# CHAPTER 3. MANAGEMENT ISSUES

Management Issues usually involve a Branch Chief. From there, considerations will move up the ladder as shown in Figure 3-A as priorities and importance dictate.

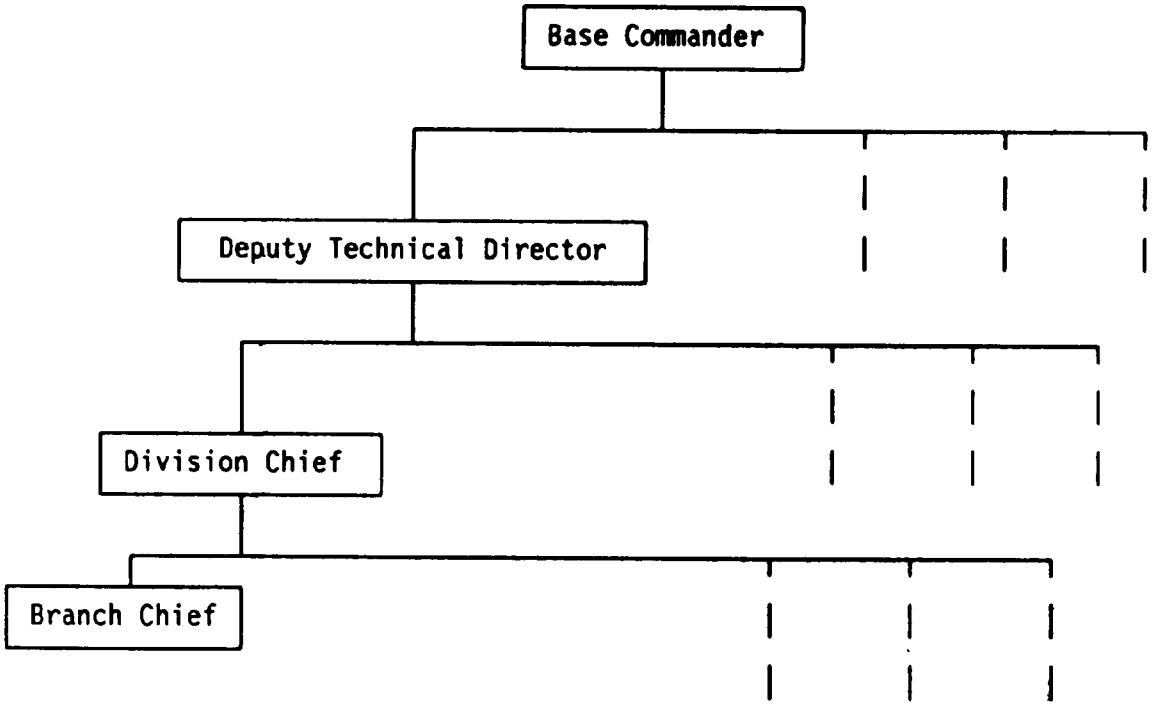


**FIGURE 3-A**
**Management Structure at Typical Military Installations**

## 3.1 PLANNING IN SOLID WASTE MANAGEMENT

3.1.1 Management Objectives. The general objective of management is to provide and maintain the system's required level of service through the efficient use of resources and management control. Specific objectives include:

- Environmental protection. To protect the health and aesthetic conditions of the living environment by removing waste in a sanitary fashion.
- Convenience. To provide a desired level of service (e.g., in terms of frequency and point of collection).
- Continuity. To provide for stability of this vital service. A contingency plan shall be available for periods when there is an interruption of collection service.

- Resource recovery and waste minimization. To reclaim and conserve natural resources.

- Safety. To store and collect the waste in as safe a manner as possible.

- Efficiency. To achieve all these objectives with the highest productivity and least cost.

3.1.2 Collection and Hauling Options

3.1.2.1 Collected solid waste is typically hauled from the point of collection to a disposal site in the collection vehicle. This procedure is called “direct haul."

3.1.2.2 Solid waste may be collected by either military personnel or contractors. There may also be a combination of approaches, depending on conditions at a specific installation. A common arrangement includes contracted collection in the family housing areas, and collection by military personnel from the commercial and industrial sources. However, collection and hauling from all areas of an installation can be accomplished by military personnel, or all solid waste collection can be contracted.

3.1.2.3 Solid waste collection (and in fact all aspects of solid waste management) are subject to the Office of Management and Budget (OMB)-required Commercial Activities (CA) reviews. Through these reviews the feasibility of providing solid waste services through contractors is assessed. If there is a cost advantage to contracted services, preference is given to that approach. Most installations have a Commercial Activities Coordinator who can answer questions about these reviews.

3.1.3 Collection Management

3.1.3.1 *Productivity.* Productivity is the ratio of output (results of activity) to input (resources consumed by the activity). The productivity of solid waste collection can be expressed in many ways, including cost per ton, cost per cubic yard, or work hours per ton/cubic yard.

- *Management responsibility.* It is management’s responsibility to design a solid waste collection system that is efficient and effective.

- *Higher productivity.* Increased productivity is not always achieved simply by the laborers working harder. Instead, in general, productivity can be increased through improved storage and collection methods such as better routing, more efficient storage devices, collecting one side instead of two sides of a street at a time, curbside collection, reduction in crew size, and mechanical systems.

3.1.3.2 *Employee Safety.* The collection and transfer system shall be operated so as to protect the health and safety of all personnel.

Regulations 29 CFR 1910 promulgated by Occupational Safety and Health Administration (OSHA) shall apply. The following general provisions shall apply to collection operations:

- *Safety manual.* Ensure that a safety manual is provided for use by the collection personnel. This manual shall include specific information on local conditions, equipment, methods, safety regulations, policies, and procedures. All personnel shall receive instructions and training in safe container and waste handling techniques and safe collection equipment operation. Back injury prevention shall be emphasized.

- *Safe driving.* Collection vehicles and equipment shall be operated in a safe, efficient manner, strictly obeying all applicable traffic and other laws.

- *Protective Equipment.* Protective equipment such as safety glasses, gloves, and footwear shall be used by collection personnel, and respirators as appropriate. Refer to Subpart I, 29CFR 1910.132-140 of OSHA Standards for General Industry.

- *Scavenging.* Scavenging shall be prohibited at all times to avoid injury and to prevent interference with collection operations.

- *Waste contact.* The potential for physical contact between the collectors and the waste, both solids and liquid, shall be minimized. When conducting manual carry-out collection, a leakproof carrying container shall be used. The collection vehicle operator shall be responsible for immediate cleanup of any spillage caused by his operations.

- *Noise disturbance.* The collection vehicle operator shall be responsible for avoiding any undue noise disturbances in residential areas.

- *Vehicle.* Vehicles shall have backup alarms as specified by DOT.

