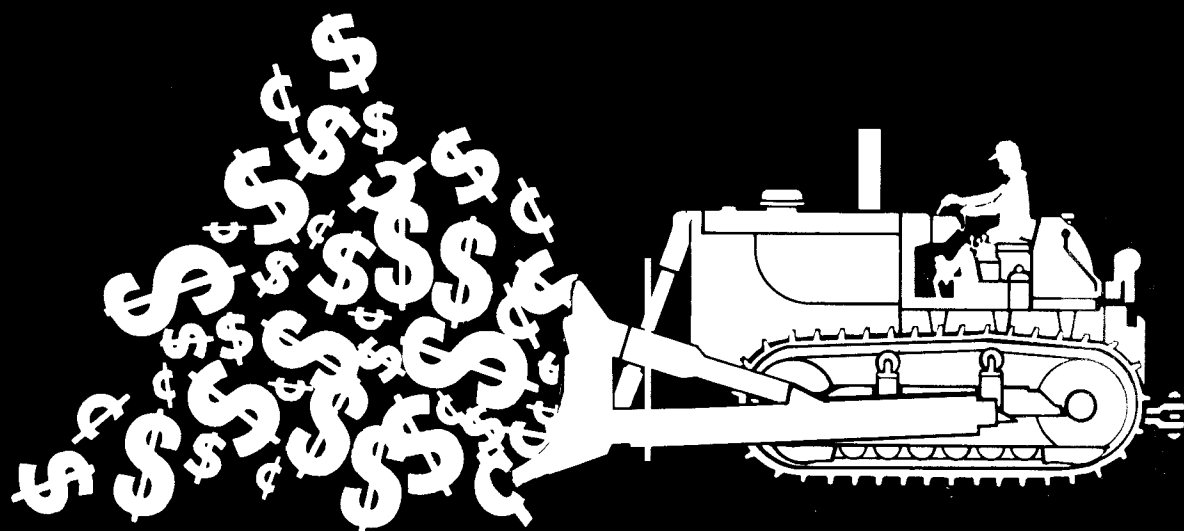


AN
ACCOUNTING
SYSTEM
for
sanitary landfill
operations



AN
ACCOUNTING
SYSTEM

for
sanitary landfill operations

This report (SW-15ts) was written by

Eric R. Zausner

Environmental Protection Agency
Library, Region V
1 North Wacker Drive
Chicago, Illinois 60606

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
ENVIRONMENTAL HEALTH SERVICE
Bureau of Solid Waste Management

1969

ENVIRONMENTAL PROTECTION AGENCY

Library of Congress Catalog Card No. 70-604125

public health service publication no. 2007

FOR SALE BY THE SUPERINTENDENT OF DOCUMENTS
U.S. GOVERNMENT PRINTING OFFICE, WASHINGTON, D.C. 20402 - PRICE 35 CENTS

20-0-271015

AN ACCOUNTING SYSTEM

for
sanitary landfill operations

Eric R. Zausner

The increasing costs and complexities of solid waste handling require new, more sophisticated management techniques. Data on performance and the costs of operation and ownership are essential for the use of these management tools. Hence, an adequate information system is a prerequisite to effective management. Although cost accounting represents only one part of the total information system, its design, installation, and utilization can represent the most significant step in the development of effective solid waste management.

Present information on landfill activities and associated costs is both inadequate and nonstandardized. The proposed system provides a guide to the type and quantity of information to be collected, its classification, and the method of collection. It is intended to be of use to municipal or private personnel involved in landfill operation and ownership.

Installation of a cost accounting system can aid the landfill manager in controlling the costs and performance of the operation, and also in planning for the future.

