CHAPTER 13

Solid Waste Management
Privatization Procedural Manual

WASTE TRANSFER

SOLID WASTE TECHNICAL ASSISTANCE

Ministry of State for Environmental Affairs

U.S. Agency for International Development

Egyptian Environmental Policy Program

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CHAPTER 13
WASTE TRANSFER

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INTRODUCTION

Once waste is collected it must be transported to a waste processing or disposal facility. If these facilities are far from where the waste is collected, it may be more cost effective to consolidate waste into higher capacity trucks at a transfer station located closer to the collection routes for transport to the facilities than to transport the waste directly in the collection vehicles to the appropriate facility. This procedure, known as waste transfer, is increasingly being used worldwide to reduce total waste collection and transportation costs.

This chapter is intended to serve as a guide to help evaluate if waste transfer is a cost effective waste transportation alternative for your planning area, and if so, how to procure waste transfer services. It should be used in close conjunction with Chapter 8, Residential and Commercial Waste Collection, to evaluate the applicability of transfer in the overall waste collection and transportation system.

Elements of Waste Transfer

Waste transfer is a supplemental transportation system that is an adjunct to collection route vehicles, which may reduce overall waste collection and transportation costs. Transfer is beneficial when the cost to haul waste directly from the collection route to the processing or disposal facility is greater than the combined costs of hauling from the route to the transfer station and then transferring the solid waste to the final destination. Transfer and transportation systems vary significantly among transfer stations, but they all consist of the following components:

- A site near waste collection routes.
- A receiving area where waste collection vehicles discharge their loads.
- Equipment to move waste from the receiving area and load it into larger vehicles.
- Transportation equipment, typically a semi-tractor and transfer trailer, to transport waste from the transfer station to the processing or disposal facility.
- Equipment to unload waste from the transport vehicles (if not self-unloading) at the processing or disposal facility.

The nationwide trend in Egypt in solid waste disposal will be toward construction of larger, more remote, regional landfills. Economic considerations, heavily influenced by regulatory and social forces, are compelling factors leading to this result.

The design, operation, and monitoring requirements of modern landfills add significantly to their construction, operating, closure, and post-closure care costs. The National Solid Waste Management Strategy[1] requires existing dumps to be closed or upgraded. Many communities will find the cost of

A large transfer station.

1 Issued by the Ministry of State for Environment, Egyptian Envirnomental Affairs Agency, Directorate General for Waste, June 2000

Transfer stations serve as the critical consolidation link in cost-effective waste transfer from the collection area to processing and disposal facilities.

upgrading existing facilities or constructing new landfills near waste genera tion sources to be prohibitively high. For these communities, transferring waste to a large regional landfill is an appealing alternative.

In addition to regulatory requirements, public opposition will make siting new landfills near population centers increasingly difficult. Gaining public and political approval for constructing new disposal capacity will become more challenging. Moreover, adequate land may not be available near densely populated or urban areas. These social, political, and geographical factors further stimulate the need for larger and more remote regional landfills.

Economic considerations, especially economies of scale, further promote development of one large landfill per governorate or regional landfills serving multiple governorates. To offset the high cost of constructing and maintaining a modern engineered landfill, governorates need to construct larger facilities that accept higher volumes of waste from all of the governorate or a greater geographic area. Landfill operators can keep the per-ton disposal cost low by maintaining a high volume of incoming waste. Rural and urban communities alike will find that the most economically viable solution to their waste disposal needs is shipping their waste to these facilities in high capacity vehicles. In these circumstances, transfer stations serve as the critical consolidation link in cost-effective waste transfer from the collection area to processing and disposal facilities.

Rural Considerations

Since small transfer stations in rural settings receive considerably lower volumes of waste and customer vehicles than large urban facilities, many of the design criteria described previously will not apply. Transfer stations can be open to accept waste for fewer hours per day and week than those in urban areas.

Cost frequently is a major consideration for small rural transfer stations, limiting what can be done. Consequently, rural transfer stations are usually uncovered or only partially covered facilities. Partially covered sites might be partially enclosed on three sides with the vehicle entrance side open, or simply have a roof with no walls. A common design uses a single open top trailer or multiple drop boxes situated beneath a raised vehicle tipping area. The raised tipping area allows vehicles to back up to the trailer or drop boxes and directly unload their waste. A hopper is not usually used.

When constructing a raised tipping area, taking advantage of natural grades within the site can reduce construction costs. If favorable grades do not exist, a simple earthen retaining wall and access ramp can be constructed to create the multilevel layout desired. Some type of safety restraint should be incorporated on the tipping area to guard against falls. Using a removable constraint, such as a rope, chain, gate, or posts, allows vehicles to unload waste unimpeded and facilitates site cleaning. All-weather gravel surfacing is a cost-effective alternative to asphalt pavement.

The use of drop boxes usually requires a concrete or asphalt pad. Ideally, the facility is surrounded by a fence and gated. The gate should be locked during non-operating hours to keep out trespassers and illegal dumpers. Fences also are helpful in containing windblown litter.

Benefits of Waste Transfer

The primary benefit of waste transfer is to reduce the cost of transporting waste from collection routes to processing or disposal facilities. Consolidating smaller loads from collection vehicles into larger transfer vehicles reduces hauling costs by enabling collection crews to spend less time traveling to and from distant disposal sites and more time collecting waste. This also reduces fuel consumption and collection vehicle maintenance costs, and results in less overall traffic, air emissions, and road wear.

Screening for unacceptable wastes is more efficient at the transfer station than at the landfill. At transfer stations, workers can screen incoming wastes on conveyor systems, tipping floors, or in receiving pits. Waste screening can have two components: separating recyclables from the waste stream and identifying any wastes that might be inappropriate for disposal such as hazardous materials, white goods, whole tires, auto batteries, and medical waste. Thus, the weight and volume of waste sent for final disposal can also be significantly reduced by these two waste screening components.

Finally, transfer stations can provide a means of improving the management of construction and demolition debris (C&D). Availability of a site closer to C&D generation sources can facilitate C&D generator disposal and reduce the indiscriminate dumping that is ubiquitous in most governorates.

In summary, transfer systems provide the following benefits.

- Increased collection crew productivity.
- Extended collection vehicle life.
- Savings in fuel and equipment maintenance costs.
- Reduced truck traffic on streets and highways.
- Reduced environmental impacts.
- Reduced wear and tear on urban streets and highways.
- Opportunity to screen waste prior to disposal.
- Opportunity to divert waste and other materials for reuse or recycling.
- Convenient sites to facilitate management of C&D by generators.
- Flexibility in accessing alternative waste processing and disposal facilities.

Deciding if a waste transfer system is appropriate and planning for its implementation can be accomplished through performing the following steps:

Step 1: Assess Waste Transfer Applicability.
Step 2: Develop Conceptual Design.
Step 3: Select Potential Transfer Station Sites.
Step 4: Compile Findings in an Assessment Report.
Step 5: Evaluate Waste Transfer Options.
Step 6: Select Preferred Waste Transfer Program.
Step 7: Implement the Selected Program.

These steps should be applied in conjunction with the steps described for planning improvements in residential and commercial waste collection in Chapter 8.