3.1.4 EPA Checklist

3.1.4.1 All operations concerning collection and storage of solid waste must comply with EPA guidelines or those established by state and local governments, which may be more stringent.

3.1.4.2 The EPA has developed a checklist of solid waste systems and operation policies (Figure 3-lB). The checklist summarizes the types of decisions that will be made by management in designing a solid waste collection and disposal system. Most, but not all, are relevant to military installations.

3.1.5 l,abor Relations. In any service or industry that is as labor-intensive as solid waste collection and disposal, a key to high productivity is management's ability to lead and work with employees. Management can promote and increase worker morale and productivity by developing better labor-relations techniques.

- Accidents shall be rapidly reported through supervisors to base safety office. Employees shall be trained to recognize unsafe acts and conditions and correctly perform job.

## CHECKLIST OF POLICIES AND PRACTICES

I. System Policies
- A. Organizational Policies
  1. Institutional arrangements
  2. Financing methods
  3. Billing system
  4. Subsidization of particular groups
  5. Legal issues
- B. Level-of-Service Policies
  1. Who receives service
  2. Citizen option versus mandatory services
  3. Point of collection
  4. Frequency of collection
  5. Type of storage devices
  6. Limit on amount of waste or number of containers
  7. Mechanized collection
  8. Yard wastes
  9. Bulk items
  10. Separate collection of garbage or recyclable materials
  11. Inner city cleanup programs
  12. Service for elderly and handicapped
  13. Corner-lot residences

II. Operational Policies
- A. Route Policies
  1. Crew size
  2. Type and size of equipment
  3. Whether drivers collect
  4. "Limousine" service
  5. Shuttle system
  6. Reservoir system
  7. Whether collection vehicle must be full before going to disposal site
  8. Times and sites for lunch and breaks
  9. Scheduling
  10. Vehicle routings and districts
  11. One-side or both-sides-of-street collection
  12. Whether vehicles can back down short street segments or make U-turns
  13. Routing on steep hills
  14. Dealing with enclosures and other obstacles
  15. Dealing with excessive haul times
  16. Seasonal variation of routes
- B. Labor Policies
  1. Wage structure
  2. Career ladder, seniority
  3. Training
  4. Safety measures and preventive health care
  5. Insurance and pension plans
  6. Holidays, vacations, sick leave
  7. Absenteeism
  8. Incentive system
- C. Management Policies
  1. Organizational structure
  2. Management information system
  3. Cost accounting system
  4. Handling requests and complaints
  5. Supervisory communications system
  6. Public relations program

FIGURE 3-1B
A Checklist of Policies and Practices for Solid Waste Management. Source: K. A. Shuster, EPA

! *Training.* Organized training in basic public relations, work rules, unit operations, safety, and equipment use and care shall be scheduled at regular intervals. Such training can reduce equipment breakdowns, improve both employee and public relations, reduce injury compensation claims, and ultimately reduce costs.

! *Safety.* Solid waste collection workers have a high injury frequency rate. Dramatic cost savings can be realized by implementing safety programs. Such safety devices as gloves, safety glasses, respirators, and special footwear can contribute significantly to the health and safety of workers.

3.1.6 Route Planning. The refuse foreman and collection truck drivers shall be involve in the routing process. To ensure maximum productivity, management shall consider potential cost savings from the three categories of routing: macro-routing, route balancing, and micro-routing.

! Macro-routing. Macro-routing determines the assignment of the daily collection routes to disposal facilities. The objective is to minimize the round-trip haul time (and hence hauling cost) from the collection routes to the disposal site. This generally means hauling to the closest disposal site. However, the closest site may not be the best choice if it has limited capacities (such as an incinerator), requires a long service time, has a poor safety record, or other such considerations. The selection of a disposal site for each collection route requires the supervisor to consider all factors that can reduce costs. Information essential to macro-routing includes haul times from the routes to the various processing and disposal sites, crew size and vehicle capacity, safety considerations, service times at the sites, condition of the site, and short and long-range capacities and costs of the sites.

! *Route balancing.* Route balancing is the process of determining the optimum number of services that constitute a fair day's work and dividing the collection task among the crews so that they have equal workloads. The data required for this analysis are: (1) time and distance data related to the components of the collection day; (2) the number and type of services and where they are located; (3) the average amount of waste generated per service, including seasonal variations; and (4) basic equipment and labor cost data. Route balancing is accomplished by analyzing each component of time in the collection day, or how each crew spends its time. Typical time components include:

  - going to or from garage to route
  - route collection time
  - to or from route to disposal site
  - time at disposal site
  - time for official breaks
  - slack time (lost time due to weather, breakdowns, etc.)

! *Micro-routing.* Micro-routing determines the path each collection vehicle will follow. The objective of micro-routing is to minimize the noncollection distance (repeat distance and streets with no services)

and delay times (such as U-turns, heavily trafficked streets, and left turns) for each collection vehicle. A common-sense approach to micro-routing includes the following general rules:

- Routes shall not be fragmented or overlapping. Each route shall be compact, consisting of street segments clustered in the same geographical area.

- The collection route shall be started as close to the garage or motor pool as possible.

- Heavily traveled streets shall not be collected during rush hours.

- Services on dead-end streets can be considered as services on the street segment that they intersect, since they can be collected only by passing down that street segment. To keep left turns at a minimum, however, the dead-end streets shall be collected when they are to the right of the truck. They must be collected by walking down, backing down, or making a U-turn.

- When practical, steep hills shall be collected on both sides of the street while the vehicle is moving downhill, for safety, ease, speed of collection, reduced wear on vehicle, and conservation of gas and oil.

- Higher elevations shall be at the start of the route.

- For collection from one side of the street at a time, it is generally best to route with many clockwise turns around blocks (Figure 3-1C).

- For collection from both sides of the street at the same time, it is generally best to route with long straight paths across street blocks.

- Minimize left turns, which generally are more difficult and time consuming than right turns. Also, right turns are safer, especially for right-hand-drive vehicles.

3.1.7 Collection Personnel

3.1.7.1 *Regular schedules.* For maximum efficiency, assign personnel with refuse-handling duties to regular schedules.

3.1.7.2 *Crew size.* Crew size selection will be affected by the amount of waste per stop, number and location of collection points, type of storage containers, haul time to unloading point, wage rates, labor preference, and management. In high-density population areas, the larger quantity of waste at a given stop makes larger trucks with three-man crews economically competitive with smaller crew sizes.