System Benefits

Implementation of a system such as the one described herein has several important advantages, as follows:

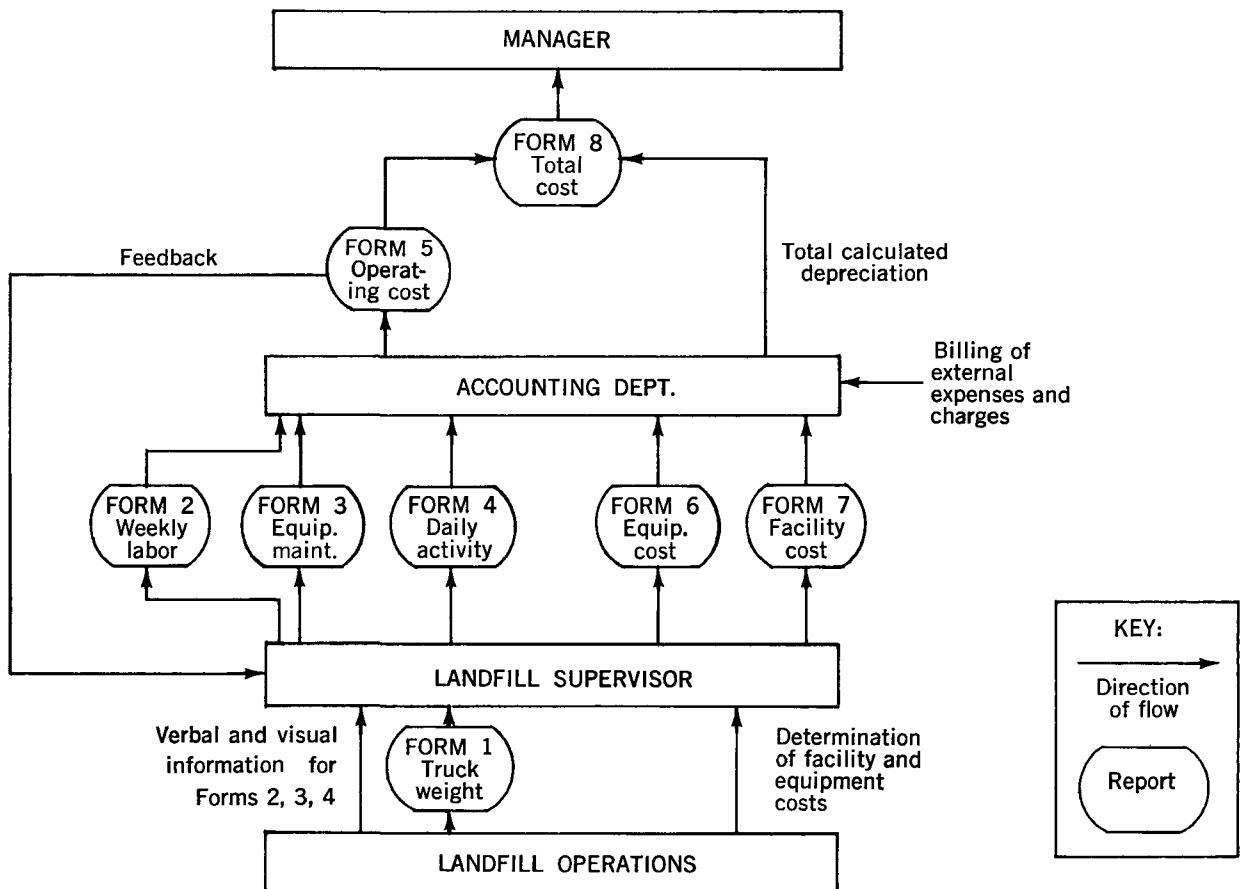
1. It facilitates the orderly and efficient collection and transmission of all relevant data. In fact, much of the recommended data is probably already being collected, although haphazardly and inefficiently. Hence, the added cost of implementing the system is minimal.
2. Reports are clear and concise, presenting only data required for effective control and analysis. Because they can be completed and understood by landfill personnel, operation of the system can be made almost foolproof.
3. The data is grouped in standard accounting classifications. This simplifies interpretation of results and comparison with data from previous years or other operations. In turn, this allows analysis of relative performance and operational changes.
4. The system accounts for **all** relevant costs of operations.
5. Accumulated data from the system can over a period of time lead to standards of performance and efficiency. These standards are used to control costs. They indicate what costs are high and what is causing them. The landfill supervisor may then take corrective action.
6. The system includes automatic provisions for accountability. Cost control becomes more effective when the individual responsible for cost increases can be pinpointed.
7. The collected data aids in short-range and long-range forecasting of operating and capital budgets. This facilitates estimation of future requirements for equipment, manpower, land, cash, etc., which, in turn, aids planning at all levels of management. The data is also available for later evaluation and analysis, using operations research techniques.
8. With only minor modifications, the system is flexible enough to meet the varying requirements of landfills of different size and scope.

