NEW TECHNOLOGIES IN SOLID WASTE MANAGEMENT

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Exhaustion of the Nation's resource base is a very real possibility. Currently, a few industries recycle waste materials, recognizing the long-term economic advantages of recovered waste materials over raw or primary materials. But this recognition has not significantly reversed the trend toward greater waste generation nor has it reduced the burden on communities across the Nation that are responsible for the day-to-day management of solid waste materials.

As President Nixon pointed out in his 1970 message to Congress on

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the environment, "If we are ever truly going to gain control of the problem, our goal must be broader: to reduce the volume of wastes and the difficulty of their disposal, and to encourage their constructive reuse instead. . . .

"As we look toward the long-range future--1980, 2000, and beyond--recycling of materials will become increasingly necessary not only for waste disposal but also to conserve resources. While our population grows, each one of us keeps using more of the earth's resources. In the case of many common minerals, more than half of those extracted from the earth since time began have been extracted since 1910."

The first concentrated effort by the Federal government to mitigate the Nation's solid waste problems began with passage of the Solid Waste Disposal Act (P.L. 89-272) in October 1965. The Act had two major purposes:

1. To initiate and accelerate a national research and development program for new and improved methods of proper and economic solid waste disposal;

2. To provide technical and financial assistance to State and local governments in the planning, developing, and conducting of solid waste disposal programs.

Since the Act was passed, Congress authorized $79,950,000 and appropriated $64,763,000 through fiscal year 1970. Of the appropriated amount, $60,274,000 was actually spent. The budget for fiscal 1971 is $20,500,000. During this time, the Office of Solid Waste Management Programs placed increasing emphasis on developing methods for recycling solid waste materials while it continued to investigate new collection, processing, and disposal techniques.

MATERIAL RECYCLING

<u>Mixed Solid Wastes.</u> Success in reusing large amounts of solid wastes depends on finding some economical way to separate the components. As an example of projects in this area, the Stanford Research Institute was engaged to determine the technical feasibility of using an air classification process to separate nonhomogeneous, dry, solid waste materials. A pilot air classifier, constructed to separate five such materials, operates on the principle that a sufficient velocity of air passing upward through the mixed wastes will separate them by particle size, configuration, and specific gravity.

This research project received additional support from the Glass Container Manufacturers Institute, Inc., after the contract for the project was completed. Through a grant to the Franklin Institute, the OSWMP is currently evaluating a device to separate municipal trash into its various components. The solid waste separator works basically on mechanical principles; it consists of a series of vibrating screens, baffler, a paddle wheel, and a gravity separator.

The OSWMP is also supporting the evaluation of a pilot-scale separator at Vanderbilt University. The unit employs a high-energy, high-strength magnetic field to separate shredded nonmagnetic metals, based on the difference in the electromagnetic properties of the waste components.

A pilot-scale wet pulverization system, designed to reclaim fiber from municipal solid waste, has been developed and successfully demonstrated. The incoming solid waste is dumped into a storage hopper from which it is fed continuously into a Hydrapulper and then forced through 1/2-inch holes. Heavy inorganic materials are removed by a bucket elevator. The pulped material passes through a liquid cyclone to separate such heavy materials as dirt, glass, and small bits of metal. The remaining organic material passes through a series of screens that progressively concentrate the paper fiber. It is estimated that 1,000 tons of solid waste might yield 200 tons of paper fiber, 80 tons of ferrous metals, and 80 tons of glass cullet.

Specific Solid Wastes. At Louisiana State University, a pilot plant is successfully turning cellulose (bagasse) into a single-cell protein substance. The facility was built after University scientists discovered a micro-organism that breaks down waste cellulose into protein. Additional work is being conducted to refine processing techniques and to analyze the protein products for digestibility and nutritional value.

It has been demonstrated on a pilot scale that waste glass can be used as an aggregate in bituminous mixtures to maintain and pave streets. Glasphalt, the name given this mixture, may help solve urban glass waste disposal problems.

SOLID WASTES AS ENERGY SOURCES

Three systems are under investigation that can process mixed municipal solid wastes and convert them into energy, a diminishing resource in the United States at this time. Solid waste has a heating value about half that of coal and a sulfur content about one-tenth that of presently utilized coal.

Supplementary Fuel. A project underway in St. Louis indicates that it is feasible to use ground municipal solid waste as a supplementary fuel for a coal-fired power plant. A full-scale demonstration unit is being built with the cooperation of a private utility and is scheduled to begin operating in early 1972. Ten to 20 percent of the total furnace charge, by weight, will be solid waste; larger amounts would cause ash-handling and air pollution problems.

Generation of Electricity. An advanced engineering concept in the solid waste management field is that involving the CPU-400, which is being developed under contract by the Combustion Power Company of Palo Alto, California. As presently configured, the CPU-400 is a fluidized-bed incinerator that burns solid wastes at high pressure. The hot gases that are produced power a turbine that drives an electrical generator. The designers of the CPU-400 estimate that it should be able to produce approximately 15,000 kilowatts while processing 400 tons of municipal solid wastes daily. This would represent 5 to 10 percent of the power requirements of the community providing the solid waste and partially offset the cost of waste disposal. In addition, solid waste haul distances could be greatly reduced by having units at strategic points in urban areas. A one-tenth-scale pilot plant is scheduled for completion in mid-1972, and a full-size prototype after 1974.