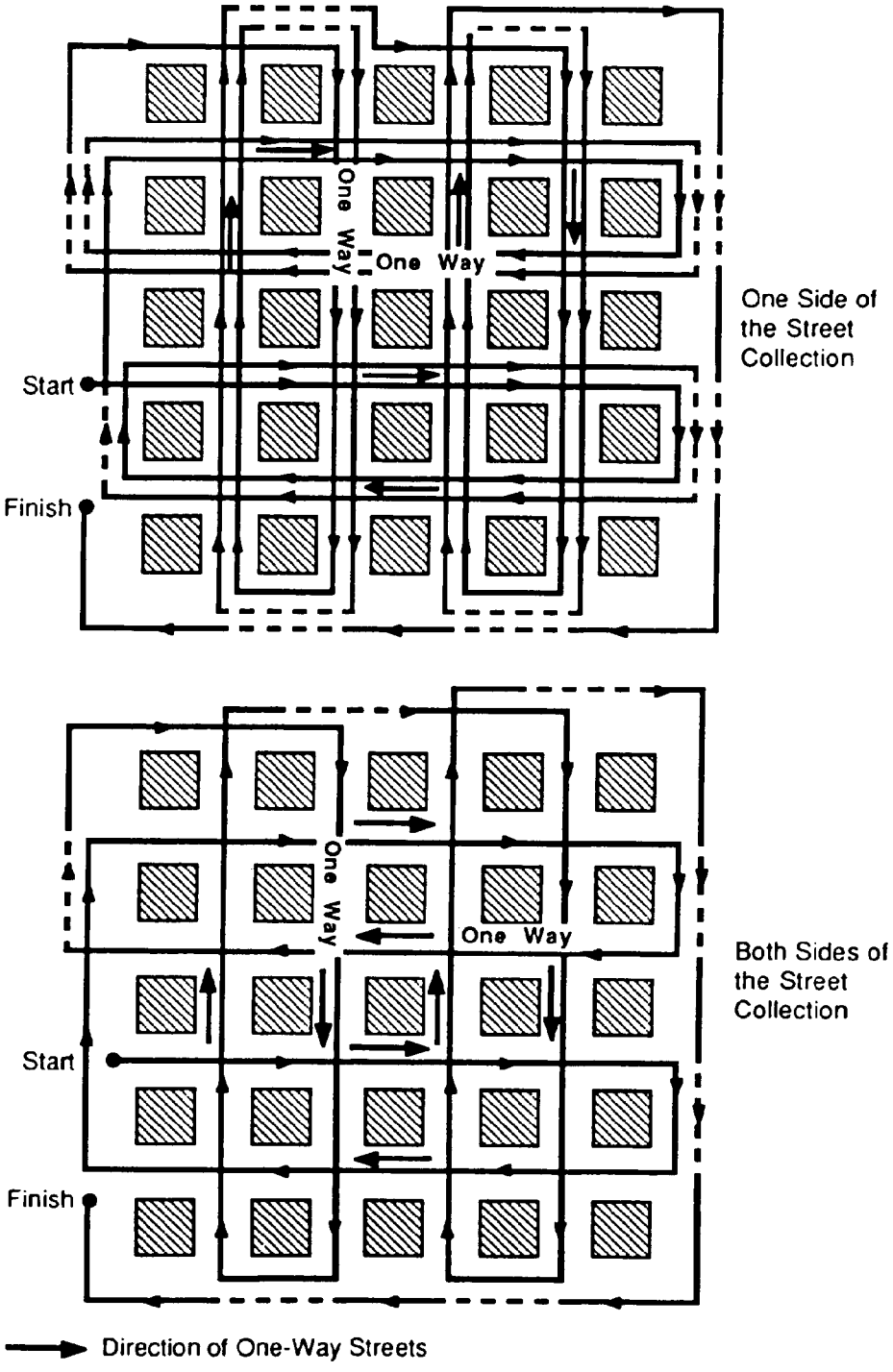


FIGURE 3-1C
Micro-Routing. Source: K. A. Shuster, EPA

3.1.7.3 *Collection crew.* Truck drivers and loaders are to be well-trained, competent personnel who are assigned regularly to refuse collection.

! *Driver.* The truck driver is the foreman of the loaders working on the truck. Duties include assisting the loaders in loading heavy or bulky materials, maintaining proper records, performing vehicle safety and maintenance checks, and general supervision of the loaders. Drivers are to obey all traffic laws. Drivers shall be trained and tested for each vehicle they are to operate.

! *Loaders.* Loaders, as well as drivers, must be familiar with requirements for segregation of materials. Loaders are required to:

- empty all solid waste from containers
- immediately clean up all spilled garbage
- protect private and public property
- make no undue noise
- serve as ground guides when backing the truck.

3.1.7.4 *Supervision.* The supervisor is in charge of refuse collection and disposal activities, and the efficiency and economy of the collection system depends on him. He supervises the collection crew; ascertains all conditions and changes that affect quantities, types, or distribution of materials collected; and effects changes in the collection system accordingly. Where more than one type of collection vehicle is used, the supervisor assigns trucks to pickup stations and routes for best utilization of each type of truck.

3.1.7.5 *Crew collection methods.* The more common collection methods appropriate for family housing areas include:

! *Assigned crew.* The crew is assigned to a collection vehicle for the entire working day. Assigned crew collection is efficient when the travel time to the disposal site is short.

! *Shuttle system.* While their driver is traveling to and from the disposal site, the crew is shuttled to help another crew. This method is more efficient when the travel time to the disposal site is long, but requires a dispatcher to coordinate the crews.

! *Reservoir system.* All crews work a large (usually centralized) area after they have completed their assigned routes. No crew is dismissed until the entire reservoir area has been collected.

! *Curbside collection.* The collection is made from containers placed at the curbside rather than at the doorstep in housing areas. Doorstep collection is not an encouraged method.

! *One side* of *street.* Generally, the collection is made on one side of street when the streets are wide, heavily traveled, or have a median divider. Also, if mechanically handled collection is used, one-side- of-street collection may be required.

! *Both sides of the street.* The collection is made on both sides of the street when the streets are narrow, lightly traveled, one-way, or when bulk containers are used and have to be mechanically handled.

3.1.8 Transfer Stations

3.1.8.1 Transfer facilities are intermediate locations for gathering waste. These facilities shall be considered when:

1. access to small but restricted-access military bases must be limited

2. disposal sites are greater than 10 miles from the collection routes

3. small-capacity collection trucks (under 20 yd3) are used

4. medium-sized containers for collection of wastes from industrial activities are used extensively.

3.1.8.2 A solid waste transfer system becomes economical when the overall cost of transfer station construction/operation and waste haul to the disposal site in transfer vehicles is less than the cost of direct haul in collection vehicles.

3.1.8.3 Solid waste transfer is not required at some bases since the distance from the collection areas to the disposal site is generally short (e.g., less than 5 miles). In some instances, however, the disposal site might be located at a remote onsite location or at an off-base regional facility. In those cases a transfer system could prove economical.