Reports and Information Flow

The cost system is designed for medium-size sanitary landfills. It assumes that the community or private firm has an accounting section or department to aid in preparation of the summary reports. The system also assumes that a scale is on-site. Actual measurement of solid waste quantities is possible only with scaled weights. Due to the system's flexibility, however, neither of these assumptions is critical. Only minor modifications are required to adopt the system to significantly larger or smaller operations. Due to the diversity of disposal operations no attempt will be made to suggest all of the possible variations.

The flow of information through the cost system is by means of reports (Diagram I). The eight reports transmit in-

DIAGRAM I
INFORMATION FLOW DIAGRAM



formation from the field where data is recorded to the point of data use — various levels of supervision and management.

The reports are most easily classified as those that are prepared daily and those that are prepared at less frequent intervals. Cost control, responsibility accounting, and the preparation of periodic summary statements cannot be accomplished without the daily recording of all pertinent activity and cost information. Data not recorded daily is not retrievable at some later date.

Daily truck weight record (Form 1). This form records the quantities, sources, and types of solid wastes delivered to the site. Cover material, if it is delivered from off-site, may be recorded on this form. If the cover material is acquired on the site, the "cover material" column may be deleted or a daily estimate of cubic yards may be recorded. The information is recorded manually on this form for the entire day. If the landfill has a scale that automatically records the weight data, that part of the form would be replaced by the weight ticket. Each delivery is recorded separately by the weighmaster. A second weighing of the empty truck may be taken, or the vehicle's tare weight (as determined by a licensing agency, etc.) may be substituted.

Truck identification, load weight, and solid waste type are useful in billing private concerns and others for the privilege of using the landfill. The record of truck delivery times and frequency, along with truck identification, load weight, and waste type, are an important aid to operation and control of a municipal collection system.

Weekly labor ticket (Form 2). This record of labor activity is recorded in duplicate at the landfill. One copy is forwarded to the payroll department for determining weekly wages. The other copy is used by the landfill supervisor for computing total labor hours and the assignment of these hours to the landfill's various activities.

Monthly equipment maintenance record (Form 3). This form facilitates the detailed collection of equipment operation and associated cost data. A separate sheet is used for each piece of equipment at the site. Daily entries are made as appropriate. The form is used for an entire month.

MONTHLY EQUIPMENT MAINTENANCE REPORT

SITE: _____

PERIOD: from _____ to _____

EQUIP. IDENT.: _____

Day	Hours operated	Fuel cost	Maintenance						
			Type of repair or service	Hours down	Labor hours	Labor cost	Parts cost	External cost	Total cost
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
25									
24									
26									
27									
28									
29									
30									
31									
Totals			XXXX						

Instructions: To be completed by the landfill supervisor at the end of each day. Entries under maintenance should be made only as they occur. This sheet is only for one piece of equipment.

BSWM (7/69)

Daily activity summary (Form 4). This form summarizes the truck deliveries, solid waste quantity disposed of, man-hours worked, machine hours utilized, cover material used (if measured or estimated), and miscellaneous expenses incurred. Since this provides a continuous cover material inventory, it is useful in keeping the landfill supervisor advised as to his present status and when more cover material will be required. The form is used for an entire month. It is completed at the end of each day by the landfill supervisor. At the end of the month, it is forwarded to the accounting department.

Less Frequently Prepared Reports

These reports may be prepared as often as desired. The Operating Cost Report is used for control purposes. Hence, the more frequently it is prepared (perhaps even weekly), the more useful it would be. The remaining reports are summary reports (preparation quarterly would be sufficient).

