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## Storage, Collection and Disposal

John M. Huie

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Solid Waste Management Series

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# Solid Waste Management

## storage, collection and disposal

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Cooperative Extension Service, Purdue University, Lafayette, Indiana



# GOOD GIVES

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## Introduction

The rapidly increasing quantity of solid wastes produced in the U.S., with its accompanying health hazards and dangers of pollution, has caused great concern among governmental agencies and private citizens alike.

The several new local, state and federal laws dealing with solid wastes point up the growing concern for the means of storage, collection and disposal of waste materials.

The statistics are alarming: collection of waste in the U.S. now averages about 5.3 pounds per person per day, or almost a ton per person per year, or nearly 200 million tons annually.

Under the pressures of increasing population, less available land, pollution and health safeguards, along with the new laws, county and city officials and concerned citizens will be seeking more extensive and/or newer, more efficient, means of disposing of solid wastes. An awareness of the various means of collection, storage, disposal and financing is needed before effective planning may be done. In this report, alternatives for solid waste management are presented.

## Why Worry about Solid Waste?

The major concern in solid waste disposal is the several factors associated with health and nuisances. The potential for transmission of diseases to men and animals through harboring rats, and insects—especially flies and mosquitoes—if disposal sites are not carefully planned and efficiently operated, is a great health problem.

Nuisances are not usually direct health hazards unless they become severe. These include such things as odor, visible smoke, gases, dust, noise, drifting paper, heavy traffic and unsightly appearance.

The relationship between solid waste disposal and water and air pollution is also a vital consideration in the design and operation of waste disposal systems. For example, incineration may increase air pollution significantly, while the ash leached from soil can pollute water supplies.

Landfill operations not properly located and operated may also contribute significantly to both water and air pollution. However, if properly located and managed, incineration, landfills, grinding or composting are some of the methods that can be used with a minimum effect on air and water pollution.

The most common method of solid waste disposal, dumping and burning, provides food and harborage for rats and insects, and burning contributes significantly to air pollution through smoke and gases. Dumps are also unsightly and often produce litter over relatively large areas.

# Solid Waste Management

(Storage, Collection and Disposal)

Prepared by John M. Huie  
Department of Agricultural Economics  
Purdue University

## Sources and Composition of Waste

### Sources

The average amount of solid waste collected is over 5 pounds per person per day (Table 1). Table 1 also indicates rural-urban differences which reflect differences in proportions collected as well as in the amount produced. It should be emphasized that these are average figures for the nation, and they reflect only material that is known or estimated to be collected. Wastes that are disposed of by the individual or business generating the waste are not included. Reflecting this, these figures are undoubtedly low. Also the amounts generated are increasing rapidly as population increases and as the amount generated per person increases.

### Composition

Solid waste is composed of a variety of items, the importance of each varying with each community. However, some idea of the relative importance of each can be seen in Table 2.

Sixty-four percent (almost  $\frac{2}{3}$ ) of waste is rubbish consisting of a conglomeration of items, the most important being paper. Paper makes up 42 percent by weight of all solid waste. Food wastes make up 12 percent with non-combustibles accounting for an additional 24 percent. These figures do not include automobiles, appliances, or industrial wastes, but refer only to waste generated by households, institutions such as schools and hospitals, and commercial establishments such as wholesale and retail stores.

**Table 1. Average Pounds of Solid Waste Collected per Person per Day, United States, 1967.**

Sources of waste	Urban	Rural	National
Households	1.26	0.72	1.14
Commercial	0.46	0.11	0.38
Combined (not separable)	2.63	2.60	2.63
Industrial	0.65	0.37	0.59
Demolition and Construction	0.23	0.02	0.18
Streets and Alleys	0.11	0.03	0.09
Miscellaneous	0.38	0.08	0.31
<b>TOTALS</b>	<b>5.72</b>	<b>3.93</b>	<b>5.32</b>

Source: Anton J. Muhich, "Sample Representativeness and Community Data," *An Interim Report 1968 National Survey of Community Solid Waste Practices*, Department of Health, Education and Welfare, p. 13.

## Recent State & Federal Laws

### Indiana Laws

Although a number of laws pertain to solid waste management, three recent state laws are of particular importance and are discussed briefly. The complete laws are included as appendices A, B, and C of this report. Copies of other laws can be obtained from the State Board of Health or through the local Cooperative Extension Service office.

**Refuse Disposal Act:** This act was passed by the 1969 Indiana General Assembly and is listed as Chapter 355, Acts of 1965, as amended by Chapter 359, Acts of 1969. It is "an act concerning the collection and disposal of

**Table 2. Composition of Refuse from an Average Municipality**

Classification	% of total solid waste by weight	% of dry weight non-combustible
Rubbish	64.0	—
Paper	42.0	6.0
Wood	2.4	1.0
Grass	4.0	6.8
Brush	1.5	8.3
Greens	1.5	13.0
Leaves	5.0	8.2
Leather	0.3	10.1
Rubber	0.6	10.0
Plastics	0.7	10.2
Oils, paints	0.8	16.3
Linoleum	0.1	27.4
Rags	0.6	2.5
Street Sweepings	3.0	25.0
Dirt	1.0	72.3
Unclassified	0.5	62.5
Food Waste	12.0	—
Garbage	10.0	16.0
Fats	2.0	0.0
Non-Combustibles	24.0	—
Metals	8.0	99.0
Glass & Ceramics	6.0	99.3
Ashes	10.0	70.2

Source: American Public Works Association, *Refuse Collection Practice*, Public Administration Service, Chicago, Illinois, 1966, p. 39.

refuse, the acquisition and financing of collection and disposal facilities, the leasing with option to purchase of incinerating plants, defining certain unlawful activities; and prescribing penalties."

The purpose of the act is ". . . to authorize counties, cities, and towns to establish, acquire, construct, install, operate and maintain certain facilities for the collection and disposal of refuse and to declare open dumps to be inimical to human health."

Section 2 defines refuse as ". . . all putrescible and nonputrescible solid and semi-solid wastes, except human excreta, but including garbage, rubbish, ashes, street cleanings, dead animals, offal and solid commercial, industrial and institutional wastes." The act further defines each of these categories of solid waste.

According to section 3, any disposal method approved by the State Board of Health may be used; however, state approval of the method must be obtained.

Section 3 outlines four specific disposal methods and one general category of "other methods." The four specific methods are (1) sanitary landfill, (2) incineration, (3) composting, and (4) garbage grinding.

In the case of incineration, both the State Board of Health and the Air Pollution Control Board of Indiana must approve *all plans* prior to construction of facilities.

If garbage grinding involving separate collection and disposal of garbage into a community sewage system through commercial type grinders or community-wide installation of individual grinders is to be provided, plans and specifications must be approved by the State Board of Health and the State Stream Pollution Control Board.

Section 30 of the Act relates to the operation of open dumps and is quoted here:

"Open dumps are hereby declared to be inimical to human health, and as such are not suitable means of refuse disposal. Except as hereinafter provided, on or after January 1, 1971, disposal of garbage, rubbish, and refuse on lands in this state shall be made only through use of sanitary landfills or by means of incineration, composting, garbage grinding or other acceptable methods approved by the state board. No person, firm, association, corporation, county, city, town, political subdivision of the state, or unit of government shall establish, operate or maintain open dumps, whether or not the service is performed for compensation or gratis, on or after January 1, 1971: Provided, however, that the state board may upon written application authorize for a limited period the continued operation and maintenance on and after January 1, 1971, of any existing open dump.

"No person, firm, association, corporation, county, city, town, political subdivision of the state or unit government shall establish, operate or maintain facilities for the collection and disposal of refuse except as set out in section 3 of this Act or under rules and regulations adopted by the state board of health on or after January 1, 1971: Provided, however, that the state board may upon written application authorize for a limited period the continued operation and maintenance on and after January 1, 1971, of any facility for the collection and disposal of refuse.

"Any failure to comply with this section shall constitute the operation of a nuisance inimical to human health. The state board of health may institute proceedings for injunctive or mandatory relief through the state attorney general in any court of competent jurisdiction for any violation or failure to comply with the provisions of this section."

**Refuse Collection and Disposal Facilities:** This act was approved in March 1969 and is referenced as Chapter 171, Acts of 1969, and known as Senate Enrollment

Act. No. 420. It is an act authorizing cities and towns, sanitary districts, or other agencies of municipal government to collect and dispose of refuse.

**Litter Control Law:** This is "an act concerning unlawful disposal of refuse and prescribing penalties." It was passed into Law as Chapter 66, Acts of 1969. According to section 1 of the act, "It shall be unlawful for any person to put, throw, dump or leave refuse in, upon or within the limits of or adjacent to any public highway, state park or recreation area, or in or immediately adjacent to any lake or stream, except in proper containers provided for sanitary storage of such refuse—or except as a part of a landfill operation otherwise permitted by law . . . "Upon conviction, violators shall be fined in an amount not exceeding . . . \$100 to which may be added imprisonment for a term not exceeding . . . 30 days." The act took effect in April, 1969.

## Federal Laws

Recognition of solid waste disposal problems at the federal level resulted in passage of the Solid Waste Disposal Act of 1965 (Public Law 89-272). The purposes of the act are:

- (1) to initiate and accelerate a national research and development program for new, improved methods of proper and economic solid waste disposal, including studies directed toward the conservation of natural resources by reducing the amount of waste and unsalvageable materials and by recovery and utilization of potential resources in solid wastes; and
- (2) to provide technical and financial assistance to states and local governments and interstate agencies in the planning, development, and conduct of solid waste disposal programs.

Under this act, federal grants for up to two-thirds of the cost of planning and constructing refuse disposal facilities are available. These are referred to as demonstration grants and are for the purpose of trying new approaches to solid waste management. Grants of up to 50 percent of the cost are also available for state and interstate agencies to survey solid waste disposal practices and problems and to develop solid waste disposal plans for such areas.

## Storage

Although they are dealt with separately in this section, it is necessary to consider the total storage, collection and disposal aspects of a solid waste disposal system before making decisions concerning any single activity within the overall system. The type of collection or disposal activity used will obviously affect storage methods.

It is helpful to classify storage methods according to their location. The most common storage location is at or near the site where refuse is generated: that is, at the residence, business, industry or farm where the waste is initially produced. Regardless of the other methods used in the total system some storage at the site is necessary. Storage here may range from completely uncontrolled rubbish piles to a sanitary landfill operation.