3.1.8.4 Some bases use transfer stations near their entry gates. Base personnel are used to collect solid waste and deliver it to the transfer stations. Contractors then transport wastes from the main gate to a disposal site. When collection routes are complicated or waste generation rates fluctuate from week to week, this concept minimizes retraining problems if contractors are changed. It also allows “on call” garbage collection since base personnel are generally more readily available than contractor personnel.

3.1.8.5 The state regulations applying to transfer stations vary greatly. Permitting is always required, but some states treat transfer stations procedurally the same as landfills and incinerators. Others are much more lenient. Permitting requirements shall be studied thoroughly before a decision is made to set up a transfer station.

3.1.9 Scrap Recycling

3.1.9.1 DoD 4160.21-H, Defense Scrap Yard Handbook, outlines practical, cost-effective methods for the recovery and recycling of scrap (defined as personal property that has been discarded and which appears to have no value except for its basic material content).

3.1.9.2 The broad objectives of the DoD Scrap Recycling Program are to:

1. ensure that no property with utilization or sales value which exceeds the value of its material content is processed as scrap

2. optimize procedures for cost-effective recovery, recycling, or sales of scrap including precious-metal-bearing materials

3. ensure that processing of scrap is in strict compliance with all applicable safety, health regulations, and environmental protection guidelines.

3.1.9.3 *Responsibilities.* The Federal Property and Administrative Services Act of 1949, as amended, assigned to the Administrator of General Services responsibility for the disposition of excess and surplus personal property (including scrap) generated by federal agencies in the United States. The Administrator delegated responsibility for disposition of all DoD generations of such property to the Secretary of Defense, who subsequently assigned overall command and management of the Defense Personal Property Utilization and Disposal Program to the Defense Logistics Agency. Specific responsibilities of the DoD installations primarily concerned with scrap recycling are outlined in Table 3-lA (DoD 4160.21-H). Specific responsibilities of the DoD installations for the management and disposal of hazardous materials and hazardous waste are outlined in DoD 4160.21-M, Chapter XXI.

3.2 DISPOSAL ALTERNATIVES. Selection of the proper disposal methods for use at an installation shall be based on protection of the environment and relative cost to the government. A resource recovery analysis shall be conducted before the disposal method is selected. Disposal may take the form of one or a combination of the following methods.

3.2.1 Contracting. Contracts with municipal or private individuals may be favorable when compared with the cost of in-house disposal. Large municipal operations of solid waste disposal facilities are frequently more efficient and environmentally more acceptable than smaller installation operations. Contracts can also be used when funds for capital expansions in an in-house facility are limited.

3.2.2 Sanitary Landfill. A sanitary landfill is an engineered disposal method in which solid waste is spread, compacted, and covered with soil daily. When properly designed, the sanitary landfill can handle nearly all types of solid waste while providing substantial environmental protection. RCRA regulations discourage the use of landfills and encourage generators to seek alternative methods of waste disposal.

3.2.2.1 Hazardous wastes shall not be disposed of at a sanitary landfill.

TABLE 3-lA
Responsibilities of DoD Installations

| | |
|---|---|
| Military Services: | a. Provide administrative and logistics support to tenanted Defense Reutilization and Marketing Regions (DRMRs) and to Defense Reutilization and Marketing Offices (DRMOs) and their Off-Site Branches, in consonance with applicable Interservice Support Agreements (ISAs). The U.S. Army Logistics Management College also provides specialized training support by conducting the Defense Scrap Management Course and Defense Metals Identification and Recovery Course. |
| | b. Establish and operate the DoD Resource Recovery and Recycling programs (Deputy Secretary of Defense Memorandum, Sales of Recyclable Materials 10 USC 2577, 28 Jan 83). |
| | c. Establish Qualifying Recycling Programs at DoD installations including those which operate under the industrial fund. |
| | d. Ensure that those installations and defense agencies with Qualifying Recycling programs make concerted efforts to divert or recover scrap or waste from the waste streams, as well as efforts to identify, collect, properly segregate, and maintain the integrity of the recyclable materials in order to maintain or enhance the marketability of the materials. |
| | e. Report/turn in all authorized scrap generations to their servicing DRMOs. |
| | f. Prepare disposal turn-in documents (DTID) (DD Form 1348-1 DoD Single Line Item Release/Receipt Document,) and accurately identify all scrap listed thereon. |
| | g. Indicate on DTID that DoD qualifying Recycling Program material is identified as such with funds to be deposited to the Budget Clearing Account **F3875--(xx 17 Navy. 21 Army, 57 Air Force and 97 for DoD Installations). No other account is acceptable. The reimbursable fund citation must be on documentation in order for sales proceeds to be returned. |

TABLE 3-lA
(cont'd.)

| | |
|---|---|
| Military Services: cont'd.) | h. Properly containerize all hazardous property in scrap condition turn-in. Identify by labeling containers and annotate DD Form 1348-1accordingly. |
| | i. Monitor, with DRMD personnel, all property sent to landfills to ensure no economically salable or recyclable property is discarded. |
| | j. Request DRMS provide sales services as needed for recyclable, marketable materials generated as a result of resource recovery programs. |
| Defense Logistics Agency (DLA): | a. Coordinate DoD policy guidance (developed by the Assistant Secretary of Defense (Production and Logistics) or other organizational elements of the Office of the Secretary of Defense) with the Military Services and other DoD components, and with federal civil agencies, as appropriate. |
| | b. Program, budget, fund, account for, allocate, and control personnel spaces and other resources required to support DLA scrap recycling installations. |
| | c. Provide agency-level command and control of the Defense Personal Property Utilization and Disposal Program (including scrap recycling, regulated property disposal, and precious metals recovery) worldwide. |
| Defense Reutilization and Marketing Service (DRMS): | a. Manage the DoD Scrap Recycling Program (including precious metals recovery) and related financial records. |
| | b. Command and control DRMRs. |
| | c. Implement applicable policies, develop procedures and techniques, and initiate other appropriate actions to ensure cost-effective and environmentally safe implementation of scrap-related programs. |

TABLE 3-lA
(cont'd.)

| | |
|---|---|
| Defense Reutilization and Marketingd. Service (DRMS) (cont'd.): | d. Comply with DoD guidance on demilitarization of scrap generations. |
| | e. Provide technical guidance to DRMRs regarding equipment procurement and development of facilities required to enhance program effectiveness. |
| | f. Maintain and control the Consolidated DoD Bidders List. |
| | g. Respond to private and public sector inquiries pertaining to the recovery and sale of scrap. |
| | h. Provide sales services and marketing advice to the Military Services on the operation of the DoD Directive 4165.60, Solid Waste Management-Collection Disposal, Resource Recovery Recycling Program. |
| Defense Reutilization and Marketing Regions (DRMRs): | a. Supervise and provide administrative and technical support to assigned sales office(s) and DRMDs. |
| | b. Coordinate, develop, and implement required ISAs with DOD components. |
| | c. Conduct sales and provide related contracting support. |
| | d. Provide appropriate comand guidance and technical assistance to DRMOs. |
| | e. Assist all assigned organizational elements to obtain needed equipment and facilities. |
| | f. Ensure that scrap is handled and stored in strict compliance with applicable safety, health, and environmental protection guidelines as well as security procedures. |
| | g. Monitor compliance with DoD guidance on the demilitarization of scrap. |

