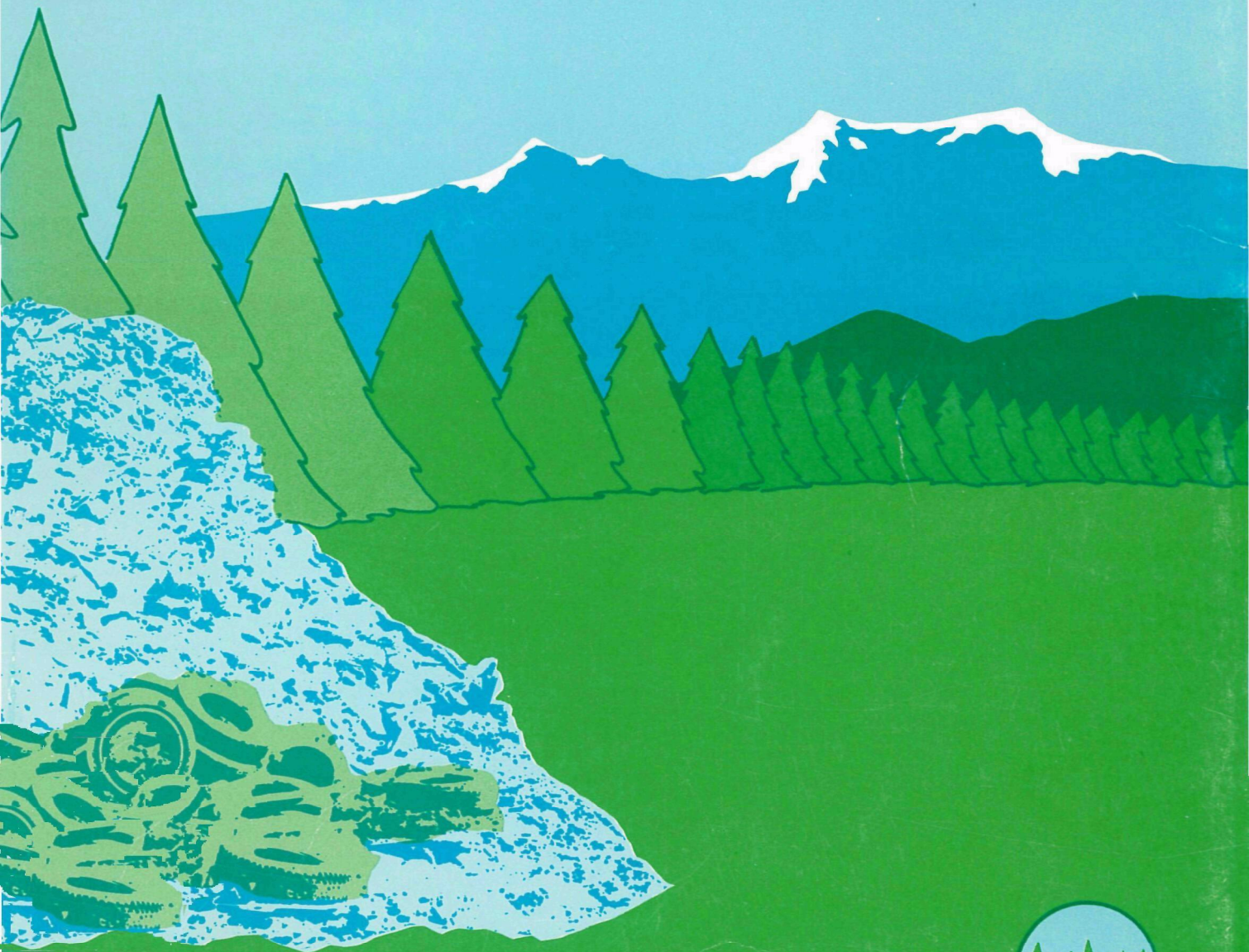


OPEN DUMP CLOSING ...

Alternative Procedures



ENVIRONMENTAL PROTECTION AGENCY
Solid Waste Management Office



OPEN DUMP CLOSING - Alternative Procedures

This training course manual has been specially prepared for the trainees attending the course and should not be included in reading lists or periodicals as generally available.

Prepared by
Training Branch
Division of Technical Operations

ENVIRONMENTAL PROTECTION AGENCY
Solid Waste Management Office

Cincinnati, Ohio 45213

1971

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MISSION 5000
Suggested One-day Course Agenda

TIME	SUBJECT	SPEAKER
8:30 - 8:45	Registration	Mission 5000 Rep.
8:45 - 9:00	Welcome	State
9:00 - 9:15	Course Objectives	Mission 5000 Rep.
9:15 - 9:45	State Regulations	State
9:45 - 10:15	Keeping the Public Informed	Headquarters
10:15 - 10:30	Break	
10:30 - 11:00	System Requisites	Mission 5000 Rep.
11:00 - 11:30	Dump Closing I: Sequence of Operations	Region
11:30 - 12:00	Dump Closing II: Rat Killing Techniques	State
12:00 - 12:30	Discussion	
12:30 - 1:30	Lunch	
1:30 - 2:00	Alternative Volume Reduction Techniques	Mission 5000 Rep.
2:00 - 2:45	Sanitary Landfill I	Headquarters
2:45 - 3:00	Break	
3:00 - 3:45	Sanitary Landfill II	Headquarters
3:45 - 4:00	Course Discussion and Summary	Mission 5000 Rep.

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Keeping the Public Informed

System Requisites

Dump Closing I: Sequence of Operations

Dump Closing II: Rat Killing Techniques

Alternative Volume Reduction Techniques

Sanitary Landfill I

Sanitary Landfill II

APPENDIX

SECTION I

STATEMENT OF COURSE OBJECTIVES

A dump is essentially an unplanned and unstructured operation, but getting rid of one is not. Past mistakes must be corrected, and an acceptable disposal operation, whether at the same or another site, must result. Far from being a simple act of abandonment, closing a dump must be a planned procedure.

Important elements in a plan for dump closure include:

- 1) Advising the public and all others directly involved with the refuse handling system of needed changes, and enlisting their support;
- 2) Preparing acceptable disposal facilities to replace those being closed;
- 3) Providing needed support facilities (better collection service, etc.) to assure continuing good operation;
- 4) Eliminating existing problems at the closed dump and restoring the site to an acceptable condition.

Closing a dump does take some background knowledge, which this one-day course is intended to provide. Closing a dump also takes planning; some human and material resources, and probably a lot of hard-headed persistence. But it is clear that we must effectively put a stop to outmoded practices which continue to waste and insult our environment.

KEEPING THE PUBLIC INFORMED

Training Staff*

I INTRODUCTION

- A The solid waste system must be designed properly to work properly but the social, cultural, psychological implications of refuse must be recognized and considered for the system to work.

II THE PUBLIC HAS A RIGHT AND A NEED TO KNOW

A Support Comes Through Understanding

- 1 The public sits in judgment on your proposed disposal operation and will decide whether or not they want it. To judge realistically they must know.
 - a The need to stop improper operations
 - b Needed human and material resources
 - c The role of individuals and public and private agencies in helping with the needed changes.
- 2 Their cooperation is needed. It is affected by their attitudes toward your operation and their understanding of what is required on their part.

B The Public Are Customers and Partners in Your Disposal Program

- 1 Householders and businessman, industry, and city or private solid waste collection agencies are probably all users of your disposal site. They must learn how to use it.
- 2 The individuals and groups served by you want to know the benefits (or disadvantages) that your disposal system offers them.

III THE INFORMATION MUST BE APPROPRIATE

A Timing Is Important

- 1 Your message is weakened if it comes too early or too late.
- 2 The sequence of events and activities must be logical.

B The Message Should Be Clear, Sufficient, and Properly Directed.

- 1 Absence of information breeds mistrust. People tend to be "down on what they are not up on." Rumor and misinformation flourish when good information is lacking.
- 2 Always be honest, but do not stir up people unnecessarily with controversial matters.
- 3 Material which is not understandable, or is directed to the wrong group, just causes confusion.
- 4 Last minute "once over lightly" efforts to reach the public may actually just stir up misunderstanding, speculation, and resentment.

IV BARRIERS TO COMMUNICATION

A Differences In Backgrounds Hinder Understanding

- 1 Language is an imperfect tool. People may not understand what you mean, particularly when the subject is technical.
- 2 Because of interests and problems different from yours, the public may view your program differently than you do. Try to anticipate their attitudes.
- 3 There may be other matters (a school bond issue, a local governmental crisis, etc.) which will affect your program even though not directly related to it. Keep your eyes open for these possible conflicts.

B Solid Waste Tends To Be an Emotionally Negative Subject

- 1 Solid waste is unwanted, by definition. The public has to understand that money and equipment for proper disposal are not being expended on the refuse per se, but on maintaining a livable environment.
- 2 Solid waste is boring, useless, ugly, or degrading to some people to the point where they block their minds to rational solutions.

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C There Is Tremendous Competition for Public Attention

V ASSETS TO COMMUNICATION

A Your Cause Is Obviously Worthy in Principle

- 1 The open dump with its rats, flies, smoke and unsightliness is generally recognized to be evil.
- 2 You represent a respected agency.

B The Public is Already Somewhat Informed and Interested About Disposal Practices.

- 1 Interest in pollutional control has already been stimulated by recent national publicity. This helps tremendously.
- 2 Getting heard or read is no longer so much of a problem. This makes it easier for you to proceed with the business of convincing the public that your approach to the disposal problem is the right one, and ought to be supported.

VI WHAT NEEDS TO BE TOLD

A What Is to Be Done, and Why

B Effects (Favorable and Unfavorable) on the User

- 1 Better environment, better service
- 2 Higher costs, etc.

C The User's Expected Role in Helping Improve the Disposal System

D The User's Responsibilities in Using the System

E Progress Reports on Your Program

- 1 Before-and-after pictures and stories of your work in eliminating dumps and establishing sanitary landfills can be most persuasive arguments in winning public support.
- 2 You need to update information on what is going on so the public will not lose interest or faith in you.

VII HOW TO DO IT

A Read "Getting Your Message Across" and get to work. Forget excuses that you do not speak well, or that this is not really your job. Public relations is everyone's.

B Remember that the public is a part of your operation. Work with:

- 1 Responsible individuals
 - a Those particularly affected by your proposed changes
 - b Generally accepted leaders
- 2 Social, civic, religious, fraternal, and volunteer organizations. Do not forget the school kids.
- 3 Mass media:
 - a The press
 - b Radio and television
 - c Posters, leaflets, displays

C Your Organization and Actions Can Win Public Support Directly

- 1 Be sure your personnel and equipment help you create a good image.
 - a Simple, neat uniforms
 - b Clean, well-maintained equipment
 - c Signs that look nice, help the user instead of just telling him what he cannot do.
 - d Courteous, informed workers
- 2 Early in the effort, make a few obviously desirable improvements and make sure the public knows about it.
 - a News coverage of dump cleanup
 - b Neat signs, early planting of trees and shrubs

VIII SOME FINAL THOUGHT

A Tell the whole story. Tell the good and the bad and never lie. Do not be bashful about your achievements, though. You have a concept to sell.

- B Do not Expect Overnight Miracles in Changing Public Attitudes. There is much competition for individuals' attention and communication can be a slow process.
- C Expect Some Opposition and Be Prepared to Overcome It. Some will misunderstand your program and some will be adversely affected despite all you can do. And a very few are opposed to any change. Answer reasonable opposition and do not wear yourself out on the others.
- D Notice That This Outline is Entitled "Keeping the Public Informed." Your Efforts Must be Diversified and Sustained to be Effective.

REFERENCES

- 1 Air Pollution Control Association. How to Tell the Air Pollution Control Story. Pittsburgh, 12pp. 1965.
- 2 National League of Cities. Careers in Municipal Public Relations. Washington, D.C., 9 pp. 1965.
- 3 Wilcomb, M.J. Getting Your Message Across. DHEW, PHS, ECA Training Institute, Cincinnati, 15 pp. 1969.

SYSTEM REQUISITES

Training Staff*

I INTRODUCTION

Open dumps arise out of need and provide a service, even if badly. They are always a part of a system, or at least a series of circumstances which takes the place of a system. Merely closing the dumps will not provide us with a sound, working system. There are many other important areas for consideration. Among these would be development of adequate collection and disposal services; dependable and sufficient financing; and a suitable management for the complete, logically developed system.

II COLLECTION SYSTEM REQUIRED

- A When no collection is provided the residents will find it nearly impossible to transport their own solid waste to one or a few more central locations. They will therefore be virtually forced to open numerous illegal dumps for disposal.
- B An Adequate Collection System Must Include:
 - 1 Frequent collection
 - a Minimum of once per week
 - b Recommended twice per week
 - 2 Collection of all materials
 - a Normal household
 - b Bulky materials on a less frequent or on call basis
 - c Commercial and industrial wastes must also be incorporated in the system by some means.
 - 3 Collection responsibility
 - a The actual collection can be done by:
 - 1) Governmental agency
 - 2) Private enterprise under one of the following conditions:

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- a) Private with no control
 - b) Exclusive franchise
 - c) Contract with governmental agency
- b Regardless of who does the collection the governmental unit is responsible to see that it is done and properly.
- 4 Transfer operations may be incorporated as a part of the system. This operation must be capable of handling all the wastes regardless of who collects them.

III DISPOSAL SYSTEM REQUIRED

- A Type of Disposal Required
 - 1 In some instances the following may be used
 - a Incineration
 - b Composting
 - c Some other central facility
 - 2 All disposal systems require at least some land disposal by the sanitary landfill.
- B Sanitary Landfill Disposal
 - 1 An area-wide approach to location of disposal sites is preferable to allow for large enough operations to be practical and economical.
 - 2 For an area such as a medium sized county it would normally be preferable to strive for one central site.
 - 3 One or more transfer stations may be required to develop the best and most economical solid waste management system.

IV FINANCING OF SOLID WASTE MANAGEMENT

- A An entirely private solid waste management system will relieve the government unit of raising the necessary capital expenditures.

System Requisites

Only under a contract arrangement will the governmental agency be responsible for raising the money necessary to operate the system.

B Means of Capital Finance for Public Agencies

1 Capital expenditures are required for:

- a Land
- b Equipment
- c Structures

2 Means of finance include:

- a Cash outlay from existing funds - normally not practical for most governmental units
- b General Obligation Bonds - these bonds are backed by the real estate tax revenue for the governmental unit. Many government units are already at the limit on these bonds due to other pressing capital requirements.
- c Revenue Bonds - these bonds are backed by the anticipated revenues from the solid waste system. A fee system is normally required to establish the income to be used for this purpose. These bonds require more groundwork to obtain and normally result in a higher interest rate than general obligation but also result in a more equitable repayment system and allows financing without incurring general obligation bond limits.
- d In some instances a combination general obligation and revenue bonds are possible and should be investigated in order to obtain the best possible financing.

C Operating, Depreciation and Finance Costs

1 Operating costs include:

- a Labor
- b Maintenance and repair
- c Utilities
- d Overhead

2 Depreciation or amortization is applied to all capital expenditures except land.

3 Intent or other finance expenses must also be paid.

4 The above three elements when combined are referred to as the "total cost" of the solid waste systems.

5 Means of payment

- a General tax revenue - although perhaps the most prevalent means this is also perhaps the least desirable since it is normally not equitably transmitted to the users and the demand for the limited amount of revenue can result in insufficient funds to perform all the necessary functions.
- b Users Fee - the utility concept of paying for solid waste management is the most equitable means and brings in a more assured income. This system does require some means of billing and fee collection but also can result in a better managed and often more economical system. The preferred system would include mandatory service and billing.

D Aids for Financial Management Systems

1 The Bureau of Solid Waste Management has prepared and published four cost accounting aids:

- a An Accounting System for Sanitary Landfill Operations
- b An Accounting System for Incinerator Operations
- c An Accounting System for Collection Operations
- d An Accounting System for Solid Waste Management in Communities

2 The appendix of this manual contains a description of how to determine the equipment and finances required for sample systems.

V SYSTEM MANAGEMENT AND SUPERVISION

A All solid waste systems require top-notch and continual management and supervision activities. If the system includes a private portion, then a combined management and supervision system of both private and public is required.

B Management Essentials

- 1 Remedial action to improve present system
- 2 Planning future system needs
- 3 Personnel Recruitment
- 4 Personnel Training
- 5 Day-to-day system supervision

6 Performance evaluation and modifications

7 Cost accounting and budget preparation

8 Public relations

- C The management and supervision functions of the system is what will normally establish the degree success of the system.

DUMP CLOSING I SEQUENCE OF OPERATIONS

Training Staff*

I After having provided for acceptable alternative disposal and other needed support services and materials, and having obtained the necessary public understanding and support, we can begin the actual closing and restoration of the dump. It is important to keep in mind that not only what is to be done but also that sequence of activities and even the timetable of events is important. Otherwise, eliminating one problem may create one or two others.

