

**Forest Service Handbook National
Headquarters - Washington Office
Washington, DC**

Forest Service Handbook 7409.11 – Sanitary Engineering and Public Health Handbook

Chapter 80 - Solid Waste Management

Amendment: 7409.11-Amendment-3

Effective date: May 1976

Duration: This amendment is effective until superseded or removed.

Superseded Directive:

Approved by:

Date approved:

Responsible Staff:

Explanation of changes:

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80.5 - Definitions

The definition of terms used in solid waste operations are or will be contained in Environmental Protection Agency (EPA) guidelines for solid waste recovery, collection, separation, and disposal systems. These guidelines will be published in the Federal Register as a requirement of the Solid Waste Disposal Act of 1965 (P.L. 89-272) and as amended by the Resource Recovery Act (P.L. 91-512). The requirement sections of these guidelines are mandatory for Forest Service operations.

To date, only thermal processing and land disposal of solid waste guidelines have been published in the Federal Register (40 CFR 240, 241). As other guidelines are developed, they will be incorporated as references to appropriate parts of this handbook.

The term "solid waste" does not include solids or dissolved material in domestic sewage or other significant pollutants in water resources, such as silt, dissolved or suspended solids in industrial wastewater effluents, dissolved material in irrigation return flows, or other common water pollutants.

80.8 - References

1. Solid Waste Management in Recreational Forest Areas Study for U.S. Department of Agriculture - Forest Service, SW-16ts, Charles S. Spooner, 1971. This establishes waste-generation rates for major recreation activities and determines cost of solid waste handling for selected Forest Service areas. It will enable officials to make more accurate estimates of volume and weight generated by various types of recreation use and projected new recreation facilities.

Cost and generation rates should be modified as local and Regional information is collected from operating existing systems.

2. Decision-Makers Guide in Solid Waste Management - U.S. Environmental Protection Agency, Office of Solid Waste Management Programs, 1974. Provides guidelines for selection and design of the various segments of a solid waste system. Discusses pertinent factors involved in economics of operation and description of available techniques that could be considered as alternatives.

Many of the discussions concern municipal government decisions; however, many of the principles are applicable to all solid waste systems. The chapters on residential solid waste collection in rural areas, transfer stations, and solid waste processing could apply to Forest Service systems.

3. Design Criteria for Solid Waste Management in Recreational Areas - U. S. Environmental Protection Agency, Harry R. Little, 1972. This contains guidelines for managing a solid waste system for recreation areas. This includes information on elements of a solid waste system and additional tables of equipment costs, some of which were discussed in item 1. There is additional information on transfer stations and methods of estimating costs of collection, transportation, and disposal. The publication also contains an appendix on accounting systems

for solid waste handling, showing data forms, and reports that enable field personnel to monitor existing solid waste operations and compare estimated versus actual costs for the budgeting and programming process.

All of these publications are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D. C. 20402.

81 - Solid Waste System

A solid waste system consists of the interlocking subsystems of collection, storage, transportation, processing, and final disposal of solid waste. The system serves an area of Forest Service land referred to as a watershed the boundaries of which are generally dictated by physical limitations of the transportation system or geographical features. In some cases, the watershed boundaries may be limited for economic reasons or State boundaries. Forest Service jurisdictional boundaries should not necessarily be a constraint on watershed boundaries. After long-range goals and program objectives are established as part of the land-use-planning process, a solid waste system is developed in four major steps:

1. An inventory program.
2. A system design program.
3. An operation and maintenance program.
4. An inspection and followup program.

82 - Inventory Program

A sound analysis is dependent on an accurate inventory of the solid waste factors, particularly those items that are related to waste generation, period of generation, and volume. A basic outline of the data needed is shown below. The exact amount of detail obtained for each item listed will depend on the specific requirements and constraints of the proposed systems.

1. Waste Generation Data.
 - a. Point of generation.
 - b. Volume generated.
 - c. Characteristics.
2. Transportation System Data.
 - a. Road length (miles).
 - b. Travel time (minutes - for various collection equipment).

3. Storage Data.

- a. Type of container (present and proposed).
- b. Placement of container (present and proposed).
- c. Time factors.

4. Collection Equipment Data.

- a. Type - existing and proposed.
- b. Capacity - existing and proposed.
- c. Time factors.

5. Disposal Opportunity Data.

- a. Location - present and proposed.
- b. Jurisdiction.
- c. Availability.

6. Cost Data.

- a. Equipment.
- b. Wages.
- c. Contract.
- d. Disposal.

7. Wasteshed Boundary Data.

- a. Physical constraints.

82.1 - Inventory-Data Recordkeeping

The inventory program must provide a method of filing the data collected in a logical manner. It must be possible to update and retrieve all information to monitor and control the system. A basic information file should consist of a Forest or District map overlay showing graphically the waste generation points, disposal sites, and transportation links between them. If needed,

supplemental data files on individual parts of the system, such as landfills, generation points, and transfer stations, can be made and keyed to the map.

If data was developed and coded to run in the SOWAD program (sec. 83.2), the data processing system is available for storage and retrieval of the information collected.