TABLE 3-lA
(cont'd.)

| | |
|---|---|
| Defense Reutilization and Marketing Office (DRMO): | a. Provide technical assistance to generating installations in the identification, segregation, collection, and storage of scrap at its source and, where feasible, provide containers to the scrap generator. |
| | b. Receive authorized scrap generations. |
| | c. Ensure adequate storage and security for scrap receipts. |
| | d. Dispose of scrap in such a way as to maximize net return to the Government. |
| | e. Perform market research to determine best sales method and optimum lot sizes. |
| | f. Optimize procedures for recovery of strategic and critical materials (including precious metals) from scrap generations. |
| | g. Ensure that scrap is handled and stored in strict compliance with applicable safety, health, and environmental protection guidelines as well as security procedures. |
| | h. Comply with DoD guidance on demilitarization of scrap. |
| Defense Property Disposal Precious Metals Recovery Program: | a. Manage Precious Metals Recovery Program (PMRP). |
| | b. Provide recovery equipment to generating installations on a nonreimbursable basis. |

TABLE 3-lA
(cont'd.)

| | |
|---|---|
| Defense Property Disposal Precious Metals Recovery Program (cont'd.): | c. Issue disposition instructions for the movement of precious-metal bearing materials to collection/recovery sites. |
| | d. Perform contracting and contracting support functions regarding the recovery of precious metals by commercial refiners. |
| | e Provide technical support to DoD and participating federal civil agency generating installations and DRMOs and assist them in improving the cost effectiveness of the PMRP. |
| Defense Industrial Supply Center (DISC): | a. Serve as integrated DoD manager for precious metals. |
| | b. Store and issue refined precious metal recovered through the PMRP. Costs incurred by DRMS are totally reimbursed by DISC from Defense Stock Fund. |
| Defense Contract Administration Services (DCAS) [Applies to DCAS and its subordinate Defense Contract Administration Services Regions (DCASRs), Defense Contract Administration Services Plant Representative Offices (DCASPROs) under the direction of the Director, DLA]: | a. Administer assigned contracts, including those which require contractors to dispose of scrap generated from work specified in their work contracts. |

3.2.2.2 Factors to be considered in a cost appraisal of the sanitary landfill disposal method include:

- permitting cost/requirements
- social considerations (future growth) affecting design, operation, and closure
- land cost
- equipment cost
- labor cost for operation and maintenance
- installation overhead to support the site design costs
- benefits in reclaiming useless land
- environmental considerations affecting design, operation, and/or closure
- monitoring costs to avoid potential problems
- potential DoD natural resources program impacts
- future land utilization needs.

3.2.2.3 Innovations in landfill operations to reduce refuse volume and extend useful landfill life include covering of baled compacted refuse and the use of a shredder to get better consistency in the material deposited.

3.2.2.4 Under new and proposed environmental regulations, construction of new sanitary landfills will require installation of a liner and leak detection system, leachate collection and treatment system, and methane collection and disposal. These items will increase construction and operation cost considerably.

3.2.3 Construction Debris or Demolition Landfill. This method is commonly used to dispose of construction and demolition materials and incinerator ashes for the purpose of changing an existing grade. Factors to be considered in the cost appraisal process include land cost and the future use of the land. Excavation in fill areas may be difficult when large concrete or stone pieces have been discarded.

3.2.4 Incineration. Incinerator operation is a waste reduction or energy recovery method and not a disposal method. The maximum economic advantage, therefore, is realized by locating the plant as close to the center of the refuse collection effort as possible. Certain criteria will affect the location of the plant as follows.

3.2.4.1 *Traffic.* Consideration must be given to the frequency and size of vehicles utilizing the incinerator facility. Access roads shall be all-season permanent roads; however, travel on and across primary roads shall be minimized.

3.2.4.2 *Elevation.* Locating an incinerator on a hillside may reduce the amount of ramp construction and excavation needed.

3.2.4.3 *Aesthetics.* The site selected shall allow the facility to be screened from public view, particularly operations associated with tipping, residue discharge, and waste salvage areas. Grounds shall be appropriately landscaped to add to the appearance of the facility. Topography and location shall be screened to mitigate noise and odors from the incinerator. Prevailing wind direction shall be evaluated to avoid odors being transmitted to residential sites. Screening effects of plantings or walls may also reduce conflicts with other land uses.

3.2.4.4 *Labor schedules.* Trained personnel are essential for efficient incinerator operation. If experienced operators are not available, training will be given under supervision of the chief operator. Common labor duties can be performed by less experienced personnel.

- *One shift operation.* Many incinerators have sufficient capacity to burn all suitable refuse within one 8-h working day. One operator can perform all the work at a small incinerator. This includes cleaning and trimming the fire before closing in the afternoon. The operator’s working hours shall be coordinated with the collection time to permit all the refuse to be incinerated and duties completed within the normal working day. Larger incinerators may require various skills for operation and maintenance. Staffing varies with the schedule of operations, number of shifts, degree of automation of plant operations and labor regulations. Most incinerator operations require 0.5 to 0.75 manhours per ton of refuse processed, excluding residue removal and major repairs.

- *Staggered hours operation.* Some incinerators have insufficient capacity to burn all refuse delivered in an 8-h working day. To provide proper refuse disposal, the incinerator must be operated longer than 8 h. Plan the operators' schedules to provide for morning cleaning of the incinerator before deliveries of refuse start, and also for later afternoon burning until all refuse has been charged, the fire trimmed, and building cleaned. Staggering the working hours permits operation of the incinerator for a period longer than 8 h, without requiring a full second shift of operators. It also provides for adequate operating personnel during the peak hours of the day when the refuse is being collected and delivered to the incinerator.

- *Refuse deliveries.* Scheduling deliveries of refuse evenly throughout the day smooths operations; i.e., the unloading platform or pit is not congested or full, and the incinerator is neither overloaded nor operating at fractional capacity. Coordinate labor shifts with collection and delivery schedules.

3.2.4.5 The residual product, noncombustible solid waste and ash, is removed from the incinerator for disposal, usually by land burial.