A A Typical Sequence of Operations Follows:

- 1 Fence or otherwise restrict unauthorized access.
- 2 Place necessary informational signs.
- 3 Assign a responsible manager to the site.
- 4 Stop the burning.
- 5 Stop the scavenging.
- 6 Stop the immediately preventable or controllable water pollution.
- 7 Close the dump to incoming refuse, or establish a specific spot on the dump for sanitary landfill operation during closing.
- 8 Control insects and rodents as the need indicates. Usually rats are the principal problem to consider.
- 9 Provide necessary drainage.
- 10 Establish grades.
- 11 Clean up the junk, compact and cover.
- 12 Seed the area or otherwise prepare it for final use.
- 13 Maintain the cleanliness of the site

B Some Mistakes or Common Inadequacies Are:

- 1 Underestimation of the increase in volume of refuse at the dump which will occur when burning stops;
- 2 Problems of policing the area because some individuals persist in dumping there after the dump is closed;
- 3 Movement of rats to nearby fields or housing if poisoning is needed and is not done; or is not done within a week after dumping is stopped;
- 4 Occasional difficulty in stopping the dump fires, particularly if the burning has carried underground;
- 5 Hazards to equipment operators when putting out fires, through caving of burned-out voids.

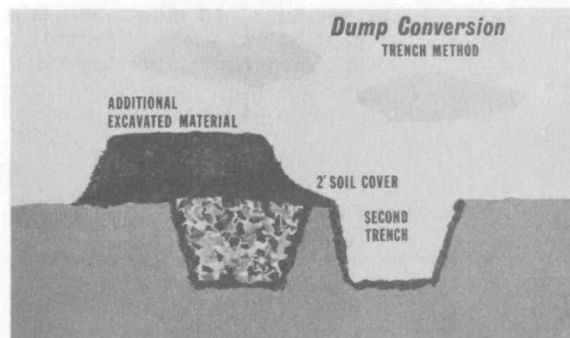
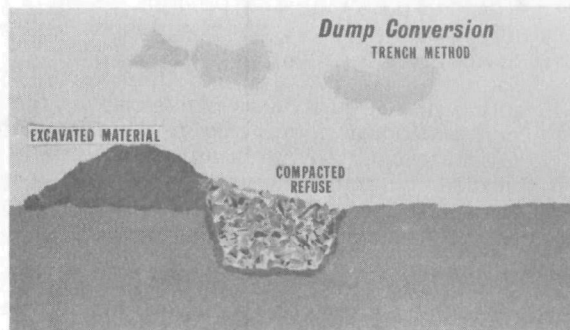
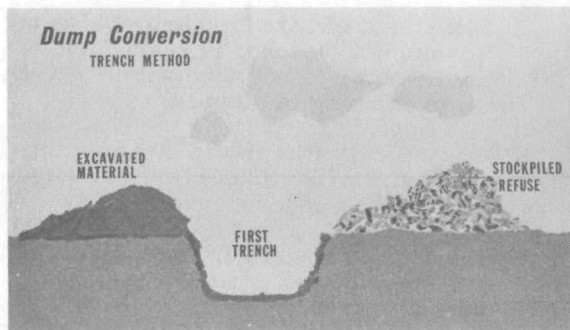
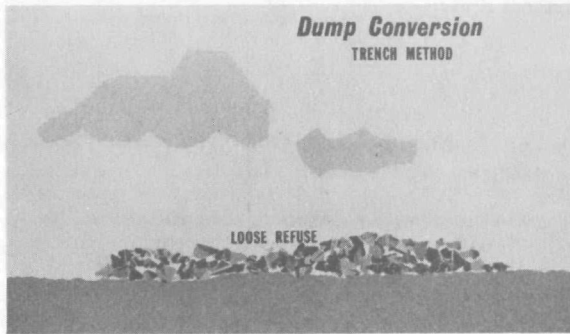
C Procedures

The dump closing and/or conversion procedure will necessarily depend a good deal on local circumstances. These include the particular problems of the dump itself, problems presented by the dump's location, and the area's intended ultimate use. If the dump is to be converted to sanitary landfill operation, the sanitary landfill method employed may affect the dump conversion process.

Where the water table depth and other considerations will permit a trench type sanitary landfill operation, for example, a trench type of dump conversion may simplify the transition. The supervisor will have to exercise his judgement in making the best use of the equipment, time, and manpower available to him, but the final result must be esthetically and functionally acceptable.

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1 TRENCH METHOD*

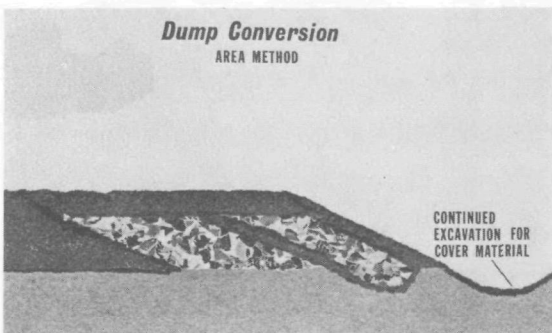
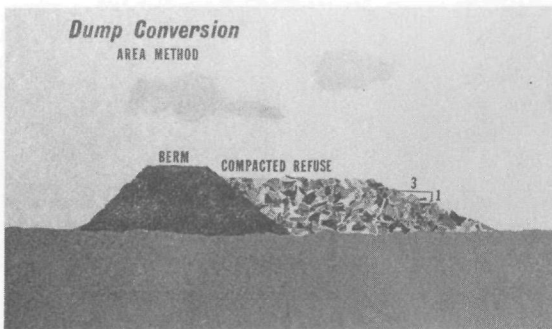
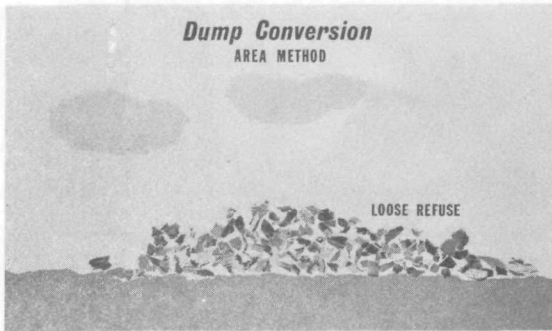


The trench method can be used where a high water table is not a problem.

In this method, the loose refuse is brought together and then spread and compacted, following the cell concept of sanitary landfill construction.

The refuse is covered with soil and graded to prevent ponding of surface water.

2 AREA METHOD



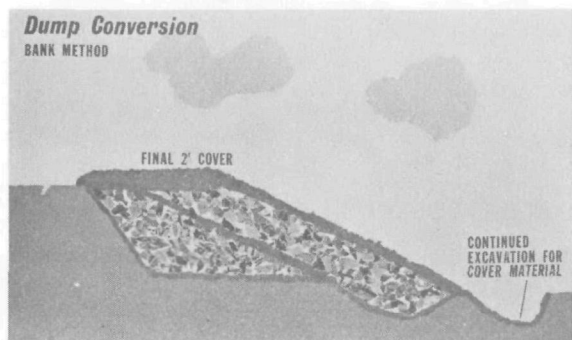
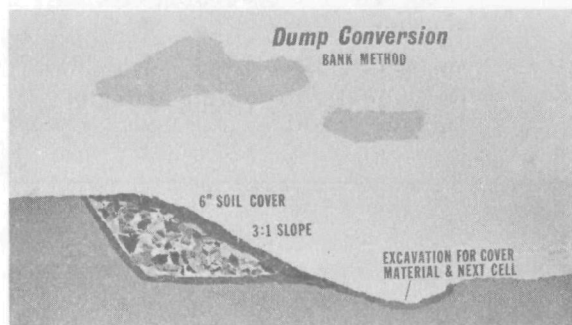
The area method is used where high water tables may prohibit the excavation of trenches.

The loose refuse which generally is spread over a large area, is first stockpiled and then compacted against an earth berm using the cell concept for sanitary landfill construction.

Soil cover material may be hauled in from adjacent areas or secured at the toe of the working face as shown.

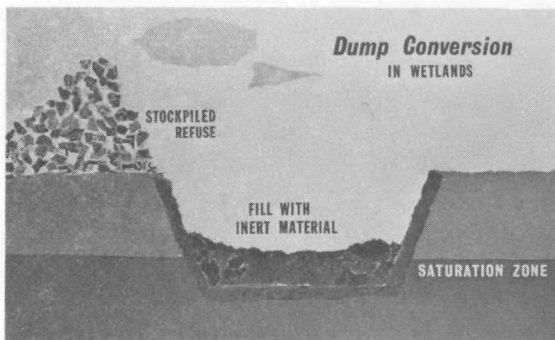
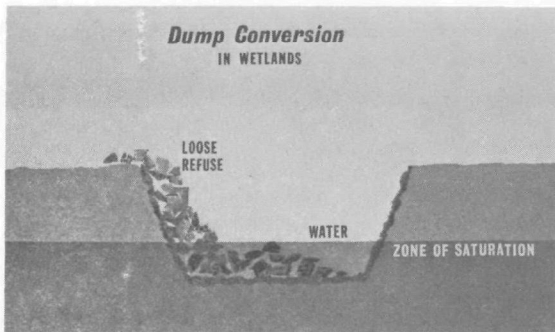
The site should be graded periodically to avoid ponding of surface runoff.

3 BANK METHOD



The bank method is a modification of the area method and merely takes advantage of the original sloping nature of the refuse. When the refuse has been set to a 3:1 slope, it is compacted and covered, thus forming the berms for the adjacent cell.

4 WETLAND METHOD



This method is used where the dump is in a marshland or in a river or other water course. The solid waste is first removed and then separated from the water by placement of a mat of impervious material that reaches above high water level.

Another means of separations between the solid waste and the water can be achieved by diverting the flow of water or if necessary, by lowering the ground water level.

DUMP CLOSING II RAT KILLING TECHNIQUES

Training Staff*

I GENERAL INFORMATION

A dump may harbor substantial numbers of rats which, in some circumstances, travel to nearby fields or housing when the incoming refuse (their food supply) is cut off. The extent of the problem has to be estimated and controlled accordingly - it is not always necessary that rat control methods be applied when a dump is closed. There may not be any rats. Very rarely, mice, cockroaches or flies may have populations which would justify terminal control; but these circumstances occur infrequently enough so that control procedures for them are not discussed here.

II ESTIMATION OF RAT POPULATIONS

Simple and reliable field estimates of rat numbers, taken before and after poisoning, are hard to arrive at. Really "scientific" methods require so much preparation as to be impractical for dump closings, and some simple estimate based on rat signs and aided with judgment usually suffices. One approach to "guesstimating" numbers is to drive out near the dump face at night, turn out the car lights and remain absolutely quiet for half an hour. Noises of rats moving give some idea of numbers. After poisoning operations, things of course should be pretty quiet.

Rats usually are not uniformly distributed all over a dump. Often they will not be numerous in the old area where dumping has ceased; there is harborage there or little food. They may not be in the immediate dumping area either, because their harborage would be disturbed there. Look for burrows, runs and droppings on the less frequently disturbed banks, fields, and dump surface immediately surrounding the dump face. Of course, dumping may be quite scattered over the dump, and in this circumstance the rat population may very well be scattered too. This means that your work will be just that harder.

III TIME SCHEDULE

- A The site will have to be closed for at least three days, even if it will continue in the future as a sanitary landfill.
- 1 The site has to be closed to dumping for at least a day, so that the rats can feed on previously deposited garbage and use up their existing food supply. Some experienced poisoners think a two to five day period is better, but most agree that longer than that will cause some hungry rats to move out,
- 2 After this period there is a "baiting day" in which the poison bait is distributed in burrows and in sheltered areas.
- 3 On the third day, the rodents are allowed to feed on the bait (if anti-coagulant type rat baits like warfarin are used, this time will have to be extended to at least 4 or 5 days).
- 4 The poison having done its work, the equipment should now be brought in immediately to work, compact, cover and seal the area.

IV SUGGESTED BAIT FORMULAS

A Red Squill

This product has probably been used for more than a thousand years, and still has merit. Its greatest advantage is its safety, because it contains a natural emetic. Rats do not vomit, and are poisoned by it. The greatest disadvantage is its bitter taste, which must be overcome with tasty baits. Here is a suggested bait formula:

Red Squill (fortified, 500 mg/kg --- 1 lb
Bait: ground fresh meat, bacon,
fresh or canned fish, grains,
selected fresh fruits or vegetables, or combinations of
these ----- 9 lbs

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Of course this will not be your total quantity; the amount needed may require a concrete mixture or clean plaster boat for mixing. If a very dry bait, such as oats, is used, you may have to add a binder of molasses, fish oil, vegetable oil, or mineral oil to aid mixing and hold the poison and bait together. It is also a good idea to add a discoloring agent for identification. Charcoal or lampblack works wonders for this; a little goes a long way and it is very cheap. Wear gloves and do not smoke while working, mix well and pay attention to what you are doing at all times. This is not a dangerous process if you exercise simple judgement of this sort.

The finished baits may be rolled up in 6 inch squares of wax paper, about a tablespoon to the bait, or distributed with a tablespoon at the site on paper squares where there is rat infestation. Larger "bait stations" of 4 to 8 ounces may be placed, cover with a board so they will be accessible to rats but screened from the weather. You would not know how much to use except by rebaiting on successive days as the baits are taken until no more "takes" are seen. Then remove all baits when the public or pets again have access to the site. For initial baiting figure for about one bait for each rat hole or a half pound every hundred square feet (10 feet by 10 feet).

B Zinc Phosphide

This is another single-dose type poison which is favored by many for dump-poisoning work. It is a black powder and so no coloring agent is needed. It has a distinct phosphine odor which makes it unattractive for children or pets, but it should certainly be used with care.

Zinc Phosphide -----	4 oz.
Bait: (same selection as for	25 lbs.
Red Squill)	
Tartar emetic -----	1½ oz.

Zinc phosphide is often used to coat ½-inch cubes of sweet potato or apple for use as baits. To mix, put the freshly cut, moist cubes in a wide pan with the poison, then using a long handled spoon, mix until all of the poison has been taken up by the cubes.

Canned mackerel is a good material for at least some of the bait. Many operators substitute oats or corn meal for half or

more of the bait to get a drier and more economical mixture. Distribute as was suggested for the squill bait. If your dump has a face, figure about a pound of bait for each ten running feet of face on the first application. If your dumping area is unrestricted you will have to bait accordingly, and may come to feel that you are trying to bait the world. At this point the merits of sanitary landfill become more evident.

C ANTU (Alpha-Naphthyl Thiourea)

This single dose poison, properly used, is an effective quick-acting poison for the Norway Rat. It has a good safety record as far as people are concerned, but dogs, cats and hogs are easily poisoned by it.

ANTU -----	8 oz.
Bait: (same selection as for Red	
Squill)	33 lbs.
Discoloring agent desirable	

D Anticoagulants

This group of poisons is excellent for home use, but many authorities prefer not to use them at all as dump poisons. They are safe and ultimately effective, but are a nuisance for dump work because they must be eaten repeatedly by the rat for several days. The baits must be out for a couple of weeks and a lot of bait is required. However, when there is time and budget for such activity, some workers do use them, particularly as a cleanup to get the few rats remaining after a single-dose poison is put out.

You must put out about 4 ounces of bait per rat. During the period of poisoning, birds may eat up a lot of your grain bait. It would not hurt them but may cause you to have to use more bait.

In the anticoagulant group are warfarin, pival, fumarin, and diphacinone. It really does not matter which one you use.

Anticoagulant (0.5% concentrate)---	25 lbs.
Corn oil or mineral oil -----	25 lbs.
Powered sugar -----	25 lbs.
Rolled or ground oats -----	100 lbs.
Corn meal or corn chop -----	325 lbs.
	500 lbs.

The complete bait may be placed in small pans not over one-half inch high and inserted under boards or other protected locations at

the dump site. The bait should be checked at two-day intervals and replenished until there is evidence that no more feeding has taken place.

Most of the anticoagulants mentioned above may also be purchased as wax treated bait blocks or rodent cakes with meat or fish flavor to attract rats.

If you want to try some water baits, try the water-soluble anticoagulants: warfasol, fumasol, or pivalyn. Use as instructed on the package.

E Gassing

Gassing of burrows is used as a supplementary measure for killing rodents. It should not be attempted by untrained operators. Several materials are available for this purpose, one being calcium cyanide. Cyanide dust ("A" - dust* or equivalent) is effective when it can be blown into a burrow system where rodents are concentrated. However, calcium cyanide dust is not effective when the ground is extremely dry. Some moisture is needed in either the soil or the air to convert the dust to gas.