In densely populated areas, distances between residences, businesses or industrial sites are sufficiently short to make pick-up at each location feasible, so storage in suitable containers at each site becomes the normal procedure.

Depending on collection and disposal methods and the location of the disposal site, it may be more effective to provide short-term storage at a transfer station. The transfer station may be simply a collection bin in a rural area where individuals deposit their own waste. This consolidates widely scattered waste into a larger volume for transfer to a disposal site.

In urban areas, transfer stations may be relatively elaborate stations used to collect refuse into a sufficiently large volume to make train or large trailer truck hauling feasible. Collection trucks unload into bins or directly onto truck or rail cars. The waste is then compacted and transported to the disposal site. This system is normally used when disposal sites are relatively distant from the solid waste producing units.

For some methods of disposal it is necessary to separate refuse into two or more categories. It may be done at its origin and then stored in separate containers at either the transfer station or the disposal site. Regardless of the location, it will increase storage and collection costs. However, it may reduce final disposal costs and permit partial recovery of the cost through a salvage operation. The feasibility of salvage depends primarily on a suitable market for the materials salvaged.

Under many refuse disposal systems, separate methods of storage, collection and disposal of large items such as tree stumps, equipment, appliances and automobiles are required. Finding satisfactory methods of handling these items offers a real challenge to communities and researchers.

## Collection

Collection is the most expensive phase of solid waste disposal and may account for as high as 80 percent of the total cost. This percentage reflects the cost of collection, and at the same time, reflects the lack of emphasis placed on the disposal aspect. As improved sanitary disposal becomes more widely used, the cost ratio will probably change. However, the importance of collection costs points up the need to carefully consider all alternatives and to plan the collection operation to minimize costs while maintaining the desired standards of operation.

There are a number of alternative methods for moving refuse from storage points to collection vehicles.<sup>1</sup>

- (1) The material may be transferred from storage containers located at curbs or in alleys.
- (2) The full containers may be carried from back doors or basements and empty containers returned.
- (3) The full containers may be emptied into carrying tubs or baskets which are then carried to the vehicles.
- (4) Full cans may be exchanged for clean empty ones.
- (5) Large portable containers may be located at strategic locations. These may be either picked up and emptied on site or carried to disposal sites with the aid of specially designed equipment. (This is, in effect, a small transfer station)
- (6) Disposal refuse bags may be used for curb, alley or back door collections.

The method or combination of methods used depends on local conditions, including the types and quantity of materials to be handled; the types of equipment available; the physical layout of the area, such as street widths; personnel practices; the convenience and frequency of pick up desired by citizens; and the amount of work and expense that the citizens themselves are willing to absorb, rather than to pay for the service. The expense of collection where the containers must be picked up from the back door or basement is likely to be greater than if refuse were picked up at the curb or alley. Less labor from the disposal service is also likely if refuse bags are used. However, this increases the cost to the refuse producer.

Collection in rural areas will normally require pick up at the road or, if an area is sparsely populated, it may require that each individual carry waste to a "community site," where it can be picked up from a large storage bin.

Alternative 5, portable containers, is often used in combination with the other methods, usually in two situations: first, where a large concentration of refuse is found within a small area, such as an apartment building, or in a commercial area where it is convenient for several units to use a central container; second, in low density rural areas where the initial collection costs are borne by the producer and a centrally located bin is provided. When selecting a method, consider the costs not only to the collecting units, but also to those producing the waste. In some cases, the community may prefer to let each household bear the initial cost of collecting the waste in a central pick-up point.

**Table 3. Collection Costs Per Ton of Refuse for Selected Areas**

City	Labor	Equip- ment	Over- head	Total	Notes
Los Angeles	6.76	2.61	3.37	12.74	Combined refuse—residential.
Evanston, Ill.	8.88	1.78	0.71	11.37	Combined refuse—residential.
Winnetka, Ill.	7.04	1.46	0.87	9.37	Combined refuse—residential.
Newark, N.J.	—	—	—	9.15	Combined refuse—residential, commercial, some industrial.
Cincinnati	7.39	1.97	2.14	11.50	Combustible and non-combustible rubbish residential, commercial, and industrial. Labor benefits included in overhead. Set-out system used.
New York City	19.28	4.44	1.24	24.96	Combustible and non-combustible rubbish. Combined refuse—residential.

Source: American Public Works Association, *Refuse Collection Practice*, Public Administration Service, Chicago, Illinois, 1968, p. 80.

<sup>1</sup> American Public Works Association, *Refuse Collection Practice*, Public Administration Service, Chicago, Illinois, 1968, p. 5-6.



**Collection Costs:** Collection costs vary widely and depend on local conditions, including differences in climate, geographical differences, the form in which refuse is presented for collection, frequency of collection, length of haul, location of collection, wage rates, population density, kind of service demanded, and efficiency of operation. It is difficult to estimate the cost of collection under any given set of circumstances, and comparisons of costs among different systems are likely to be almost meaningless unless differences in costs can be attributed to these factors. Data in Table 3 indicate the variation in costs at different locations, and the levels of costs incurred per ton of refuse. Costs per ton ranged from \$9.15 to \$24.96 with differences in labor costs accounting for the major portion of the variation. Labor accounted for 60 to 80 percent of the collection cost.

## Disposal

Within the standards established by the Indiana Board of Health, there are several technically feasible methods of solid waste disposal. The two most frequently used are incineration and sanitary landfills. However, other less frequently used methods may be preferable under certain conditions and with improved technology some of these may become more prominent.

### Sanitary Landfills

This method is a planned and systematic method of disposal by compacting the waste and covering it with a layer of earth (approximately 6" to 8") at the end of each day, or more frequently if needed to minimize nuisance or hazards to public health and safety. A two foot cover of earth is applied to the top of a completed landfill.

Properly operated landfills have a generally good appearance, once the cover material is applied. A landfill eliminates fires, smoke, odors, rodents, flies, mosquitoes and other public health nuisances common to open dumps. This method is not to be confused with open dumps. Sanitary landfills do not allow burning and all waste is completely covered at least once a day.

Two methods of landfilling are in general use. The area method is best suited for marshes, gently sloping land or where quarries, ravines, valleys or other depressions exist.

However, these locations should be studied carefully for possible water pollution through surface runoff or underground leaching. A thorough geological survey of these sites is a necessary step. Normally, the earth cover for an area fill is hauled in or obtained from an adjacent area. Use of the trench method involves cutting a trench in the earth, spreading the solid waste thinly in the trench, compacting it, and then using the excavated earth for covering.

The trench method is best suited for flat or gently sloping land where the water table is not near the surface. One of the major advantages of this method is that it yields its own cover material. However, trenching is likely to require land that would normally have relatively good alternative uses.

A variation of these two methods, often used in combination with the area or trench is slope or ramp disposal. In this case, the waste is dumped on the side of an existing slope. It is spread, compacted and covered. This variation will normally permit one piece of equipment to

perform all the operations in small landfills.<sup>2</sup> Each of these methods is shown pictorially in Figure 1.

**Site Selection:** Selection of a site is likely to be a major hurdle in establishing a sanitary landfill. To keep the cost of hauling to a minimum, the site should be as near the source of refuse as practical. However, other factors must be considered. It is important to have good access roads and to minimize the amount of travel through residential areas. The roads should be adequate for the size trucks using the site during all weather conditions. Ideally, more than one access route is desirable, so that if one is closed, the site can still be used.

Characteristics of the soil are important. The cover material should have good workability and compaction characteristics. Sandy loam soil is considered excellent.

The potential for ground and surface water pollution from landfills means that a geological investigation of the site should be considered. Solid waste normally contains contaminants and infectious materials that can be serious health hazards or nuisances if permitted to enter water supplies. The geological investigation should include information on ground water levels and movements, and an examination of the site topography and the surrounding area to determine potential flooding and runoff.

The eventual use of the finished landfill should be considered in site selection. After five to ten years, experience has shown that the site is a potential location for nearly any use.

One frequent use of landfills is for parks or other recreational developments, and one site in Chicago now is used for multi-story housing development. Landfills have residential, business and industrial potential.

For construction purposes, it may be necessary to go below the depth of the landfill to find solid footing, or to use special construction methods for the necessary stability. Also, caution should be taken to prevent danger from trapped gases released in the decomposition process.

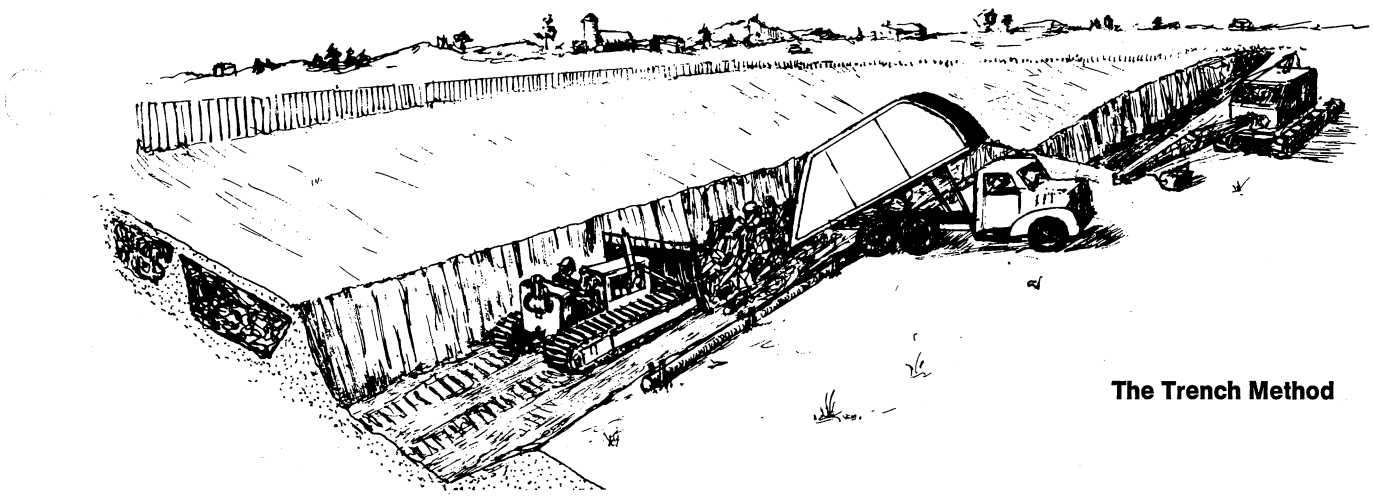
The area landfill method has been effectively used to reclaim land and thus to increase its value. When this becomes feasible, it offsets some of the disposal costs, and may also have a positive effect on adjacent land values. This, of course, can help overcome the potential short run negative effects of landfill property. More importantly, it may change the attitude of adjacent property owners toward the location of landfills.