STEP 1:

ASSESS WASTE TRANSFER APPLICABILITY

Deciding if waste transfer is appropriate for your community requires determining if the benefits outweigh the costs. Break-even analysis is typically used to establish the initial economic feasibility of transfer versus direct haul. In a break-even analysis, the cost per ton for direct haul and transfer options are plotted against distance. The principal information required to conduct the break-even analysis includes:

- Transfer station and processing/disposal site locations.
- Average payloads of collection vehicles and transfer vehicles.
- Travel speeds and distance for haul vehicles.
- Transfer facility size, technology, and operating practices.
- Collection and transfer vehicle operating costs.

Estimates for these variables may be based on your own experience, on information from other governorates with collection and transfer experience, or obtained via third-party solid waste experts familiar with both the technical and economic issues. Complex projects might require the assistance of architects, civil, geotechnical, mechanical, and transportation engineers, lawyers, and other specialists.

Figure 13.1 demonstrates a representative "cost versus distance" relationship between direct hauling waste to processing or disposal facilities in collection vehicles versus consolidation, transfer, and hauling in larger vehicles. It illustrates that the total cost of transfer is a combination of the cost of owning and operating the transfer station plus the actual transfer haul costs. The transfer costs are based on distance. On the other hand, the direct haul costs for collection vehicles are only those costs to own and operate a waste collection vehicle.

In the examples shown in Figure 13.1, the average cost per ton to move the waste from the collection vehicle onto the transfer vehicle is L.E. 30. This is the cost per ton to build, operate, and maintain the station. However, the transfer trailer can transport waste on a much lower "per kilometer (km)" basis than collection vehicles because it can carry the waste of several individual collection vehicles.

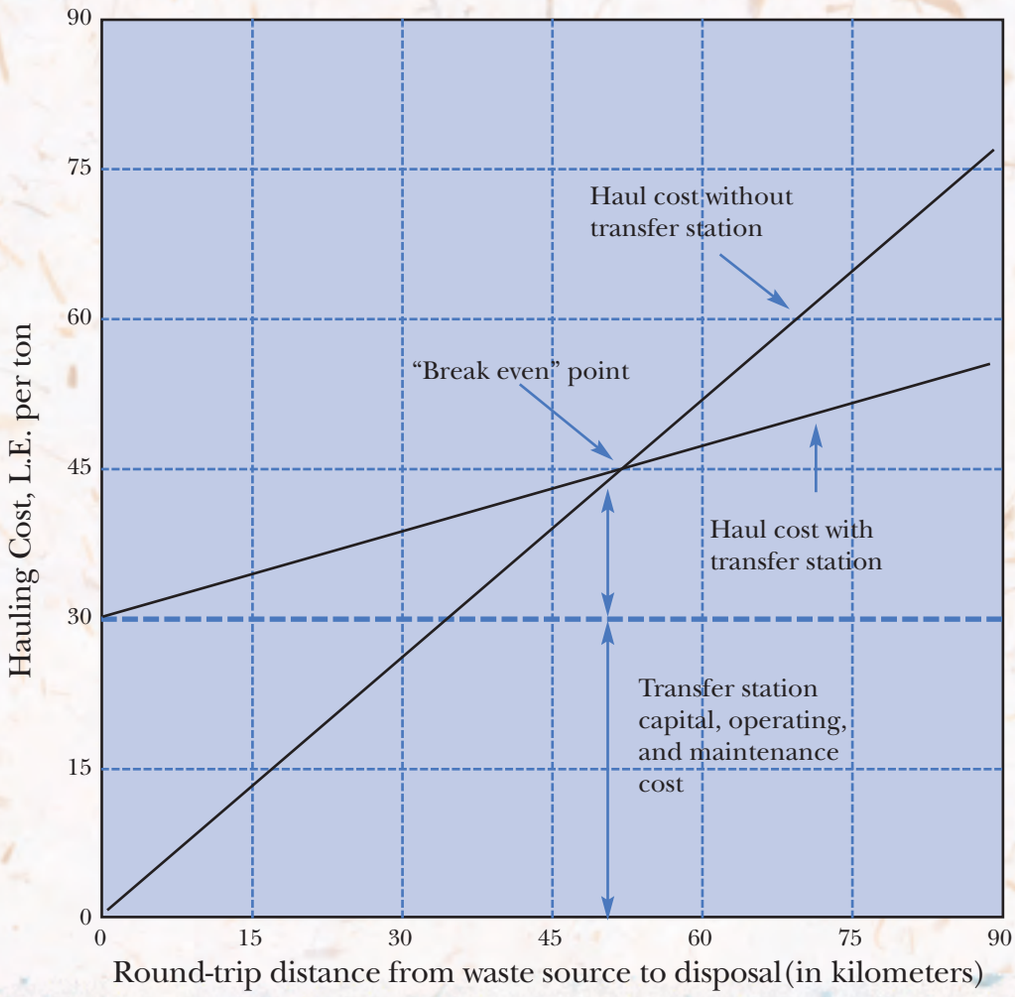
Compaction Unit Transfer Station.

Dumping trailer.

Using the assumptions listed, the cost per ton per km (ton-km) using a collection vehicle is L.E. 1.43 (L.E. 10 operating cost divided by 7 tons per average load). In this example, the transfer hauling vehicle's cost per ton-km is much lower, at L.E. 0.48 (L.E. 10 divided by 21 tons per average load). Figure 13.1 shows how this cost per ton-km advantage for the transfer hauling vehicle soon overcomes the initial cost of developing and operating the transfer station. In this case, based on the indicated assumptions, cost savings will start to be realized when the round-trip hauling distance exceeds 50 km (25 km one way).

Because the cost to own, operate, and maintain collection vehicles, transfer stations, and transfer hauling vehicles will vary depending on local parameters, the break-even point indicated on Figure 13.1 will vary. The formulae used in generating Figure 13.1 are provided in Figure 13.2 to allow for site-specific calculations.

Figure 13.1: SAMPLE COMPARISON OF COSTS WITH AND WITHOUT TRANSFER STATION



Source: USEPA, Waste Transfer Stations: A Manual for Decision Making, (EPA530-R-02-002), pg.3.

If the location of the processing or disposal facility to which waste is being transported is known, and the distance from the end point of all of the collection routes is less than the break-even distance calculated, then there is no benefit from waste transfer. On the other hand, if the distance from the end of some or all of the collection routes exceeds the break-even distance calculated, then there is potential benefit and you should follow the subsequent steps for siting, designing, and implementing a waste transfer system.

Figure 13.2: CALCULATING TRANSFER STATION BREAK-EVEN POINTS

To calculate the break-even point for waste transfer, first determine the following values:

1. **Transfer Station Cost:** cost to build, own, and operate transfer station, in L.E. per ton.

2. **Direct Haul Payload:** average payload of collection vehicle hauling directly to landfill, in tons.

3. **Transfer Haul Payload:** average payload of transfer truck hauling from transfer station to landfill, in tons.

4. **Transportation Cost:** average cost of direct or transfer hauling, in L.E. per km.

Once these values are known, use the following formulas to calculate cost at different distances:

Cost of Direct Haul
(no waste transfer station)

$$\frac{\text{Distance (km) x Transportation Cost (L.E. per km)}}{\text{Direct Haul Payload (tons)}}$$

Cost of Transfer Haul

$$\frac{\text{[Transfer Station Cost (L.E. per ton) + Distance (km)] x Transportation Cost (L.E. per km)}}{\text{Transfer Haul Payload (tons)}}$$

Filling trailers with waste to be transferred.