A foot pump is an effective means of blowing calcium cyanide dust into rodent burrows. After inserting the pump hose an appreciable distance down the burrow entrance, the operator turns the valve to "dust" and pumps 2 to 6 strokes with the handle, which blows the dust into the burrow system. The he turns the valve to "air" and pumps an additional 10 strokes or so, which forces the dust throughout the system. He watches the ground nearby for escaping dust to show him where there are other openings to the burrow system, then quickly closes and seals these auxiliary openings to prevent escape of the gas or of the rodents it is meant to kill. When a foot pump is not available for dispensing the dust, the operator can use a hand duster or a long-handled spoon. However, he must be sure to place the dust at least 8 inches down inside the burrow.

Burrows may be reopened by rats shortly after they have been gassed. This represents either a failure of the gassing operation or a new rodent infestation and indicates a need for re-treatment.

Caution: Cyanide fumes are highly toxic and rapidly fatal. Avoid inhaling dust

or fumes. Cyanide gas is lighter than air. Therefore, burrows that may lead under occupied buildings must not be gassed. Indoor fumigation with this gas must be done only by thoroughly trained professional fumigators.

V SOME SUGGESTED SOURCES FOR SUPPLIES

These are merely put forth to give you a start in looking for materials. The list is by no means exhaustive, and mention of these suppliers in no way should be construed as an endorsement of their products over those of any not mentioned.

American Cyanamid Co., Agricultural Chemicals Div., 30 Rockefeller Plaza, New York 20, New York.

California Spray-Chemical Corp., Richmond, California.

Continental Chemiste Corp., 2256 West Ogden Avenue, Chicago 12, Illinois.

J. T. Eaton and Co., Inc., 3110 W. 65th Street, Cleveland, Ohio 44102 (squill, and warfarin bait blocks).

Elco Manufacturing Co., 2039 Fifth Avenue, Pittsburgh 19, Pennsylvania.

Hopkins Agricultural Chemical Co., P. O. Box 584, Madison, Wisconsin.

Hub States Chemical and Equipment Co., 2002 N. Illinois Street, Indianapolis, Indiana 46202.

Miller Chemical and Fertilizer Corp., 2226 N. Howard Street, Baltimore 18, Maryland.

Niagara Chemical Div., Food Machinery and Chemical Corp., Middleport, New York.

S. B. Penick and Company, 50 Church Street, New York 8, New York.

John Powell and Company, 10 Light Street, Baltimore 3, Maryland.

Prentiss Drug and Chemical Co., 101 W. 31st Street, New York 1, New York.

Pyrrole Chemical Corp., 817 Spring Lane, Portsmouth, Ohio.

*Manufactured by American Cyanamide Co., New York, N. Y.

Dump Closing II: Rat Killing Techniques

Gallard Schlesinger Chemical Corp., 37-11
29th Street, Long Island City 1, New York.
(zinc phosphide).

Seacoast Laboratories, Inc., 156 Perry
Street, New York 14, New York.

Selco Supply Co., 109 Elm Street, Eaton,
Colorado.

Stephenson Chemical Co., P. O. Box 188,
College Park, Georgia.

Wil-Kil Pest Control Co., 522 West North
Avenue, Milwaukee 12, Wisconsin.

Andrew Wilson, Inc., Springfield, New
Jersey.

Wisconsin Alumni Research Foundation,
506 North Walnut Street, Madison,
Wisconsin.

An excellent reference for poisoning
operations is: Control of Domestic Rats
and Mice, PHS Publication 563, by
Bayard F. Bjornson, Harry D. Pratt, and
Kent S. Littig.

ALTERNATIVE VOLUME REDUCTION TECHNIQUES

Training Staff*

I INTRODUCTION

Even with onsite volume reduction methods finding increasing use in the United States, there still exists a very real need for more centralized volume reduction systems. Some of the newer approaches to volume reduction are grinding, baling and liquid-waste pulping. All of these techniques serve to reduce the amount of land required for final disposal.

II GRINDING

To date refuse grinding has been utilized principally in conjunction with the composting process. Recently the grinding process has been considered for use with baling, sanitary landfill, and incineration. Several manufacturers are now producing or developing grinders suitable for use with municipal refuse.

A Advantages of Grinding

- 1 Some volume reduction achieved
- 2 Elimination of voids
- 3 Permits easier handling of material
- 4 Permits easier compaction of material
- 5 Homogenizes material somewhat
- 6 Promotes more complete burnout from incineration

B Disadvantages of Grinding

- 1 Some materials not grindable
- 2 Need for downtime alternative procedure

C Grinder Designs

- 1 Horizontal hammermills - Floating hammers on a rapidly rotating rotor strike the material. When sufficient size reduction is achieved, the material passes through grate bars. Several mills may be arranged in series to achieve even further particle size reduction.

*Training Branch, Division of Technical Operations, Solid Waste Management Office, Cincinnati, Ohio

- 2 Vertical hammermills - These are similar to horizontal mills except that the rotor is now vertical. Material is fed in at the top of the mill and passes down through a series of rapidly moving hammers. No grate system is used.

3 Other designs

- a Impact mills
- b Knife hogs

III BALING

Baling of material has been widely practiced by agriculture and industry. Balers have been developed to handle material ranging from hay to paper to metal. The refuse balers being developed now in the U.S. are generally variations of the older baler designs.

A Advantages of Baling

- 1 Volume reduction
- 2 Increased payload after transfer
- 3 Easy handling
- 4 Better dust and odor control
- 5 Possible use for bales

B Disadvantages of Baling

- 1 Nonbaleable items exist
- 2 Too high moisture content can cause extrusion of juices
- 3 Need downtime alternative procedure or stand-by baler

C Baler Designs

- 1 Agricultural type baler - The basic baler has been "beefed-up" to withstand abrasiveness of solid waste.
 - a Nearly continuous operation
 - b Single reciprocating hydraulic ram
 - c Compression in one direction only

- d Tie-wires used to enclose bale
- 2 Scrap metal type baler - This baler is similar to junk automobile balers.
 - a Batch operation - one bale per cycle
 - b Several hydraulic rams used
 - c Compression in two or three directions
 - d Bales may or may not be enclosed

D Grinding May Be Beneficial to Baling For the Following Reasons:

- 1 Increase bale densities
- 2 More uniform moisture distribution
- 3 Less loss of fines
- 4 Less presorting
- 5 Less bridging problems

IV LIQUID WASTE PULPING

Recently, wet-paper pulping equipment has been adapted to handle general municipal refuse. The addition of water to the refuse apparently makes a large portion of the wastes (particularly cardboard and paper) more readily grindable.

A Advantages

- 1 Material amenable to recycling
- 2 Hand sorting not necessary
- 3 Material easy to handle
- 4 Less problem with dust and fines
- 5 Extend life of final disposal site

B Disadvantages

- 1 Need for downtime alternative procedure
- 2 Potential for water pollution
- 3 Economics not yet proven

C The pulper consists of a drum, into which refuse and water are mixed. At the bottom of the drum is a rapidly rotating grinding blade overriding a perforated face plate.

The pulped material is extruded through this plate. Other features of this pulper are:

- 1 Junk-chute where nongrindables are automatically ejected
- 2 Grit (ground glass and heavy particles) is separated from process in liquid cyclone
- 3 Pulp is dewatered
- 4 Process water is recycled

D Material From This Process is Not Used For Baling

V INCINERATION

Incineration is a volume reduction technique using controlled combustion to burn solid, liquid, or gaseous wastes to gases and residue containing little combustible material.

A Advantages

- 1 Extend life of land disposal site
- 2 Can be centrally located
- 3 Reduce organic content of solid waste

B Disadvantages

- 1 Careful maintenance required
- 2 High capital and operational costs
- 3 Potential for air and water pollution
- 4 Substantial portion of solid waste nonincinerable

C Unit Processes

- 1 Weighing, unloading and storage
- 2 Furnace charging
- 3 Drying, ignition and combustion in furnace
- 4 Residue quenching and handling
- 5 Flue gas cleaning
- 6 Process water treatment

VI COMPOSTING

Composting is a solid waste volume reduction technique in which organic solid waste is microbially degraded under controlled conditions to yield a nuisance-free product of potential value as a soil conditioner.

A Advantages

- 1 Reduction of amount of material for final disposal
- 2 Production of usable soil conditioner
- 3 Amenable to salvaging

B Disadvantages

- 1 Much maintenance required
- 2 High capital and operational costs
- 3 Limited market for final product

C Unit Processes

- 1 Weighing, unloading and storage
- 2 Sorting to remove salvables and noncompostables
- 3 Particle size reduction
- 4 Digestion (mechanically aided)
- 5 Curing
- 6 Packaging for sale

VII CONCLUSIONS

All of the aforementioned volume reduction techniques must ultimately be accompanied by some form of land disposal. Not only is there material remaining after each of these processes, but also there are materials which, due to their nature, must by-pass the volume reduction phase and be disposed of directly. In the future, it appears that more emphasis will be placed on resource recovery which will serve as another valuable form of volume reduction.

SANITARY LANDFILL I
Training Staff*

I INTRODUCTION

A Definitions and Description

1 American Society of Civil Engineers

"Sanitary Landfill is a method of disposing of refuse on land without creating nuisances or hazards to public health or safety, by utilizing the principles of engineering to confine the refuse to the smallest practical area, to reduce it to the smallest practical volume, and to cover it with a layer of earth at the conclusion of each day's operation or at such more frequent intervals as may be necessary."⁽¹⁾

2 Solid Waste Management Training
Branch ECA Training Institute

"A Sanitary Landfill can be defined as a system for the final disposal of solid wastes on land, in which the waste is spread and compacted on an inclined, minimized working face in a series of cells and a daily cover of earth is provided so that no hazard or insult to the environment results."

B History and Development

- 1 Used by the Greeks over 2,000 years ago (burial without compaction)
- 2 Early municipal waste burial in United States
 - a Champaign, Illinois, 1904
 - b Columbus, Ohio, 1906-1910
 - c Davenport, Iowa, 1916
- 3 Mixing and covering waste in inert material (soil or ash)
 - a Germany
 - b England, called "controlled tipping"
- 4 Landfill practices with compaction by heavy equipment started in U.S. around 1930

a New York City

b Fresno, California; Jean L. Vincenz originated term "Sanitary Landfill"

5 Used by U.S. Army during World War II

II METHODS OF SANITARY LANDFILLING

A Area Method

- 1 Best suited for gently sloping land and is also used where quarries, ravines or other suitable land depressions exist.
- 2 Cell walls are formed by the adjacent cells.
- 3 Normally the earth cover material is hauled in or obtained from adjacent areas.

B Trench Method

- 1 Best suited for flat or gently sloping land where the water table is not near the surface.
- 2 A trench is cut in the ground and the solid waste placed at the bottom of a working slope.
- 3 Excavated earth from the cut is used as the cover material.

III PLANNING AND DESIGN CONSIDERATIONS

A Preliminary Planning - Should Include Consideration Of:

- 1 A competent designer and planning group
- 2 A public information program
- 3 A survey of solid wastes practices
- 4 Financing methods
- 5 Use of completed site
- 6 Site zoning arrangements

*Training Branch, Division of Technical Operations, Solid Waste Management Office, Cincinnati, Ohio

B Design Responsibilities and Resources

1 Planner or planning agency

- a Responsible for area planning
- b Extent of planning detail does vary
- c Legal responsibility will vary with establishing authority

2 Design engineer

- a Must collect and evaluate data, schedule implementation activities, and consider such items as landfill life, public health and personnel safety potentials and ultimate use.
- b Should have a thorough understanding of the state, county and local laws, rules or regulations concerning sanitary landfill site selection, design and operation.
- c Responsible for final site selection
 - 1) Each government agency having area authority should be contacted
 - 2) Health department should not be excluded as an information source
 - 3) State geological survey agencies may assist in site selection
 - 4) The U.S. Soil Conservation Service may provide additional data

3 Additional Resource personnel

- a Land surveyor
 - 1) Property description and location
 - 2) Topographic description of existing conditions
 - 3) Field layout of proposed project
 - 4) Final topography survey and facility location
- b Geologist
 - 1) Soil types and suitability
 - 2) Bedrock elevations and rock types

c Hydrogeologist

- 1) Estimated ground water table elevation
- 2) Surface water location and interrelationship

d Meteorologist or climatologist

- 1) Prevailing winds
- 2) Rainfall predictions
- 3) Frost penetration determinations
- 4) Temperature variations

e Health officials

- 1) State and local laws
- 2) Sanitation practices
- 3) Nuisance evaluations
- 4) Aesthetic acceptability

f Public works officials

- 1) Potable and fire control water supplies
- 2) Sewers - storm and sanitary
- 3) Roads - bridges and tunnels
- 4) Collection methods (if applicable)

g Utility officials

- 1) Telephone availability
- 2) Electricity - location and adequacy
- 3) Estimate of available assistance

h Equipment specialist

- 1) Selection of proper equipment
- 2) Maintenance methods
- 3) Proper operating techniques

- 4 Other public officials may be able to assist in site selection and in the solicitation of citizen support.

- 5 The engineer's responsibility does not end with initial design or construction of facilities but includes:

- a Continuing operating evaluation
- b Ultimate usage

IV SITE SELECTION

A Land Requirements

- 1 In place refuse densities
- 2 Cover material requirements
- 3 Per capita refuse production

B Relative Location to Generating Areas

- 1 Time spent in hauling refuse more important than distance
- 2 Highway systems available with ready access to and from the site
- 3 The capacities of vehicles operating in the system
- 4 Utilization of transfer operations

C Relationship to Community Growth

- 1 Direction and magnitude of projected growth
- 2 Redevelopment and density of refuse
- 3 Long-range area development
- 4 Commercial and industrial development

D Utilities

- 1 Electrical power for lights and equipment
- 2 Water supply for sanitary purposes, equipment washing and fire protection
- 3 Sewer service for sanitary wastes
- 4 Telephone, radio communications

E Nuisances That Can Affect Site

- 1 Traffic to and from site
- 2 The noise of mechanical equipment

- 3 Dust is inevitable under certain weather conditions

F Soil Conditions

- 1 Less suitable soils can sometimes be improved.
- 2 Cover material may have to be brought to site

G Ground Water

- 1 Location of ground water table and proximity to surface
- 2 Leachate from fill

H Access to Site

- 1 Preferably over high speed, unrestricted routes with easy on-off access in both directions
- 2 All weather on-site roads constructed for heavy traffic
 - a Laid out to eliminate crossing of traffic and consequent tie-ups
 - b Waiting space on-site for scales
 - c Parking space for employee's automobiles and stand-by equipment
- 3 Traffic controlled by signs and if necessary, by traffic control lights

I Legal Aspects

- 1 Jurisdiction, or lack of same, in any area for solid waste disposal
- 2 State, county and/or local laws

J Public Opinion

Public opinion toward sanitary landfilling is generally negative and the term "sanitary landfill" is synonymous with open dump.

K Political Considerations

Political considerations must also be considered and may range from lack of political support to lack of authority.

L Climatic Conditions

- 1 Wind
- 2 Rain or snow
- 3 Temperature

M Ultimate Land Use

- 1 Parks and playgrounds
- 2 Industrial sites
- 3 Agriculture

V SITE PREPARATION

A Preliminary Work

- 1 On-site inspection, site surveys, clearance and cleanup of site
- 2 Construction of all weather access and on-site roads
- 3 Provision of utilities and drainage facilities
- 4 Provision of adequate employee facilities
- 5 Provision of weighing facilities
- 6 Provision of communication facilities
- 7 Provision of adequate fire protection
- 8 Provision of equipment maintenance facilities
- 9 Provision of adequate fencing

B Nature of Work

It must be remembered that the finished design of a sanitary landfill is an engineered project and all work undertaken to prepare the site and operate the sanitary landfill be considered as any other engineered job including:

- 1 Use of proper equipment
- 2 Use of proper construction techniques
- 3 Adequate supervision of all preliminary site work and actual landfill operation

C Additional Facilities

- 1 Guard rails or bumper logs at the top of the working face

- 2 Guide barrels and directional signs
- 3 Identification signs and information signs
- 4 A fence completely enclosing the landfill site
- 5 Drop-off boxes for after hours usage

VI SANITARY LANDFILL EQUIPMENT

The selection of equipment for sanitary landfill operations is dependent upon many variables, including (1) type of refuse to be handled, (2) compaction requirements, and (3) versatility.

A Crawler Tractor

The crawler tractor, and less commonly, the rubber-tired tractor and the steel wheel compactor, are basic pieces of equipment. The crawler tractor can use dozer blades, landfill blades, front-end loader and can pull scraper. It is versatile and can perform all operations including (1) spreading, (2) compaction, (3) covering, (4) trenching, and (5) hauling material.

