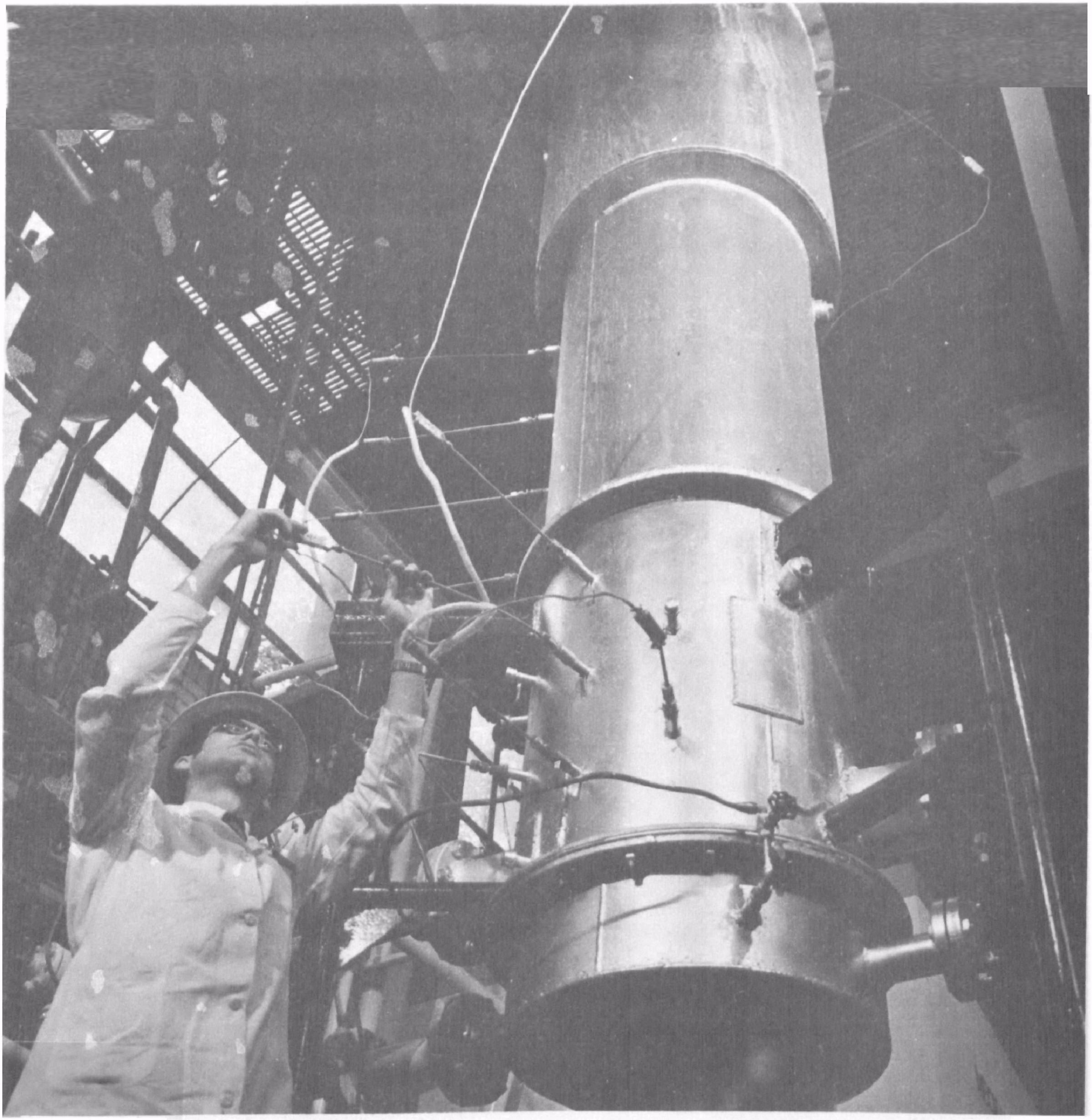

What's New in Solid Waste Management?

