoid unrecyclable, toxic and/or overpackaged products.
- Make excess packaging an issue at your local stores.
- Encourage family, friends and neighbors to reduce the trash they generate and to recycle at home.
- Publicize your support for recycling through letters to your public officials and newspaper editors.
- Work for strong reduction/recycling laws at local, state and federal levels.
- Help establish and support local recycling centers and drop-off points.
- Oppose the construction, expansion and operation of incinerators in your area.
- Attend and testify at public hearings on waste management in support of reduction/recycling programs.
- Make sure that your elected officials are aware of your priorities, needs and concerns.
- Insure that environmental rights—your right to clean water, air, soil and food—are the central issues in every local, state and national election.