**Costs:** The cost of solid waste disposal by sanitary landfills, by most estimates, is considerably lower than any other frequently used method. Most estimates of operating costs range from a low of \$0.50 per ton of refuse to about \$4.00 per ton. In a recent national survey 360 landfills which met the criteria for a sanitary landfill reported an average operating cost (plus amortization of equipment and land cost) of \$1.05 per ton.<sup>3</sup> However, this estimate does not include collection costs. When it becomes necessary to locate landfill sites some distance from collection points, transportation costs may increase and may overcome the cost advantage in the disposal operations.

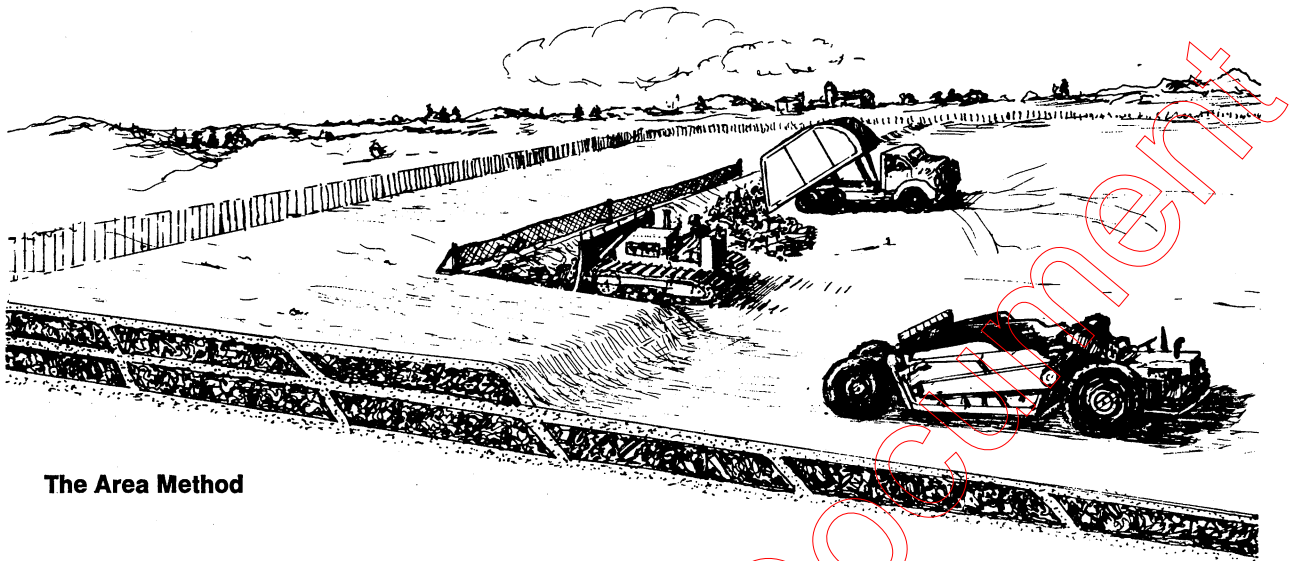
**Labor Requirements:** Labor requirements will vary with type of site, method of receiving waste, number and size of loads, equipment, etc., but the following data should

<sup>2</sup> Artist sketches from U.S. Department of Health, Education, and Welfare, *Sanitary Landfill Facts*, Publication SW-4ts, 1968, pp. 6 & 7.

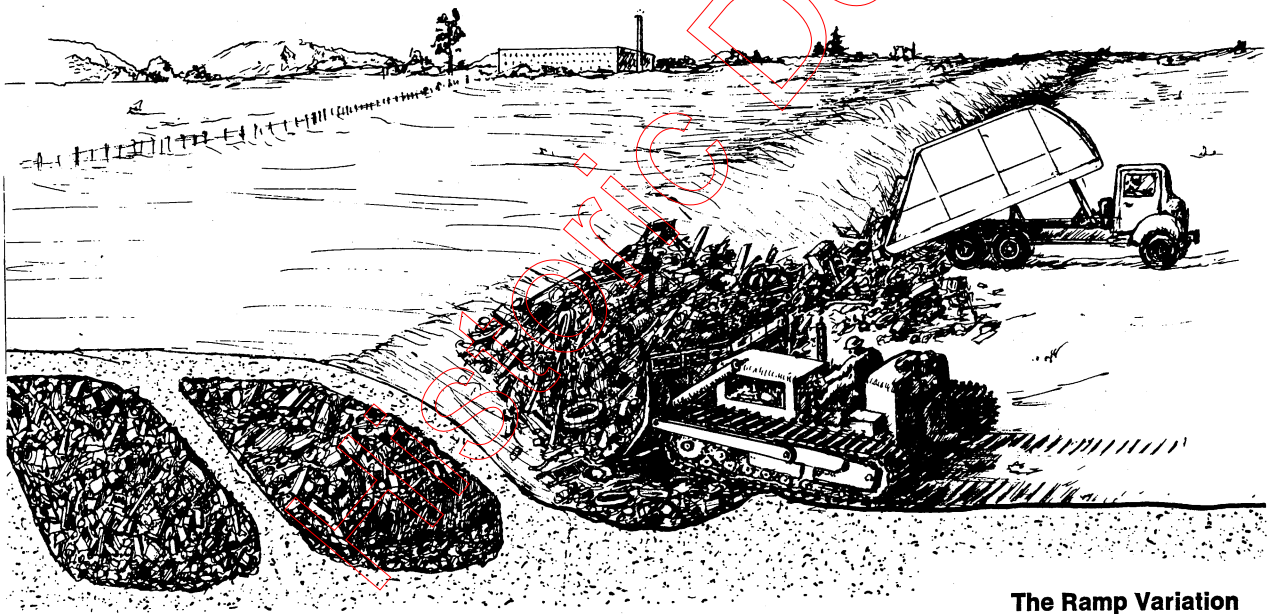
<sup>3</sup> Albert J. Klee, "The Role of Facilities and Land Disposal Sites," *An Interim Report 1968 National Survey of Community Solid Waste Practices*, Department of Health, Education and Welfare, p. 29.



**The Trench Method**



**The Area Method**



**The Ramp Variation**

**Figure 1. Sanitary Landfill Methods**



be helpful. Data reported on the landfill operations of 138 cities showed that all but 34 cities with populations of 15,000 or less operated the fill with only one man. Of 38 cities with a population between 15,000 and 50,000, 15 used one man, 18 used two men and 3 used three men.

**Equipment Requirements:** Equipment suited for landfill operation are a bulldozer, front-end loader, drag line shovel, scraper, and backhoe. In most of these, considerable flexibility can be achieved by changing blade types, split buckets and other variations.<sup>4</sup> In addition, most equipment manufacturers have equipment specifically designed for landfill operations. These should be carefully considered in planning for a landfill.

Experience indicates that one piece of equipment, such as a front-end loader, can handle landfills serving up to 50,000 persons, unless unusual conditions exist. For instance, if fill has to be moved long distances, additional equipment will be necessary. Under most conditions, unless considerable road traveling is necessary, crawler-type tractors appear to be the most satisfactory. For estimating requirements, data in Table 4 may be used.

**Table 4. Guide for Estimating Equipment Requirements for Sanitary Landfills**

Population served	Suggested loader capacity (cu. yds.)	Tractor (HP)
6,000-10,000	.75	30
10,000-20,000	1.00	45
20,000-50,000	1.75	45-65

Source: John Bell, *Sanitary Landfills*, Unpublished mimeo, Purdue University, p. 16.

**Land Requirements:** A rule-of-thumb used for estimating requirements is one acre per year for every 10,000 persons served. This assumes a six-foot depth of compacted refuse. In areas where a significant volume of industrial wastes is present, this requirement may need to be expanded. The six-foot depth can, of course, also be increased to reduce the total acreage required.

**Board of Health Standards:** The Indiana State Board of Health has developed minimum standards for the selection, operation and maintenance of a sanitary landfill. These are included as appendix D. Also the Board of Health has developed an outline for communities developing information about landfill proposals for the State Board's review prior to approval of the specific site. This is included as appendix E.

## Incineration

Incineration is the reduction of combustible wastes to inert residue by high temperature burning. It is an economic, nuisance-free, sanitary method for reducing the volume of refuse which must then be disposed of by other means. Well-designed and operated incinerators can be expected to reduce the amount of waste to within 5-35 percent of its original weight or to 3-15 percent of its volume.

The design and operation of the plant and the composition of the refuse are major factors influencing the quantity of non-combustible materials. Generally speaking, the newer the plant, the more effective it is.

Some of the major advantages of incineration are (1) the need for much less land than a landfill operation, (2) a more central location may be possible, which reduces hauling costs, (3) operation is not greatly affected by climate, (4) a relative flexibility obtained by increasing or decreasing the hours of operation per day or the degree and thoroughness of burning, and (5) under certain conditions it may be possible to develop a market for salvageable metals.

The major disadvantages of incineration are (1) the high investment and operating cost, (2) it is not a final disposal operation, which means that the residue still must be disposed of in a landfill or by other means, (3) air pollution is likely to be more severe than with some other methods.<sup>5</sup>

**Costs:** While costs will vary greatly with a number of factors, the initial cost of incinerators can be expected to range from \$5,000 to \$8,000 per ton of rated 24-hour capacity. One engineering estimate used for a 200-ton plant for a central Indiana community was based on \$5,500 per ton, or a total of \$1,100,000.<sup>6</sup> Actual construction cost per ton of refuse burned will probably be considerably higher because of down time for maintenance and repair, which may run as high as 20 to 30 percent.

Estimates of the total annual cost of operating an incinerator range from about \$4.00 to as high as \$15 to \$18 per ton of refuse including capital costs. Annual operating and maintenance costs can be expected to account for 40 to 50 percent of this total. Maintenance cost alone may run as high as 35 percent of the annual operating cost. Based on reported costs from a national survey, the average annual operating cost was \$4.10 per ton and capital cost averaged \$7,100 per ton of refuse.<sup>7</sup>

**Labor Requirements:** For small plants one person may be able to handle the entire operation while larger plants may require five or six men per shift. One estimate required four men for a 200-ton per day plant; one supervisor, one machine operator, one changing floor operator and one man on the operating floor. For an additional shift only three men are required.