B Rubber-Tired Tractor

- 1 Found where only one piece of equipment can be purchased
- 2 With bucket can rapidly carry and distribute cover material

C Steel Wheeled Compactor

Can increase densities. Used where operation is on relatively flat terrain and normally found working in conjunction with crawler-tractor.

D Auxiliary Equipment

- 1 Water truck - to keep down dust
- 2 Sheepfoot and rubber-tired roller - additional compaction
- 3 Dump trucks - for hauling cover material
- 4 Motor graders - for finished grading of completed fill
- 5 Refuse shredders
- 6 Draglines

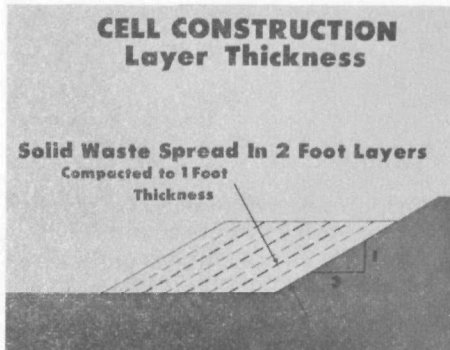
SANITARY LANDFILL II

Training Staff*

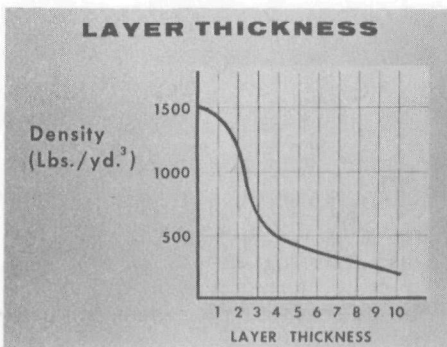
I OPERATIONAL CONSIDERATIONS

The cell concept is used in both the area and trench methods.

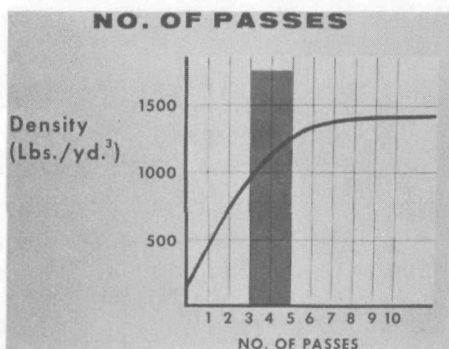
A Cell Development



- 1 This technique requires the initial construction of a 3:1 slope or berm. Refuse is deposited at base of slope, spread upward in two foot layers and then compacted to about a one foot thickness.



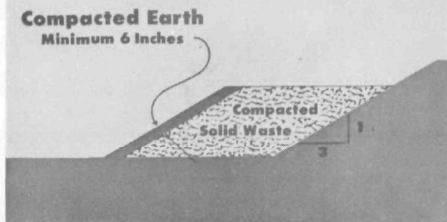
- 2 This recommended practice is based on field determinations which show that an optimum density is achieved by using a two foot thickness.



- 3 To achieve this optimum density requires about 5 passes over each layer of refuse.

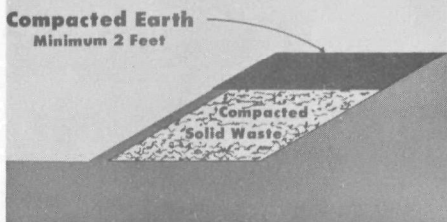
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CELL CONSTRUCTION WORKING FACE COVER



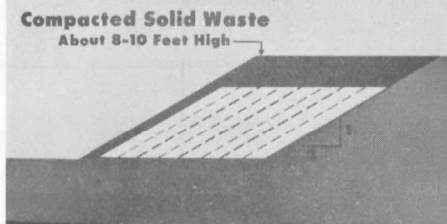
- 4 Building of cell continues (as outlined in step 1 above) until the day's incoming refuse is compacted in place or desired length is reached. The working face is then covered with 6" of compacted soil.

CELL CONSTRUCTION FINAL TOP COVER



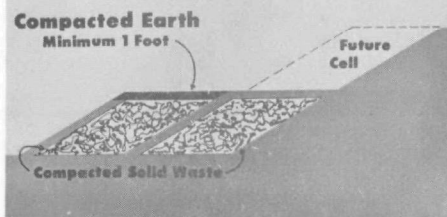
- 5 Top of cell is covered by no less than two feet of compacted earth. Additional mounding can be provided to allow for settlement and graded to prevent ponding on surface.

CELL CONSTRUCTION CELL HEIGHT



- 6 Cell height is measured vertically and is normally 8-10 feet. This will vary and in some cases may be greater, depending on the skill of the operator and amount of refuse being handled.

CELL CONSTRUCTION INTERMEDIATE TOP COVER



- 7 If additional lifts (layers of cells) are to be placed above, an intermediate cover of 1 foot of compacted earth can be provided.

- 8 Other considerations
 - a In area method, side slopes are also maintained at 3:1 slope and covered with 6" of compacted earth.
 - b Minimum cell width in Trench Method is about twice the width of a tractor.
 - c Cell width in Area Method dependent on amount of solid waste deposited and number of pieces of equipment working on slope.
 - d In both methods the width is maintained as narrow as possible without interfering with unloading of refuse and movement of equipment.
- B Control of Dust and Blowing Litter
 - 1 Protection of existing terrain
 - 2 Litter fences
 - 3 Water sprays and waste oil on on-site roads
 - 4 Apply ground cover
- C Winter Operations
 - 1 Sanitary landfill trenches may be dug in advance of cold weather
 - 2 Area to be excavated may be covered with leaves or straw
 - 3 Cover materials may be stockpiled in loose fashion
- D Wet Weather Operations
 - 1 Standby disposal site near all-weather access road
 - 2 All-weather access roads constructed to the disposal point as fill progresses
 - 3 Cover material covered or demolition and construction materials stockpiled for this purpose
 - 4 Surface drainage slopes and ditches
- E Ground Water and Related Pollution Problems
 - 1 High water table operational difficulties
 - a Inability to properly compact the refuse
 - b Floatation of refuse
 - c Limitations upon the mobility and usefulness of landfill equipment and/or collection vehicles
 - 2 Water pollution caused by direct horizontal or verticle leaching as result of:
 - a Chemical contaminants
 - b Biological contaminants
 - c Decomposition products
 - 1) CO_2
 - 2) CH_4
 - 3) Hydrogen sulfide
 - 4) NH_3
 - 3 Remedial action

Sites having high water tables may be utilized by using one or more of the following methods:

 - a Use only that portion of the site sufficiently above the water table to preclude pollution (2' to 5' above known highwater is recommended as a minimum). Cover material may be obtained:
 - 1) On-site, above the water table; or,
 - 2) In an adjacent site by excavating a pond or lake; or,
 - 3) By hauling from another location to the site
 - b Permanently lower the water table with:
 - 1) Underground drains; or,
 - 2) Drainage ditches
 - c Temporarily lower the water table with:
 - 1) Well points or wells; or,

2) Direct pumping

- 3) Deposit only nonputrescible, relatively inert materials to a point sufficiently above the highest known water table so that possible water pollution is avoided

F Conditioning of Cover Material

1 Rock at the fill site

- a The selection of a sanitary landfill site containing massive rocks may result in the following problems:
- 1) On-site cover may be unavailable, difficult to separate and use, or too coarse to be effective
 - 2) Equipment operation is hindered and/or increased maintenance costs result
 - 3) Uneven and unpredictable terrain may upset landfill equipment and/or collection vehicles
- b Sites containing massive rocks may be used by employing one or more of the following methods:
- 1) Haul cover material from some other source
 - 2) Remove excessively large rocks or bury them on site

2 Coarse cover materials

- a Sanitary landfill cover materials which is coarse and/or permeable may result in the following conditions:
- 1) Surface waters may seep into the refuse fill
 - 2) Noncohesive soils may be subject to wind erosion
 - 3) The cover material may shift under the vibration and pressure of heavy equipment
- b Sanitary landfill cover material which is too granular may be improved by adding quantities of cohesive soil during placement, spraying cover with asphalt emulsion, or simply applying a clay cover over the coarser material.

3 Clay cover material

- a Cover materials containing a high percentage of clay may result in the following conditions:
- 1) Greasy surface, difficult to compact when wet
 - 2) Excavation difficulties
 - 3) Cracking in the process of drying
- b Clay covers can be improved by adding coarser material; sand, cinders, etc.

G Salvaging Operations

The reuse and receiving of solid waste holds great promise as a means for reducing the nation's total waste problem. At the present time, however, a real need is seen for prohibiting salvaging operations at sanitary landfills, in order to insure clean, orderly sites and to help maintain their integrity. No matter how commendable, a salvaging operation almost inevitably leads to poor sanitation and should be located elsewhere.

H Large Bulky Items

Cars, refrigerators and other white goods, etc., can be handled simply by reducing their volume and placing at the bottom of the fill.

I Animal Feeding

Hog feeding, sea gulls, etc., have no place in the sanitary landfill and should be eliminated.

J Hot Loads

Should be handled according to a preconceived plan, away from the working area in a place where most everyone should be familiar beforehand.

K Sewage Sludge and Reprocessed Oil Sludge

This type of waste, together with other wastes such as magnesium and chromate wastes, can be accommodated at a sanitary landfill provided that their disposal has been anticipated and the site designed accordingly.

II LANDFILL COSTS AND ULTIMATE USE

A Total Cost of Operation

- 1 Generally falls between \$2 - \$4/ton of solid waste landfilled
- 2 In large operations may be less than \$1/ton of solid waste landfilled
- 3 Consists of initial investment for land, equipment, construction features and operating costs

B Ultimate Use

- 1 Depends on rate of settlement (95% during first 2-5 yrs)
- 2 Must coincide with regional plan
- 3 Should consider problems with gas production
- 4 Must utilize effective planning, particularly when considering construction of buildings and facilities in the proximity of the sanitary landfill

REFERENCES

- 1 American Society of Civil Engineers, Committee on Sanitary Landfill Practice. Sanitary Landfill ASCE-Manuals of Engineering - No. 39, 62 pp. 1959.
- 2 American Public Works Association, Committee on Refuse Disposal. Municipal Refuse Disposal. APWA Research Foundation Project No. 104. Chicago: Public Administration Service, 2nd Ed. 528 pp. 1966.
- 3 Orange County Road Department. The Orange County Refuse Disposal Program. Santa Ana: Orange County Road Department, 44 pp. 1965.
- 4 Planning is the Key to Ames' Landfill Success. Refuse Removal Journal, 1:7:9, July 1958.
- 5 Weaver, Leo and Keagy, Donald M. The Sanitary Landfill Method of Refuse Disposal in Northern States. Public Health Service Publication No. 226, U. S. Government Printing Office, Washington, D. C. 1952.

APPENDICES

SOLID WASTE DEFINITIONS

Training Staff*

ACRE

Unit for measuring land, equal to 43,560 sq. ft.; or 4840 sq. yd.; or 160 sq. rds.

ACTINOMYCETES

A large group of microorganisms closely related to bacteria, but the cells show branching, and form masses like the fungi do, except that the cells are much smaller. Actinomycetes give the characteristic odor of rich earth, are important in giving off-tastes to food and water, and are of significance in the stabilization of solid wastes (composting) and sewage.

AERATION

The process of exposing something to air or charging a liquid with gas.

AFTERBURNER

A device used to burn or oxidize the combustible constituents remaining in the effluent gases from prior combustion processes.

AGGREGATE

Crushed rock or gravel screened to sizes for use in road surfaces, concrete, or bituminous mixes.

AIR, AMBIENT

The surrounding environmental air.

AIR, COMBUSTION (EXCESS)

Air supplied in excess of theoretical air, usually expressed as a percentage of the theoretical air. Also called excess air.

AIR, COMBUSTION (OVERFIRE)

See AIR, COMBUSTION (SECONDARY)

AIR, COMBUSTION (PRIMARY)

Air admitted to a combustion system at the point of initial oxidation of the fuel. For example the air admitted through the fuel bed.

AIR COMBUSTION (SECONDARY)

Air introduced above or beyond the fuel bed by natural, induced, or forced draft. It is generally referred to as overfire air if supplied above the fuel bed through the side walls and/or the bridge wall of the primary chamber.

AIR, COMBUSTION (STOICHIOMETRIC AIR)

See AIR, COMBUSTION (THEORETICAL)

AIR, COMBUSTION (THEORETICAL)

Air, calculated from the chemical composition of waste, required to burn the waste completely without excess air. Also designated as stoichiometric air.

AIR, COMBUSTION (UNDERFIRE)

See AIR, COMBUSTION (PRIMARY)

AIR DEFICIENCY

Insufficient air, in an air-fuel mixture, to supply the oxygen theoretically required for complete oxidation of the fuel.

AIR POLLUTANT

A substance when present in the atmosphere in concentrations large enough to interfere directly or indirectly with man's comfort, safety, health, or full use or enjoyment of his property. The substance source may be natural or manmade.

AIR POLLUTION

The presence of contaminants in the air to such a degree that the normal self-cleansing or dispersive ability of the atmosphere cannot cope with them.

AIR QUALITY STANDARDS

Levels of atmospheric contamination by specific pollutants or combinations of pollutants prohibited under laws or ordinances enforced by municipal or state governments or regional agencies.

*Training Branch, Division of Technical Operations, Solid Waste Management Office, Cincinnati, Ohio

ALKALINITY

A quantitative measure of the capacity of liquids or suspensions to neutralize strong acids or to resist the establishment of acidic conditions. Alkalinity results from the presence of bicarbonates, carbonates, hydroxides, volatile acids, salts, and occasionally of borates, silicates and phosphates. Numerically it is expressed in terms of the concentration of calcium carbonates that would have an equivalent capacity to neutralize strong acids.

ALGAE

Plants found in sunlit situations on land as well as in fresh and salt water over a wide range of latitude, grow as individual cells, small clumps or as large masses.

ANGLE OF REPOSE

The maximum angle which the inclined surface of a pile of loosely divided material can make with the horizontal.

AQUIFER

Underground water-bearing geologic formation or structure.

ARCH, DROP

Any vertical refractory wall supported by arch construction, which serves to deflect gases in a downward direction. (Sometimes referred to as a curtain wall.)

ARCH, FURNACE

A substantially horizontal structure extending into the furnace, to serve as a deflector of gases.

ASHES

The residue from the burning of wood, coal, coke, and other combustible material.

AUXILIARY-FUEL FIRING EQUIPMENT

Equipment to supply additional heat by the combustion of an auxiliary fuel, for the purpose of attaining temperatures sufficiently high (a) to dry and ignite the waste material, (b) to maintain ignition thereof, and (c) to effect complete combustion of combustible solids, vapors, and gases.

BACKFILL

The material used in refilling a ditch or other excavation, or the process of such refilling.

BACKHOE

A mechanical hoe or pull shovel.

BACTERIA

Single-celled organisms, microscopic in size, which possess rigid cell walls and when motile have flagella. The cell nucleus is not surrounded by a membrane. There are three major groups true bacteria, actinomycetes, and budding bacteria. Some are capable of causing human, animal, or plant diseases. Some are important in sewage or refuse stabilization.

BACTERIA, AEROBIC

Bacteria which require the presence of free (dissolved or molecular) oxygen for their metabolic processes. Oxygen in chemical combination will not support aerobic organisms.

BACTERIA, ANAEROBIC

Bacteria that do not require the presence of free or dissolved oxygen for metabolism. Strict anaerobes are hindered or completely blocked by the presence of dissolved oxygen and in some cases by the presence of highly oxidized substances such as sodium nitrates, and perhaps sulfates.

BACTERIA, FACULTATIVE

Bacteria which can exist and reproduce under either aerobic or anaerobic conditions.

BAFFLE

Any refractory construction intended to change the direction of flow on the products of combustion.

BAFFLE CHAMBER

A device designed to promote the settling of fly ash and/or coarse particulate matter by changing the direction and/or reducing the velocity of the gases produced by combustion.

BAFFLE, WATER-COOLED

A baffle composed essentially of closely spaced boiler tubes.

BEARING CAPACITY

Maximum ability of a material, to support an imposed load, before failure.

BECCARI PROCESS

Composting process developed by Dr. Giovanni Beccari in 1922. Initial anaerobic fermentation is coupled with a final stage in which decomposition proceeds under partially aerobic conditions. Later modifications were the Verdier and Bordas processes.

BEDDING, ANIMAL

Material, usually organic, which is placed on the floor surface of livestock buildings for animal comfort and to absorb urine and other liquids, and thus promote cleanliness.

BEDDING, PIPE

Ground or supports in which pipe is laid.

BEDROCK

The solid rock underlying soils and the regolith, or exposed rock at the surface without a cover.