STEP 2:

DEVELOP CONCEPTUAL DESIGN

This step involves making decisions concerning many of the factors that affect transfer system design, operation, and cost. The general decisions reached in this step can be applied by the contractor at a variety of facility sites and over a wide range of facility sizes. However, specific design decisions and their costs can only be finalized once a specific site is selected. A site design plan can be developed after determining who will use the facility and how they will use it.

Decide Who May Use the Facility

Transfer stations can restrict access to governorate or contracted waste collection vehicles only, or allow delivery of materials from generators as well. The types of users that should be accommodated vary depending on where the facility is located and who owns and operates the transfer station. Transfer stations operated under contract with a governorate could be open to use for specified wastes such as C&D, or to general use by the public. However, the general public should only be allowed to use a transfer station for one of the following reasons:

- Waste collection is not universally provided in the planning area.
- Some wastes, such as bulky waste, green waste, or C&D, are not collected.
- Public access is part of a strategy to prevent illegal dumping by providing a convenient place for residents to deposit waste.

If it is decided that the public can have access, separate unloading areas and traffic patterns for private vehicles and collection vehicles will be necessary for safety and efficiency,

Decide Which Materials to Accept

In addition to accepting municipal solid waste (MSW) at your transfer stations you may want to accept other wastes and recyclable materials. This is a policy decision that is based upon the factors discussed in this section. Acceptable materials could include C&D, green waste, household hazardous waste, or recyclables. If your governorate offers programs that manage parts of the waste stream separately, it might reduce expenses by locating these other material management programs at the transfer station. Savings might result by:

The questions to be answered in developing the conceptual design for a waste transfer system are:

1. What types of waste and/or recyclable materials will the transfer station accept?
2. What volume of material will the transfer station manage?
3. How much waste will the facility receive during peak flows?
4. Will the transfer station receive waste from the general public or limit access to governorate and/or contractor waste collection vehicles?
5. What additional functions will be carried out at the transfer station (i.e., material recovery programs, special waste handling, vehicle maintenance)?
6. What are the characteristics of the collection vehicles that will use the facility?
7. How much waste storage space is needed?
8. What type of transfer technology will be used?
9. How will waste be shipped? Truck or rail?

Inside a transfer station.

- Using dual-collection vehicles for waste and single stream recyclables, or wet and dry wastes collected simultaneously, and delivering both materials to the transfer station in one vehicle.
- Continuing to use separate collections for waste and recyclable material streams, but having all processing facilities located at one site, thus minimizing the cost of multiple utility connections, traffic control systems, office space, and administration. This approach also eliminates the cost and complexity of multiple siting and permitting efforts.

Table 13.1 provides a description of waste types commonly handled at transfer stations.

Table 13.1: WASTES COMMONLY HANDLED AT TRANSFER STATIONS

Waste Category	Description
Municipal Solid Waste (MSW)	Generated by households, businesses, institutions, and light industry. MSW includes a mixture of putrescible (easily degradable) and non-putrescible (inert) materials including discarded containers, packaging, food wastes, and paper products. Three types of MSW collected in integrated solid waste management programs are commonly diverted for recycling, composting, or other separate handling: green waste, household waste, hazardous waste, and recycling.
Green Waste	Commonly includes leaves, grass clippings, tree trimmings, and brush. Green waste can be diverted so that it may be composted or mulched instead of disposed.
Household Hazardous Waste (HHW)	Hazardous wastes generated by households, such as cleaning products; pesticides; herbicides; used automotive products such as motor oil, brake fluid, and antifreeze; and paint.
Recyclables	Discarded materials that can be reprocessed and manufactured into new products. Common recyclables include cardboard, paper, newsprint, ferrous metals, plastic, glass containers, aluminum cans, motor oil, and tires.
Construction and Demolition Debris (C&D)	Debris resulting from demolition or construction of buildings, roads, and other structures. It typically consists of concrete, brick, wood, masonry, roofing materials, sheetrock, plaster, metals, excavated soils and tree stumps. Sometimes C&D debris is managed separately from MSW; other times it is mixed with MSW.

Certain wastes are unacceptable at transfer stations for the following reasons

- They are prohibited by federal regulations (e.g., PCBs, lead acid batteries, radioactive materials).
- They are difficult or costly to process (e.g., tires).
- They pose a health or fire hazard.
- They are prohibited at the processing or disposal facility where the transferred waste is delivered.
- They are so large that they could damage trucks or equipment during waste loading operations.

The following types of wastes generally are not accepted at transfer stations:

- Large bulky objects such as tree stumps, mattresses, or furniture.
- Infectious medical waste.
- Hazardous waste.
- Explosives.
- Radioactive materials.
- Fuel tanks (even if empty).
- Dead animals.
- Asbestos containing materials (ACMs).
- Liquids and sludge.

This should be used as a suggested list, as your transfer station could be designed to process some of these materials. However, while these and other unacceptable wastes represent a small fraction of the solid waste stream, properly managing them can require significant effort by the transfer station operator. The section on waste screening in Appendix A further discusses how to properly manage and reduce the frequency of unacceptable waste at a transfer station.

Assess Transfer Technologies

This section describes the basic methods of handling waste at transfer stations, explains which methods are most appropriate for small and large transfer stations, and addresses the advantages and disadvantages of each method. If waste transfer services will be procured from the private sector, the method will be selected by the contractor. However, it is still useful to understand the advantages and disadvantages associated with each so that an informed evaluation of methods proposed by bidders can be made. The method used to handle waste at the transfer station from the time it is unloaded by collection vehicles until it leaves the site is central to any transfer station's design. In the simplest cases, waste from collection vehicles is unloaded directly into the transfer container or vehicle. As this eliminates opportunities to inspect or sort the material, other floor tipping methods should be considered as well. Figure 13.3 shows simple diagrams of the various transfer methods described below. Table 13.2 presents advantages and disadvantages of waste receiving and storage technologies.

Live floor transfer trailer.

Options for Unloading Waste from Collection Vehicles

Options for unloading waste from collection or residential vehicles at the transfer station include:

- Directly unloading waste into the top of a container or transfer trailer parked below the unloading vehicle, or onto a tipping floor at the same level as the unloading vehicle (Figure 13.3-A).
- Unloading waste into a surge pit located below the level of the unloading vehicle (Figure 13.3-B). Waste can be moved and piled for short-term storage on the tipping floor or in a pit. Short term storage allows waste to be received at the transfer station at a higher rate than it leaves the facility, increasing a transfer station's ability to handle peak waste delivery periods.