FILMSCRIPTS ON SOLID WASTE MANAGEMENT

This script is one of a series published to help lecturers, teachers, and group leaders prepare for viewing and discussion of solid waste management films. It is also intended for those in an audience who want a permanent record of the data presented in a film. It was written by Stuart Finley, Inc., the producer of the film, in close cooperation with staff of the Federal solid waste management program.

Titles and publication numbers of scripts for solid waste management films are shown below.

The Third Pollution SW-39c.1
Burn, Bury, or What? SW-39c.2
Recycling SW-39c.3
5000 Dumps SW-39c.4
In the Bag SW-39c.5
The Green Box SW-39c.6
The Stuff We Throw Away SW-39c.7
What's New in Solid Waste Management? SW-39c.8

Instructions for borrowing or purchasing these films are given with each script and are summarized in the brochure *Films Tell the Story*, available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402.

U.S. Environmental Protection Agency

1972

WHAT'S NEW IN SOLID WASTE MANAGEMENT

37-minute, 16-mm motion picture, sound, color. Order no. M-2049-X.*

WHAT'S NEW IN SOLID WASTE MANAGEMENT shows a variety of new and improved solid waste management techniques, featuring specially developed equipment, in actual operation. These projects are part of the demonstrations and investigations conducted under provisions of the Solid Waste Disposal Act. The film is designed for technical audiences and is particularly intended to assist public works directors and elected officials who must evaluate alternative systems and equipment, including costs, capacities, and other data.

INTRODUCTION (Trench Incinerator)

Truck drives up; man throws out tires and wood; can of refuse is removed; all is thrown into the trench incinerator

Sometimes the Federal Government does the strangest things!

Here the ingredients are a few old tires . . . some fire wood . . . and a can full of refuse.

Technician sets fire; men climb ladder to platform of trench incinerator; closeup of fire with black smoke; stack with black smoke

Now we're ready to create some intentional air pollution. This field laboratory in Cincinnati is being operated by the Bureau of Solid Waste Management of the Department of Health, Education, and Welfare† to study the technology of incineration. The objective is to discover how to incinerate solid wastes as completely as possible, economically, and yet minimize air pollution . . . both particulate matter and gasses.

Trench incinerator burning with black smoke; oxygen is supplied and smoke disappears; pan to top of stack to see black smoke disappearing

This experimental "trench incinerator" is designed to regulate combustion rates and temperatures. As the air feed is adjusted, combustion is improved.

***Borrow from: National Medical Audiovisual Center**
Purchase from: Stuart Finley, Inc.
3428 Mansfield Road, Falls Church, Va. 22041
Area Code 703/802-7700
Prints–$300
Cleared for TV
†Now the Office of Solid Waste Management Programs of the U.S. Environmental Protection Agency.

Operation of the trench incinerator continues showing men with walk-ie-talkie communications, control measurements in adjacent building, etc. . . . culminating in another example of air injection with smoke clearing in stack

It works! Or, to be more accurate, a novice might think it's working by outward appearances. But the control of stack emissions is a tricky business. Tomorrow's incinerators are going to need new and improved technology if they are to conform to increasingly strict air pollution standards. But, what about the Director of Public Works of a typical city or county? Should he wait until this research is completed before he builds needed new facilities? Or should he risk wasting huge sums of money constructing facilities which might soon be obsolete? This film is intended for the Directors of Public Works of America and the elected officials who depend on them for technical guidance. It illustrates some recent developments and innovations. This film and individual demonstration project reports along with personal consultation with your regional office of the Bureau of Solid Waste Management can eliminate expensive time-consuming travel to demonstration projects all over the country, thus simplifying your evaluation of alternative techniques available today.

GENERAL PROBLEM (Fresno, California)

Burning dump near Fresno

If consumers really consumed, this problem wouldn't exist. But mostly, consumers use and throw away. Every day . . . ten pounds per person. America discards a million tons of residential, commercial, and industrial solid waste a day. Collection and disposal costs about $4.5 billion a year.