3.2.4.6 *Manufacturer Information.* Manufacturer-sponsored training shall be included as part of the procurement package for an incinerator. The manufacturer must provide a detailed operating and maintenance manual. State and federal regulations shall be consulted to determine the allowable emission standards. No incinerator shall be purchased which does not meet these standards. A guarantee in writing shall be obtained from the manufacturer stating that the incinerator will operate at or below the maximum allowable emissions, and liability will be retained by the manufacturer for getting the incinerator into compliance.

3.2.5 Composting. Composting is an engineered process to promote the biochemical decaying of organic material. The product, compost, may be used as a soil conditioner or fuel. As a soil conditioner, compost provides improved workability, increased water retention, and resistance to erosion. In considering the composting process, market availability and reliability are critical to the cost appraisal. Separate collection, segregation, or sorting of garbage from other refuse and increased capital and operating costs may be substantial when compared with the same value of the product. Compost is useful for agricultural purposes and may be used as a cover material on slopes or at a sanitary landfill because of its resistance to erosion. Composting may also prove practical when agricultural tenants (with leases per 10 USC 267) are able to use the material for soil conditioning. In some processes, cured compost may serve as a feedstock for other products, including wallboard, fertilizer, and fuel. As a fuel, the energy yield is poor when compared with alternative fuel sources.

3.2.6 Pyrolysis. Another method of volume reduction is pyrolysis. This system is to a pressure cooker in using heat and pressure to convert refuse to oil and sludge. This system was effective in treating sewage sludge at a military installation but was neither cost effective nor easy for the user to maintain.

3.2.7 Materials Recover . Materials may be recovered for recycling or reuse through one 0 a vane y of techniques discussed in Section 4.3. Reusable or recyclable materials are separated at the source, whenever possible, to reduce the overall cost. Materials commonly processed this way include high-grade paper, newspaper, corrugated cardboard, glass, batteries, waste oil, and aluminum cans and other metals. Also, methane gas can be captured from properly designed collection systems for use during landfill operations.

3.2.8 Miscellaneous Disposal Methods. Alternatives for disposal may be available for special applications.

3.2.8.1 *Hog Feeding.* This method requires separate handling, transportation, and processing of select types of garbage. To serve as the sole supply for a minimum efficient size farm requires an installation with a complement of about 10,000 personnel. Processing is regulated at the local, state, and federal level. Where markets exist, revenues from the sale of this output may be advantageous. The DRMO will supervise the sale in accordance with Defense Disposal Manual (DoD 4160.21-M).

3.2.8.2 *Garbage Grinding.* This is usually an individual disposal method of grinding select garbage and disposing of it through the sewer network and wastewater treatment process. Garbage grinding is usually not an acceptable alternative on a large scale. The capacity of the sewage disposal facility and cost of grinder installation shall be considered in comparison to the savings realized in the remaining disposal process.

3.2.8.3 *Open Burning.* Open burning is generally prohibited except for the infrequent burning of agricultural wastes in the field, silvicultural treatment for forest management purposes, land clearing debris, construction debris, diseased trees, debris from emergency cleanup operations, and ordnance.

3.2.8.4 Open burning of ordnance requires a RCRA Permit (40 CFR 264, Subpart X). The open burning and detonation of waste explosives is described in 40 CFR 265.382. Waste explosives include waste that has the potential to detonate and bulk military propellants that cannot safely be disposed of through other modes of treatment. Detonation is a violent chemical reaction within a chemical compound, or a mechanical mixture involving heat and pressure which proceeds through the reacted material at a supersonic velocity, exerting extremely high pressure on the surrounding medium, and forming a propagating shock wave originally of supersonic velocity. Open burning is the combustion reaction of any material without control of combustion air, containment of combustion reaction in air enclosed device, and/or control of gaseous combustion product emissions. Owners or operators choosing to open burn or detonate waste explosives must do so in accordance with the following table and in a manner that does not threaten human health or the environment. All explosives to be disposed of by detonation or open burning should be turned over to Explosive Ordnance Disposal (EOD) office. The individual should never attempt to detonate or open burn explosives without first contacting EOD.

| Pounds of waste explosives or propellants | Minimum distance from open burning or detonation to the property of others, m (ft) |
|---|---|
| O to 100 | 204 (670) |
| 101 to 1,000 | 380 (1,250) |
| 1,001 to 10,000 | 530 (1,730) |
| 10,001 to 30,000 | 690 (2,260) |

3.2.8.5 Disposal of explosives or explosives-contaminated wastes is the responsibility of EOD. Disposal of explosives by detonation or open burning should take place on a range or impact area that has an approved Environmental Assessment for detonation. Many installations are not allowed to open burn waste explosives and must use an incinerator designed for explosives or explosives-contaminated wastes. If no such incinerator exists on an installation, these types of wastes must be shipped to an installation having one. In either case, no waste explosives should be burned without first contacting the installation EOD office. Reference should also be made to any command's standard operating procedure on explosives incineration.

### 3.2.9 Environmental Health and Safety Requirements

Decisions concerning disposal methods must consider the health and safety of installation personnel and the local population. Factors to be considered before selecting the disposal method include:

- pollution of groundwaters, surface waters, and potable water supply
- air quality
- dust control and respiratory health hazards
- noise control
- litter control and aesthetic nuisance avoidance
- traffic safety both on and off site
- fire safety
- ingress control
- vector and bird control
- gas generation and migration (sanitary landfill).

### 3.2.10 Cost Considerations

Items to be considered in comparing costs among the various disposal methods shall include:

*Operating costs*

- materials and supplies
- labor costs including fringe and additional benefits
- equipment rental
- cost of utilities: electricity, water, telephone, and others
- maintenance and repair of equipment and facilities
- permit and closure costs.

*Capital costs*

- facilities, land, and land improvements such as roads, aprons, and fences
- equipment
- investment costs and cost of capital.

*Overhead*

- supervision, where this varies among disposal methods
- installation support.

## 3.3 PLAN DEVELOPMENT

3.3.1 Plan development consists of evaluating the technical/legal/social economic alternatives identified through the evaluation process and tying them to a new budget plan. Major modifications to existing facilities or construction of new ones require line item listing in military budgets. Such expenditures do not come out of normal base operating funds. Third-party financing is another option for acquiring solids handling equipment or setting up resource recovery facilities.

3.3.2 Requests for new equipment such as trucks, have to compete with vehicle requests for other base activities. Replacement of completely worn out equipment is more normal than replacing just to keep with state-of-the-art practices.

3.3.3 Any request for funds must be accompanied by a cost-effectiveness analysis.

3.3.4 Planning Steps

3.3.4.1 In most cases, the engineer and the decision maker do not have an opportunity to study the entire solid waste management system and develop a total knowledge of the base under all conditions. Time and economic constraints often lead to decisions based on little or no information. In order for engineers and decision makers to be able to respond to these situations and to ensure that the best use is made of time and available funds in the resolution of solid waste management problems, the following step-by-step planning procedure is recommended.