Landfill operating cost report (Form 5). This report summarizes the landfill's operations. It is compiled from all the daily tickets. As a summary of the landfill's total operating costs, it may be used to hold the supervisor responsible for any adverse trends in costs. In addition, the calculated unit cost and efficiency factors are helpful to the supervisor in analyzing these adverse cost trends and controlling them. This is more fully discussed under **system utilization**.

If most of the expenses incurred in operating the facility are billed directly to the municipality, the necessary cost data required for preparation of this form would not normally be available to the supervisor. Under these circumstances, the supervisor should forward the information he has collected (the daily tickets) to the accounting department. This department will then compile the complete Operating Cost Report and send a copy back to the landfill supervisor.

A more detailed breakdown of the expenses that should be included under each category is in Form 5a. Form 5a need not be prepared; it is only shown to indicate the relevant cost groupings.

DAILY ACTIVITY SUMMARY

SITE: _____

DATE: ____ / ____ / ____

SIGNATURE: _____

DAY	Solid waste		Cover material				Man hrs.	Machine hrs.		Expense*		Site hrs.
	Loads	Tons	Begin	Rec'd	Used	Remain		Use	Down	\$	Type	
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												
30												
31												
Totals			X			X					X	

Instructions: To be completed by landfill supervisor at the end of each day. Some of data is to be summarized from Forms 1 and 2. Record cover material in either tons or cubic yards. Today's beginning cover material equals yesterday's remaining.

* Record only miscellaneous expenses that would not be recorded by the accounting department and are incurred at the site.

BSWM (7/69)

LANDFILL OPERATING COST REPORT

SITE: _____

PERIOD OF REPORT: from _____ to _____

	Data	Actual this period	% var. from budget	% var. from last period	% var. this period last year
Totals	Total tons received				
	Total operating cost				
	Total operating cost/ton				
Unit costs*	Labor/ton				
	Cover material/ton				
	Equip. operation/ton				
	Overhead/ton				
Efficiency factors*	Cover material util.				
	Overtime hours/total labor hours				
	Labor efficiency				
	Equip. % downtime				
	Equipment utilization				
	Equipment efficiency				

Instructions: To be completed by accounting department from Forms 1, 2, and 3. One copy to landfill supervisor.

* Calculations: Unit cost = aggregate cost ÷ tons solid waste received. Note that cover material unit cost is cover material cost ÷ tons of solid waste received.

Cover material utilization = cover material used ÷ tons of solid waste received.

Labor efficiency = tons received ÷ labor hours.

Equipment utilization = tons received ÷ equipment hours.

Equipment efficiency = equipment cost ÷ equipment hours.

Equipment % downtime = total hours down ÷ total equipment hours.

BSWM (7/69)

FORM 5a

OPERATING COST CLASSIFICATIONS

Labor costs

Include all wages at base pay, plus all overtime pay, and labor fringe benefits.*

Cover material costs

Include all costs for the delivery of cover material. This category may be excluded if cover material is not delivered from off the site. The cost of labor, equipment, and overhead required to obtain on-site cover may be substituted.

Machine operating costs

Include oil, gasoline, grease, equipment repairs, and maintenance.

Overhead costs

Include all utilities, supervisor's salary, building repairs and maintenance, liability and property insurance, and charges from other departments.

*Labor fringe benefits include group insurance, pension costs, social security contributions, vacation costs, etc., whether actually budgeted to the operating agency or absorbed in municipal general funds.

Equipment and facility cost reports (Forms 6 & 7). These two reports are compiled at the landfill site or wherever the data is available. They are then updated only when additional equipment or facilities are acquired. The periodic depreciation charges are then computed and posted by the accounting department.

Landfill total cost summary (Form 8). This report summarizes all the activities and costs incurred by the landfill during the period. It is compiled from data available in present and past Operating Cost Reports and the depreciation data available on the Facility and Equipment Cost Reports.

Report Flow Summary

A brief summary may help to put the system in perspective. Operating reports are generated daily at the landfill site and transmitted periodically to the accounting department. The accounting department combines these reports with additional information it accumulates to produce total operating costs.