**Land Requirements:** While land needs will vary considerably with the size of plant, two to four acres is a normal requirement. Extensive shielding, unusual traffic patterns or extra storage space may require additional acreage. However, this estimate does not include space for sanitary land-filling of non-combustibles or ash. If space and other requirements are satisfactory, it is advisable to have space for the disposal of ash near the incinerator.

**Site Selection:** Many of the same criteria for landfill site selection hold true for incinerator sites. The site should be as near the major source of waste as is practical, and good year-round road access should be provided. Truck traffic should be routed to minimize travel in residential areas, and the incinerator should be above all potential flood levels. One of the advantages of an incinerator is the reduced danger of water pollution, so geological conditions are not as critical as in the landfill. However, a disposal site for the ash must be provided and potential water pollution does exist here.

<sup>5</sup> It is technically feasible to reduce air pollution to minimum levels, but at relatively high costs.

<sup>6</sup> Clark, Dirtz and Associates, *Report on Solid Waste Facilities for the City Kokomo, Indiana*, January 1968, p. 54.

<sup>7</sup> Albert J. Klee, "Role of Facilities and Land Disposal Sites," *An Interim Report 1968 National Survey of Community Solid Waste Practices*, Department of Health, Education and Welfare, p. 39.

<sup>4</sup> John M. Bell, *Sanitary Landfills*, Unpublished mimeo, Purdue University, p. 16.

## Grinding

Technically, this is a processing rather than a disposal operation. Grinding reduces the volume of waste and increases the ease of handling.

Two different types of grinding units, home disposal units and municipal grinders, are in general use. In some communities, households and business establishments that have large volumes of garbage are encouraged to install garbage disposals to grind the garbage and dispose of it in the sewer system. The sewer system then becomes the collection method, and disposal is handled at the sewer treatment plant.

Some non-digestible residue may collect and will require a final disposal process of some type. Although grinding greatly increases the capacity requirement of the sewer plant, it is an effective method of handling a portion of the solid waste. Lack of capacity in sewer systems in many small towns and the widespread use of septic tanks in rural areas suggest that this process is most feasible in larger communities.

However, paper, metal, wood, plastic, yard trimmings, etc., must still be handled separately. The grinders serve only to reduce the volume of high volume, low density materials and to change the composition of the refuse collected through other means.

The cost of installing home grinders (disposal units) will vary from \$75 to \$200 depending on purchase price, installing cost and building code requirements. They are, of course, much more easily and economically installed in a house under construction. The useful life of home grinders will normally range from 10 to 20 years, although some periodic servicing will be required. "The average annual cost to a householder for a \$150 garbage grinder with a 20-year life expectancy, installed when the house is built and with the costs included in the mortgage, are about \$10.30 for purchase and installation; \$5.00 for repairs; \$1.00 for water and electricity; and \$.75 for sewage treatment, for a total cost of about \$17.00 a year."<sup>8</sup> Costs for the same installation in an older home will probably be 50 percent more.

The primary advantage of this way of handling food wastes are convenience and sanitation. These are especially important in commercial establishments, such as restaurants, hotels and hospitals where large quantities of food wastes are produced.

The second grinding procedure involves using large municipal grinders for food waste disposal. Food wastes are collected separately and ground in one or more large grinders at strategic points within the locale. The grinders may discharge the ground waste into the sewer or, if they are located at the sewage treatment plant, they may discharge the waste directly into the digesters. This latter option reduces the cost of treatment, but other costs may be increased by the plant location. Each situation must be evaluated separately.

While no accurate cost figures are available, reported costs vary from \$.25 to \$3.00 per ton of garbage processed. Investment costs will vary from less than \$10,000 for a 5-ton per hour grinder installed in a sewage plant, to over \$500,000 for larger, more elaborate plants of 300-ton per day capacity which require a separate building. The cost of a collection and disposal system for waste which cannot be ground must also be calculated in these estimates.

<sup>8</sup> APWA, *Municipal Refuse Disposal*, p. 238-239.

## Composting

This is a biochemical process that breaks down organic materials to a sanitary, nuisance-free, humus-like material. While under certain conditions, this process may be no more expensive than incineration, costs are normally higher and its feasibility is dependent on the market for the composted material. This method must be combined with means of disposal to handle non-compostible materials. It has not been used frequently in the United States.

## Pyrolysis

This is a new method of waste disposal and is still very much in the experimental stages. Basically, pyrolysis is a low oxygen, high temperature, burning procedure.

While the costs of operating pyrolysis units are still conjectural, they would appear to be slightly less than conventional incineration at \$7.00 to \$12.00 per ton. The more expensive units have the added factor of air pollution controls. Major advantages are expected to be the elimination of air pollution—only CO<sub>2</sub> and H<sub>2</sub>O are discharged; increased flexibility—smaller units should be economically feasible, construction can be completely underground, many materials that give trouble in conventional methods such as rubber, plastic, tars, greases, and oil can be easily handled; and finally, there appears to be greater probability that the residue can be separated into classifiable materials with some economic value.

This process appears to offer some advantages over other methods, especially in areas where land for landfills is not available, or where air pollution from conventional incineration is a major problem. It should be noted, however, that some waste materials, primarily certain industrial wastes, cannot be handled by this process and will require a separate disposal process.

## High Temperature Incineration

This is another experimental process, which involves adding combustible materials to waste, thus increasing the burning temperature. Raising the temperature increases the weight and volume reduction and decreases air pollution. Preliminary estimates indicate some advantages over conventional incineration in air pollution and waste reduction at a cost somewhat above the conventional incineration process.

## Salvaging and Recycling

If waste is looked upon as a resource out of place, rather than something that must be disposed of, then the potential of utilizing waste for production of some useable product becomes an immediate concern. In the past, a number of uses have been tried with varying degrees of success. Feeding garbage to hogs, composting and reprocessing of paper and metals are the most common. While these have not yet been effective in significantly reducing the waste problem, increased interest and continued research, both in developing new techniques and in economic analysis, show potential and may well be the long run solution to the solid waste problem.

## What are the Alternative Ways to Organize?

Regardless of methods used to organize the storage, collection and disposal of solid waste, the total system

must be explored and effectively coordinated. There are three basic alternatives, and a number of combinations of the three are in use: (1) each waste producer handle his own, (2) a private business may handle the service or, (3) a public agency may accept responsibility.

Some of the storage function is nearly always handled by the initial waste producer. Regulations governing the type and place of storage are usually imposed by those responsible for the collection and/or disposal functions of the system and/or by public ordinance.

Some storage, i.e., at a transfer station, may be handled by the private business or public agency responsible for collection. Storage bins are often placed for use in rural areas or in highly congested areas. To even out the flow of waste at a disposal site, a storage function may also be necessary. However, most of the storage function is normally handled by the waste producer.

Collection from storage containers and disposal can be handled by the individual, by a private business or by a public agency. Each community must decide which method is most likely to provide the quality of service desired at the least cost, under its conditions.

Although it is not expected that a private firm will operate without normal profits, the profit incentive may make the firm more efficient and able to provide the service at a cost below that achieved through a public agency.

On the other hand, a publicly operated collection and/or disposal facility may provide greater flexibility in adjustment to changing conditions and response to individual and community demand. Public officials often prefer not to accept the responsibility of daily operation of the function and use contracts, inspection or other procedures to regulate the activities of a private firm. A critical difference, especially in small communities which have limited funds for investment, is in financing. If a private firm contracts to furnish the function, no public financing is necessary for equipment, buildings or other capital items. On the other hand, if the community already has equipment not being fully used, potential may exist for more efficient use of this equipment and, thus, reduction in total costs. It is important to recognize that each community is faced with different circumstances and must weigh available alternatives in light of its own situation.

Frequently a combination of public and private operators is found, especially in larger communities. Recent surveys indicate that the disposal method depends partly on the source of waste. Figure 2 shows the types of organization found in a 1968 national survey of household, commercial and industrial wastes. Public collection accounted for 56 percent of household wastes, 25 percent of commercial wastes and 13 percent of industrial waste. Private collection accounted for 32 percent of household wastes, 62 percent of commercial wastes and 57 percent of industrial wastes. Collection by the individual householders, institutions or industries accounted for 12, 13 and 20 percent for household, commercial and industrial wastes, respectively.<sup>9</sup>

Based on the survey, 79 percent of all landfill sites were publicly owned. Ninety-six percent of the incinerators were publicly owned and operated.<sup>10</sup>

These estimates indicate that most communities with solid waste programs have decided to make heavy use of public agencies in both collection and disposal, but that there is also room for private businesses to contribute, especially in collection.

Regardless of methods or organizational structure, there are several factors which suggest that many communities (counties, cities or towns) will be exploring the possibilities for working with other counties, cities or towns to develop joint waste disposal plans. Some of the important factors are: (1) the location of an acceptable site within the geographic boundaries of cities and towns is difficult, (2) considerable volume of waste is necessary to achieve potential economies of size, especially for incineration, (3) joint planning will probably reduce the number of sites required and increase the likelihood of agreement on the site or sites selected, (4) cooperation will expand the tax base for financing the operation, (5) administration may be simplified, (6) it becomes feasible to employ more competent personnel and specialized equipment with a larger unit.

A number of time-tested ways for two or more communities to work together are available:

- (1) One jurisdiction may develop and operate the system and charge other jurisdictions or individuals on the basis of population, assessed valuation, volume or weight of waste or some other factor.
- (2) Two or more jurisdictions may jointly develop a disposal system (collection, and/or disposal) and designate one of the jurisdictions to operate it. Costs could be shared on the basis of population, volume or weight of waste, assessed valuation or some other agreed upon method.
- (3) Establish a special district including two or more jurisdictions. This district has all the powers of a separate legal entity, including the power to issue bonds, and levy taxes and user charges.

Indiana House Bill 81 (Chapter 359, Acts of 1969), House Bill 1292 (Chapter 244, Acts of 1969) and Senate Bill 420 (Chapter 171, Acts of 1969) provide the legal authority for local units to cooperate. These bills are summarized on pages 3-4 of this report and are included in full in the appendix.

## What are the Alternative Ways to Finance?

Several alternatives for financing the development and operation of a solid waste disposal system are used.