Truck moving across landfill; compactor and trucks at landfill

At Fresno, California, sanitary landfills are replacing open burning dumps. The Fresno Region includes the central city and smaller nearby centers, all rapidly urbanizing, and the surrounding central area of the County, part of the San Joaquin Valley, devoted to high-yield crops and livestock and poultry production. The Region, like countless others, generates a combination of municipal, industrial, and agricultural wastes; and followed, until recently, a variety of uncoordinated and largely inadequate collection and disposal practices.

Collection truck downtown; truck and crew collecting wastes at hospital

Then, State and local agencies, aided by a Federal demonstration grant, undertook a unique study of the Region's solid waste problems and management needs. Using computerized systems-analysis techniques, a number of alternative integrated management systems were developed, as well as ways to measure their relative effectiveness in terms of a better environment. The completed study indicates that about one-third of the total waste

Street sign in hardpan field; man spades up clod of earth and breaks it apart with his hands

load expected by the year 2000 can be effectively managed by improving existing methods but new techniques will be required to dispose of the other two-thirds. For example, it is proposed that organic matter including sewage sludge, manures, and agricultural and food processing wastes be composted, thus making constructive use of a portion of the region's solid wastes. The local people call this unusable saline land "hardpan." By the year 2000, a million tons of compost a year from the Fresno region can be made available to reclaim its usefulness.

Suburban collection

Meantime, conventional collection and disposal procedures must be improved to handle the one-third of the total waste load that can be effectively managed by existing methods. Planned improvement includes a semi-automated collection system, closed transport, and disposal in sanitary landfills, with only hospital and other specialized wastes being incinerated. This proposed plan is tailored for the Fresno Region, but the basic procedures can be applied by any community. Literature is available on this and other general systems analysis demonstration grant projects from the Bureau of Solid Waste Management to guide local officials undertaking comparable studies.

COLLECTION – REFUSE SACKS (Barrington, R.I.)

Refuse collection in Barrington with metal cans

Some solid waste innovations in the field of *collection*.

The traditional metal garbage can is a part of the fundamental collection problem, making the operation costly, dirty, noisy, and hazardous. Gathering loose refuse or handling 55-gallon oil drums is even more inefficient. Any system that would improve working conditions or streamline the collection process could save money and improve service.

Collection truck rounds corner

The stakes are high because most communities spend more for collection than disposal . . . a national average of $5.39 per person per year.

Refuse sack collection; transport to landfill; landfill operation

In Barrington, Rhode Island, a demonstration project has evaluated large-size paper refuse sacks. Each householder received a lidded, stand-type holder, two strong kraft paper bags a week, and a set of instructions. Garbage, wrapped separately, and rubbish went into the same bag together. Odor and spilled refuse problems were solved by instructions on bag closure and a limited leash ordinance for dogs. Town officials and residents of Barrington are pleased with the new bag system. Eighty-eight percent of the residents surveyed indicated approval, commenting on reduced noise and litter and neater container appearance. Town officials now have fewer service complaints and note improved employee morale. The bags cost about 9¢ each, or 18¢ per household per week. Town officials estimate that the bag system cut the man-minute-per-ton collection time in half. The resultant savings offset about two-thirds of the expense of the sacks. The total collection cost with the bag system for twice-a-week collection (two bags a week per household) was $18.38 per house per year. A complete description of paper refuse sack collection systems is shown in the film *In the Bag* made by the National Refuse Sack Council.

Completed grassed sanitary landfill	This is Barrington's first landfill . . . almost ready to become a Little League ballfield.