3.3.4.2 *Step 1: Problem Definition and Specification.* The first and most critical step in any planning study is to obtain a clear problem statement and corresponding specifications from the persons responsible for making decisions about solid waste management. Problem statements and specifications usually are derived from the concerns of the public or regulatory agencies. Difficulties often arise because solid waste Systems are not well understood at all levels of decision making. Consequently, the engineer may have to redefine a problem that was originally specified at a higher level.

3.3.4.3 *Step 2: Inventory and Data Accumulation.* An inventory is made of all pertinent factors about the installation, and data are collected as needed to meet the problem specifications. The main purpose of the inventory is to define the existing solid waste system(s) as completely as needed and as accurately as possible and to collect certain other basic information (such as population data)--a task that requires a considerable amount of judgment. It is an important step in planning because all subsequent recommendations for action will be based on the findings of this step. Therefore, it is essential that at this level of planning all the functional elements of the solid waste management system be considered.

3.3.4.4 *Step 3: Evaluation and Alternative Development.* This step involves the detailed evaluation and analysis of the data accumulated in Step 2. During this step the programs of the plan begin to be formed. In some cases, it may be necessary to collect additional data and information. Reliability and maintainability must be considered when evaluating alternatives. However, before the programs are formed, it is important to review the original problem statement and specifications. Often some revisions are needed in light of the data gathered during the inventory.

3.3.4.5 Since a problem can have more than one solution, it is beneficial for decision-making purposes to develop alternatives composed of one or more programs. When practical, these alternatives shall be documented for presentation in the plan.

3.3.4.6 In developing alternatives, it is especially important that all functional elements be coordinated to ensure system continuity--from onsite storage through processing and final disposal. By evaluating the coordinated programs, the planner is able to recommend viable alternatives.

3.3.4.7 *Step 4: Program and Plan Selection.* A limited number of alternatives are selected by the engineer for inclusion in the plan. The alternatives are reviewed by the engineer, the chief engineer, and the base commander, when appropriate. The logic of alternatives is reviewed and programs are changed as necessary to include review comments. The administrative control of all programs is identified and evaluated during this step. This is important because solid waste management will not function properly without responsive control. Hence, the engineer must develop a thorough knowledge of the social and jurisdictional structure of the base.

3.3.4.8 The final action in this step is the selection of a preferred set of activities to form the plan. The programs can be selected from a single alternative, or they can be selected from various alternatives. The final selection will be made by the base commander and/or designees.

3.3.4.9 *Step 5: Development of Implementation Schedule(s).* When planning failures have occurred, the lack of a well-defined implementation schedule acceptable to administrative and management organizations is often the principal contributing factor. The degree of documentation in any implementation schedule depends on the type of programs developed in the plan. If possible, the degree of documentation that will be required for implementation shall be set by the engineer and decision maker during the problem-specification stage (Step 1) of the plan development. Most military solid waste management plans will be local in nature and require rather simple implementation schedules such as step-by-step sequences for a chosen program.

## 3.4 PLAN SELECTION AND IMPLEMENTATION

3.4.1 Once a complete waste management plan including a line item budget has been selected, organization structures must be put in place. Then schedules and milestones must be set. Planned reviews and updates shall be included in the schedule. Again, the requirements of RCRA Subtitle D must be carefully reviewed.

3.4.2 Figure 3-4A shows an implementation schedule for a management plan that involves the functional elements of storage, collection, transfer/transport, and disposal. In essence it covers starting from scratch at a new military installation. Less complicated activities can, however, be isolated on the chart so reasonable schedules could be proposed for them.

3.4.3 Implementation steps can be discussed only briefly. There are no "standard practices" in solid waste management to cover the wide variety of options that can arise.

3.4.4 Developing Alternatives. Waste management programs are presented to decision makers in the form of alternatives so that the decision makers can make their own judgments on the probable success of each one. The most important requirement for an alternative is that it be quantifiable with

respect to equipment, disposal sites, economics, etc. An alternative can be as simple as specifying the details of one-person versus two-person collection crews, or it may be as complex as specifying landfill disposal of all wastes versus processing wastes at multiple stations and selling recovered materials to numerous dispersed markets. Every alternative must satisfy the requirement of measurability. Documentation for each alternative, regardless of complexity, must encompass the following: (1) performance, (2) economic analysis, (3) impact assessment, and (4) administration and management and an implementation schedule.

3.4.4.1 *Performance.* Performance means getting the job done. The work force and equipment required to provide the level of service desired by the installation must be specified. The details of performance will vary with individual installations, but Significant details that must be identified include (1) level of service, (2) equipment reliability and flexibility, (3) equipment and work force expandability, and (4) program compatibility with other environmental programs (air and water) and with future changes in solid waste technology.

3.4.4.2 With these details established, it is possible to contrast performance functions of a recommended program with performance functions of alternatives without additional planning studies. This is an important part in achieving plan implementation.

3.4.4.3 *Economic Analysis.* Once the details of performance have been identified, it is important to analyze the economic impacts of each alternative. The analysis must include estimates of capital cost as well as of operating costs. The cost of an alternative normally will be expressed as an annual cost. When divided by the annual quantity of wastes handled, the cost can also be expressed as a unit cost. Unit costs, such as dollars per ton, are often used to compare the cost effectiveness of alternatives.

3.4.4.4 When cost estimates are completed, financing methods can be identified. Some alternatives will require line item appropriations, whereas others may be financed from a general operating fund.

3.4.4.5 *Impact Assessment.* The programs of a waste management plan will have an impact on an installation through changes to the natural environment and through involvement of the base personnel. Any activities that significantly affect the environment (e.g., landfill and incineration) require an Environmental Assessment. Although environmental assessments do not need to be approved by EPA, state, or local regulatory agencies, it is prudent that federal agencies solicit comments from EPA, state, and local agencies prior to finalizing these documents. If an Environmental Impact Statement (EIS) is required, then formalized procedures for EPA approval must be followed.

3.4.4.6 Activities that require voluntary support of base personnel (e.g., recycling) must anticipate human reactions to such requests. Few hard and fast rules apply. A useful generalization is to keep all requests for voluntary participation simple and painless and simultaneously emphasize the benefits to participants.