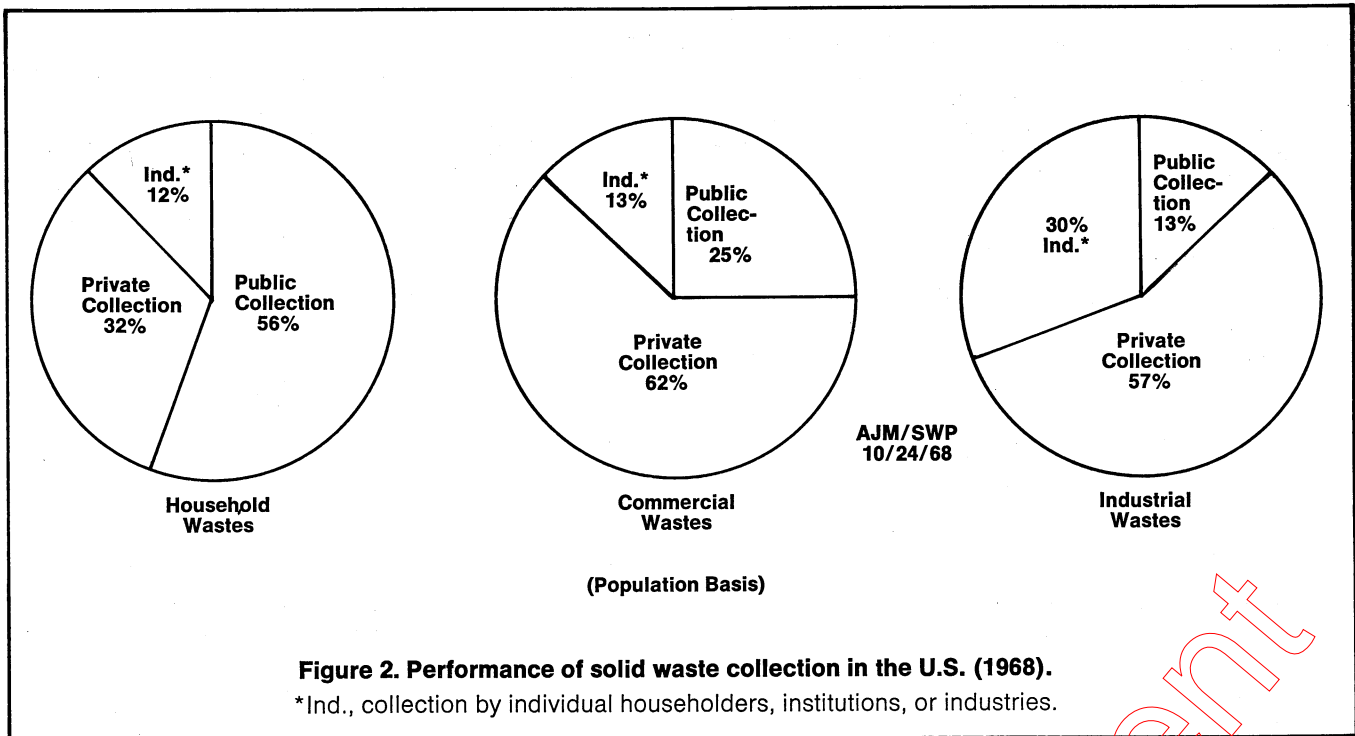
**Storage:** Storage costs are normally financed by the individual household or business. The most frequent exception to this is in cases where community storage bins are located either in rural areas or in urban areas where large concentrations of solid waste exist. Storage functions that exist at transfer stations or at disposal sites may not be directly financed by the waste producer.

**Collection:** Generally, collection operations are financed through a general tax or by a user fee based on weight and volume, or on a flat fee basis. Rates may differ among types of users, as rates for households may differ from those for a retail store or an industry. If rates are selected for financing, they should be kept to a minimum to discourage promiscuous dumping. Some rate schedules now in use are summarized in the next section. Table 5 on page 12 outlines the methods of a sample of communities in a 1964 survey.

<sup>9</sup> Anton J. Muhich, "Sample Representativeness and Community Data," *An Interim Report 1968 National Survey of Community Solid Waste Practices*, Department of Health, Education and Welfare, p. 19.

<sup>10</sup> *Ibid.*, p. 36.





**Disposal:** Disposal operations have been financed by the same general methods as collection. In cases where two or more local governmental units cooperate, a number of different financing arrangements may be worked out. Normally, one existing unit or an especially formed district will be responsible for the actual operation of the system. The governmental unit then may charge others a certain percentage of the total cost for use. The percentage is based on population, assessed valuation, on a per ton or per cubic yard basis, or by some other procedure. In cases where a taxing unit pays the cost, individuals within their jurisdiction normally use the facilities free of any additional charge.

Alternatively, one unit may develop and operate the system and charge all users, including municipalities, industries, businesses or individuals. Under this method, operation is very similar to that of a public utility.

The alternatives for organizing or managing a solid waste disposal system and the means of financing are outlined below and some of the major consequences of each alternative are listed.

1. Public management and public financing
  - Must operate within a strict budget constraint
  - Service paid for by taxpayers
  - No billing or collection system necessary
  - Individual costs not necessarily related to quantity of waste
  - No added charge required to use service
  - Direct control and supervision of service by a public body
2. Private management and public contract
  - Profit incentive built into system
  - Less direct control or supervision by a public body
  - Contract is basis for control of operation
  - Probably easier to enforce strict sanitary standards
  - Otherwise same as "1"
3. Public management user fee
  - Service paid by users
  - Billing and collection system required

- Tends to be regressive
  - Direct control and supervision of service by a public body
4. Private management and user fee
    - Service paid for by users
    - Tends to be regressive
    - Profit incentive built into system
    - Less direct control or supervision by a public body
    - Likely easier to enforce strict sanitary standards

## What are Some Indiana Communities Doing?<sup>11</sup>

### Porter County

Porter County, with a 1970 population of about 86,000, is an example of one community that has depended on joint, private, public collection of solid waste and on private ownership and operation of disposal.

**Collection:** Private operators collect most of the refuse in rural areas and in many of the subdivisions of cities and towns in the county. A charge of \$2 per month is made to residents for pick-up of refuse. In addition to the private operators, Valparaiso, with a 1968 population of 18,000, collects solid waste from residents of the city weekly. The 1969 budget for this service was \$109,000, which includes \$16,000 for disposal. Collection costs in 1968 were about \$93,000 or slightly over \$5 per person per year. In addition to Valparaiso, ten of the small cities and towns in the county have contracts with private firms to collect and dispose of their solid wastes.

**Disposal:** With the exception of one open dump still in operation, three privately owned and operated sanitary landfills are used for disposal of solid wastes. A representative rate schedule for disposal at the landfill sites is:

<sup>11</sup> I am especially indebted to C. L. Spuller, Area Community Extension Agent, Plymouth, Indiana, for the information in this section.

**Table 5. Methods of Financing Refuse Collection Services, 1964.**

Size of community	Number of communities in sample	General tax	Service charge	Tax and service charge	Other
5,000- 9,999	180	47% *	39%	13%	1%
10,000- 24,999	307	46	38	16	0
25,000- 49,999	190	52	33	14	2
50,000- 99,999	93	58	28	13	1
100,000-999,999	74	60	27	14	0
Over 1,000,000	6	67	0	33	0
Total	850	50%	35%	14%	1%

\*Percentages may not add to 100 due to rounding.  
 Source: American Public Works Association, APWA Reports, August, 1966, p. 4.

- Minimum charge . . . . \$1 per load
- Pick-up trucks . . . . . \$1.50 per load
- Parker trucks . . . . . \$ .50 to \$ .55 per cubic yd.
- Valparaiso . . . . . \$16,000 per year

Under these systems, the county regulates the operation of the landfills through an ordinance. Requirements include a 300-foot perimeter between the landfill and roads or adjacent property. No burning or sorting through the refuse is permitted, except that logs and brush can be burned twice a month in an area adjacent to, but separate from, the landfill operation.

In general, the landfill will accept anything, except old cars and wire fences. Appliances are crushed and covered with other refuse.

### Carroll County

This is a relatively small, rural county with an estimated 1968 population of slightly over 18,000. Delphi, the county seat, has a population of about 3,000. In this case, the city of Delphi and the county cooperated in the location of a sanitary landfill site on county-owned land.

**Collection:** The city of Delphi has a public collection service, while two other communities in the county have collection contracts with private firms. The remainder of the county residents have to handle their own collection.

**Disposal:** One landfill owned jointly by the city of Delphi and the county serves both county and city needs. It is operated by an individual who is selected by bid. The operator received \$1400 per month (\$16,800 on an annual basis) for the first six months of operation. In the second year of operation, the low bidder was \$1280 per month (\$15,360 per year). In addition to this, the operator is permitted to charge private individuals on the following basis:

- Cars and station wagons . . . . No charge
- Pick-up trucks and trailers . . \$1 per load
- Large trucks . . . . . \$2 per load
- Parker trucks . . . . . \$ .50 per cubic yd.

Regulations are similar to those found in Porter County.

### Adams County

Adams County had a 1970 population of about 27,000 and includes four towns ranging from 500 to 8,500 popu-

lation. This is an instance where the county owns and operates the disposal sites, and the other jurisdictions cooperate through contracts with the county. Adams County purchased two sites, one in the northern and one in the southern end of the county, and equipment to operate the landfills.

All residents and businesses within the county may use the sites free of charge but out-of-county residents are not permitted to use the sites. The only restriction on residents is that no junked cars or old fence wire are accepted.

**Plymouth:** The city of Plymouth, with a population of about 8,000, owns and operates its collection and disposal system. The city collects refuse in residential areas for \$2 per month.

Disposal is handled through a 40-acre sanitary landfill operation. Use of the landfill is restricted to residents of Plymouth, Center and West Townships. Other residents are effectively discouraged through a \$20 per load fee, regardless of its size. Two men, each working three days per week, operate the landfill. Rates for individuals unloading at the landfill are as follows:

- Car or station wagon . . . . . \$ .50 per load
- Two-wheel trailer . . . . . \$1.50 per load
- Pick-up truck under ¾ tons . . . . \$1.50 per load
- Trucks over ¾ tons . . . . . \$2.50 per load
- Semi-trucks . . . . . \$5.00 per load
- Packer trucks . . . . . \$5.00 per load

### Wayne County

This is an example of a sanitary district that has been in operation for several years. The Richmond Sanitary District covers the city of Richmond, which has a 1970 population of 47,000, and some outlying areas. Recently, however, the district signed a contract with the county to operate a disposal site for the remainder of the county, and the county agreed to provide a new site and to provide part of the cost of operation. The county pays \$7,500 annually for rental of a 45-acre site and \$7,500 annually to the Sanitary District for the cost of operation. The total population served is now about 83,000.