COLLECTION – Container & Truck (Wichita Falls, Texas)

Container train collection	Another attempt to reduce collection costs and improve service! Wichita Falls, Texas, is demonstrating a systems analysis study of the container train method of collection. Wheeled container trains collect residential refuse . . . a technique which is most appropriate on relatively flat terrain and in low traffic areas. The container train system conserves expensive packer truck time and functions well where a packer truck can't go.
Master truck picks up container	The load is weighed using a novel strain gauge as it is transferred to the master truck.
Man in cab with data transmitter **Computer center** **Master truck completes pickup**	The cab operator transmits weight data to a processing center where it is fed into a computer along with data on routes and equipment and personnel usage. The data is analyzed overnight, providing information on operational patterns and costs, allowing immediate response to changing operational needs and correlating the type and volume of waste generation with land-use and population density. This information will permit development of a complete management model, simulating the container-train collection and disposal system.
Man at desk studying printout	Planners can then rely on the model to project optimum configuration and expansion of the system, including selection of suitable additional landfill sites, as population grows and land-use patterns change. Thus, *computer* technology can contribute significantly to solid waste technology and sound management planning for the future.

COLLECTION – RURAL CONTAINERS (Chilton County, Alabama)

Chilton County rural crossroads with container; another container with lady depositing; several containers in	We here in rural Alabama have quite a problem collecting our solid waste. The homes are so widely scattered that it creates quite a problem because we can't . . . it's not practical to have house-to-house pickups. So, we place these containers in strategic places for these people, and people traveling the road can place

their waste in these containers. These containers are mostly for housewives. It works for us 24 hours a day. We keep them there 7 days a week, and they're there at all times. People know they're there at all times. They're there--2 o'clock in the morning, if they have something they want to get rid of, they carry it to the container. Now, we're in a dry county. However, we collect quite a few beer cans which would otherwise go out on the side of the road, and spoil the looks of the countryside, which they were doing until we placed the containers there.

Alexander at desk; panton map

I'm Bob Alexander, County Engineer for Chilton County at Clanton, Alabama. We have a rural waste collection in Chilton County that we believe is second to none. We have containers scattered throughout the county for the people to deposit their waste in, that we pick up completely 3 times a week. We have two routes in this system—an upper route and a lower route.

Truck approaches container, empties it, and departs

These routes cover about 700 square miles and serve 26,000 people. Of these, 9,000 live in municipalities and have house-to-house collection. The 17,000 rural residents who are served by the containers bring their refuse an average of 1.6 miles to a container. The 90 containers have replaced all of the small, random, rat-infested dumps. Now all of them have been cleaned up and the rats have been exterminated. The container collection system uses one truck and employs one man. Containers are emptied every other day. During the first eighteen months of operation, 25-hundred tons of refuse has been collected from the rural containers at a cost of $9.79 per ton including operating costs and equipment depreciation. Other rural counties have already adopted this system. One nearby county improved the container design by reducing its height and providing a sure-close lid. A report on this project provides cost data which have been developed by the Project Director and his Engineering Consultant. A descriptive film illustrates this project.

Chilton County landfill

The county's new central landfill serves both rural residents and the city collection systems. It has been operated at $2.50 per ton including operational costs and equipment depreciation.

Alexander at his desk

We believe that this collection system we have is one of the best things that ever happened to the county. Prior to this collection system, we had garbage and waste scattered throughout the county. At this time, we have one central landfill that we're bringing this waste to . . . the people are just delighted.

DISPOSAL – LANDFILL TECHNIQUES
(Kenilworth-Oxon Cove, Washington, D.C.)

Oxon Cove sanitary landfill; wide pan of earth covered area

Now some ideas on solid waste *disposal*.

Today's most economically acceptable disposal method is the sanitary landfill. A film *Burn, Bury, or What?* describes the difficulties the District of Columbia has had attempting to devise a workable solid waste system.

Rolling equipment in working area

This is a new fill operated by the District of Columbia on a site straddling the District-Prince George's County, Maryland, line, on land owned by the National Park Service. The site was selected because of its proximity to the city and the need for fill material in preparation for park development.