BENCH MARK

A point of known or assumed elevation used as a reference in determining and recording other elevations

BERM

An artificial ridge of earth.

BITUMINOUS

Containing asphalt or tar

BLADE

Steel plate, concave in vertical plane, affixed to a tractor used for excavation and spreading.

BLADE (SANITARY LANDFILL)

A U-blade with extension fabricated on top to increase volume of solid waste that may be pushed and spread.

BLADE (U)

A dozer blade with extension on both sides, protruding forward at an obtuse angle to the blade, enabling handling of a larger volume of solid waste.

BLUE TOPS

Grade stakes whose tops indicate finish grade level.

BOGIE (TANDEM) (TANDEM DRIVE UNIT)

A two axle driving unit in a truck. Also called tandem drive unit or a tandem.

BOOM

In a revolving shovel, a beam hinged to the deck front, supported by cables. Any heavy beam which is hinged at one end and carries a weight-lifting device at the other.

BORING

Rotary drilling.

BORROW PIT

An excavation from which material is taken to a nearby job.

BOULDER

A rock which is too heavy to be lifted readily by hand.

BREECHING OR STOCK CONNECTION

A passage for conducting the products of combustion to the stack or chimney.

BRICK, ALUMINA - DIASPORE FIRECLAY

Brick made essentially of diasporic or nodular clay, and having an alumina content of 50, 60, or 70 per cent plus or minus 2½ percent.

BRIDGE WALL

A partition wall between chambers over which pass the products of combustion. (see CURTAIN WALL).

BTU (BRITISH THERMAL UNIT)

The quantity of heat required to increase the temperature of one pound of water from 60° to 61°F.

BUCKET

An open container affixed to movable arms of a loader to move and spread solid waste and soil, and also to excavate soil.

BULKY WASTE

Large items of refuse such as appliances, furniture, large auto parts, trees and branches, palm fronds, stumps, flotsam, etc.

BULL CLAM

A bulldozer fitted with a curved bowl hinged to the top of the front of the blade.

BULLDOZER

A tractor equipped with a front pusher blade.

BURNER, PRIMARY

A burner installed in the primary combustion chamber to dry out and ignite the material to be burned.

BURNER, REFUSE

A device for either municipal or on-site volume reduction of refuse by burning, and of simple construction. Not to be confused with incinerator, which, properly designed and operated, can produce an acceptable emission and residue.

BURNER, SECONDARY

A burner installed in the secondary combustion chamber to maintain a minimum temperature and complete the combustion process. (Sometimes referred to as an afterburner.)

BURNING AREA (INCINERATOR)

The horizontal projected area of grate, hearth, or combination thereof on which burning takes place.

BURNING RATE, INCINERATOR

The amount of heat released (Btu) per unit size (ft^2 , ft^3) per unit of time (min., hr., day) e.g. Btu per ft^3 of furnace volume per hour. Another, though less exact, expression may be by quantity of solid waste (pounds, tons) per unit or unit size (furnace or ft^2 , ft^3) per unit of time e.g. (tons per furnace per day).

BYPASS (BREECHING)

An arrangement of breechings or flue connections and dampers to permit the alternate use of two or more pieces of equipment by directing or diverting the flow of the products of combustion.

CAPACITY, INCINERATOR

a) Design Capacity - The capacity at which the designer expects that the incinerator will be capable of operating; the number of tons of solid waste per 24 hour period, which is anticipated that the plant can process.

b) Rated Capacity - tons of waste per 24 hour day which can be processed, according to specified criteria. Trend is to use criteria relating to residue quality and air pollution standards.

c) Dependable Capacity - plant capacity considering nonoperating time (maintenance, down time etc.) - usually expressed as a percentage of the rated capacity.

d) Actual Output - actual amount of material processed per day even though the plant may be operated for only a portion of the day.

CAPILLARY ATTRACTION

The tendency of water to move into fine spaces, as between soil particles, regardless of gravity.

CAPILLARY WATER

Underground water held above the water table by capillary attraction.

CARBON DIOXIDE

An odorless, colorless, and nonpoisonous gas. One source is from sanitary landfills undergoing aerobic and/or anaerobic microbial decomposition which is highly soluble in water, forming carbonic acid.

CARBON MONOXIDE (CO)

A colorless gas characterized by an exceedingly faint metallic odor and taste. It is extremely poisonous, inducing asphyxiation. As much as 0.2% in air is poisonous and 0.43% will induce asphyxiation.

CARBON NITROGEN RATIO

The ratio of carbon to nitrogen. Abbreviated C/N.

CARRIER

A person who harbors a specific infectious agent in the absence of discernible clinical disease and serves as a potential source or reservoir of infection for man.

CARRY-CLOTH

A large canvas or burlap cloth square used in transfer of refuse from homes by collectors in backyard carryout service. Serves as a carrying container (see CARRYING CONTAINER).

CARRYING CONTAINER

A transfer container carried by the collector in backyard carryout service. Usually of 30-50 gallon capacity and especially constructed of plastic or aluminum. In England these are called skips.

CAT

A trade marked designation for any machine made by the Caterpillar Tractor Company. Widely used to indicate a crawler tractor or mounting of any make.

CATALYTIC COMBUSTION SYSTEM

A catalytically active substance, interposed in the exhaust gas stream to burn or oxidize vaporized hydrocarbons or odorous contaminants.

CELL

The volume of compacted solid waste enclosed by natural soil and/or cover material in a sanitary landfill.

CELL DEPTH

Vertical thickness of compacted solid waste enclosed by natural soil and/or cover material in a sanitary landfill.

CELL THICKNESS

Perpendicular distance between cover material placed over the last working faces of two successive cells in a sanitary landfill.

CHARGING CHUTE

A passage through which waste materials are charged into an incinerator from above by gravity.

CHARGING RAM

A reciprocating device to meter and force refuse into a furnace.

CHECKER WORK

A pattern of multiple openings in refractory through which the products of combustion pass to promote turbulent mixing of the gases.

CHIMNEY (STACK, FLUE)

See STACK.

CHIPPER

A size reduction device relying primarily on the shearing, cutting, or chipping action produced by sharp-edged blades attached to a rotating shaft (mandrel) which shaves or chips off pieces of the charged object.

CLAMSHELL

A shovel bucket with two jaws which clamp together by their own weight when it is lifted by the closing line.

CLAY

Soil particles less than 0.002 mm in diameter according to USDA classification.

CLEANER BARS

Metallic bars affixed to wheeled equipment to remove mud and solids from wheel area.

CLIMATE

Long-term manifestations of weather. More rigorously, the climate of a specific area is specified by the statistical collection of its weather conditions during a specified interval of time (usually several decades).

COLLECTION

The act of picking up refuse at home, business or industrial site and putting it in a truck.

COLLECTION, CONTRACT

City pays a contractor for doing collection work.

COLLECTION METHODS (CREW ORGANIZATION)

a) Daily Route Method

A collection crew is assigned a weekly route, divided into daily routes. The crew is then responsible for refuse pickup at all collection points on the assigned daily routes. Weather, refuse quantities and other variables will cause the elapsed time for completion of each daily route to vary. The crew is allowed to go home after completion of the day's route, whether it takes less or more than the established work day to complete.

b) Definite Working Day

A variation of the large route method. Definite routes are laid out and a crew assigned to each. Collection proceeds along a route for the length of time adopted for a working day. The next day, collection begins where the crew stopped the day before. This continues until the route is completely collected, whereupon the crew starts collection again at the beginning of the route without interruption.

c) Large Route Method

A variation of the task system in which work is laid out for a normal week's activity for a single crew. The crew may work each day without a fixed stopping point or number of hours, but the route must be entirely completed within the working week.

d) Single Load Method

A variation of the task system in which areas or routes are laid out which under normal conditions each provide a full load of refuse. Each crew usually has two or more such routes for a day's work. The crew quits for the day when the assigned number of routes are completed. See also TASK SYSTEM.

COLLECTION METHODS (CREW INTEGRATED)

a) Inter-Route Relief Method

A collection method in which regular crews help collect other routes when their own assignments are completed.

b) Reservoir Route Method

The use of several crews to pick up a central route after having collected marginal routes around the central route.

c) Swing Crew Method

The provision of one or more extra crews to help out at any point where they are needed.

d) Variable Size Crew Method

System which provides a variable number of collectors for the individual crews, depending on the amount and conditions of work on particular routes.

COLLECTION METHODS (PICK UP OPERATIONS)

a) Backyard Carry Service

The collection personnel proceed to the place on a householder's premises where the refuse is regularly stored and transfer the accumulated material from the householder's containers to a carrying barrel. The carrying barrel is then taken to the collection vehicle and emptied. A number of premises may be served before barrel has to be emptied.

b) Curb Service

The householder sets the refuse container at the curb where it is then emptied into the collection truck by the collection personnel. The householder then takes the empty container back to the regular storage area.

c) Set-out Service

A special set-out crew carries the full refuse containers to the curb a few minutes before the collection vehicle arrives. The refuse is then emptied into the truck and the empty containers are left at the curb. The householder has the responsibility to take back the empty containers.

d) Setout, Setback Method

Full refuse containers are carried by a special set-out crew from back doors or other places on the householder's premises to curbs or alleys a few minutes before the collection vehicle arrives. Refuse is loaded in the same manner as when it is placed at curbs or alleys by the householders, leaving empty containers at the curbs or alleys. A special set-back crew returns the empty cans to their regular locations within a short time after they are emptied.

COLLECTION, MUNICIPAL

City pays employees; operation by city departments.

COLLECTION, PRIVATE

Citizens or firms, individually or in limited groups, pay collectors or private operating agencies.

COLLECTION STOP

Stop made by the collection vehicle and crew on the route to collect refuse from one or more service stops.

COLLECTION TIME (PICK-UP TIME)

Elapsed or cumulative time spent by the refuse collection crew in collecting refuse from a collection stop. Does not include travel time between collection stops on the route.

COLLECTOR, BAG-TYPE

A filter wherein the cloth filtering medium is made in the form of cylindrical bags.

COLLECTOR, CYCLONE

A structure without moving parts in which the velocity of an inlet gas stream is transformed into a confined vortex from which centrifugal forces tend to drive the suspended particle to the wall of the cyclone body.

COLLECTOR, FILTER FABRIC

A device designed to remove solid dispersoids from a carrier gas by passage of the gas through a porous medium.

Two basic types of filters are presently employed. In one, a fibrous medium is used as the collecting element and in the other, a medium is utilized as a support for a layer of collected particles, relying on the coat of collected particles to serve as the principal collecting medium.

COMBUSTION CHAMBER (PRIMARY)

Chamber where ignition and burning of the waste occurs.

COMBUSTION CHAMBER (SECONDARY)

Chamber where combustible solids, vapors, and gases from the primary chamber are burned and settling of fly ash takes place.

COMBUSTION, COMPLETE

The complete oxidation of the fuel, regardless of whether it is accomplished with an excess amount of oxygen or air or just the theoretical amount required for perfect combustion.

COMMERCIAL OPERATOR (OHIO'S DEFINITION)

All persons, firms, or corporations who own or operate stores, restaurants, industries, institutions, and other similar places, public or private, charitable or non charitable, and includes all responsible persons other than householders, upon the premises of which garbage or other refuse or both is or are created.

COMMUNICABLE DISEASE

An illness due to an infectious agent or its toxic products which is transmitted directly or indirectly to a well person from an infected person or animal, or through the agency or an intermediate host, vector, or inanimate environment.

COMMUNICABLE PERIOD

The time or times during which the etiologic agent may be transferred from an infected person or animal to man.

COMPACTED YARDS

Cubic yard measurement of material after it has been placed and compacted in a fill.

COMPACTION

Reduction in bulk of fill by rolling and tamping.

COMPACTOR COLLECTION TRUCK

Enclosed vehicle provided with special mechanical devices for loading the refuse into the main compartment of the body, for compressing the loaded materials, and for distributing the refuse within the body.

COMPACTOR (STEEL WHEEL)

A gas or diesel powered machine equipped with steel wheels to provide good compaction and crushing effort, used to spread and compact soil and solid waste.

COMPOSTING

A controlled microbial degradation of organic waste yielding a nuisance-free product of potential value as a soil conditioner.

COMPRESSION

For steel wheel rollers, the compacting effect of the weight at the bottom of the roll, measured in pounds per linear inch of roll width.

CONDUIT

A pipe or tile carrying water, wire, or pipes.

CONSTRUCTION AND DEMOLITION WASTES

Waste building materials and rubble resulting from construction, remodeling, repair, and demolition operations on houses, commercial buildings, pavements, and other structures.

CONTAINER, CARRYING

A transfer container carried by the collector in backyard carryout service. Usually of 30-50 gallon capacity and especially constructed of plastic or aluminum. In England these are called skips.

CONTAINER, STORAGE (DETACHABLE)

A partially mechanized self-service refuse removal procedure with specially constructed containers and vehicles. It is mechanized in that special equipment is used to empty the containers and haul refuse to the disposal site. It is self-service in that the customer puts the refuse in the container.

CONTAINER, STORAGE (DISPOSABLE)

Specially designed plastic or paper sack refuse storage containers which are intended for disposal along with its contents.

CONTAINER STORAGE (LIFT AND CARRY)

Detachable container system in which service vehicle has lifting arms to pick up container and contents together for transportation to disposal site.

CONTAINER STORAGE (PULL-ON)

Detachable container system in which large container (approximately 20-40 cubic yards) is pulled onto service vehicle mechanically and carried to disposal site for emptying.

CONTAINER STORAGE (REAR LOADER, DETACHABLE)

Detachable container system in which roll-out containers, typically 1 to 3 yard capacity are hoisted at the rear of the collection vehicle and mechanically emptied. Container is left with the customer.

CONTAINERS, STORAGE (REUSABLE, INDIVIDUAL)

Galvanized metal or plastic containers specifically intended for use to store solid wastes. Sizes normally vary from 20 to 82 gallons. The container has tight fitting cover and suitable handles.

CONTAINER STORAGE (SIDE LOADER, DETACHABLE)

Detachable container system similar to rear loader (which see) except loaded at side of collection vehicle.

CONVEYOR

A device that transports material by belts, cables, or chains.

CONVEYOR, SCREW

A revolving shaft fitted with auger-type flights that moves bulk materials through a trough or tube.

CORE

A cylindrical piece of an underground formation cut and raised by a rotary drill with a hollow bit.

COVER MATERIAL

Granular material, generally soil, that is used to cover compacted solid waste in a sanitary landfill, generally free of large objects that would hinder compaction and free of organic content that would be conducive to vector harborage, feeding and/or breeding.

CRANE

A mobile machine used for lifting and moving loads without use of a bucket.

CRANE, BRIDGE

A crane consisting of a lifting unit that hangs from and that can travel along a movable horizontal rail that rides between two parallel, horizontal rails.

CRANE, MONORAIL

A crane consisting of a lifting unit that hangs from a suspended, horizontal rail in such a way that the unit can travel the length of the rail.

CRAWLER

One of a pair of roller chain tracks used to support and propel a machine, or any machine mounted on such tracks.

CUT

Portion of land surface or area from which earth or rock has been removed or will be removed by excavation. The depth below original ground surface to excavated surface

DAMPER

A manually or automatically controlled device to regulate draft or the rate of flow of air or other gases.

DAMPER, BAROMETRIC

A hinged or pivoted balanced blade, placed so as to admit air to the breeching, flue connection or stack thereby automatically maintaining a constant draft in the incinerator.

DAMPER, BUTTERFLY

A plate or blade installed in a duct, breeching, flue connection or stack, which rotates on an axis in its plane to regulate flow of gases.

DANO BIOSTABILIZER SYSTEM

Aerobic, thermophilic composting process in which conditions of moisture, air, and temperature are maintained in a single slowly revolving cylinder that retains the compostable refuse for one to five days. The refuse is later windrowed.

DEAD ANIMALS

Those that die naturally or from disease or are accidentally killed. Condemned animals or parts of animals from slaughter houses or similar places are not included in this term, but are regarded as industrial refuse.

DEADHEADING

Traveling without load, except from the dumping area to the loading point.

DECOMPOSITION (AEROBIC)

Reduction of the net energy level and change in chemical composition of organic matter by aerobic microorganisms.

DECOMPOSITION (ANAEROBIC)

Reduction of the net energy level and change in chemical composition of organic matter caused by microorganisms in an anaerobic environment.

DEGLASSER

See OSBORNE SEPARATOR.

DENSITY

The ratio of the weight of a substance to its volume.

DEPTH OF FILL

Total distance between undisturbed earth or bottom of solid waste in the sanitary landfill and top of final cover material.

DESIGN RUNOFF RATE

Maximum runoff rate (occurring expected) in a given period of time, during and immediately following rainfall.