Reloading Options

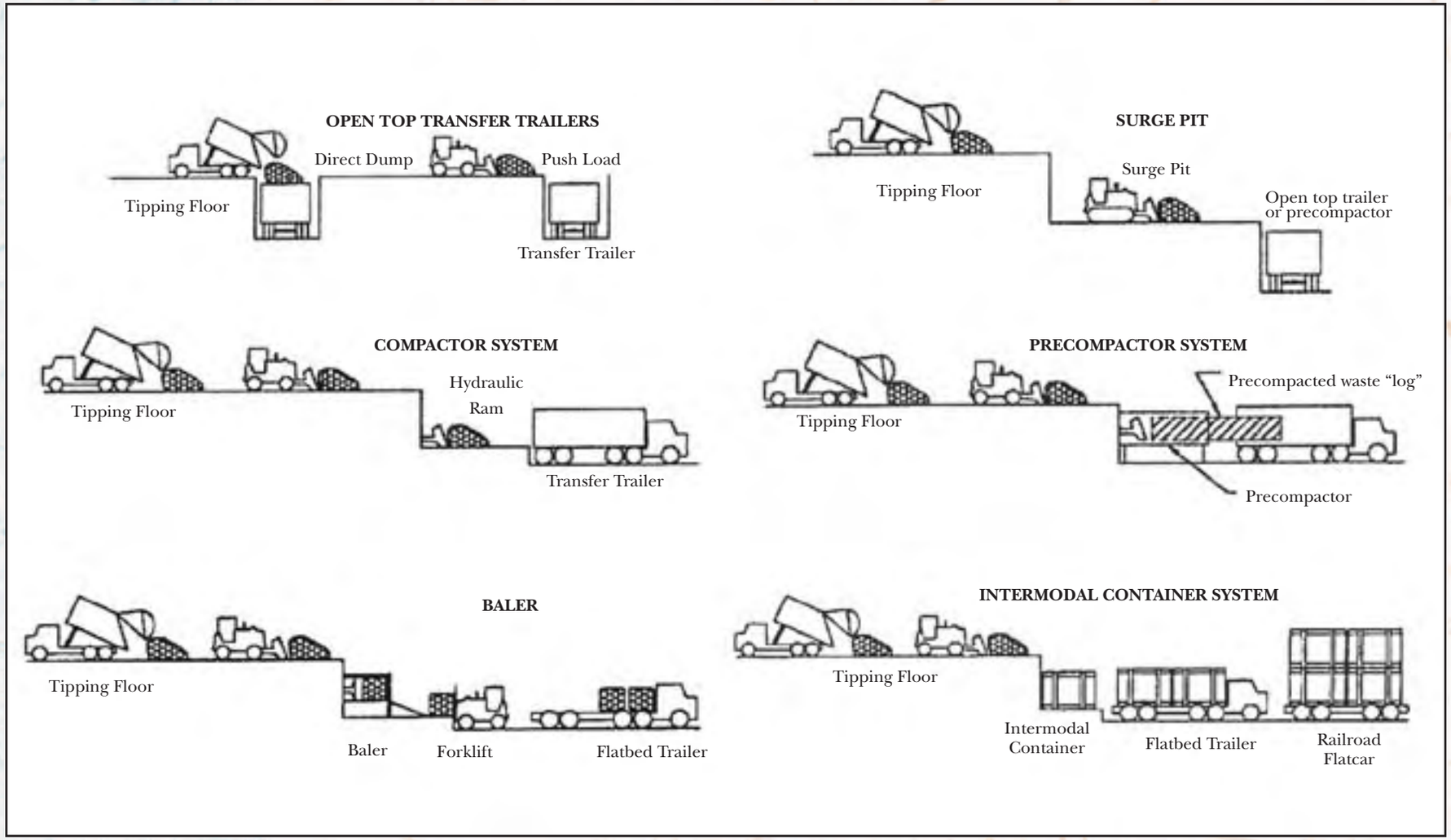
Options for reloading waste into a transfer container or vehicle include:

- Reloading directly from a tipping floor or pit into top-load containers or transfer trailers parked below the tipping floor or pit (Figures 13.3-A and 13.3-B).
- Reloading into a compactor that packs the waste into the end of a container or transfer trailer (Figure 13.3-C).
- Reloading into a preload compactor that compacts each truckload of material and then ejects the compacted "log" into the end of a container or transfer trailer (Figure 13.3-D).
- Reloading into a baler, which makes bales that can then be loaded onto a flatbed truck (Figure 13.3-E).

One disadvantage of methods that compact wastes prior to transfer is that compaction will significantly limit subsequent recovery of materials for recycling or composting at a landfill site. Table 13.3 shows the pros and cons of technology options for reloading.

Surge pit receiving and storage at large transfer station.

Figure 13.3: TRANSFER METHODS



Source: DuPage County, 1998. Solid Waste Transfer in Illinois: A Citizen's Handbook on Planning, Siting and Technology

Table 13.2: TRANSFER STATION RECEIVING AND STORAGE OPTIONS

Technology	Advantages	Disadvantages	Applications
Direct dump into transfer vehicle or storage container	• Simple: low potential for equipment breakdown. • Low capital cost. • Potentially less housekeeping; no tipping floor, pit, or compaction equipment to clean. • Much smaller building footprint possible, but advantage might be decreased by need for large space for queuing.	• Transfer station not usable if containers are not available; no short-term storage to accommodate peak inflow. • Potential queuing problems. • Low payloads in transfer. • Fall hazard. • Limited ability to screen. • No opportunity for materials recovery. • Generally not suitable for large collection vehicles. • Potential storage container damage from direct dumping.	Most suitable for small quantities and short transfer distances.
Waste storage on tipping floor	• Simple: low potential for equipment breakdown. • Generally less expensive and provides more operational flexibility than pits. • Can break up buly items and compact waste to increase density and payload.	• Waste on tipping floor may be messy and hazardous. • Potential for accidents between delivery vehicles and station mobile equipment. • Requires driving space for vehicles to pull forward when dumping load. • Equipment needed to reload waste into container/trailer. • Requires additional fire control equipment for waste on floor.	Suitable for small and large stations:can manage all waste types.
Surge pit	• Storage disconnects waste receipt from waste loading. • Can break up bulky items and compact waste to increase density and payload. • No extra space required for delivery vehicles to drive forward when unloading. • Eliminates potential for collision between delivery vehicle and station equipment.	• Expensive to construct. • Presents fall hazard to people and vehicles. • Hazardous to equipment operator working in pit when waste being unloaded from delivery vehicles. • Difficult to remove unacceptable waste found in pit. • Extra building level adds cost. • Equipment needed to reload waste into transfer vehicle. • Requires additional fire control equipment for waste in pit.	Most suitable for large waste quantities with high peak flows.

Table 13.3: RELOADING WASTE TECHNOLOGY OPTIONS

Technology	Advantages	Disadvantages	Applications
Top-loading trailers and containers	• Gravity loading is simplest method. • Can be supplemented with com paction using equipment that tamps waste from top. • Suiatable for a wide range of waste types includind C&D and bulky wastes.	• Trailer/container coverings allow odor and litter to escape. • Potential damge to trailer from loading heavy or sharp waste objects. • Noisy loading process.	Suitable for small and large stations.
Compaction into trailer or container	• Allows complete closure of trailer or container thus controlling odor and litter. • Compaction allows maximum utilization of cargo space.	• Trailer or container heavier construction to withstand compaction reduces payload capacity. • Higher capital cost for trailer fleet. • Overloading of rear axle of trailer (near compactor) and underloading of front axle. • Hydraulic power equipment can be noisy.	Not commonly used in new stations.
Pre-load compaction into rear-loading trailer or container	• Allows use of lightweight trailer or container thus alllowing more payload. • Allows use of closed trailer or container and contol of litter and odor. • Payload can be measured as it is compacted; ability to optimize payload.	• High capital cost. • Complex equipment more susceptible to break down; station not usable once short term capacity is full. • Redundancy requirement (two compactors) increases cost. • Totally dependent upon electrical power supply. • Less suitable for oversize waste. • Hydraulic power equipment for compactor noisy. • High power consumption.	• Most suitable for high-volume stations with long transfer. • Ideally suited for intrermodal transfer to rail system.
Baling	• Allows efficient transportation due to high density of bales; light container construction. • Completely closed container reduces allows odor and litter control. • Allows opimum landfill space utilization.	• High capital cost. • Complex equipment susceptible to breakdown; station not usable once short term capacity used. • Hydraulic power equipment for baler noisy. • Special equipment needed at landfill.	Suitable for large waste quanties requiring transfer over long distances.