CU compactor spreading and compacting wastes

The District's well-operated Oxon Cove Landfill was made possible by experience gained in converting its notorious Kenilworth Dump into a model sanitary landfill with the assistance of a demonstration grant from the Bureau of Solid Waste Management. The Kenilworth site, also owned by the National Park Service, is now being transformed into parkland, while Oxon Cove will become a public golf course . . . both community assets. The creation of new recreational facilities is desirable, but residents and landowners usually react with strong disfavor to a proposal for a sanitary landfill nearby. Thus, directors of public works are often inhibited in site selection and may face protracted negotiations to resolve objections.

CU earth being pushed over waste; equipment working face and covering

Good sanitary landfilling procedure continuously covers the refuse with a layer of clean earth after consolidating it in the smallest practical area and volume. The working face is kept as narrow as possible to minimize equipment, personnel, and cover required. On flat terrain, the face may be as high as 8 to 10 feet on a three-to-one slope so the heavy compactors can apply maximum pressure. Almost any solid waste can be disposed of in a sanitary landfill, and often unusable land can be reclaimed. An operating cost of three dollars to three-fifty per ton is common in urban areas but high volume operations or rural landfills frequently cost less. The Bureau's publication *Sanitary Landfill Guidelines* contains useful information for public works officials.

DISPOSAL – ROUGH TERRAIN LANDFILLS (Los Angeles County)

Traffic Los Angeles freeway; land-fill operation

Los Angeles County, California, has seven million residents and generates three-quarters of a million tons of solid wastes every month. It also has mountainous areas where deep cuts, canyons, and ravines provide large natural sites for large capacity refuse disposal operations. Working faces are often quite steep, requiring adherence to rigid safety controls. The Los Angeles County Sanitation Districts operate the fills and charge a disposal fee of only $1.75 a ton. These are some of the largest and best landfills in the world. The County is conducting a demonstration project to develop operating standards for both public and private fills. A technical film has been produced illustrating techniques.

DISPOSAL – STRIP MINE LANDFILLING (Allegheny County, Maryland)

Long pan of abandoned strip mine

This is rough terrain, too, but there's nothing natural about an abandoned strip mine. It's a man-made scar on the landscape, offering a special opportunity for rehabilitation through sanitary landfilling. To demonstrate the feasibility of such an operation, the State of Maryland, Allegheny County, and the Cities of Frostburg and Cumberland are participating in a federally-assisted demonstration project, providing centralized disposal for the solid wastes of sixty thousand people at three abandoned mine sites.

CU landfill operation; wider shot

The County operates the fills at a disposal cost of slightly over a dollar-a-year per person served. Municipalities have closed their dumps, and deliver collections to the sites. Strip mine landfilling is practical and could provide disposal sites for urban areas. The refuse could be transported by truck, railroad, or barge . . . but the longer the haul, the higher the cost. However, the major problem is that local folks often resist receiving someone else's refuse.

DISPOSAL – GULLY LANDFILLING (Sarpy County, Nebraska)

Gully landfill project sign, panning across road to tree-covered gully

In Sarpy County, Nebraska, a few miles outside Omaha, another federally-assisted project has demonstrated the value of sanitary landfilling to reclaim gullied farm land made useless by years of unchecked erosion.

Road at crest of hill panning to gully

Standard landfill methods were used to dispose of wastes from surrounding communities. A gully like this was cleared, an earthen dam constructed at its mouth to establish a stable grade, and refuse deposited behind the dam.

Wide shot of reclaimed tract

Here is the reclaimed tract. Gully landfilling requires a thorough engineering study to design the dam and spillway and prevent drainage and erosion problems and water pollution from leaching. This project was sponsored by Sarpy County and operated by the Sarpy Soil and Water Conservation District. Your local soil and water conservation district can provide technical assistance with similar projects.

DISPOSAL – ABOVE GRADE LANDFILL (Virginia Beach, Virginia)

Refuse trucks bring in wastes

Virginia Beach had no natural depressions suitable for a landfill and thus accepted the suggestion of the director of Virginia's solid waste agency to build an experimental elevated landfill. A total of up to 800 tons a day is being received including Norfolk's wastes. The deposit area was originally excavated to a depth of four feet, somewhat above the water table, to provide an initial supply of earth cover; and wells have been sunk to monitor any effects on ground water.