System Utilization

Now that the actual system has been described and one possible set of forms illustrated, utilization must be discussed. Only with efficient and intensive utilization of the information generated, can the additional time, effort, and money required to implement and maintain the system be justified.

All the factors which affect the quality and effectiveness of sanitary landfill operations can be translated into costs. Extent of cover material use, the size of the face, degree of compaction, litter control and dust control, among others, determine how good a job of sanitary landfilling is performed, and they are more costly than simple operation of an unattended open dump. Cost control at a landfill does not call for economizing at the expense of quality. To the contrary, once a level of acceptable operation has been determined along with the attendant costs, the cost control system can help the supervisor maintain that level of operation.

The routine control of costs is slightly more complicated. Effective cost control has two prerequisites: recognition of

LANDFILL FACILITY COST REPORT

SITE: _____

DATE: ____ / ____ / ____

(for use by acctg. dept. only)

Item or category	Description	Date put in use	New cost	Est. total life	Other comments	Annual depreciation	Monthly depreciation
All land						XXXXXX	XXXXXX
Roads							
Lights							
Fences							
Surveys							
Other							
Improvements							
Scales							
Garages							
Buildings							
Other							
Facilities							
Totals	X	X		X	X		

Instructions: To be completed by supervisor or accounting dept., if they have data available. "Est. total life" should be based on remaining life as estimated by the supervisor. Land purchased subsequent to the original land purchase should be included. Depreciation may be either straight-line or on an accelerated basis.

LANDFILL TOTAL COST REPORT

SITE: _____

PERIOD OF REPORT: from _____ to _____

Data	For this period	Budget --- this period	Year to date	Budget --- year to date
Tons of solid waste received				
Total operating cost				
Total depreciation cost				
Total cost				
Operating cost per ton				
Depreciation cost per ton				
Total cost per ton				

Instructions: To be completed by the accounting department, when requested or periodically, from data available in operating cost report or capital cost reports. Copies sent to the city manager (or his equivalent).

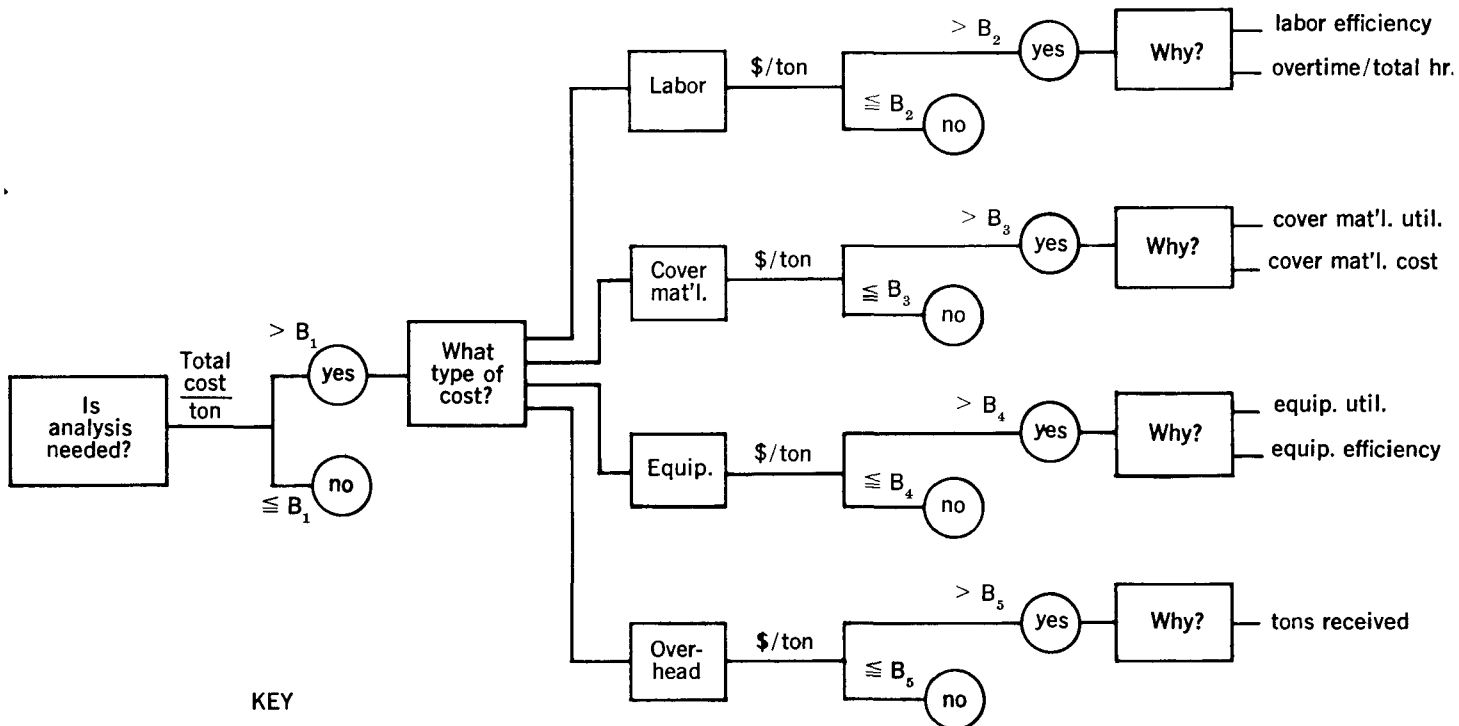
excessive costs and identification of responsibility for the increased costs. By comparing present unit costs with the currently budgeted unit costs and the actual unit costs of the previous period and the same period last year, some determination can be made of whether present costs are excessive. The determination of responsibility is facilitated by the efficiency factors. The system described allows both of these critical factors to be determined. Corrective action may then be effectively initiated.