Options for Unloading Waste from Transfer Vehicles

Options for unloading waste from transfer trailers at the processing or disposal facility include push-out blades, walking floors, and trailer tippers. With push-out blades and walking floors, the trailers unload themselves. A trailer tipper lifts one end of the trailer (or rotates the entire trailer) so that the load falls out due to gravity. Unloading baled waste at the landfill requires front-end loaders equipped with forks. Table 13.4 shows the pros and cons of different unloading technology options.

Many interrelated factors need to be considered when deciding on the appropriate technology for a transfer station. The major factors include design capacity, distance to the disposal site, cost, reliability, safety, and method of unloading at the disposal site. Each technology has both advantages and disadvantages. A combination of technologies may be used to mitigate some of the disadvantages of a particular design. For example, large transfer stations might have a top loading system as a backup in case the preload compactor breaks down or in case of an electric power outage.

Determine Transfer Station Size and Capacity

Whether you contract for waste transfer services or perform the function using government forces, you will need to determine the size and capacity of the transfer station needed. The physical size of a planned transfer station is based on the following factors:

- **The definition of the service area**. Sometimes this is relatively simple, such as "all waste generated in the governorate, or "all waste collected by the residential and commercial waste contractor." The break-even analysis performed earlier may reveal that waste transfer is only applicable for those parts of the planning area located beyond a certain distance from processing or disposal facilities.

- **The amount of waste generated within the service area**, including projected changes such as population growth and recycling programs, as well as allowing for seasonal variations (See Chapter 2, Solid Waste Management Planning, for more information on determining what types and quantities of waste are generated in your service area.).

Dumping waste at the landfill.

Table 13.4: UNLOADING WASTE TECHNOLOGY OPTIONS

Technology	Advantages	Disadvantages	Applications
Transfer trailer with push-out blade	Allows for unloading anywhere.	• Push out blade uses some trailer capacity (volume and weight) thus reducing potential payload. • Relatively complex equipment can break down; truck cannot unload. • Waste can get stuck behind push-out blade. • Blade can bind during extension or retraction.	Most suitable for short distance, low-volume transfer.
Transfer trailer with walking floor	Allows for unloading anywhere.	• More prone to leak liquids from the bottom of the floor. • More prone to damage from dense or sharp objects that fall into empty trailer.	Suitable for range of volumes and distances.
Trailer tipper for transfer trailers and trailer mounted containers	• Allows use of lightweight trailers to maximize payloads. • Ideal for rail-based container intermodal system.	• High reliability or redundancy required-no way to unload trailers at landfill if tipper fails. • Tippers can be unstable if placed over soft ground or waste at landfill.	Most siutable for high volume, long distance hauling to large landfill (to justify tipper cost).
Open-top railcar tippers.	Extremely fast, large-volume unloading.	• Fixed unloading point requires reloading and some other form of transport from unloading point to final disposal point.	Most suitable for a fixed disposal method such as a waste-to-energy facility.

Small collection vehicle.

- **The number and types of vehicles delivering waste**.
- **The types of materials to be transferred**, e.g., compacted versus loose MSW, green waste, C&D, etc.
- **Daily and hourly arrival patterns of users**. Hourly arrivals tend to cluster at two times in the day, with typical peaks at mid-morning and mid-afternoon. Peak hourly arrivals tend to dictate a facility's design more than average daily arrivals.
- **The availability of transfer trailers** or intermodal containers, and how fast they can be loaded.
- **Expected increases in tonnage** delivered during the life of the facility. For example, in a governorate with annual population growth of 3 to 4 percent, a facility anticipating a 20-year operating life would typically be designed for about twice the capacity that it uses in its first year of operation.
- **The relationship to other existing and proposed solid waste management facilities** such as processing and composting facilities and landfills.

The same factors are used to determine the size of the following transfer station features:

- **Amount of off-street vehicle queuing (waiting) space.** At peak times, vehicles must often wait to check in at a facility's scalehouse. It is important that the queue (line) not block public streets or impede vehicular or pedestrian traffic.
- **Number and size of unloading stalls**, and corresponding number of transfer trailer loading positions.
- **Short-term waste processing and storage areas** (for holding waste until it can be reloaded into transfer vehicles).

Present and projected daily, weekly, and annual waste volumes (including seasonal variations) are needed to determine the facility size required to accommodate waste deliveries. The maximum rate at which waste is delivered is a crucial consideration as well. In general, it is best to build a facility to accommodate present and projected maximum volumes and peak flows, with a preplanned footprint for facility expansion.

A useful exercise is calculating how much tipping floor space a facility would require to store a full day's waste in case of extreme emergency. One approach to estimating the required tipping floor space is to begin with a base area of 150 square meters (m^2) and add to it 1 m^2 for each ton of waste received in a day (assuming the waste will be temporarily piled 2 meters (m) high on the tipping floor). For example, if the facility receives 100 tons of waste per day (tpd), a tipping floor space of 250 m^2 would be required (i.e., 150 m^2 + (100 tpd x 1 m^2/ton) = 250 m^2). Figure 13.4 presents formulas for helping determine transfer station capacity.

Figure 13.4: FORMULAS FOR DETERMINING TRANSFER STATION CAPACITY

Stations with Surge Pits Based on rate at which wastes can be unloaded from collection vehicles:	C = PC x (L / W) x (60 x HW / TC) x F
Based on rate at which transfer trailers are loaded:	C = (Pt x N x 60 x Ht) / (Tt + B)
Direct Dump Stations	C = Nn x Pt x F x 60 x HW / [(Pt/Pc) x (W/Ln) x Tc] + B
Hopper Compaction Stations	C = (Nn x Pt x F x 60 x HW) / (Pt/Pc x Tc) + B
Push Pit Compaction Stations	C = (Np x Pt x F x 60 x HW) / [(Pt/Pc) x (W/Lp) x Tc] + Bc + B

Key to Abbreviations:
C = Station capacity (tons/day)
PC = Collection vehicle payloads (tons)
L = Total length of dumping space (m)
W = Width of each dumping space (m)
HW = Hours per day that waste is delivered
TC = Time to unload each collection vehicle (minutes)
F = Peaking factor (ratio of number of collection vehicles received during an average 30-minute period to the number received during a peak 30-minute period)
Pt = Transfer trailer payload (tons)
N = Number of transfer trailers loading simultaneously
Ht = Hours per day used to load trailers (empty trailers must be available)
B = Time to remove and replace each loaded trailer (minutes)
Tt = Time to load each transfer trailer (minutes)
Nn = Number of hoppers
Ln = Length of each hopper
Lp = Length of each push pit (m)
Np = Number of push pits
Bc = Total cycle time for clearing each push pit and compacting waste into trailer

Source: Decision-Makers Guide to Solid Waste Management, Second Edition (EPA530-R-95-023), p. 4-23.