Lake in foreground of mountain of trash

Additional earth cover was excavated from a borrow pit which is being left to fill with water, forming an artificial lake. Around the lake, the land-building operation is forming a bowl. It will eventually rise to a height of about 70 feet above grade.

Pan of bowl

This is the inner loop of the bowl. Soon it will be a ten-thousand seat amphitheater with the lake as a background. The other side of the hill will serve as a ramp for soapbox derbies. Nearby picnic grounds, tennis courts, and other recreational facilities will be built.

Mount Trashmore one year later with height of nearly 70 feet

One year later . . . and Mount Trashmore (as they've nicknamed it) is nearly seventy feet high, an unusual attraction in this flat coastal region. Today's wastes building tomorrow's recreation facilities. Virginia Beach's demonstration may serve as the impetus for similar projects elsewhere.

DISPOSAL – THE MOLE (King County, Washington)

Container of waste being emptied into mole hopper

At the fill site of the King County, Washington, Department of Sanitary Operations, a hydraulic unloader lifts a 42-cubic-yard container of refuse arriving from a transfer station and empties it into the hopper of a prototype machine, constructed with the assistance of a Bureau of Solid Waste Management Demonstration grant.

Interior of mole cab; man at controls; exterior of cab; pan down to

This unusual device is called "the mole" and it buries refuse . . . processing up to 100 tons an hour. It extrudes a continuous bale

refuse trenching and compacting

of densely compacted refuse. Auxiliary equipment digs, backfills, and compacts the trenches. The concept is feasible and the technique may prove economically attractive where conventional sanitary landfill methods cannot be employed. The film *Waste Away*, which is available from the Bureau, shows operational details for the Seattle-King County solid waste system.

DISPOSAL – INCINERATION (Shippensburg, Pennsylvania)

Shippensburg incinerator, exterior of building as truck backs into unloading dock

Waste handling inside building

Borough manager Smith opening combustion chamber porthole

Even a small community may find incineration feasible and economically attractive. The Shippensburg Pennsylvania Sanitary Authority is faced with disposing of the solid wastes of only 12,500 people, but has no suitable area available for a conventional sanitary landfill. With the assistance of a Federal demonstration grant, the Authority has built a pilot incinerator with a uniquely designed rotary combustion chamber which has the configuration of an inclined bowl. It consists of two units, each capable of handling 36 tons of combustible solid wastes every 24 hours.

Flames through porthole

The facility is designed to meet air pollution control standards and eliminate environmental health hazards, while achieving maximum incineration and reducing the refuse to the smallest possible volume.

Flames through rotary grate

The rotary combustion chamber, a stainless steel perforated drum, revolves in a steady stream of air, facilitating combustion.

Flames within drum; residue dropping into truck; truck pulls away from building

A well-designed incinerator, properly operated and maintained, should be able to handle about eighty percent of typical urban solid wastes . . . reducing weight by as much as seventy percent or more. This project has demonstrated that a small-community incinerator can be economical and provide a high degree of combustion, producing a residue with a very low percentage of unburned material.

DISPOSAL – LARGE OBJECT INCINERATOR (Stamford, Connecticut)

Stamford incinerator being charged; zoom back to show entire plant and stack without visible emission

Many communities which normally incinerate their refuse have difficulty with bulky wastes such as stumps and volatile material which would be dangerous to handle in a conventional incinerator. For this reason, the City of Stamford, Connecticut, applied for a demonstration grant to build this unique front-charged incinerator equipped with an electrostatic precipitator for air pollution control. Stack emissions are being analyzed under various operating conditions. It is possible for even new

	incinerators to be forced out of service because of nonconformance to increasingly strict air pollution regulations.
Fire chamber panning to precipitator and stack	However, the attractiveness of incineration lies in its extensive volume reduction. A properly designed and operated incinerator can reduce refuse to less than 10 percent of its original volume. The Bureau's publication *Incinerator Guidelines* contains detailed technical information.