DESTRUCTIVE DISTILLATION

The heating of organic matter when air is not present, resulting in the evolution of volatile matter and leaving solid char consisting of fixed carbon and ash.

DIKE

Bank of material, normally earth, constructed to form a barrier. A levee.

DISEASE AGENT

Any organism or material capable of causing disease.

DISINFECTION

Killing of pathogenic agents outside the body by chemical or physical means directly applied.

DISPOSAL AREA

A site, location, tract of land, area, building, structure or premises used or intended to be used for partial and/or total refuse disposal.

DISPOSAL, OCEAN

A sea dumping process which had been used extensively in the past, but which lost considerable popularity after the U.S. Supreme Court in 1933 outlawed dumping off the New Jersey shore by the city of New York.

DISPOSAL, ON-SITE

Includes all means of disposal of refuse on premises before collection. Examples are garbage grinding, burning, or incineration, and burial.

DISPOSAL, WASTE

The final deposition of waste by man. This does not include its ultimate dissemination by forces other than man.

DOZER

Abbreviation for bulldozer or shovel dozer.

DOZER SHOVEL (SHOVEL DOZER)

A tractor equipped with a front-mounted bucket that can be used for pushing, digging, and truck loading.

DRAFT

The pressure difference between the incinerator, or any component part, and the atmosphere, which causes the products of combustion to flow thru the gas passages of the incinerator to the atmosphere.

Natural: The negative pressure created by stack or chimney due to its height and the temperature difference between the flue gases and the atmosphere.

Induced: The negative pressure created by the action of a fan, blower, or ejector, which is located between the incinerator and the stack.

Forced: The positive pressure created by the action of a fan or blower, which supplies the primary or secondary air.

DRAGLINE

A revolving shovel which carries a bucket attached only by cables, and digs by pulling the bucket toward itself.

DRAWBAR

In a tractor, a fixed or hinged bar extending to the rear; used as a fastening for line and towed machines or loads.

DRAWBAR HORSEPOWER

A tractor's flywheel horsepower minus friction and slippage losses in the drive mechanism and the tracks or tires.

DREDGE

To dig under water. A machine that digs under water.

DRUM MILL

A long, inclined steel drum that rotates and grinds solid waste in the rough interior of the drum, the smaller ground material falling through holes near the end of the drum and the larger material dropping out the end.

DUCT

A pipe, tube, or channel that conveys a substance.

DUMP

See (OPEN DUMP)

ECOLOGY

The science that deals with the study of the interrelationships of living organisms to their environment.

EFFLUENT SEEPAGE

Diffuse discharge of ground water to the ground surface.

EFFLUENT (STACK)

The gas and particulates that reach the atmosphere from the burning process.

EMISSION (STACK)

See EFFLUENT (STACK)

ENDEMIC

The regular occurrence of a fairly constant number of cases of a disease within an area.

ENERGY SOURCE

The source from which an organism derives the energy for metabolic activities, e.g., sunlight, sulfur, cellulose, hydrogen, etc.

ENGINE SIDESCREEN

A rugged fabrication to fit on engine housing of a tractor or other machine to prevent accumulation of paper and protect the engine from damage.

ELECTROSTATIC PRECIPITATOR

A device for collecting dust, mist or fume from a gas stream, by placing an electrical charge on the particle and removing that particle onto a collecting electrode.

EPIDEMIC

The occurrence in a community or region of a group of illnesses of a similar nature, clearly in excess of normal expectancy, and derived from a common or propagated source.

EPIDEMIOLOGY

The study of the causes, transmission, and incidence of diseases in communities or other population groups.

EROSION, SOIL

The wearing away of the land surface normally by wind or running water.

ETIOLOGICAL AGENT

The pathogenic organism causing a specific disease in a living body.

EVAPO-TRANSPIRATION

The sum of water removed by vegetation and that lost by evaporation for a particular area during a specified time.

EXCESS AIR

See (COMBUSTION AIR (EXCESS))

EXPANSION CHAMBER

See (SETTLING CHAMBER)

EXPANSION JOINT (REFRACTORY)

An open joint left for thermal or permanent expansion of refractories. Also, small spaces or gaps built into a refractory structure to permit sections of masonry to expand and contract freely and to prevent distortion or buckling of furnace structures from excessive expansion stresses.

FAIRFIELD-HARDY DIGESTER (COMPOST)

A patented product of Fairfield Engineering Company, Marion, Ohio, which decomposes garbage, sewage sludge, industrial and other organic wastes by a controlled continuous aerobic-thermophilic process.

FAN, INDUCED-DRAFT

A fan exhausting hot gases from the heat-absorbing equipment, dust collector or scrubber.

FAN, OVERFIRE AIR

A fan used to provide air to a combustion chamber above the fuel bed.

FERMENTATION

Any energy-yielding oxidation in which the oxidant is organic.

FIELD CAPACITY (SEE MOISTURE HOLDING CAPACITY)

Quantity of water held by compacted solid waste where application of additional water will cause it to drain rapidly to underlying material.

FILL DEPTH

See DEPTH OF FILL.

FIREBRICK

Refractory brick of any type.

FLUE (CHIMNEY, STACK)

See STACK.

FLUE GAS

Waste gas from combustion processes which may contain water vapor or dilution air added after the combustion chambers.

FLUE GAS SCRUBBER (WASHER)

Equipment for removing fly ash and other objectionable materials from the flue gas by means of sprays, wet baffles, etc. Also reduces excessive temperatures of effluent.

FLUIDIZING

Causing a mass of finely divided solid particles to assume some of the properties of a fluid, as by aeration.

FLUME

An artificial channel, often elevated above the ground, used to carry fast flowing water.

FLY ASH

All solids including ash, charred paper, cinders, dusty soot, or other partially incinerated matter, carried in the flue gases.

FLY ASH COLLECTOR

Equipment for removing fly ash from the products of combustion.

FOMES (PLURAL, FOMITES)

An inanimate object not supporting bacterial growth but serving to transmit pathogenic organisms from human to human.

FOMITE

See FOMES.

FOOD WASTE DISPOSER

See GARBAGE GRINDING.

FOOT

In tamping rollers, one of a number of projections from a cylindrical drum.

FRONT END LOADER (COLLECTION)

Detachable container system in which collection vehicle has arms which engage container (usually 1-10 yard capacity) move it up over the cab and empty it into the vehicle body. Container is left with the customer.

FUNGI

Simple plants without photosynthetic pigment. The cells have a nucleus surrounded by a membrane, and the cells are connected together in long filaments called hyphae, which may grow together to form a visible body. Simpler fungi are involved in stabilization of solid waste (composting) and sewage.

FURNACE

The chambers of the incinerator into which the refuse is charged, ignited and burned.

GARBAGE

Animal and vegetable waste resulting from the handling, preparation, cooking and serving of foods. It does not include food wastes from industrial processing.

GARBAGE GRINDING

A method of uniformly reducing food waste or garbage and placing the reduced product in sewer systems. The reducing device may be a home sink grinder, or a large central grinder which serves industry or the community. It is noted that the ground garbage, which should pass through a sewage treatment plant, must still be disposed of as sewage sludge after treatment.

GARBAGE GRINDING (CENTRAL)

The grinding by mechanical means of garbage accumulated by municipal, commercial, or private delivery vehicles.

GARCHEY (GANDILLON)

A patented system for the water carriage and temporary storage of household wastes by means of a storage and flushing device mounted under the sink and tubing to convey the refuse to a central holding tank.

GAS BARRIER

Any device or material used to divert the flow of gases through soil from a sanitary landfill or other land disposal technique.

GASES

Normally formless fluids which occupy the space of enclosure and which can be changed to the liquid or solid state only by the combined effect of increased pressure and decreased temperature.

GASES (COMBUSTION)

Mixture of gases produced in the combustion chambers.

GASES, (FLUE)

Waste gas from combustion process, which may contain water vapor or dilution air added after combustion chambers.

GASIFICATION

The process of processes whereby solid or liquid matter is converted to such gases as carbon dioxide, methane, or ammonia through biological activity.

GRADER

A gas or diesel pneumatic wheel machine equipped with a centrally located blade that can be angled to cast to either side, with independent hoist control on each side.

GRADE STAKE

A stake indicating the amount of cut or fill required to bring the ground to a specified level.

GRADIENT

Slope along a specific route, as of a road surface, channel or pipe.

GRAPPLE

A clamshell-type bucket having three or more jaws.

GRATE

Surface with suitable openings, to support the refuse and permit passage of air through the burning fuel.

GRATE, DEAD PLATE

A stationary grate thru which no air passes.

GRATE, FIXED

A grate which does not have movement.
A stationary grate.

GRATE, RECIPROCATING

A forced-draft grate whose sections move continuously and slowly, forward and rearward, for the purpose of agitating and moving the burning refuse material from the charging to the discharge ends of an incinerator furnace.

GRATE, ROCKING

An incinerator stoker with moving (and stationary) grate bars which are trunnion supported. In operation, the moving bars oscillate on the trunnions, imparting a rocking motion to the bars, and thus agitating and moving the burning refuse along the grate.

GRATE, STATIONARY

See GRATE FIXED

GRATE, TRAVELING GRATE

A traveling grate stoker consists of an endless grate similar to a chain grate, but with grate keys mounted on transverse bars. The lead nose of each key on one bar overlapping the rear end of the keys on the preceding bar. The transverse bars are mounted on chains and are driven by sprockets.

GRAVEL

Rock fragments from 2 mm to 64 mm (.08 to 2.5 inches) in diameter. Or a mixture of such gravel with sand, cobbles, boulders, and not over 15 percent of fines.

GROUND PRESSURE

The weight of a machine divided by the area in square inches of the ground directly supporting it.

GROUNDWATER

Water occurring in the zone of saturation in an aquifer or soil.

GROUNDWATER FLOW

Flow of water in an aquifer or soil. That portion of the discharge of a stream which is derived from groundwater.

GROUNDWATER, FREE

Groundwater in aquifers not bounded or confined by impervious strata.

GROUNDWATER RUNOFF

That part of the groundwater which is discharged into a stream channel as spring or seepage water.

GROUSER

A ridge or cleat across a track shoe which improves its grip on the ground.

GROUT

A cementing or sealing mixture of cement and water, to which sand, sawdust, or other fillers may be added.

HAMMERMILL

A grinding machine that operates by impaction of material against heavy metal hammers loosely pinned to a shaft rotating at a high velocity.

HAMMERMILL SYSTEM

A composting process similar to the rasping system (which see), except that a rapidly spinning hammermill shreds the refuse, instead of a slowly turning rasping machine which serves the same purpose.

HARDPAN

Hardened, compacted or cemented soil horizon.

HAUL DISTANCE

- a) Distance which cover material must be transported to the working face.
- b) Distance collection truck must travel from its last pick-up stop to the working face of a sanitary landfill or tipping floor of a solid waste volume reduction or disposal facility.
- c) Distance transfer vehicle must travel from solid waste processing station to point of final disposal.

HAUL TIME

Elapsed or cumulative time spent hauling collected refuse from the route or from transfer station to the disposal point.

HEARTH, DRYING

A solid surface upon which waste material with high moisture content, or liquids or waste material which may turn to liquid before burning, is placed for drying or burning.

HEAT, AVAILABLE

The quantity of useful heat per unit of fuel available from complete combustion after deducting dry-flue-gas and water-vapor losses.

HEAT BALANCE

An accounting of the distribution of the heat input and output, usually on an hourly basis.

HEAT EXCHANGER

A set of tubes to accommodate exhaust gases with means for passing room air over outside of tubes such that heat of gases is transferred to room air used for heating ventilation air supply to room or process equipment.

HEAT OF COMBUSTION

See HEAT VALUE

HEAT RELEASE RATE

The amount of heat liberated during the process of complete combustion and expressed in B.T.U. per hour per cubic foot of the internal furnace volume in which such combustion takes place.

HEAT VALUE, HIGH

The heat liberated per pound of refuse when burned completely and the products of combustion are cooled to the initial temperature, as in a calorimeter.

HEAT VALUE, LOW

The high heat value minus the latent heat of vaporization of the water formed by burning the hydrogen in the fuel.

HOG FEEDING

A conservation process in which the food waste or garbage portion of refuse is disposed of by feeding to hogs. State regulations throughout the country require that garbage be treated prior to feeding.

HORSEPOWER

A measurement of power that includes the factors of force and speed. The force required to lift 33,000 pounds one foot in one minute.

HORSEPOWER, DRAWBAR

Horsepower available to move a tractor and its load, after deducting losses in the power train.

HORSEPOWER, SHAFT (FLYWHEEL OR BELT HORSEPOWER)

Actual horsepower produced by the engine, after deducting the drag of accessories.

HOST

The living body, human or animal, that provides food and shelter for the disease organisms.

HUMUS

Decayed organic matter. A dark fluffy swamp soil composed chiefly of decayed vegetation, that is also called peat.

HYDRAULIC GRADIENT

Change in the hydraulic head per unit distance.

HYDRAULIC HEAD (WATER IN SOIL)

The elevation with respect to a standard datum at which water stands in a riser or manometer connected to the point in question in the soil.

HYDROGEN SULFIDE

Gas product of the reduction of sulfate, odorous in concentrations as small as parts per billion.

HYDROGRAPHER

Person who measures and analyzes discharge, precipitation and runoff, etc.

HYDROLOGY

Science dealing with the properties, distribution and flow of water on or in the earth.

IDLER

A wheel or gear which changes the direction of rotation of shafts, or the direction of movement of a chain or belt.

IMPACTMILL

A grinding machine that operates by impaction of material against heavy metal projections rigidly attached to a shaft rotating at a high velocity.

IMPERVIOUS

Resistant to penetration by fluid.

INCINERATION

The controlled combustion process of burning solid, liquid, or gaseous combustible wastes to gases and to a residue containing little combustible material.

INCINERATOR

Any device used for the burning of refuse where the factors of combustion, i.e., temperature, retention time, turbulence; and combustion air, can be controlled.

INCINERATOR, BATCH FED

An incinerator which is charged with refuse periodically; the charge being allowed to burn down or burn out before another charge is added.

INCINERATOR, COMMERCIAL

A predesigned, shop-fabricated unit, possibly shipped assembled as a package for general refuse.

INCINERATOR, CONTINUOUS FEED

An incinerator into which refuse is charged in a nearly continuous manner so as to maintain a steady rate of burning.

INCINERATOR, INDUSTRIAL

A specifically designed, site-erected unit for disposal of a particular industrial waste.

INCINERATOR, MULTIPLE CHAMBER

An incinerator consisting of two or more refractory-lined chambers, interconnected by gas passage ports or ducts and designed in such a manner as to provide for complete combustion of the material to be burned. Depending upon the arrangement of the chambers, multiple-chamber incinerators are designated as in-line or retort types.

INCINERATOR, MUNICIPAL

A specifically designed, site-erected unit for disposal of refuse collected from residential, commercial, and industrial sources.

INCINERATOR, RESIDENTIAL

A predesigned, shop-fabricated unit, shipped assembled as a package for individual dwellings.

INCUBATION PERIOD

The time interval between the infection of a susceptible person or animal and the appearance of signs or symptoms of the disease.

INDORE PROCESS

Anaerobic composting method originating in India in the 1920's. Organic waste such as garbage, straw, leaves is placed in alternate layers with night soil, sewage sludge or animal manure into pits or trenches 2 or 3 feet deep or piled on open ground to a height of about 5 feet. Pile is turned twice in six months; drainage is used to keep compost moist. Similar to Bangalore process. The Van Mannen process is a recent modification.

INFECTION

The entry and development or multiplication of a particular pathogen in the body of man or animal.

INFECTION (RESERVOIR OF)

Man, animals, plants, soil or inanimate organic matter in which an infectious agent lives and multiplies and depends primarily for survival, reproducing itself in such manner that it can be transmitted to man. Man himself is the most frequent reservoir of infectious agents pathogenic for man.

INFLUENT STREAM

Stream or portion of stream that contributes water to the groundwater supply.

INOCULUM

Material such as bacteria placed in a culture medium, soil, compost, etc. in order to initiate biological action.

INTERFLOW

That portion of rainfall which infiltrates into the soil and moves laterally through the upper soil horizons until intercepted by a stream channel or until it returns to the surface at some point down slope from its point of infiltration.

ISOTROPIC SOIL

Soil having the same property (or properties), such as permeability, in all directions.

JUNK

A collection of secondary materials; sorted but unprocessed.

LANDFILL

Deposition of refuse on land with earth cover applied on a weekly or more frequent basis so that no nuisance or insult to the environment results.