3.4.4.7 *Administration and Management.* The administrative functions and organizations for implementation must also be identified for each

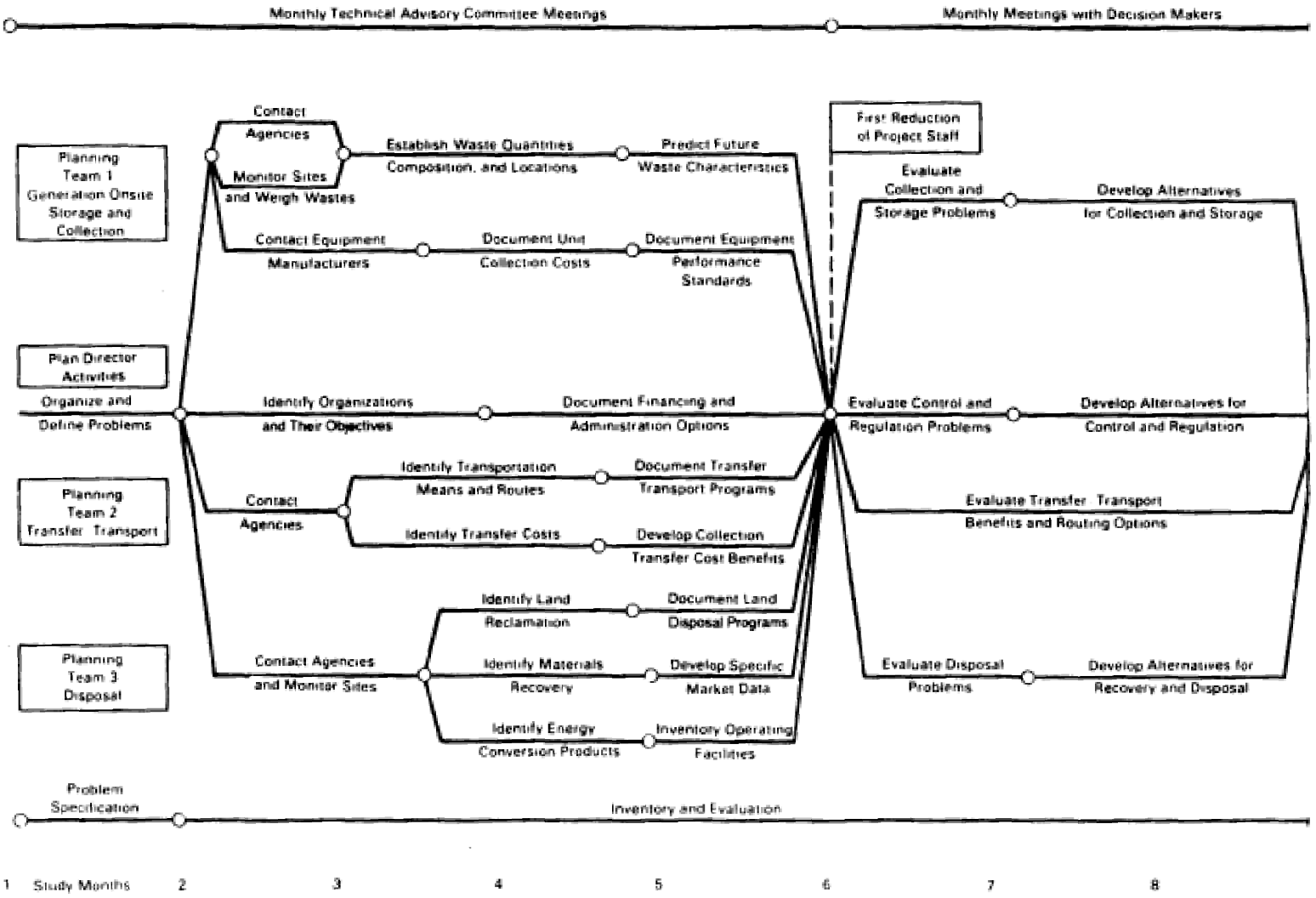


FIGURE 3-4A. Plan Implementation Schedule

Note The management plan covers a region and involves the functional elements of storage, collection, transfer transport, and disposal

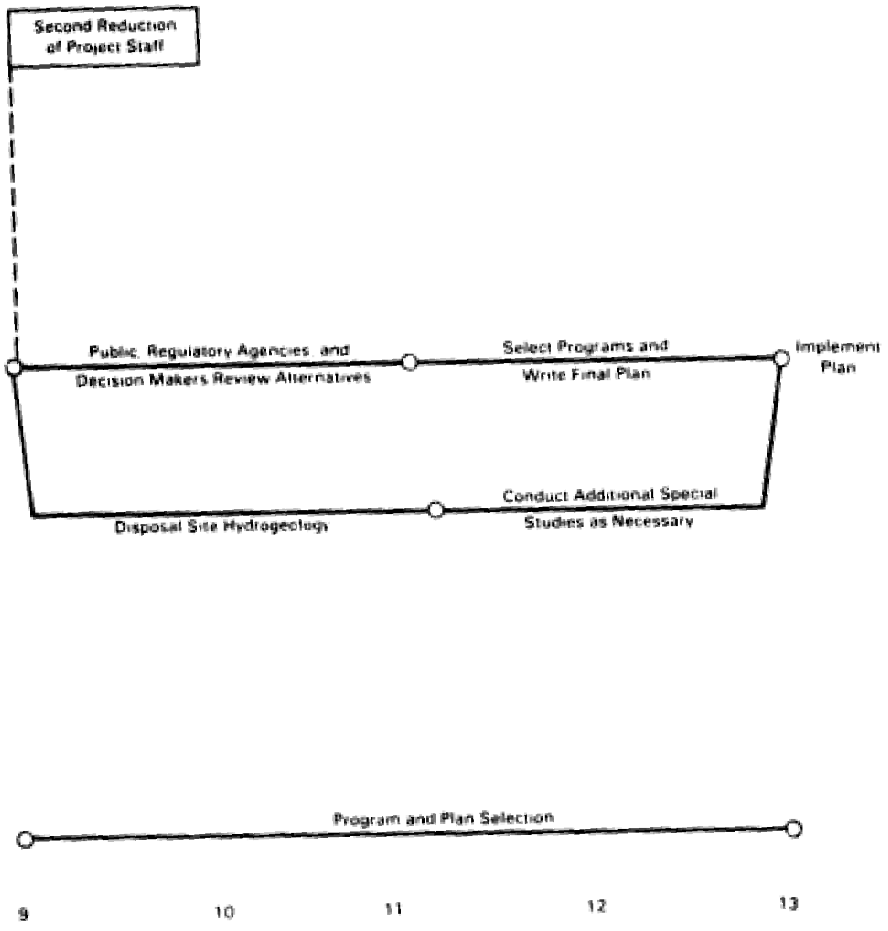


FIGURE 3-4A. Plan Implementation Schedule (cont'd)

alternative. It is most practical for the engineer to develop details of administration only for the short-term planning period (7 years into the future). Detailed administrative planning for the long term is meaningless because changes can occur so rapidly in the solid waste management field. Managers responsible for operations during the short term will usually establish organizational policies and functions for the long term.