DISPOSAL – MILL VOLUME REDUCTION (Madison, Wisconsin)

Plant exterior, truck approaches	The City of Madison, Wisconsin, employs the landfill disposal method but is using a hammermill to reduce the volume of wastes *before* disposal.
Wastes on conveyor **Masked man climbs past mill**	The pilot plant has some deficiencies in design. A straight-line feed to the mill would eliminate pile-ups experienced with this one; and dust and noise controls would improve working conditions; but the two mills tested are simply constructed, easy to operate, and reliable.
Man inspecting hammers	Modifications have made hammers easier and quicker to reach and change; and control problems, which initially caused frequent stops due to overloading, have been corrected.
Man inspecting large metal reject	The mill rejects resilient objects ballistically, but may have trouble with fibrous materials such as rugs or bundles of paper.
Mill being stopped	When a jam occurs, the mill can be stopped and opened in four minutes or less, and there is very little "down time."
Milled refuse coming out	This is the milled product . . . about 15 percent garbage and with a moisture content varying between 30 and 50 percent. Milling garbage alone has not proved practical, but either rubbish alone or combined refuse mills quite satisfactorily.
Milled refuse being unloaded at the fill site; milled refuse being leveled	Milling reduces the volume of the waste, effectively extending the life of the landfill. The milled product spreads and grades easily. Project measurements indicate that when the milled refuse is compacted to a depth of six feet, a density of nine-hundred to eleven-hundred pounds-per-cubic-yard can be obtained. This is twice that of unmilled refuse handled in the same way.
Man walks across uncovered fill, stoops to inspect, breaks a handfull of refuse apart	Test cells of milled refuse have been left without earth cover for up to three years as an experiment and no sanitary or esthetic problems were detected. The material is inert and non-odorous, doesn't harbor or attract rodents, and breeding of flies has not

been noted. Milled refuse provides a more uniform surface, is more stable, and requires less cover.

Tractor-trailer driving across uncovered milled fill

Based on data collected at this facility, the cost of grinding refuse at an optimally designed installation was estimated to be between two-dollars-and-forty-five-cents and four dollars a ton, depending on the capacity of the plant.

DISPOSAL – COMPOSTING (Gainesville, Florida)

Exterior of Gainesville receiving building; truck crosses to compost pile

At Gainesville, Florida, municipal solid wastes are milled, but for a different reason . . . to prepare them to be converted into compost.

Man walks to compost stockpile, picks up handfull, sniffs and shreds it

The humus-like soil conditioner is stockpiled for use by the city, Alachua County, and the University of Florida . . . all participants in this demonstration project . . . and for sale, largely in bulk to the citrus industry.

Manned control panel and picking table

Incoming refuse first passes a picking table for removal of salvageable or large non-compostable items. Ready markets for baled cardboard, paper, and rags have been found . . . but none for glass, cans, and other metals. These are disposed of, along with other non-compostables and trash, at a land disposal site. Beyond the picking table, the high-rate mechanical composting system performs a series of preparatory operations before depositing a moist mixture of ground refuse and sewage sludge from the adjacent sewage treatment plant in one of two digestor tanks. During the six-to-eight-day digestion period, the mixture is aerated periodically to speed biological degradation. The resulting relatively stable compost receives a final grinding on its way to the stockpile.

Compost production line: mill, milled refuse, rejected metals, compost dropping to conveyor

The primary crusher-disintegrator, which proved particularly troublesome, was replaced with a different type; and a variety of other mechanical and operating problems are being systematically solved. Methods are also being developed for evaluation of the system's performance and public health aspects. Compost can be useful in some situations, but neither composting nor the salvage associated with it are presently profit-making ventures. They are methods of handling small parts of the total waste load beneficially. Usually, they can be only equally small parts of a comprehensive solid waste management program.