LANDFILL, SANITARY

- a) A method of disposing of refuse on land without creating nuisances or hazards to public health or safety, by utilizing the principles of engineering to confine the refuse to the smallest practical area, to reduce it to the smallest practical volume, and to cover it with a layer of earth at the conclusion of each day's operation or at such more frequent intervals as may be necessary. ASCE
- b) A sanitary landfill is a system for final disposal of solid waste on land, in which the waste is spread and compacted on an inclined, minimized working face in a series of cells and a daily cover of earth is provided so that no hazard or insult to the environment results. (DHEW, CPE, ECA, Training Institute, Solid Waste Management Branch)

LANTZ PROCESS

A destructive distillation process, in which combustible fractions of solid waste are converted to combustible gas, charcoal, and a variety of distillates.

LEACHATE

Liquid emanating from a land disposal cell that contains dissolved, suspended and/or microbial contaminants from the solid waste.

LIFT

A layer of cells covering a designated area of a sanitary landfill.

LIFT DEPTH

Vertical thickness of a compacted volume of solid waste plus thickness of cover material immediately above the same volume of solid waste in a sanitary landfill.

LIQUID LIMIT

Minimum moisture content which will cause soil to flow if jarred slightly.

LOAM

A soft, easily worked soil containing sand, salt, and clay.

LOAMY

A broad grouping of soil texture classes; includes all sandy loams, clay loams, loam, silt, and silt-loam textures. Sometimes subdivided into moderately coarse-textured, medium-textured, and moderately fine-textured groups.

LYSIMETER

Device to measure the quantity or rate of water movement through or from a block of soil, usually undisturbed and in situ, or to collect such percolated water for analysis.

MANOMETER

A u-shaped tube or an inclined tube filled with a liquid used to measure pressure difference.

MANURE

The fecal and urinary defecations of livestock and poultry. Manure may often contain some spilled feed, bedding or litter.

MEMBRANE BARRIER

Thin layer or thickness of material impervious to the flow of gas or water.

METALS

In the secondary materials industry, includes all nonferrous materials, copper, brass, aluminum, zinc, lead, etc.; not iron and steel.

METHANE

An odorless, colorless, nonpoisonous and explosive gas, one source is from sanitary landfills undergoing anaerobic microbial decomposition.

MICROORGANISMS

Generally any living things microscopic in size and including the bacteria, actinomycetes, yeasts, simple fungi, some algae, rickettsiae, spirochaetes, slime molds, protozoans, and some of the simpler multicellular organisms. Some produce disease in man, animals, or plants; some are involved in stabilization of solid waste (composting) and sewage.

MIXING CHAMBER

Chamber usually placed between the primary combustion chamber and the secondary combustion chamber where thorough mixing of the products of combustion and air is accomplished by turbulence created by increased velocities of the gases, checker-work and/or turns in direction of the gas flow.

MOISTURE PENETRATION

Depth to which moisture penetrates following irrigation or rainfall before the rate of downward movement becomes negligible.

MULTICYCLONE

A dust collector consisting of a number of cyclones, operating in parallel through which the volume and velocity of gas can be regulated by means of dampers in order to maintain dust-collector efficiency over the load range.

MUNICIPAL COLLECTION

See COLLECTION, MUNICIPAL

MULTIPLE CHAMBER INCINERATOR

See INCINERATOR, MULTIPLE CHAMBER.

NITROGEN OXIDES (NO_x)

Gases formed from atmospheric nitrogen and oxygen whenever anything is burned in air. Usually NO_x breaks down to oxygen and nitrogen except when NO_x is cooled suddenly from a high temperature.

OCEAN DISPOSAL

See DISPOSAL, OCEAN

ODORANT

A gaseous nuisance which is offensive or objectionable to the olfactory senses.

ODOR THRESHOLD

The lowest concentration of an odor in air that can be detected by a human.

OFFAL

Intestines and discarded parts from the slaughter of animals.

OPACITY RATING

The apparent obscuration of an observer's vision to a degree equal to the apparent obscuration of smoke of a given rating on the Ringelmann Chart.

OPEN BURNING

Uncontrolled burning of wastes in the open or in an open dump.

OPEN DUMP

The consolidation of waste from one or more sources at a central disposal site which has little or no management. Some of the problems associated with open dumps are: vector breeding, fires, air pollution, water pollution, unsightliness, wasted land, disease and accident potentials.

ORGANIC

Containing carbon. Organic materials oxidize or burn easily and, when they contain nitrogen or sulfur - or both - they give off odorous by-products. See METHANE, HYDROGEN-SULFIDE.

ORGANIC ACID

A product of biochemical activity containing the carboxyl group which readily reacts with other compounds.

ORGANIC CONTENT

Synonymous with volatile solids except for small traces of some inorganic materials such as calcium carbonate which will lose weight at temperatures used in determining volatile solids.

ORSAT

An apparatus used for analyzing flue gases volumetrically by measuring the amounts of carbon dioxide, oxygen, and carbon monoxide.

OSBORNE SEPARATOR

Device to effect the efficient removal from compost of small particles of glass, metals, and other products. Patented by R.G. Osborne Laboratories, Los Angeles. Utilizes a pulsed rising column of air to separate heavy items contained in compost. Also called deglasser.

OVERFIRE AIR

See AIR, COMBUSTION (SECONDARY)

OXIDATION

Removal of electrons from an atom or molecule.

OXYGEN RECORDER

An instrument for continuously monitoring the percentage oxygen content of flue gas.

PARTICLE CONCENTRATION

Concentration expressed in terms of number of particles per unit volume of air or other gas. (Note: On expressing particle concentration, the method of determining the concentration should be stated; that is, number/vol. or wt./vol.)

PARTICLES

A small, discrete mass of solid or liquid matter. Included under particles are aerosols, dusts, fumes, mists, smokes, and sprays.

PARTICLE SIZE

An expression of the size of liquid or solid particles expressed as the average or equivalent diameter.

PARTICLE SIZE DISTRIBUTION

The relative percentage by weight or number of each of the different size fractions of particulate matter.

PARTICULATE MATTER

Material which is suspended within or discharged to the atmosphere in finely divided liquid or solid form at atmospheric temperature and pressure.

PATHOGEN

Any infective agent capable of producing disease; may be a virus, rickettsia, bacterium, protozoan, etc.

PEAT (HUMUS)

A soft light swamp soil consisting mostly of decayed vegetation.

PERCHED WATER TABLE

Underground water lying over dry soil, and sealed from it by an impervious layer.

PERCOLATION

A qualitative term applying to the downward movement of water through soil.

PERMEABILITY (QUALITATIVE)

The quality or state of a porous medium relating to the readiness with which it conducts or transmits fluids.

pH

Negative log of Hydrogen Ion concentration.

PICKING TABLE OR BELT

Table or belt at which solid waste is sorted by removing certain items. Normally associated with composting and salvaging operations.

PIN, TRACK

A hinge pin connecting two sections or shoes or a crawler track.

PITOT TUBE

An instrument which will sense the total pressure and the static pressure in a gas stream. It is used to determine gas velocity.

PLASTICITY (SOIL)

Property of a soil which allows it to be deformed without appreciable volume change or cracking.

PLASTIC LIMIT

The minimum amount of water in terms of percent of oven-dry weight of soil that will make the soil plastic.

POLLUTANTS, AIR

Any solid, liquid or gaseous matter in the effluent which tends to pollute the atmosphere.

POLLUTION

The presence in a body of water (or soil or air) of substances of such character and in such quantities that the natural quality of the body of water (or soil or air) is degraded so it impairs the water's usefulness or renders it offensive to the senses of sight, taste, or smell. Contamination may accompany pollution. In general, a public health hazard is created, but in some cases only economy or esthetics are involved as when waste salt brines contaminate surface waters and when foul odors pollute the air.

POLYVINYL CHLORIDE - (PVC)

A common plastic material (general formula $\text{CH}_2 = \text{CHCl}$) which releases HCl when burned.

POROSITY

Ratio of the space in any porous material (such as a soil) that is not filled with solid matter, to the total space occupied; generally expressed as a percentage. The porosity of an aquifer is equal to the sum of the specific yield and the specific retention.

POWER TAKEOFF

A place in a transmission or engine to which a shaft can be so attached as to drive an outside mechanism.

POWER TRAIN

All moving parts connecting an engine with the point or point where work is accomplished.

PREMISES

A tract or parcel of land with or without habitable buildings.

PRESSURE

Total load or force acting upon a surface expressed as a weight per unit area i.e. pounds per square inch (psi).

PRIMARY AIR

(See PRIMARY COMBUSTION AIR)

PRIMARY COMBUSTION CHAMBER

See COMBUSTION CHAMBER (PRIMARY)

PRIVATE COLLECTION

See COLLECTION, PRIVATE

PROCESS WEIGHT

The total weight of materials introduced into an incinerator including solid fuel charges but excluding liquid or gaseous fuels and combustion air.

P.S.I. (PSI)

Pressure in pounds per square inch.

PULVERIZATION

The crushing of brittle material such as glass to a small size.

PUTRESCIBLE

Capable of being decomposed by micro-organisms with sufficient rapidity as to cause nuisances from odors, gases, etc. Kitchen wastes, offal, and dead animals are examples of putrescible components of solid waste.

PUTRESCIBLE MATTER IN RESIDUE

Unburned organic matter in the residue that is fermentable, or capable of decaying, or of assimilation by animals and micro-organisms.

PYROMETER

An instrument for measuring and/or recording temperature.

QUARRY

A rock pit. An open cut mine in rock chosen for physical rather than chemical characteristics.

RADIATION PYROMETER

A pyrometer which determines temperature by measuring the intensity of radiation from a hot body.

RASPING MACHINE

A grinding machine consisting of a large verticle drum containing heavy hinged arms which rotate horizontally over a rasp and sieve floor.

RASPING SYSTEM

A composting procedure in which refuse is ground through a screen partly covered with steel pins that have the effect of a rasp. Compost piles are turned during a three to six week period. Developed in the Netherlands in 1951.

RATED LOAD

The maximum load which a crane is designed to handle safely.

REDUCTION (IN CHEMISTRY)

Addition of electrons to an atom or molecule.

REFRACTORY (REFRACTORIES)

Nonmetallic substances capable of enduring high temperatures and used in linings of furnaces. While their primary function is resistance to high temperature, they are usually called upon to resist one or more of the following destructive influences: abrasion, pressure, chemical attack and rapid changes in temperature.

REFUGE

A hiding place or shelter for rats, mice, and insects. It is important to distinguish between refuge and refuse, the latter being synonymous with solid waste. The confusion comes about because refuse frequently serves as a refuge for vermin.

REFUSE

Comprises all solid wastes of the community and semi-liquid or wet wastes with insufficient liquid content to be free flowing Synonym Solid Waste.

REFUSE, COMMERCIAL

All solid wastes which originate in businesses operated for profit even as office buildings, stores, markets, theaters and privately owned hospitals and other institutional buildings.

REFUSE, DOMESTIC

All those types which normally originate in the residential household or apartment house. Does not include bulky wastes requiring special pickup.

REFUSE FILL

A systematic and periodic operation conducted to compact and cover the refuse, on less than a daily basis. (See OPEN DUMP)

REFUSE, INDUSTRIAL

All solid wastes which result from industrial processes and manufacturing operations such as factories, processing plants, repair and cleaning establishments, refineries and rendering plants.

REFUSE, MOISTURE CONTENT

The weight loss on drying a sample to constant weight under standard conditions, tentatively 70°C for refuse.

REFUSE (RESIDENTIAL)

See REFUSE (DOMESTIC)

REFUSE SHED

A region or area which for reasons of topography, contiguous population and/or other common features, includes refuse sources which may be considered collectively in general planning. Usually synonymous with the general populated or metropolitan area, and not necessarily limited by lines of political jurisdiction.

REFUSE, STREET

Material picked up by manual and mechanical sweeping of streets and sidewalks, litter from public letter receptacles, and dirt removed from catch basins.

REFUSE TRAIN

A number of open carts hitched in series and pulled by a motor vehicle, the purpose of the train being to collect solid waste.

RENDERING

A process of salvaging fats and oils, animal feed, and other products from animal waste by cooking. Dead animals, fish, and wastes from slaughter houses and butcher shops are commonly used.

RESIDUE

All of the solid material collected from the process of incineration, consisting of grate siftings, material from off the end of the grates and particulate collected from air pollution control devices.

RESPIRATION

Any energy-yielding oxidation in a living organism in which the oxidant is an inorganic compound. Oxygen need not be involved, though it is the most common oxidant.

RESPIRATION, AEROBIC

Oxidation of organic compounds by oxygen. (See also RESPIRATION).

RESPIRATION, ANAEROBIC

A type of respiration among some bacteria in which an inorganic oxidant (NO_3 , SO_4) other than oxygen is used. (See also RESPIRATION)

RETAINING WALL

A wall separating two levels.

RINGELMANN CHART

A printed or photographically reproduced series of four shades of gray, by which density of smoke emissions from an incinerator may be estimated. A clear stack is recorded as 0, and 100% black smoke as 5. No. 1 smoke is 20% dense; No. 2, 40% dense; No. 3, 60% dense; No. 4, 80% dense.

RIPARIAN RIGHTS

Rights of a land owner to water on or bordering his property, including right to prevent diversion or misuse of upstream water.

RIPPER

A towed machine equipped with teeth, used primarily for loosening hard soil and soft rock.

ROLL BAR

Steel protection over the cab of a tractor or loader to prevent injury to the operator.

ROLLER, SUPPORT

In a crawler machine, a roller that supports the slack upper part of the track.

ROLLER, TRACK

In a crawler machine, the small wheels that rest on the track and carry most of the weight of the machine.

RUBBISH

Non bulky domestic and commercial solid waste exclusive of garbage.

RUBBISH CHUTE

A pipe, duct or trough through which waste materials are conveyed by gravity from the upper floors to a storage area preparatory to burning or compaction.

RUBBISH, COMBUSTIBLE

Miscellaneous burnable materials. In general, the combustible component of rubbish.

RUBBISH, NONCOMBUSTIBLE

Miscellaneous refuse materials that are unburnable in ordinary incinerators.

RUBBISH, YARD

Prunings, grass clippings, weeds, leaves, and general yard and garden wastes.

RUBBLE

Broken pieces of masonry and concrete.

RUNOFF

The portion of precipitation or irrigation water which is returned to the stream as surface flow.

SAND

Soil particles ranging from 0.05 to 2.0 mm in diameter. Soil material containing 85 percent or more particles of this size.

SALVAGING

The controlled removal of reusable materials.

SANITATION

The control of all those factors in man's physical environment which exercise or may exercise a deleterious effect on his physical development, health, and survival.

SATURATE

To fill all the voids in a material with fluid, to form the most concentrated solution possible under a given set of physical conditions in the presence of an excess of the substance.

SCARIFIER

See RIPPER

SCAVENGING

The uncontrolled picking of materials.

SCOOTER

A small, usually single-passenger, 3-wheeled vehicle with body of 1 cubic yard capacity, used in refuse collection especially to negotiate long driveways and narrow alleys. Collected refuse is emptied into a collection truck. Some have dump bodies; others have a stationary bed which holds the collector's carry-cans.

SCRAP

In the secondary materials industry, applies to iron and steel scrap only.

SCRUBBER, FLUE GAS

See FLUE GAS SCRUBBER (WASHER)

SECONDARY AIR

(See COMBUSTION AIR (SECONDARY))

SECONDARY COMBUSTION CHAMBER

(See COMBUSTION CHAMBER SECONDARY)

SECONDARY MATERIALS

Those materials which might go to waste if not collected and processed for reuse. Includes scrap, metals, waste, and junk. (See under definitions of each).

SECTION

An area equal to 640 acres or 1 square mile.

SEEPAGE

Movement of water through soil without formation of definite channels.

SEPARATOR, BALISTIC

A separating device that operates by dropping mixed material onto a high speed rotary impeller so that materials of different physical characteristics are hurled off at different velocities and subsequently land in several separate collecting bins.

SEPARATOR, INERTIAL

A material separation device that relies on ballistic or gravity separation of materials having different physical characteristics.

SEPARATOR, MAGNETIC

Any separating device that removes metals by means of magnets.

SEMI-GROUSER

A crawler track shoe with one or more low cleats.

SERVICE STOP

Residence, commercial establishments, or other living or business unit receiving periodic refuse collection service.

SETTLEMENT

A gradual subsidence of material.

SETTLEMENT, DIFFERENTIAL

A subsidence of material that is not uniform throughout the plane of the material.

SETTLING CHAMBER

Any chamber designed to reduce the velocity of the products of combustion to promote the settling of fly ash from the gas stream.

SETTLING VELOCITY

The velocity at which a given dust will fall out of dust-laden gas under the influence of gravity only. Also known as "terminal velocity".

SEWAGE SLUDGE

A semiliquid substance consisting of suspended sewage solids combined with water and dissolved material in varying amounts.