Assess Transfer Station Number and Size Options

Design capacity is determined by the maximum distance from which waste can be economically delivered to the transfer station. The waste from the collection area that can efficiently reach the waste transfer station determines the volume of waste that must be managed. This is the facility's initial design capacity. Beyond a certain distance, another transfer station might be necessary, or it might become just as cost-effective to do direct hauling without a transfer station.

In urban or suburban areas alternative size/number scenarios should be considered. For example, a midsize governorate (population 500,000) might decide that two 500 ton-per-day transfer stations would best serve its community. This same governorate could alternately decide that a single 1,000 ton-per-day transfer station is its best option, even when the longer driving distances are considered. When deciding which approach is best for your governorate, issues to consider include the impacts the transfer station(s) will have on the surrounding area, siting complications, and the cost to build and operate the transfer station(s). Each approach offers advantages and disadvantages that must be reconciled with local needs.

The biggest advantage of constructing large transfer stations is the economies of scale that can significantly reduce capital and operational costs. Centralizing waste transfer operations allows you to reduce equipment, construction, waste handling, and transportation costs. The siting of a single facility may often prove easier than siting multiple facilities.

A major drawback to building a single large facility is locating a tract of land that adequately meets facility requirements. Large facilities tend to concentrate impacts to a single area, forcing one neighborhood to shoulder the burden for the entire city. A single facility will also result in longer travel times for collection crews, which leads to increased crew down time and increased wear and tear on collection vehicles. Another consideration is that a single facility cannot divert waste to a backup facility if a need arises. The single facility must have additional equipment in case of equipment failure or other emergencies.

In other situations, multiple smaller sites might better address a community's needs. Decentralizing waste transfer operations spreads impacts over a wider area. Although it is generally more expensive to build and operate several small transfer stations rather than one large station with the same total capacity, savings from reduced travel times might offset these capital costs and result in lower overall system costs. Multiple facilities also are better able to serve as backups for one another in case of scheduled or emergency shutdowns of facilities. The major disadvantage to building multiple facilities is that the difficulties encountered in siting a single facility are multiplied.

Rural Considerations

Transfer stations serving rural areas tend to be small. They are optimally located within a reasonable driving time from the service area's largest concentration of residences and businesses. For example, a rural transfer station could be located near one of the service area's larger communities and sized to take waste from all waste generators within approximately 50 km. As an example, two 50 ton-per-day transfer stations might each serve six small communities. Alternately, fewer transfer stations could be used, necessitating longer average travel distances. For example, a single 100 ton-per-day transfer station could be used to serve the same 12 small communities, but it would be located farther from the outlying communities.

Small transfer station.

STEP 3:

SELECT POTENTIAL TRANSFER STATION SITES

Identifying a suitable site for a waste transfer station can be a challenging process. Site suitability depends on numerous technical, environmental, economic, social, and political criteria. When selecting a site, a balance needs to be achieved among multiple criteria that might have competing objectives. For example, a site large enough to accommodate all required functions and future expansion might not be able to be centrally located in the area where waste is generated. Likewise, in densely developed urban areas, ideal sites that include effective natural buffers may not be available. Less than ideal sites may still present the best option due to transportation, environmental, and economic considerations. Issues relating to whether the site is in an urban, suburban, or rural setting will also play a role in final site selection. The relative weight given to each criterion used in selecting a suitable site will vary based on your community's concerns, needs, and expectations.

All siting criteria should be developed before identifying potential transfer station sites. This approach ensures siting decisions will be objective. Three categories or sets of criteria are applied during various stages of the siting process. It is important to note that it is unlikely that any site will meet all the criteria, in which case, each criterion's relative weight and importance must be considered. The three categories are as follows:

1. Exclusionary.
2. Technical.
3. Community-specific.

Define Exclusionary Siting Criteria

Siting a waste transfer station in areas with preclusive siting criteria may be prohibited by federal laws or regulations. Even when siting in excluded zones is allowed, the added engineering designs or strong public opposition can significantly increase construction costs. In general, it is best to avoid siting in these areas. Exclusionary criteria might include areas such as:

- Protected sites of historical, archeological, or cultural significance.
- Prime agricultural land.
- Parks and preserves.
- Land reserved for military uses.
- Wetlands.
- Endangered and protected flora and fauna habitats.

Some examples of federal laws defining these areas include:

- Law 102/1983 for Natural Protectorates.
- Law 4/1994 for Protection of the Environment.

The siting process should include up front and continuous public participation. Establishing credibility and trust with the public is as important as addressing environmental, social, and economic concerns about the facility. The public must be a legitimate partner in the facility siting process to integrate community needs and concerns and to influence the decision-making process. Planners and decision-makers should read Chapter 7, Public Awareness and Communications, for guidance on best practices for communicating and building support with the public.

Define Technical Siting Criteria

The second category of criteria to develop includes technical parameters that help define the best potential facility sites. These criteria provide guidance on specific engineering, operation, and transportation conditions that should be considered to ensure that potential sites are feasible from technical, environmental, and economic perspectives. These criteria address the following issues:

- **Location central to collection routes:** To maximize waste collection efficiency, transfer stations should be located centrally to waste collection routes. As a general guideline for urban and suburban areas, transfer stations should be no more than 15 km away from the end of all collection routes. Beyond that distance, collection routes might need to be altered to enable waste to be collected and deposited at the transfer station within one operating shift.

- **Access to major transportation routes:** The transfer station should have direct and convenient access to truck routes, major arterials, and highways (or rail access, if appropriate). For urban areas, direct access to rail lines will significantly reduce the number of large transfer trailers leaving the station and traveling area roads. It is preferable to avoid routing traffic through residential areas. Traffic generated by transfer stations contributes to congestio,; increased risk to pedestrians, increased air emissions, noise, road deterioration, and litter.

A large transfer station.

- **Site size requirements:** The area required for specific transfer stations varies significantly depending on the volume of waste to be transferred, rates at which waste will be delivered, the functions to be carried out at the site, and the types of customers the facility is intended to serve. Locating a site of sufficient size is critical to operating efficiencies and to minimizing impacts on the surrounding community. Engineering input can establish preliminary size criteria based on a conceptual design.

- **Sufficient space for onsite roadways, queuing, and parking:** Transfer stations typically have onsite roadways to move vehicles around various parts of the transfer site. Waste collection trucks can be up to 12 m long. Transfer trailers that move waste to a disposal facility are typically 18 to 25 m long. These vehicles require wide roadways with gradual slopes and curves to maneuver efficiently and safely. Also, the site will need space for parking transfer vehicles and to allow incoming and outgoing traffic to form lines without backing up onto public roads.