RESEARCH PROJECTS

Men loading and operating fluidized bed incinerator	Some current research! A new approach to handling solid wastes more effectively . . . a new concept of incineration being studied at the University of West Virginia. Refuse, already ground to a uniform consistency, is fed into a fluidized bed reactor, equipment commonly used by the chemical industry to obtain controlled reactions between gases and solids. Here, the modified pilot reactor becomes a furnace in one of many varied research projects being conducted with Federal aid under programs of the Bureau of Solid Waste Management of the Department of Health, Education, and Welfare.
Demonstration tube of boiling water; man drops red balls in	This is a simulation of the reaction inside the furnace. The fluidizing gas is air, moving up the column at controlled velocities. The fluidized bed contains particles of inert sand raised to the ignition temperature of the material to be burned. When the air and the suspended sand reach the fluidized state resembling a boiling liquid, the particles of ground waste are added, and combustion occurs.
Close-up of red balls agitating in boiling water	The fluidized bed incinerator is still experimental, but it already promises more complete and cleaner burning.
Two men examining residue	Project personnel examine the residue which constitutes only a small fraction of the original volume of the refuse. Stack emissions from the fluidized bed furnace contain far less particulate loading than conventional incinerators.
Attendants at hospital collect waste; man separates waste materials	Another university research project is examining hospital wastes. Think how diverse they are. In addition to the ordinary ones . . . garbage, paper, and other dry combustibles, and non-combustibles such as bottles and cans . . . hospitals generate unusual wastes related to medical treatment and surgical procedures. Hospital wastes require special handling since they may contain pathogenic material. In order to develop data on the nature and volume of the various waste materials, and to devise better management methods, they are identified and carefully separated.
Man examining waste samples	Analysis of the different materials and their processing may even point to desirable changes in the design of hospital service areas and waste handling equipment.

Two men remove molten glass from kiln and pour into mold	Glass has few equals as a container. Being chemically inert, it won't react with any other substance. But, after use, neither will it oxidize and degrade . . . nor burn at ordinary incinerator temperatures. These Clemson University scientists are seeking a solution to the solid waste problem posed by millions of discarded bottles and jars.
Glass sample **Glass goes into coating apparatus; coated sample**	They start with water-soluble glass, already in wide commercial use, and through a chemical vapor deposition process, coat it with a very thin overlay of inert material. A container made in the same way would hold anything.
Time lapse; broken sample disintegrates beside unbroken sample	But break the film, and the glass slowly dissolves. It works in the lab, but commercial production may be some years away.
Man examining caged chickens; pan down to waste trough; water flushes through; filtration tank with man taking sample	Chickens and other animals concentrated in commercial cages and feed lots contribute increasingly to the solid waste load. In this University of California experimental closed hydraulic system, water flushes the manure to a high-rate oxidation pond. There its nutrients are reclaimed photosynthetically in the production of algae. The digested sludge can be used as fertilizer, and the dried algae as supplemental food for ruminant animals. Resources from waste through research.
Teacher and students at strip mine	These students, inspecting an abandoned strip mine, are a new breed. Their graduate studies emphasize environmental control. Several universities are expanding their curricula to provide qualified engineers in this crucial area . . . recognition that specialized training, as well as imaginative research, is essential for effective solid waste management and the total protection of the environment.
New York City strike	Solid waste collection and disposal costs Americans over four and a half billion dollars a year. Your community may have a budget in the thousands, hundreds of thousands, or millions. Every dollar of this should be spent wisely to provide good service efficiently and economically. The selection of solid waste system components is of primary importance. The equipment and methods must match your local requirements and limitations. However, certain general principles seem to apply to all communities today. Labor costs are rising . . . particularly when working conditions are unpleasant or dangerous. A disruptive situation, such as the noteworthy New York City garbage strike, can reflect on staff officials and elected officials alike. Environmental enhancement is becoming more important and solid waste management practices

must be geared toward protecting air, water, and land and eliminating unsightly litter.

Summaries of all projects and up-to-date information are available from your regional office or the Office of Information of the Bureau of Solid Waste Management.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1972— 759-397/134