83 - Solid Waste System Design Program

This program will include all activities involved in evaluating inventory data and determining the best method or combination of methods of collection, storage, transportation and disposal to meet the solid waste management objectives established in a particular watershed.

There are normally a number of alternatives to be appraised containing numerous variables to be evaluated in the process of selecting effective, cost-efficient combinations. The objectives of system design are achieved through solid waste system analysis.

83.1 - Solid Waste System Analysis

System analysis is an approach to problemsolving applied to complex operations which are the result of interlocking actions of many related elements. It is used to reach new equilibrium when an adjustment in the operation of one element in the system touches off a chain reaction of adjustments in the functioning of other elements. For solid waste systems, it will tell how to make cost-effective use of available resources; how collection routes should be laid out, effects of various collection equipment and storage facilities, as related to disposal opportunities. It provides the cost for alternatives and, as a planning tool, it will tell how much each phase of system operation for each alternative plan will cost so that cost-effective choices are identified.

83.2 - Solid Waste System Design

Solid waste system design (SOWAD) is a computer program which has been developed in the Forest Service to aid in the analysis of complex solid waste systems and serve, in part, as the data bank on all solid waste systems. It is detailed in Solid Waste Systems Design (SOWAD) Computer Users' Guide, Ernest Hirsch and Malcolm Kirby, Management Sciences Staff, Forest Service, USDA, Berkeley, California, 1973.

Although the Users' Guide is specifically designed to handle a computer approach to systems analysis, it does describe many of the procedures necessary in any type of analysis of a solid waste problem.

83.3 - Solid Waste Collection

Waste collection involves the picking up of the solid waste from points within the watershed area and is very closely interfaced with transportation routes to these sites and the disposal area. Collection and transportation are the most costly part of the Forest Service solid waste system. Waste collection and transportation can be conducted by either Forest Service personnel (force account) or by formal contract or cooperative agreement. The differences between these methods and the total cost involved should be compared from both the economic and

administrative viewpoint. Beside the direct cost factors, the following items should be considered:

1. Contracting or cooperative agreements can provide flexibility in supporting a total solid waste management operation. A private contractor or local authority can work with adjacent Forest users, such as special-use permittees and private homes who could not be included in a normal force account operation. Often the combined total volume enables the contractors to provide the collection service at a cost below that needed to operate a separate Forest Service system of equal quality.
2. Contract collection tends to offer a wider range of storage and collection hardware. Advantage can be taken of all sizes of bulk containers and variety of utilization schedules.
3. Contract collection does not use up any Forest Service manpower ceilings, and workload is reduced to inspection and administration of the contract.
4. Certain key phases of the contract or agreement require supervision and inspection by a competent engineer to ensure compliance; especially for activities like water quality monitoring, evaluation of construction specifications, and review of complex operating procedures.
5. Number and capability of available contractors in the area.

The majority of the cost in a force account or contract operation is attributed to wages. Particular attention must be devoted to the alternatives available in collection systems. Items that most seriously affect collection costs are frequency of collection, assigning excessive manpower, low utilization of specialized collection equipment, excessive or inefficient waste pickup points and uncontrolled utilization of public areas.

Frequency of collection should not exceed twice a week and should be limited to once a week wherever possible. Additional collections required for holiday periods or other exceptionally high use periods should be limited to the duration of a special need. Collection frequencies can generally vary between the height of the recreation season and its beginning or ending periods.

Forest Service collection crews should be limited to the minimum size that is consistent with the method and equipment employed. It generally requires special circumstances to gain efficiency by using multiman crews.

or normal operations of collecting and controlling material deposited in authorized containers, solid waste collection methods used by the Forest Service must comply with requirements contained in Environmental Protection Agency Guidelines for the Collection of Residential, Commercial and Industrial Solid Wastes. Preliminary copies of these guidelines are available through the Washington Office Engineering Staff. The guidelines will be distributed when finalized.

Consideration should be given to special collection-disposal systems, such as pack it in--pack it out. Pack it in-pack it out requires a cooperative effort by the Forest users. They are asked to collect, store, and transport their solid waste either off the Forest or to a designated storage point. No public collection services are provided. Instead, direction and information signs are erected, and, in some systems, a convenient supply of plastic sacks for collecting solid waste is provided.

Best applications of this system are in areas that receive light recreational use where collection costs are high due to distance and remote locations; for example, small end-of-the-road, destination-type facilities and trail heads. Only applications that reduce costs or save manpower should be considered.

Communications, publicity, and personal public contact by Forest Service personnel are important factors in making the system work. These costs must be considered.

The pack it in--pack it out system is new and applications are changing. Personnel interested in this system should check with the Washington Office and with other Regions for latest reports and information.

83.4 - Solid Waste Storage

Onsite storage is the provision of containers that receive the waste at the time it is discarded. The capacity required is dependent upon the frequency of waste collection and the amount of waste being generated. The type of container must be compatible with the type of collection equipment employed. All containers should meet Environmental Protection Agency collection guidelines or local codes, whichever are more stringent.

Containers that are to be emptied manually must not exceed a 32-gallon capacity to avoid personal injury from lifting filled containers. Use of plastic liners has eliminated the need to be handling the heavier container shell. Damaged containers should be replaced immediately.