- **Truck and traffic compatibility**: Transfer stations receive surges of traffic when collection vehicles finish routes simultaneously. Transfer station traffic will vary locally, but tends to peak twice a day. The first peak is often near the middle of the morning, and the second at the middle of the afternoon. Therefore, the best sites for transfer stations are located away from areas that have peak auto, bus, and pedestrian traffic at these times.

- **Ability for expansion:** When selecting a site, allow for subsequent increase in the daily tonnage of waste the facility will be required to manage and add processing capabilities. It is frequently less expensive to expand an existing transfer station than to develop a new site due to the ability to use existing operations staff, utility connections, traffic control systems, office space, and buildings.

Transfer station fueling.

- **Space for receiving other wastes and recyclables:** A transfer station could be sited in areas also conducive to recycling or composting activities. Transfer stations may be designed to enable residents and businesses to drop off C&D and green waste. Transfer stations may also incorporate processing or transfer of recyclable materials.

- **Buffer space:** To mitigate impact on the surrounding community, a transfer station should be located in an area that provides separation from residences or sensitive areas such as hospitals. Buffers can be natural or constructed and can take many forms, including open spaces, fences, sound walls, trees, berms, and landscaping.

- **Gently sloping topography:** Transfer stations often are multilevel buildings that need to have vehicle access at several levels. Sites with moderately sloping terrain can use topography to their advantage; allowing access to the upper levels from the higher parts of the natural terrain and access to lower levels form the lower elevations. Completely flat sites need ramps or bridges constructed to allow vehicle access to upper levels (or areas excavated to allow access to lower levels). Sites with steep slopes should be avoided.

- **Access to utilities:** Transfer stations require utilities to operate, such as electricity for lighting, balers and compactors; water for facility cleaning, restrooms, and drinking; and sanitary sewer systems for waste-water disposal. Smaller transfer stations in rural areas may use wells for water supply, and some may use septic systems, or truck their waste water for offsite treatment.

Define Community-Specific Criteria

The third category of criteria to consider is impacts that the facility will have on the surrounding community. These criteria are more subjective than technical in nature and incorporate local, social, and cultural factors. Examples of these criteria include:

- Impact on air quality.
- Odor and noise.
- Impact on traffic, aesthetics, and quality of life.
- Impact on the local land use and infrastructure.

Apply the Criteria

After determining all three categories of siting criteria, apply the criteria to narrow down all possible sites. It is likely every site will have some shortcomings. First, plot the exclusionary criteria on maps. This will help the planning team visualize the impact of federal regulations. Once unsuitable areas are eliminated, the team's technical criteria and community-specific criteria should be applied to all remaining options. Information for each potential site should be developed so the planning team can rank the sites. Based on the team's ranking, the top two to four sites should undergo more rigorous analysis to determine technical feasibility and compliance with environmental, economic, and other community objectives.

STEP 4:

COMPILE FINDINGS IN AN ASSESSMENT REPORT

In Step 4, the findings from completing the previous steps in this chapter should be compiled and summarized in an assessment report, and circulated among all stakeholders and governmental officials to solicit input. The process of developing this document will illuminate any fundamental systemic problems, and help identify the waste transfer options that may rectify them.

The document should include the following components:

- A summary of findings from the break-even analyses.
- Descriptions of the conceptual design including:
  - Types of waste to be handled.
  - Who the users will be.
  - What functions will be performed other than transfer.
  - Estimates of average and peak daily waste volumes.
  - Type of transfer technology.
  - How waste will be shipped.
- Results of site selection process.
- Preliminary recommendations of potentially viable transfer system options that appear worthy of inclusion in transfer scenarios to be evaluated in Step 5.

The highlights of the report findings should be presented in the mass media for public review and feedback from customer groups and government officials.

Waste loading at the transfer station.

STEP 5:

EVALUATE WASTE TRANSFER OPTIONS

Step 5 involves formulating individual scenarios that can then be evaluated using the design criteria selected by the planning team. Each scenario will consist of choosing an option that includes both the collection and transfer components that comprise the integrated waste collection and transportation system. Changing any one of the components produces a new scenario that needs to be separately evaluated. Making final decisions concerning components of the system must take into account policy decisions and service objectives made earlier in the planning process, as well as the planning team design criteria.

The decision making process can be facilitated by applying system design criteria. These may include, but not necessarily be limited to the following:

- Compliance with national laws and local ordinances.
- Cost effectiveness and affordability.
- Health and safety.
- Environmental compatibility.
- Effectiveness.
- Public acceptance.
- Efficiency.

The relative importance assigned to each of these design criteria in the evaluation will vary depending on the input received from governorate officials and expectations of the public. In every case it is highly likely that affordability and cost effectiveness will be a priority. Accurate evaluation of the affordability design criteria will require the application of full cost accounting principals and financial management tools described in detail in Chapter 3, Solid Waste Financial Management.

It is essential that this step be performed in conjunction with the selection of the preferred residential and commercial waste collection system as described in Chapter 8.

Develop Preliminary Cost Estimates

Once the decisions for all the collection and transfer system components have been made for all parts of the planning area, the next step is to apply full cost accounting techniques to each transfer scenario using the approach described in Chapter 3. This step should consist of developing preliminary system cost estimates.

Use of the approach requires the planner to seek out and develop a great deal of data for input. To use the approach for the purpose of calculating a preliminary cost estimate for each scenario (combination of system component options) please see Chapter 3.

Summarize Results

The estimated cost and the assessment of the compatibility of each scenario with the design criteria should be summarized in spreadsheet form to facilitate comparison of all waste transfer scenarios analyzed by the planning team. Be sure to integrate any analyses and findings relating to residential and commercial waste collection resulting from application of the steps in Chapter 8. The spreadsheet should be incorporated into a brief narrative report to solicit feedback from stakeholders and serve as the basis for final decision-making by the appropriate governorate officials. To facilitate this objective, several copies should be produced and widely disseminated among all interested parties.

STEP 6:

SELECT PREFERRED WASTE TRANSFER PROGRAM

Once the cost of each of the waste collection and transfer scenarios has been calculated, the final decision making process can begin, which consists of the following tasks:

- Calculate impact on rates/tariffs for categories of ratepayers and cost recovery methods.
- Solicit final round of stakeholder input.
- Provide governorate officials with all qualitative and quantitative analyses and findings to select the integrated waste collection and transfer system that is most compatible with design criteria.

Calculate Rates/Tariffs and Evaluate Cost Recovery Methods

Before selecting the preferred waste collection and transfer system, the governorate needs to know if and how it will be able to pay for it. The planning team should use full cost accounting methods described in Chapter 3 to evaluate cost-related issues that apply to each of the scenarios under consideration. These issues include the following:

- "Willingness to pay".
- Impact on tariffs.
- Impact on "cost recovery" options.
- The method of fee collection.

The results will include proposed fee schedules and identification of the pros and cons associated with each of the practical means for covering the cost of the waste collection and transfer system.

Solicit Final Stakeholder Input

Once the planning team has calculated how much each of the collection and transfer scenarios will cost each group of ratepayers, these groups will be better able to make informed decisions about the program they prefer. It is essential that a period of time be allowed for widespread dissemination to and feedback from, the public at large. Governorate officials might find it useful to host public meetings to discuss the preferred waste collection and transfer system.

Unloading at a transfer station.