SEWAGE TREATMENT RESIDUES

Coarse screenings, grit, and dewatered or air-dried sludge from sewage treatment plants, and pumpings of cesspool or septic tank sludges, which require disposal with municipal solid wastes.

SHALE

A rock formed of consolidated mud.

SHEARS

A size reduction machine that operates by cutting material between large blades.

SHEEPSFOOT

A tamping roller with feet expanded at their outer tips.

SHOE

A ground plate forming a link of a track, or bolted to a track link. A support for a bulldozer blade or other digging edge to prevent cutting down.

SHORING

Temporary bracing to hold the sides of an excavation from caving.

SHOVEL

A digging and loading machine or tool.

SHOVEL, DIPPER (SHOVEL) (DIPPER STICK)

A revolving shovel that has a push type bucket rigidly fastened to a stick that slides on a pivot in the boom.

SHOVEL DOZER (DOZER SHOVEL)

A tractor equipped with a front-mounted bucket that can be used for pushing, digging, and truck loading.

SHOVEL, HOE (DRAGSHOVEL; PULLSHOVEL, DITCHING SHOVEL, BACKHOE)

A revolving shovel having a pull-type bucket rigidly attached to a stick hinged on the end of a live boom.

SHOVEL-OFF

Any collection vehicle lacking a mechanical emptying device, and which must be unloaded by hand.

SHOVEL, REVOLVING

A digging machine that has the machinery deck and attachment on a vertical pivot, so that it can swing independently of its base.

SHOVEL-UP

Refuse which is not stored in containers for collection, and must be laboriously hand loaded with forks or shovels into a carrying container or collection vehicle.

SHREDDERS

Chops up discarded automobiles and other ordinarily low-grade sheet and coated scrap in continuous operation producing premium grade fist - sized pieces that are 99 per cent steel.

SHRINKAGE

Loss of bulk of soil when compacted in a fill. Usually is computed on the basis of bank measure.

SILT

Small, 0.05 to 0.002 mm in diameter, mineral soil grains intermediate between clay and sand. Waterborne sediment with diameters of individual grains approaching that of silt. Soil material containing 80 percent or more silt and less than 12 percent clay.

SINTERING

A heat treatment which causes adjacent particles of material to cohere at a temperature below that of complete melting.

SLAG

A liquid mineral substance formed by chemical action and fusion at furnace operated temperatures.

SLAGGING OF REFRACTORIES

Destructive chemical action upon refractories at high temperatures, resulting in the formation of slag. Also, the coating of refractories by ash particles, which form a molten or viscous slag on the refractories.

SLOPE

Degree of deviation of a surface from the horizontal, usually expressed in percent or degrees.

SLOUGH

Wet or marshy area.

SLURRY

Cement grout

SMOKE

An aerosol consisting of all the dispersible particulate products from the incomplete combustion of carbonaceous materials entrained in flue gas as gaseous medium.

SMOKE ALARMS

Instruments that provide an objective method of continuous measurement and recording of smoke density by measuring the amount of light obscured by smoke when a beam of light is shone through the smoke in a flue. Most of the instruments have on them a scale, graded according to Ringelmann shades. They can be fitted with an alarm that operates when the smoke is above a preset density.

SMOKE DENSITY

The amount of solid matter contained in smoke and often measured by systems that relate the grayness of the smoke to an established standard.

SOIL

Natural body, developed from weathered minerals and decaying organic matter, covering the earth. The upper layer of the earth in which plants grow.

SOIL EROSION

Detachment and movement of soil from the land surface by wind or water, including normal soil erosion and accelerated erosion.

SOIL, (HEAVY)

A fine grained soil, made up largely of clay or silt.

SOIL, ISOTROPIC

Soil having the same property (or properties), such as permeability, in all directions.

SOIL, TIGHT

Soil that is relatively impermeable to water movement.

SOLID WASTE MANAGEMENT

The purposeful systematic control of the storage, collection, transportation, processing and disposal of solid waste.

SPARK ARRESTER

A screen-like device to prevent sparks, embers, or other ignited materials above a given size from being expelled to the atmosphere.

SPECIFIC GRAVITY (SOLIDS OR LIQUIDS)

The ratio of the mass of a body to an equal volume of water.

SPOIL

Dirt or rock which has been removed from its original location.

SPOT LOG

A log or marker placed to show a truck driver the spot where he should stop to be loaded.

SPOTTER

In truck use, the man who directs the driver into loading or dumping position.

STABILIZE

To make soil firm and to prevent it from moving.

STACK (CHIMNEY, FLUE)

A vertical passage for conducting products of combustion to the atmosphere.

STACK EFFECT

The phenomenon of vertical movement of hot gases in a stack because of the temperature (density) difference between the gases and the atmosphere.

STADIA

Measurement of distance by proportion to the space on a vertical rod seen between upper and lower instrument cross hairs, usual proportion is one vertical to 100 horizontal.

STAKE, SLOPE

A stake marking the line where a cut or fill meets the original grade.

STATION

Any one of a series of stakes or points indicating distance from a point of beginning or reference.

STATIONARY PACKER

An adjunct of a refuse container system which compacts refuse at the site of generation into a pull-on detachable container (see PULL-ON CONTAINER).

STEERING BRAKE

A brake which slows or stops one side of a tractor.

STEERING CLUTCH

A clutch which can disconnect power from one side of a tractor.

STERILIZATION

Destruction of all microorganisms and their spores outside the body by chemical or physical means.

STOCKPILE

Material dug and piled for future use.

SUBSIDENCE

To settle or sink. Usually applied to peat and muck soils and refers to the settling due to oxidation, compaction, shrinkage, and wind erosion.

SUBSOIL

That part of the soil beneath the topsoil, usually that not having an appreciable organic matter content.

SULFUR, OXIDES OF

Compounds of sulfur combined with oxygen. Those of significance in air pollution include sulfur dioxide (SO_2) and sulfur trioxide (SO_3).

SUMP

Pit, tank, or reservoir in which water is collected or stored.

SURFACE COMPACTION

Molding together and collapse of structure of surface soil when subjected to pressure.

SURFACE CRACKING

Creation of discontinuities in the cover material of a sanitary landfill as a result of settlement and decomposition of solid waste and/or a change in moisture content of the cover material which may result in exposure of solid waste, entrance or egress of vectors and entrance of water.

SURFACE WATER

A body of water whose top surface is exposed to the atmosphere including a flowing body as well as a pond or lake.

SURVEYING

To find and record elevations, locations, and directions, by means of instruments.

SWILL (SLOPS)

Semi-liquid waste material consisting of garbage and free liquids.

TAILINGS

Second grade or waste material separated from pay material during screening or processing.

TAMP

Pound or press soil to compact it.

TAMPING ROLLER

One or more steel drums, fitted with projecting feet, and towed by means of a box frame.

TANDEM

A double-axle drive unit for a truck or grader. (A bogie).

THEORETICAL AIR

(See COMBUSTION AIR - THEORETICAL)

THERMAL CONDUCTIVITY

The specific rate of heat flow per hr. through refractories, expressed in Btu per sq. ft. of area, for a temperature difference of one degree Fahrenheit, and for a thickness of one inch. Btu/(sq. ft.) (hr) (deg. F) (in.)

THERMAL SHOCK RESISTANCE

The ability to withstand sudden heating or cooling or both without cracking or spalling.

THERMOCOUPLE

Two lengths of wire; made from different homogeneous metals, connected to form a complete electric circuit which develops an electromotive force (emf) when one junction is at a different temperature than the other.

THERMOPHILS

Bacteria or other microorganisms which grow best at temperatures of roughly 45° to 60°C. Not to be confused with thermotolerant, which resist high temperatures. Others: mesophiles - grow best at medium temperature, 25° to 40°C; psychrophiles - grow best at colder temperatures, below 20°C.

TIDAL MARSH

Low flat marshlands traversed by inter-laced channels and tidal sloughs and subject to tidal inundation. Vegetation usually consists of bushes, grasses, and other salt tolerant plants.

TILTH

Soil condition in relation to lump or particle size.

TILTING DOZER

A bulldozer whose blade can be pivoted on a horizontal center pin to cut low on either side.

TIPPING FLOOR

Unloading area for vehicles that are delivering refuse to an incinerator.

TOE

The projection of the bottom of a face beyond the top.

TONS PER DAY (INCINERATION)

Denotes the weight of refuse which can be properly processed by an incinerator within a 24 hour period.

TOPSOIL

The topmost layer of soil, usually refers to soil containing humus which is capable of supporting a good plant growth.

TOPOGRAPHIC MAP

A map indicating surface elevation and slope.

TORQUE, FULL LOAD

The torque necessary for a motor to produce its rated horsepower at full-load speed.

TOTAL COST OF BIDDING

A method of establishing the purchase price for movable equipment where by the buyer is guaranteed that maintenance shall not exceed a set maximum amount during a fixed period of time (normally 5 years) and that the equipment will be repurchased by the seller at a set minimum price at the end of the fixed time period.

TRACK

A crawler track.

TRACK, CRAWLER

One of a pair of roller chains used to support and propel a machine. It has an upper surface which provides a track to carry the wheels of the machine, and a lower surface providing continuous ground contact.

TRACK ROLLER

In a crawler machine, the small wheels which are under the track frame and which rest on the track.

TRACTOR (CRAWLER)

See TRACTOR TRACK

TRACTOR LOADER (TRACTOR SHOVEL OR SHOVEL DOZER)

A tractor equipped with a bucket which can be used to dig, and to elevate to dump at truck height.

TRACTOR, PNEUMATIC WHEEL

A gas or diesel powered machine equipped with 4 pneumatic tires, used to spread, excavate and compact soil and solid waste.

TRACTOR, RUBBER-TIRED

See pneumatic wheel tractor.

TRACTOR, TRACK

A gas or diesel powered machine equipped with continuous roller belt over cogged wheels for moving over rough or low bearing capacity terrain, used to spread, excavate and compact soil and solid waste.

TRANSFER STATION

A fixed facility used for removing refuse from collection trucks and placing it in long-haul vehicles.

TRASH

Exact meaning is vague but it is usually synonymous with rubbish.

TRAVEL TIME

The elapsed or cumulative time of travel between collection stops on the route.

TREAD

The ground contact surface on a tire or track shoe.

TROUGHING

Making repeated dozer pushes in one track, so that ridges of spilled material hold dirt in front of the blade.

TRUCK, BOTTOM DUMP (DUMP WAGON)

A trailer or semitrailer that dumps bulk material by opening doors in the floor of the body.

TRUCK, COMPACTOR COLLECTION

Enclosed vehicle provided with special mechanical devices for loading the refuse into the main compartment of the body, for compressing the loaded materials, and for distributing the refuse within the body.

TRUCK CAPACITY

Volumetric capacity for refuse.

TRUCK, DUMP

A truck or semitrailer that carries a box body with a mechanism for discharging its load.

TRUCK, PLATFORM (RACK BODY TRUCK)

A truck having a flat open body.

TRUCK, REAR DUMP (END DUMP)

A truck or semitrailer that has a box body that can be raised at the front so the load will slide out the rear.

UNDERGROUND RUNOFF (SEEPAGE)

Water flowing toward stream channels after infiltration into the ground.

UTILITY (PRIVATE)

Firm providing service under a government license or monopoly franchise. May collect or dispose of solid waste.

VAN MANNEN PROCESS

Anaerobic composting process which is a modification of the Indore method (which see). Used in the Netherlands from about 1932. City refuse is heaped in long rows and moistened. Decomposition takes about six months.

VAPOR PLUME

The stack effluent consisting of flue gas made visible by condensed water droplets or mist.

VAPORS

The gaseous form of substances which are normally in the solid or liquid state and which can be changed to these states either by increasing the pressure or decreasing the temperature alone.

VECTOR (OF DISEASE)

A living insect or other arthropod, or animal (not human) which transmits infectious diseases from one person or animal to another.

VEHICLE, ABANDONED

Motor vehicles and trailers that are discarded on public or private property longer than a specified time.

VEHICLE (OF INFECTION)

Water, food, milk, or any substance or article serving as an intermediate means by which the pathogenic agent is transported from a reservoir and introduced into a susceptible host through ingestion, through inoculation or by deposit on the skin or mucous membrane.

VOLATILE MATTER OF REFUSE

The weight loss of a dry sample on heating to red heat in a closed crucible.

VOLATILE SOLIDS

The sum of the volatile matter and fixed carbon of a refuse sample, as determined by allowing a dried sample to burn in a heated and ventilated furnace.

WALL, AIR-COOLED

A wall in which there is a lane for the flow of air directly in back of the refractory.

WALL, CURTAIN

A partition wall between chambers, which serves to deflect gases in a downward direction. (Sometimes referred to as a drop arch.)

WALL, SUPPORTED

A furnace wall that is anchored to and has its weight transferred to a structure (usually steelwork and castings) outside of the high temperature zone.

WALL, WATER-COOLED

A furnace wall containing water tubes.

WASTE

Useless, unwanted, or discarded materials resulting from normal community activities. Wastes include solids, liquids, and gases, solid wastes are classed as refuse.

WASTE HANDLING

The manipulation or transportation of waste.

WASTE, PROCESSING OF

An operation in which the physical or chemical characteristics of the waste is changed. Example of this would include compaction, composting and incineration.

WATERSHED

Total land area above a given point on a stream or waterway that contributes runoff to that point.

WASTE, SOLID

See REFUSE

WATER TABLE

The surface of underground, gravity-controlled water.

WET DIGESTION

A solid waste stabilization process proposed by Dr. William Oswald of the University of California, on the basis of experience with anaerobic sewage lagoons. A wide variety of mixed solid organic wastes is placed in an open digestion pond to decompose anaerobically. Much of the carbonaceous matter is converted into carbon dioxide and methane. The soluble and suspended fraction is converted aerobically by algae in a biooxidation pond.

WET MILLING

Mechanical size reduction of solid waste after it has been wetted to soften the paper and carboard constituents.

WETTING AGENT

A chemical that reduces the surface tension of water so that it soaks into porous material more readily. Example - synthetic soap powder.

WORKING DRAWING

Any drawing showing sufficient detail so that whatever is shown can be built without other drawings or instructions.

WORKING FACE

That portion of the compacted solid waste at a sanitary landfill which will have more waste placed on it and/or is being compacted prior to placement of cover material.

ZOONOSIS

A disease of animals transmissible to man. Some examples are anthrax, bubonic plague, murine typhus, some of the salmonellae.

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CONNECTICUT STATE DEPARTMENT OF HEALTH
SOLID WASTES SECTION

RODENT CONTROL PROGRAMS AT REFUSE DISPOSAL AREAS

When closing a site or converting an open-face dump to a sanitary landfill type of operation, it will be necessary to carry out a rodent-baiting program. The rodents must be exterminated so that they will not migrate to surrounding areas when their food supply is cut off at the refuse disposal site.

A Time Schedule

- 1 It will be necessary to close the site for a minimum of three days.
 - a On the first day, the site must remain free of activity to allow the rodents to feed on refuse deposited on the previous day.
 - b On the second day, the bait is distributed in burrows and in sheltered areas.
 - c On the third day, the rodents are allowed to feed on the bait.
- 2 Dumping may be resumed and heavy equipment should be brought in on the fourth day to initiate conversion to sanitary landfill and/or to spread, compact, cover and seal the area if the site is being closed. There should be no delay in completing this work.

B The Bait

- 1 Upon agreement with local officials to bait an area, the Connecticut State Department of Health will order the poison and have it sent to the town. The town should notify this department when the poison has been delivered in order that a date for baiting may be scheduled.
- 2 The town will be responsible for storing the poison safely, preferably under lock and key.
- 3 The ingredients are to be purchased by the town and mixed under the supervision of the staff of the Connecticut State Department of Health.

4 Ingredients for a 100 pound mix:

- a 90 pounds of fish meal cat food.
- b 10 pounds of corn meal.
- c 25 ounces of zinc phosphide poison (contains an emetic).

C Distributing the Bait

- 1 The town will be responsible for the following:
 - a Have men available for work with heavy shoes.
 - b Provide, for each worker, gloves which are to be disposed of afterwards.
 - c Provide a mixing container, hoes for mixing, and a spade.
 - d Provide long-handled spoons and buckets or pails for each worker.
 - e Provide soap and water for immediate hand washing after distributing the poison.
- 2 There will be no smoking while distributing the bait.
- 3 The Connecticut State Department of Health will supervise the distribution program.

Baiting should not be done on days when rain or snow is predicted during the next 24 hours. On the morning of the day scheduled for the baiting program, there should be close communications between the state and town officials to be certain that the weather conditions are favorable for the baiting program.

Rats may contain disease-bearing fleas and ticks and, therefore, care should be taken to assure they are promptly buried in with the refuse during conversion operations with minimum of handling.