All funds for the district and the county are raised through taxes and no charges are made to residents of the district, county or private haulers.

## Appendix A Refuse Disposal Act

Chapter 355, Acts of 1965, as amended by Chapter 359, Acts of 1969

AN ACT concerning the collection and disposal of refuse, the acquisition and financing of collection and disposal facilities, the leasing with option to purchase of incinerating plants, defining certain unlawful activities; and prescribing penalties.

BE IT ENACTED BY THE GENERAL ASSEMBLY OF THE STATE OF INDIANA:

SECTION 1. It is the purpose of this act to authorize counties, cities and towns to establish, acquire, construct, install, operate and maintain certain facilities for the collection and disposal of refuse and to declare open dumps to be inimical to human health.

This act shall be known and may be cited as the "Refuse Disposal Act."

SEC. 2. As used in this act unless the context clearly indicates otherwise: (1) "Refuse" shall mean all putrescible and non-putrescible solid and semi-solid wastes, except human excreta, but including garbage, rubbish, ashes, street cleanings, dead animals, offal and solid commercial, industrial and institutional wastes.

(2) "Garbage" shall mean all putrescible animal solid, vegetable solid and semi-solid wastes resulting from the processing, handling, preparation, cooking, serving or consumption of food or food materials.

(3) "Rubbish" shall mean all non-putrescible solid waste, excluding ashes, such as cardboard, paper, plastic, metal or glass food containers, rags, waste metal, yard clippings, small pieces of wood, excelsior, rubber, leather, crockery, and other waste materials that ordinarily accumulate around a home, business or industry. It shall not include garbage, ashes, bulk refuse, dead animals, hazardous refuse, industrial waste or building waste resulting from the operations of a contractor.

(4) "State board" shall mean the State Board of Health of Indiana.

(5) "Refuse Disposal Facility" shall mean a "Sanitary Landfill," an "Incinerator," a "Composting Facility," a "Garbage Grinding Facility," or such other suitable Refuse Disposal Facility which is constructed and approved as hereafter provided in this act.

SEC. 3. Every such county, city and town in the State of Indiana is hereby authorized and empowered to establish, acquire, construct, install, operate and maintain facilities for the collection and disposal of refuse, to secure the collection and disposal of refuse accumulated within or without the corporate limits of such county, city or town, and to issue revenue bonds to pay in whole or in part the costs of such facilities. Approval shall be obtained from the state board for any method or methods used for the disposal of refuse prior to obtaining land or facilities. One (1) or more of the methods listed below may be used:

(a) "Sanitary Landfill"—Where a sanitary landfill is to be employed, information necessary to evaluate the project shall be submitted to the state board for review and approval prior to purchase of land or equipment.



(b) "Incineration"—Where incineration is to be employed, the plans and specifications of every incinerating plant or other facility, along with other information necessary to evaluate the project, shall be submitted to the state board and the air pollution control board of the State of Indiana for review and approval prior to construction of the facilities. In addition, an approved method for the disposal of non-combustible refuse and incinerator residue shall be provided.

(c) "Composting"—Where composting is to be employed, the plans and specifications of composting facilities, along with other information necessary to evaluate the project, shall be submitted to the state board for review and approval prior to construction of said facilities. In addition, provision shall be made for the proper disposal of all refuse not suitable for composting.

(d) "Garbage Grinding"—Where garbage grinding is to be provided involving the separate collection and disposal of garbage into a community sewerage system through commercial-type grinders or community-wide installation of individual grinders, the plans and specifications of the garbage grinding facilities, along with other information necessary to evaluate the project, shall be submitted to the state board and the state stream pollution control board for review and approval prior to construction or installation of the facilities. Provision shall be made for the proper disposal of all remaining refuse unsuitable for grinding.

Other Methods—Other suitable refuse disposal methods or facilities may be used, provided the plans and specifications along with other information necessary to evaluate the project, are submitted to the state board for review and approval prior to the acquisition, construction, installation, or operation of the method or facility.

SEC. 4. Every such county, city or town is hereby authorized and empowered to contract with persons for the collection or disposal of refuse and to provide that persons contracted with shall have the exclusive right to collect or dispose of any or all refuse pursuant to the provisions of section 3 of this act.

SEC. 5. The county council, common council of the city or town board may make appropriations for the acquisition, establishment, operation and maintenance of the refuse collection and disposal premises and facilities or services.

Such appropriation or appropriations may include the employment of a person or persons and provision of such vehicles and equipment which may be necessary or incidental to the collection or disposal of refuse.

SEC. 6. The construction, acquisition, improvement, equipment, custody, administration, operation and maintenance of any such facilities for the collection and disposal of refuse and the collection of revenues for the use thereof and the service rendered thereby shall be under the supervision and control of the board of county commissioners, the board of public works of the city, or of the committee or body authorized to perform the duties of a board of public works in cities or towns where there is no such board, or the county council, common council or town board may in its discretion provide by ordinance that the same shall be under the supervision and control of the sanitary board of such city or town. The term "board" when hereinafter used in this act shall be construed to mean the board of public works of the city, or the committee or body authorized to perform the duties of a board of public works in towns or in cities where there is no such board; and in counties, the board of county commissioners.

SEC. 7. The board shall have the power to take all steps and proceedings and to make and enter into all contracts or agreements necessary or incidental to the performance of its duties and the execution of its powers under this act: Provided, That any contract relating to the financing of the acquisition, construction or purchase of any such

facilities shall be approved by the county council, common council of such city or town board, before the same shall be effective. The board may employ engineers, architects, inspectors, superintendent, manager, collectors, attorneys and other employees as in its judgment may be necessary in the execution of its powers and duties and may fix their compensation, all of whom shall do such work as the board shall direct. All such compensation and all expenses incurred in carrying out the provisions of this act shall be paid solely from funds provided under the authority of this act, and the board shall not exercise or carry out any authority or power herein given it so as to bind said board or said city beyond the extent to which money shall have been or may be provided under the authority of this act.

Any contract or agreement, except a lease with option to purchase as authorized hereafter in this act, with any contractor or contractors for labor or material, exceeding in amount the sum of one thousand dollars (\$1,000), shall be made under and pursuant to the provisions of section 95 of "An Act concerning municipal corporations," approved March 6, 1905. After the construction, installation and completion of the facilities or the acquisition thereof, the board shall operate, manage and control the same and may order and complete any extensions, betterments and improvements of and to the facilities that the board may deem expedient, if funds therefor be available or are made available as provided in this act, and shall establish rules and regulations for the use and operation of the facilities and do all things necessary or expedient for the successful operation thereof.

SEC. 7a. Any city, town or county constructing, acquiring or maintaining collection and refuse disposal facilities and any other city, town or county desiring use of such facilities shall have power to contract for the payment of the cost and expenses of such facilities, or any portion thereof, for any term not exceeding twenty-five (25) years; provided however, that any such contract prior to the execution thereof shall be approved by ordinance or resolution of the governing body of each city, town or county by the state board.

SEC. 8. The acquisition, establishment, construction, installation, operation and maintenance of facilities and land for the collection and disposal of refuse may be financed through general taxation, through service rates or through a combination of these methods.

SEC. 9. All necessary preliminary expenses actually incurred by a board in the making of surveys, estimates of cost and revenues, employment of engineers or other employees, the giving of notices, and all other expenses of whatsoever nature, necessary to be paid prior to the issuance and delivery of the revenue bonds pursuant to the provisions of this act, may be met and paid in whole or in part in the following manner: Said Board may, from time to time, certify such items of expense to the controller, county clerk, city clerk or clerk-treasurer, as the case may be, directing him to pay the several amounts thereof, and thereupon said officer shall at once draw a warrant or warrants upon the county treasurer, city treasurer or said clerk-treasurer and the county treasurer, city treasurer or clerk-treasurer shall issue a warrant or warrants, which warrant or warrants shall be paid out of the general funds of said county, city or town not otherwise appropriated, without a special appropriation being made therefor; or, in case there are no general funds not otherwise appropriated, said official shall recommend to the county council, common council or town board the temporary transfer from other funds a sufficient amount to meet such items of expense, or the making of a temporary loan for such purpose, and such county council, common council or town board shall thereupon at once make such transfer of funds or authorize such temporary loan: Provided, however, That the fund or funds from which such payments are made shall be fully reimbursed and repaid out of the first proceeds of the sale of revenue bonds thereafter provided for, and before any other disbursements are made therefrom, and the amount so advanced to pay such preliminary expenses shall be a first charge against the proceeds resulting from the sale of such revenue bonds until the same has been repaid as herein provided.

SEC. 10. The cost of such facilities shall be deemed to include the cost of acquisition, the cost of all property and rights deemed necessary or convenient for installing, constructing and equipping such facilities, interest on bonds prior to and during the acquisition, installation, construction and equipment of such facilities and for six (6) months after the start of collection of rates and charges as herein provided, engineering and legal expenses, expense for estimates of cost and revenues, expense for surveys and plans, other expenses necessary or incident to determining the feasibility or practicability of the method or methods to be used for the disposal of refuse, administrative expense, and such other expenses as may be necessary or incident to the financing herein authorized.

SEC. 11. Nothing in this act contained shall be so construed as to authorize or permit any county, city or town to make any contract or to incur any obligation of any kind or nature except such as shall be payable solely from the funds provided under this act or through general taxation or through a combination of these methods. Funds for the payment of the cost of such facilities may be provided in whole or in part by the issuance of revenue bonds of the county, city or town, the principal and interest of which bonds shall be payable solely from the special fund herein provided for such payment, and said bonds shall not, in any respect, be a corporate indebtedness of such county, city or town. All the details of such bonds shall be determined by ordinance or ordinances.