Production of Steam. In Lynn, Massachusetts, the OSWMP has supported the successful evaluation of the feasibility of using a spreader-stoker type boiler that burns a mixture of ground solid waste and fuel oil to produce a low-temperature, low-pressure steam. The process then calls for the steam to be superheated in a separate facility for industrial purposes.

COLLECTION AND TRANSPORTATION

Expenditures for collection and transportation operations constitute approximately 75 percent of the estimated $4.5 billion spent each year on solid waste management in this country.

The OSWMP is currently supporting three projects involving the movement of solid wastes via hydraulic pipelines. A pneumatic system used to collect waste from high-rise apartments is successfully operating in Sweden. Designers of the Disney World facility being built in Florida plan to use a network of pipelines to transport wastes to a central location. It is expected that pneumatic systems will be used at several sites in the "Operation Breakthrough" program of the U.S. Department of Housing and Urban Development.

The City of Wichita Falls, Texas, uses a container-train and "mother" truck method to collect its municipal solid wastes. The unique thing about the system, however, is that a computer is used to optimize the collection operations.

The city, with the support of an OSWMP demonstration grant, has equipped its collection vehicles with devices that weigh the solid waste as it is picked up. The figures are electronically transmitted to the computer, which analyzes them by measuring them against the location of the pick-up, the characteristics of the particular neighborhood, and other pertinent information. The computer then schedules rendezvous points for the "mother" truck and the train to minimize waiting time, which results in better utilization of the city's equipment and personnel.

Compaction and shredding are two other ways of processing solid waste that are becoming increasingly important in many solid waste management systems. Both can be used to extend the life of a sanitary landfill. The OSWMP is currently investigating the feasibility of baling wastes and transporting them from urban areas by rail. Results to date suggest that such a system has economic and technical potential.

INCINERATION

New incineration methods have been investigated recently. In one project, a small-scale Torrax system facility was built in 1969 to dispose of 75 tons of municipal solid waste daily. This project is scheduled to be completed in June 1971. In the system, very hot air is mixed with solid waste as it passes into the top of a gasifier. The primary purpose of the gasifier is to decompose the organic and hydrocarbon gases. Only the non-combustibles and difficult-to-burn wastes reach the base of the gasifier. At that point, they are either completely burned in the high-temperature area or converted to a molten slag, which becomes an inert residue when immersed in water. The combustible gases are drawn into the igniter unit where they are mixed with outside air and completely burned. The exhaust from the igniter is cooled in a water spray tower or is used to generate steam. The relatively cool exhaust is cleansed of entrained particulate matter as it passes through a fabric dust collector and is then discharged into the atmosphere.

Two incinerators that may be used by smaller communities are also being evaluated. One has a rotating, saucer-shaped grate made of perforated stainless-steel. Air is forced through the holes to enhance the combustion of the wastes. A 3,300 pound/hour incinerator demonstrated in Shelbyville, Indiana, has a vortex configuration. This enables it to burn wastes faster than an ordinary incinerator of the same size because it has a higher heat-release rate.

In a high-temperature incineration process known as the Melt-Zit, municipal solid waste is charged midway up the stack. The combustible materials burn there, while the heavier noncombustibles fall on the fuel bed and are melted. The resulting molten slag and iron flow from the base of the unit, and, if quenched rapidly in water, become grit or sand-like particles, which are sterile and inert.

Using a technique known as pyrolysis (destructive distillation), the Bureau of Mines of the U.S. Department of the Interior has proved that scrap tires can be converted into useful byproducts. The Firestone Tire and Rubber Company, which supported this research, is reportedly building a full-scale unit.

SOURCE REDUCTION

Perhaps one of the most challenging and perplexing questions facing those concerned about the increasing generation of solid wastes is the matter of source reduction. If products were redesigned to serve the same function they do now but created less waste when discarded or could be more easily recycled, we could, so to speak, solve the problem before it arose. For example, some progress is being made in designing dissolvable or degradable bottles at the University of Toronto in Canada, the University of Aston in

Birmingham, England, and Clemson University in South Carolina. If these materials can be perfected, some of the problems associated with containers will be solved.

THE FUTURE

These are examples of technologies that are emerging now. What future methods will be employed for solid waste management is debatable. One thing is sure, however--systems are becoming more complex, place more emphasis on resource recovery, and in many cases are going to require a regional approach to establish a satisfactory system.

It should be stressed, however, that total reliance must not be placed on new technologies. There is much that can be done now to upgrade community solid waste management practices. Responsible officials should replace antiquated systems with available acceptable methods, make improvements in existing collection systems to bring about greater efficiency and economy of operation, and give attention to putting their systems on a sound management basis.

Only by this combination of approaches can we be confident that we are doing all that can be done to conserve our Nation's resource base.

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