Where larger containers are utilized in conjunction with mechanical collection devices, attention must be given to the safety features and utility they offer the user. The placement and appearance of onsite storage containers must receive a three-way consideration by installation planners. Trade-offs must occur to achieve results among:

1. Efficient collection and safety (sufficient number and capacity).
2. Utility for the user (containers conveniently located).
3. General appearance (attractively designed to encourage use).

Less storage capacity can be furnished, because of better utilization of available storage, if placement is done in such a way as to prevent the user from developing a possessive attitude toward a particular container. Single containers at individual recreation units encourage this possessiveness and result in overflowing containers in some areas while others receive little or no waste. Consolidation of storage benefits collection by introducing fewer pickup points. Odor

and vector control depends mostly on the tightness of containers, regardless of their location; however, for those who are encouraged to deposit waste, it is desirable to limit their encouragement to areas away from the user's other activities.

83.5 - Solid Waste Transportation

This phase involves the selection of equipment (vehicles) and routing (transportation system) necessary to haul solid waste from the collection point to the disposal area. Most Forest Service operations will consist of trucks using a combination of Forest Service, county, and State routes. The selection of any particular routing and equipment combination will depend on the economics; usually lowest total -- purchase plus maintenance plus operation -- costs and exact local requirements. Solid waste system design analysis or simple time and cost calculations can be used to check out and compare alternatives.

Transportation routing and equipment capabilities should consider the establishment and use of transfer stations (sec. 80.8, item 2). No exact criteria exists for deciding on when a transfer station should be used. The usual application involves a situation where the disposal site is far enough away to result in many man-hours spent in hauling.

83.6 - Solid Waste Disposal

Laws, regulations, and policies on solid waste disposal sites are covered in FSM 7460. The crucial nature of the impact of the disposal site requires the utmost care in selection of an area as a disposal area and the construction and operation of the final facility.

Exhibit 1 may be used in the preliminary investigation of possible suitable areas for sanitary landfills. Before final site locations are chosen, however, a thorough soils and geological investigation by qualified individuals is necessary.

Exhibit 1

SOIL CHARACTERISTICS USED IN DETERMINING SITE SUITABILITY FOR SANITARY LANDFILLS

Soil Characteristic	Suitable Range	Range of Limited Suitability	Unsuitable Range
Depth: Of developed solum To hard rock	Over 3 feet Over 6 feet	1 1/2 - 3 feet 4 - 6 feet	Less than 1 1/2 feet Less than 4 feet
Drainage	Well drained	-----	All with restricted drainage
Depth to seasonal high watertable	Over 12 feet	6 - 12 feet	Less than 6 feet
Soil Texture - USDA Soil Classification	Sandy loam, fine sandy loam, loam silt loam, silty clay loam, sandy clay loam	Loamy sand, silt, clay loam, sandy clay	Clay, silty, clay sand, organic soil
Slop	0 – 8%	8 – 15%	Over 15%
Stoniness	Non stony, or slightly stony	Very stony	Extremely stony
Flooding Hazard	Never flooded	Flooded less frequently than once in 50 years	Flooded more frequently than once in 50 years
Risk of free flow to groundwater	Not underlain by limestone or coarse sand and gravel	6 or more feet of fine soil over limestone or coarse sand and gravel	Less than 6 feet of fine soil over limestone or coarse sand and gravel
Acidity	Below pH 6.5	Above pH 6.5	-----
Cation Exchange	Greater than 10 meq/100gm	5-10 meq/100gm	Less than 5 meq/100gm
Base Saturation	Below 60%	Above 60%	-----
1/ Loughry, F. Glade, <u>The Soil Factor in Sanitary Landfill</u> , Pennsylvania Department of Health, January 1968.			

84 - Operation and Maintenance Program

This starts with the implementation of the solid waste system selected and continues for as long as the system stays in service. The activities considered part of this program are:

1. Purchase and management of equipment.
2. Development of contract specifications, work plans, and instructions for force account crews.
3. Working with local authorities on problems involving solid waste operations involving Forest Service land and/or disposal of waste generated at Forest facilities.
4. Active data collection and records and reports of various waste generators and landfills and verifying volumes estimated versus volumes actually collected.
5. Developing cost data for input into the budget needs for future operations and establishing acceptable work standards for various solid waste operations.

85 - Inspection and Followup Program

This activity involves checking out of the system design and operation and evaluation of compliance with original plans and project criteria. Included in this program would be:

1. Inspection of Contract Operations. This must be done to ensure that the job is done as specified and the contractor paid. Followup action would include revisions of specifications, methods of estimated costs, and, if necessary, recommended contract work or change orders.
2. Special Uses. To ensure compliance with conditions of permits. Checklists can be developed, if needed. They would be used to document any discrepancies noted and serve as backing for getting these corrected or the permit cancelled.
3. Force Account. Work done by Forest Service crews should be checked for quality and quantity. Equipment should be checked for compliance with safety standards and efficiency of operations. Again, checklists could be developed to aid the inspection depending on the complexity of the operation.