SEC. 12. All revenue bonds issued pursuant to the provisions of this act shall bear interest at not more than six percent (6%) per annum, payable semiannually, and shall mature serially, either annually or semiannually and beginning at such time and extending over such period of years as may be determined by ordinance. The bonds shall be authorized by ordinance of the county council, common council of the city or town board and shall be issued in the name of county, city or town. The bonds shall contain a statement on their face that the county, city or town shall not be obligated to pay the same or the interest thereon except from the special fund provided from the net revenues of the facilities for the collection and disposal of refuse. All such bonds shall be, and shall have and are hereby declared to have all the qualities and the incidents of, negotiable instruments under the laws of the state. The bonds and the interest thereon shall be exempt from all taxation, state, county and municipal. Such bonds shall be executed in the same manner as other bonds issued by cities are executed, and shall be sold in accordance with the provisions of chapter 178 of the Acts of 1943, and all acts amendatory thereof or supplemental thereto. No suit to question the validity of such or to prevent their issuance shall be instituted after the date fixed for the sale of such bonds. The terms and conditions of such bonds shall be determined and set forth in the ordinance authorizing such bonds.

SEC. 13. All moneys received from any bonds issued pursuant to this act, after reimbursements and repayment to said county, city or town of all amounts advanced for preliminary expenses as provided in section 9 of this act, shall be applied solely to the payment of the costs of the facilities, and any surplus of bond proceeds over and above such amount shall be paid into the fund established for the payment of the principal of and interest on the bonds. There shall be and hereby is created and granted a lien upon such moneys, until so applied, in favor of the holders of the bonds.

SEC. 14. The county council, common council or town board shall, in the ordinance authorizing the bonds, create a sinking fund for the payment of the bonds and the interest thereon and the payment of the charges of banks or trust companies for making payment of the bonds or interest, and shall set aside and pledge the net revenues of the facilities, hereby defined to mean the revenues of the facilities remaining after the payment of the reasonable expense of operation, repair and maintenance, into said fund at intervals to be determined by said ordinance, for (a) the payment of interest upon such bonds as such interest shall fall due, (b) the payment of the bonds as they fall due, and



(c) the accumulation of reasonable reserves in the sinking fund as a margin for safety and a protection against default, and for the payment of premiums upon bonds retired by call or purchase. Such required payments shall constitute a first charge upon all the net revenues of the facilities.

SEC. 15. The county council, common council of every city or town board now or hereafter owning, operating and maintaining facilities for the collection or disposal of refuse shall have power, by ordinance, to establish and maintain just and equitable rates or charges for the use of and the service rendered by such facilities, and, in the event that it has authorized the issuance of revenue bonds under the authority of and pursuant to the provisions of this act, it shall be its duty so long as such bonds are outstanding to establish and maintain such rates or charges with respect to those facilities acquired by the proceeds of such bonds. Such required rates or charges shall be sufficient in each year for the payment of the proper and reasonable expense of operation, repair, depreciation and maintenance of the facilities, and for the payment of the sums required to be paid into the bond fund as provided by this act. Such required rates or charges may by ordinance be made payable either by the users of the facilities or the owners of the property served by the facilities or by the county, city or town; or, alternatively, such required rates or charges may be divided between such users or owners and the county, city or town in such proportion as shall be fixed by ordinance. Revenues collected pursuant to this section shall be deemed the revenues of the facilities. No rates or charges shall be established until after a public hearing at which all the users of the facilities and owners of property served or to be served thereby and others interested shall have an opportunity to be heard concerning the proposed rates or charges and the provisions concerning payment of the same. After introduction of the ordinance fixing rates or charges and providing for the payment of the same, and before such ordinance is finally enacted, notice of such hearing, setting forth the proposed schedule of rates or charges and the provisions concerning payment of the same, shall be given by one (1) publication in a newspaper published in the city, if there be such a newspaper, but otherwise in a newspaper having general circulation therein, at least ten (10) days before the date fixed in such notice for the hearing, which may be adjourned from time to time. After such hearing the ordinance, either as originally introduced or as modified and amended, shall be passed and put into effect. A copy of the schedule of rates and charges so established shall be kept on file in the office of the board, and also in the office of the county clerk, city clerk or clerk-treasurer, and shall be open to inspection by all parties interested. Any change or readjustment of rates or charges or of such provisions for payment may be made in the same manner as the same were originally established as hereinabove provided: Provided, however, That if such change or readjustment be made substantially pro rata as to all classes of use or service, no hearing or notice shall be required. The aggregate of the required rates or charges shall always be sufficient to pay the cost of operation, repair and maintenance of the facilities, to provide reasonable depreciation, and to pay the sums required to be paid into the bond fund provided in section 14 of this act. If any rate or charge so established and to be paid by any such user or owner shall not be paid within thirty (30) days after the same is due, the amount thereof, together with a penalty of ten percent (10%) and a reasonable attorney's fee, may be recovered by the county, city or town in a civil action in the name of the county, city or town.

The county, city or town shall be subject to the same charges and rates established as hereinabove provided, or to charges and rates established in harmony therewith, for the use of and for the services rendered by such facilities, and shall pay such rates or charges when due, and the same shall be deemed to be a part of the revenues of the facilities and shall be applied as herein provided for the application of such revenues.

SEC. 16. The ordinance authorizing the issuance of bonds may contain such terms and conditions deemed necessary and proper for the

safeguarding and protection of the bondholders not inconsistent with the provisions of this act. Any holder of any of such bonds or any of the coupons attached thereto may either at law or in equity, by suit, action, mandamus or other proceeding, protect and enforce any and all rights hereunder or under such ordinance, and may enforce and compel performance of all duties required by this act or by such ordinance to be performed by the county, city or town issuing the bonds or by the board or any officer, including the making and collecting of reasonable and sufficient charges and rates for the use of and services rendered by the facilities for the disposal of refuse, provided only that the county, city or town may not be compelled to pay rates or charges on behalf of other users or owners. If there be any failure to pay the principal or interest of any of the bonds on the date therein named for such payment, any court having jurisdiction of the action may appoint a receiver to administer the facilities on behalf of the county, city or town and the bondholders, with power to charge and collect from all users or owners rates sufficient to provide for the payment of the expenses of operation, repair and maintenance and also to pay any bonds and interest outstanding and to apply the revenues in conformity with this act and the said ordinance.

SEC. 17. No garbage grinding unit shall be installed on any private property under the provisions of this act unless the owner of such property and the tenant thereof, in the event the property is not occupied by the owner, shall file a written request for the garbage disposal service provided for by this act, and the installation of such garbage grinding unit. The users of such garbage grinding units shall have the right to discontinue the service at any time by filing a written request for the discontinuance of such service with the board. All property rights in such garbage grinding units shall remain in the county, city or town, and the county, city or town shall have the right to remove the same upon the discontinuance of the service by the user or in the event any rates or charges shall not be paid within thirty (30) days after the same are due. The users of such units shall be responsible for any damages thereto and the cost of repair or replacement, ordinary wear and tear excepted.

SEC. 18. Every county, city or town is hereby authorized to contract or mutually agree with any industry, commercial or institutional establishment for the collection and for the disposal of solid industrial, commercial or institutional refuse. All fees collected shall be deposited with the treasurer or clerk-treasurer of the county, city or town for the administration, operation and maintenance of the refuse collection and disposal project.

SEC. 19. Every county, city or town in the State of Indiana is hereby authorized and empowered to lease, with option to purchase, an incinerating plant or plants, or Other Refuse Disposal Facilities within or without the corporate limits of such county, city or town for the disposal of refuse; Provided, however, That no contract of lease with option to purchase shall be entered into (a) for a term of more than thirty (30) years, (b) unless the lessor is a corporation organized under the laws of the State of Indiana or duly admitted to do business in the State of Indiana, and (c) unless there shall first be filed with the board a petition therefor signed by fifty (50) or more resident taxpayers of such county, city or town, and the board shall have, after investigation, determined that a need exists for such incinerating plant or plants: or Other Refuse Disposal Facilities. The terms and conditions of said option to purchase shall be specified in the lease.

SEC. 20. In the event said option to purchase is exercised, the county, city or town may, in order to procure funds to pay the purchase price thereof, issue and sell bonds under the provisions of the general statutes governing the issue and sale of bonds of the county, city or town. In the event the county, city or town has not exercised the option to purchase at the expiration of such lease, and upon the full discharge and performance by the county, city or town of its obligations under such lease, the incinerating plant or plants, or Other Refuse Disposal Facilities

covered by such lease shall thereupon become the absolute property of the county, city or town and the lessor corporation shall execute proper instruments conveying to the county, city or town good and merchantable title thereto. In the event the county, city or town elects not to exercise the said option to purchase, then the board, subject to the approval of the city, town or county council shall have the power to extend the lease of the Refuse Disposal Facility for such term, not to exceed a period equal to the term of the original lease, and not for a period longer than otherwise prohibited in this act, and for such consideration as the parties to the original lease, or their assignees, shall agree, at the end of which period the Refuse Disposal Facility covered by such lease shall thereupon become the absolute property of the county, city or town and the lessor corporation shall execute all proper instruments to convey the same to the lessee.

SEC. 21. The lessor corporation proposing to build such incinerating plant or plants, or Other Refuse Disposal Facilities, including the necessary equipment and appurtenances thereof, shall submit to such county, city or town, subsequent to the execution of such lease, plans, specifications and estimates for such incinerating plant or plants or Other Refuse Disposal Facility. Such plans and specifications shall be submitted to the state board of health and shall be approved by the state board and by such county, city or town in writing prior to the execution of such lease. Provided nothing in this section shall prohibit the city or town board or in counties, the board of county commissioners, from contracting for such preliminary engineering design work as necessary to initiate planning and engineering the Refuse Disposal Facility and making provisions for the payment for such services.

SEC. 22. Such lease may provide that as a part of the lease rental for such incinerating plant or plants the lessee shall agree to pay all taxes and assessments levied against or on account of the leased property, to maintain insurance thereon for the benefit of the lessor corporation, and to assume all responsibilities for repair and alterations thereon or thereto during the term of such lease.

SEC. 23. Any county, city or town may, in anticipation of the acquisition of a site and the construction and erection of such incinerating plant or plants, or Other Refuse Disposal Facilities, including the necessary equipment and appurtenances thereof, make and enter into a lease with option to purchase with such lessor corporation subject to the approval of the state board of tax commissioners prior to the actual acquisition of such site and the construction and erection of such incinerating plant or plants, or Other Refuse Disposal Facilities, but such lease so entered into shall not provide for the payment or any lease rental by the lessee until such incinerating plant or plants, or Other Disposal Facilities are completed and ready for refuse disposal, at which time the stipulated lease rental may begin. The lessor corporation in such lease shall agree to furnish a bond satisfactory to such lessee and conditioned upon the final completion of such incinerating plant or plants, or Other Refuse Disposal Facilities within the period specified in such lease, unavoidable delays excepted.