At the highest level of management, the Total Cost Report indicates whether costs are excessive, in which case the supervisor of the particular sanitary landfill can be held responsible. The supervisor, in turn, can use the cost system to determine the cause of increased costs. He may trace the increased costs to the particular cost element, and possibly to the employee, piece of equipment, or method of operation responsible. All of the needed data is in Form 5 (the Operating Cost Report). To aid the supervisor in the analysis of Form 5, a decision tree may be used (Diagram II). It illustrates the methodology required to analyze the cause of increased costs. For clarity, a hypothetical situation will be examined.

Let us assume that the landfill supervisor receives his copy of the Operating Cost Report from the accounting department. His analysis of the data starts at the extreme left of Diagram II. Quite obviously, the first question to be answered is whether any analysis is required. If total operating cost per ton is less than or equal to the budget, the answer is No. However, if total cost per ton is greater than the budget, additional analysis is indicated. Next, it is desirable to isolate the cost element which is abnormally high. It may be one or more of the four shown (labor, cover material, equipment, or overhead). Let us assume that only labor cost per ton is higher than its budgeted amount. (We are now on the uppermost branch.) We must determine why labor cost per ton increased, so that corrective action can be taken. Several factors are listed which may be relevant. Assume "overtime hours per total labor hours" is excessive. This implies that either scheduling is poor, there is a temporary peak load, the

DIAGRAM II

DECISION TREE FOR SANITARY LANDFILL COST VARIANCE ANALYSIS



KEY

- B_1 = Total cost/ton budgeted
- B_2 = Labor cost/ton budgeted
- B_3 = Cover mat'l. cost/ton budgeted
- B_4 = Equip. cost/ton budgeted
- B_5 = Overhead cost/ton budgeted

employees are working overtime when not required, or perhaps more regular employees are required. Under any of these circumstances, corrective action could be initiated by the supervisor.

This example is an over-simplification of actual operations. Nevertheless, it does illustrate the use of the decision tree (Diagram II) and more importantly, the methodology needed

to pinpoint and correct factors which might have caused increased costs.

In addition to routine cost control, the data collected is useful in doing special analyses of trends in composition and quantity of wastes, peak load hours, on-site waiting times, and equipment evaluations. These and other quantitative evaluations can improve performance and reduce the costs of operation.

U S GOVERNMENT PRINTING OFFICE 1970 O-380-584

Environmental Protection Agency
Library, Region V
1 North Wacker Drive
Chicago, Illinois 60606