SEC. 24. When the lessor corporation and the county, city or town have agreed upon the terms and conditions of any such lease and before the final execution of such lease, a notice shall be given by publication to all persons interested of a hearing to be held before the board, which hearing shall be on a day not earlier than ten (10) days after the publication of such notice. The notice of such hearing shall be published one (1) time in a newspaper of general circulation printed in the English language in the county, city or town in accordance with the provisions of Chapter 96, Acts of 1927, as amended. Such notice shall name the day, place and hour of such hearing and shall set forth a brief summary of the principal terms of the lease agreed upon, including the location, name of the proposed lessor corporation, character of the property to be leased, the rental to be paid, the term of the lease, and a summary of the terms of purchase under the option. The proposed lease, drawings, plans, specifications and estimates for such incinerating plant or plants, or Other



Refuse Disposal Facilities shall be available for inspection by the public during said ten (10) day period and at said meeting. All persons interested shall have a right to be heard at the time fixed, upon the necessity for the execution of such lease and upon the fairness and reasonableness of rental and purchase price provided for therein. Such hearing may be adjourned to a later date or dates, and following such hearing the board may either authorize the execution of such lease as originally agreed upon or make such modifications therein as may be agreed upon with such lessor corporation, but in no event shall the lease rentals or purchase price as set out in the published notice be increased. The cost of the publication of the notice shall be borne by the lessor corporation.

SEC. 25. In the event the execution of the lease as originally agreed upon, or as modified by agreement, is authorized by the board, the board shall give at least thirty (30) days' notice of the date upon which the lease will be executed by publication one (1) time in a newspaper of general circulation printed in the English language in the county, city or town in accordance with the provisions of Chapter 96, Acts of 1927, as amended. No action to contest the validity of the lease or to enjoin the performance of any of the terms and conditions of the lease shall be instituted after the execution of said lease.

SEC. 26. A county, city or town desiring to have an incinerating plant or plants, or Other Refuse Disposal Facilities erected on land owned or to be acquired by such county, city or town may sell said land to the lessor or may lease for nominal rental to the lessor, such land for the same period of years that such county, city or town leases the incinerating plant or plants, or Other Refuse Disposal Facilities, and may grant an option to the lessor to purchase such land within six (6) months after the termination of the lease of the incinerating plant or plants or other Refuse Disposal Facilities in the event such county, city or town shall default under the terms of the lease and such lease shall by such default be terminated. In the event the option price on such land is not fixed in the original lease, then the price to be paid for such land under such option shall be determined by appraisement to be made by three (3) appraisers residing in the county, city or town, appointed by the judge of the circuit court having jurisdiction in the county.

SEC. 27. Any county, city or town desiring to lease an incinerating plant or plants or Other Refuse Disposal Facilities under the provisions of this act shall annually levy a tax sufficient to produce each year the necessary funds with which to pay the lease rental stipulated to be paid by such county, city or town in such lease. Such levy shall be reviewable by other bodies vested by law with such authority to ascertain that the levy is sufficient to raise the amount required to meet the rental of such lease.

SEC. 28. Any incinerating plant or Other Refuse Disposal Facility leased by a lessor corporation to any county, city or town under the provisions of this act shall be exempt from all state, county and other taxes, including all sales and use taxes applicable to tangible personal property incorporated or to be incorporated in any such incinerating plant or Other Refuse Disposal Facilities: Provided, however, That the rental paid to a lessor corporation under the terms of such lease shall be subject to all applicable taxes under the laws of this state.

SEC. 29. Action taken by the state board pursuant to the provisions of this act shall not limit the powers of other units of government to make or enforce other laws, ordinances or regulations for the storage, collection, removal or disposal of refuse, if the laws, ordinances, or regulations do not conflict with the provisions of this act and to this effect the provisions of this act shall be construed as cumulative or alternative.

SEC. 30. Open dumps are hereby declared to be inimical to human health, and as such are not suitable means of refuse disposal. Except as hereinafter provided, on or after January 1, 1971, disposal of garbage, rubbish, and refuse on lands in this state shall be made only through use of sanitary landfills or by means of incineration, composting, garbage grinding or other acceptable methods approved by the state board. No

person, firm, association, corporation, county, city, town, political subdivision of the state, or unit of government shall establish, operate or maintain open dumps, whether or not the service is performed for compensation or gratis, on or after January 1, 1971: Provided, however, That the state board may upon written application authorize for a limited period the continued operation and maintenance on and after January 1, 1971, of any existing open dump.

No person, firm, association, corporation, county, city, town, political subdivision of the state or unit of government shall establish, operate or maintain facilities for the collection and disposal of refuse except as set out in section 3 of this act or under rules and regulations adopted by the state board of health on or after January 1, 1971: Provided, however, That the state board may upon written application authorize for a limited period the continued operation and maintenance on and after January 1, 1971, of any facility for the collection and disposal of refuse.

Any failure to comply with this section shall constitute the operation of a nuisance inimical to human health. The state board of health may institute proceedings for injunctive or mandatory relief through the state attorney general in any court of competent jurisdiction for any violation or failure to comply with the provisions of this section.

SEC. 31. The state board may adopt reasonable regulations to carry out the provisions of this act.

SEC. 32. If any section, subsection, sentence, clause, phrase or word of this act is for any reason held to be unconstitutional such determination shall not affect the validity of any of the remaining portions of this act.

SEC. 33. Whereas, an emergency exists for the immediate taking effect of this act, the same shall be in full force and effect on and after its passage.

(Chapter 359, Acts of 1969, amends all but Sections 8, 10, 22, 29, 31, 32 and 33 of the 1965 Act.)

## **Appendix B**

### **Senate Enrolled Act No. 420**

**AN ACT authorizing cities and towns to establish and maintain facilities for the collection and disposal of refuse.**

*Be it enacted by the General Assembly of the State of Indiana:*

**SECTION 1.** (a) As used in this act unless the context clearly requires otherwise:

The word "municipality" shall include cities, towns or sanitary districts comprising one or more cities or towns.

The word "Board" shall mean the Board of Sanitary Commissioners, the Board of Trustees of a town, utility service board or any other agency or municipal government designated

by law or authorized pursuant to law to perform services in the collection and disposal of refuse.

(b) The Board shall have the right to establish, acquire, by purchase or condemnation, construct, install, operate and maintain facilities for the collection and disposal of refuse; to contract with other governmental agencies or private contractors for the collection or disposal of refuse; to secure the collection and disposal of refuse accumulated within or without the corporate limits of such municipality or county wherein said municipality is located and to issue revenue bonds to pay in whole or in part the cost of such facilities. In executing any or all of the powers and duties, as aforesaid, such Board may do so either directly or by contract with other governmental agencies or private contractors.

SEC. 2. In order to carry out its powers, functions and duties under section 1 of this act, such Board shall be authorized:

(a) To prepare a schedule of reasonable service charges and collect the same from any and all persons who own, lease or are in possession or control as tenants or as agents of lots and lands situated inside and outside the boundaries of the sanitary district of such municipality which said lots and lands or users of said facilities are benefited by reason of any use of said refuse disposal facilities.

(b) To establish rates for service charges to collect refuse on the basis of volume, weight or type of refuse to be disposed. In executing any or all of its powers and duties, such Board shall have authority to enforce collection of said service charges by direct billing or with the permission of the county council, by certifying such charges and the description of the real property to which such service charges relate, to the county auditor for collection in the same manner as real property taxes. Provided, That said charges may by ordinances, be made payable either by the users of the facilities or the owners of the property served by the facilities or by the municipality; or, alternately, such required rates or charges may be divided between such users or owners and the municipality in such proportions as shall be fixed by ordinance. Revenue collections pursuant to this Act shall be deemed the revenues of the facilities. No rates or charges shall be established until after a public hearing, at which all of the users of the facilities and owners of property served, or to be served thereby, and others interested shall have an opportunity to be heard concerning the proposed rates or charges and the provisions concerning payment of the same. After introduction of the resolution fixing rates or charges and provisions for the payment of same, and before such resolution is finally enacted, notice of such hearing, setting forth the proposed schedule of rates or charges and the provisions concerning payment of the same, shall be given by one (1) publication in a newspaper published in the municipality, having a general circulation therein, at least ten (10) days before the date fixed in such notice for the hearing, which may be adjourned from time to time. After such hearing, the resolution, either as originally introduced or as modified and amended, may be passed and put into effect. A copy of the schedule of rates and charges so established shall be kept on file in the office of the Board and also in the office of the City



or Town Clerk and shall be open to inspection by all parties interested. Any change or readjustment of rates or charges of such provided for payment may be made in the same manner as the same originally established as hereinabove provided: Provided, however, That if such change or readjustment be made substantially pro-rata as to all classes of use of service, no hearing or notice shall be required. The aggregate or the required rates or charges shall always be sufficient to pay the costs of operation, repair and maintenance of the facilities, to provide reasonable depreciation and to pay the sum required to be paid into the fund established to operate said facilities. If any rate or charge so established and to be paid by any such user or owner shall not be paid within thirty (30) days after the payment is due, the amount thereof, together with a penalty of ten percent (10%) and a reasonable attorney's fee, may be recovered by the city or town in a civil action in the name of the city.

(c) To extend the service area for refuse collection, by contract with other governmental agencies, private individuals, corporations, associations or public utilities or trusts for the assessment, billing and collection for such service charges for the collection of refuse as may be established by the Board.

(d) To provide all necessary equipment, land, buildings or contract for the construction, installation, operation or maintenance for the disposal of refuse. To contract for maintenance, operation, or the sale of by-products of said facilities including, but not limited to, salvage materials, maintenance of equipment, sale of steam, sale of compost, or for the operation of a sanitary landfill, incinerator, or such other suitable refuse disposal methods or facilities as may be in existence or hereinafter to be created by said Board for such term not to exceed twenty-five (25) years.

(e) To contract for the use of private refuse disposal facilities including, but not limited to, incinerators, sanitary landfills, composting, garbage grinding or such other suitable refuse disposal methods or facilities as may be approved by the Board.

**Appendix C**  
**House Enrolled Act No. 1079**

AN ACT concerning unlawful disposal of refuse and prescribing penalties.

*Be it enacted by the General Assembly of the State of Indiana:*

SECTION 1. It shall be unlawful for any person to put, throw, dump or leave refuse in, upon or within the limits of or