Governorate Officials Select Preferred Waste Transfer System

Internal deliberation on the input received from the planning team and the general public can now take place among all of the appropriate governorate officials. With the data available, they can choose a system with the highest probability of achieving waste collection and transfer objectives, that is still affordable to the majority of families and businesses in the governorate. In the event that officials select to change one or more of the components of a system scenario, the scenario should be subjected to Step 5 before receiving final approval.

STEP 7:

IMPLEMENT THE SELECTED PROGRAM

If the services are to be provided directly by the governorate then the implementation plan should address the same issues and program elements that must be addressed when procuring private sector services. However, instead of developing technical documents for an RFT, the in-house plan would include detailed descriptions in personnel and operating instruction manuals of how the services are to be performed by governorate employees.

The planning team is now ready to begin the task of implementing the selected waste collection and transfer system.

Contracting with the private sector for provision of waste transfer services requires the following actions:

- Establish the program funding mechanism.
- Procure a contractor.
- Develop and implement a means of contract administration and monitoring.
- Develop a public awareness and communications program.

Each of these tasks is described briefly below.

Establish the Program Funding Mechanism

The governorate must be able to pay for the waste transfer station system regardless of whether the service is provided by a contractor or by the governorate. Before any new service is implemented, the governorate must decide on who will pay, and how the money will be collected. Chapter 3 provides further information on an approach to funding solid waste management services.

Waste transfer stations are generally part of an overall ISWM system, in which case no separate fee system is needed. As much information as possible about how the system will be funded should be provided to the contractor.

Procure a Contractor

The competitive procurement or bidding process requires the preparation of two major documents by the contracting agency:

- A Request for Qualifications (RFQ).
- A Request for Tender (RFT).

Both of these documents are prepared by, or under the guidance of, a Technical or Tender Committee.

The RFQ is used to pre-qualify contractors who then will be allowed to submit bids or tenders in response to the RFT. Generally it provides the contracting industry with an overview of the project and outlines the disciplines and level of expertise needed to perform the project. The RFQ provides guidance on how the contractors should respond and how their responses will be evaluated.

The RFT is the document the pre-qualified bidders use to prepare their tenders. It generally consists of a book of conditions and annexes, including technical specifications. It provides great detail about the required services and typically becomes a part of the contract between the governorate and the selected contractor.

If waste transfer services are being procured and implemented at the same time as waste collection services then the development of technical specifications will be integrated with those developed for waste collection service as described in Chapter 8. If waste transfer service is being implemented as an adjunct to existing public or private waste collection operations then the process described in Appendix A will yield stand-alone documents required for the RFT.

Guidance on how to prepare and use an RFQ and an RFT is presented in Chapters 4 and 5.

The draft contract, general conditions of the contract, and appendixes are all part of the RFT and ultimately will form the basis for the contract between the governorate and the successful bidder. Consequently, it is extremely important to prepare these documents carefully to ensure that the long-term contract relationship is properly formulated and that the responsibilities and risks are appropriately assigned between the parties.

Appendices to the general conditions are used to set forth specific information necessary to completely define the requirements of the work and to provide any information affecting the performance of the service. Typical topics covered include the following:

- Technical Specifications.
- Bidder's Technical Proposal.
- Facilities and Equipment.
- Contract Performance Letter of Guarantee.
- Supplemental Information.

Instructions on how to prepare a draft contract, general conditions, and appendices are provided in Chapter 5, Tendering and Contracting. Specific instructions on how to prepare technical specifications for the appendices of an RFT for waste transfer services can be found in Appendix A of this chapter.

Develop and Implement a Means of Contract Monitoring and Administration

When a governorate signs a contract with a private sector contractor to provide any solid waste management service, the contract must be monitored by the governorate to ensure that the contract terms and conditions are being met, and that residents and businesses are being provided the services specified in the contract. The governorate must develop an organizational structure to administer and monitor the contract and contractor operations.

Large transfer station.

Contract monitoring and administration of a solid waste services contract requires development of a governorate institutional infrastructure dedicated solely to that purpose. Chapter 6 is designed to provide guidance for those governorate officials and administrators responsible for development and implementation of the organization and infrastructure for monitoring contracts for any type of solid waste management service.

Develop a Public Awareness and Communicationβ Program

A public awareness and communications campaign is critical to the successful implementation of any solid waste management system component, particularly when its implementation has potential negative impact on community neighborhoods. Optimizing citizen support requires a comprehensive and professionally developed long term plan. Implementation plan developers should refer to Chapter 7 for a description of how to manage a general public awareness campaign to ensure that the public understands the purpose of waste transfer and the impact on system costs. It describes the steps that must be conducted to implement a successful public awareness campaign. In addition, it provides guidelines on building a public awareness and communications team (PACT) within the contract monitoring organization that can take the responsibility of managing such a campaign. It explains in simple terms who will do what, when, and how.

APPENDIX A: INSTRUCTIONS AND EXAMPLES FOR TECHNICAL SPECIFICATIONS

Technical specifications are part of the appendices to the contract general conditions of the RFT. They should provide a comprehensive description of the services desired and define the specific requirements related to the provision of those services. The technical specifications should provide the following information, typically organized as follows:

- Definitions.
- General Description of Services.
- Service Specifications.
- Minimum Technical Requirements.
- Performance Standards.
- Performance Monitoring.
- Measurement and Payment.
- Penalties.

Detailed instructions on how to prepare all of these sections is provided in Chapter 5. Information specific to waste transfer for the technical specifications is presented in this appendix.

General Description of Services

The General Description of Services can be divided into three sections:

- Scope of Services.
- Background Information.
- Summary of Intent.

The content to include in each of these sections is described briefly below.

Scope of Services

The scope of services should begin the process of defining for the bidders the services that they will need to provide if they are successful in getting the contract. The scope of services should state that the contractor will furnish all labor, supervision, materials and supplies, permits, licenses, insurance, and equipment necessary for waste collection and transfer services as specified for the service area. Collected waste should be transferred as specified and transported to the designated disposal facility. The contractor may divert waste to beneficial use subject to your review and approval on a case-by-case basis. The contractor should perform these services in conformance with the specifications and requirements contained in the RFT.

Background Information

So that bidders can submit a responsive proposal, you will need to provide them information concerning the scope of services to be provided. All relevant factual information obtained or created in the program planning process should be summarized in clear tabular form and included in the introduction and background section to the service specifications in the RFT. Examples include population, number of dwelling and commercial business units, transfer station sites, estimated quantities of each type of waste to be transferred, and any information relating to provision of waste collection and transfer services.

Sample Summary of Intent:

The intent of the government as prescribed in this RFT is to provide waste collection and transfer services at the best price and with the highest quality of service. To this end, the governorate has provided some information to all pre-qualified bidders in order to assist them to compute fair and reasonable financial offers. However, it is the sole responsibility of pre-qualified bidders to exercise due diligence in assessing all existing work conditions and to ultimately rely on their own assessments in the calculation of prices submitted in the tender offer.

Summary of Intent

This is a general statement that clearly presents your intent in seeking a contractor for this service.

Service Specifications

Service specifications describe the work to be done. The primary objective of service specifications is providing bidders with a clear understanding of what services you want the contractor to provide. It tells the potential contractor what, where, and when. Service specifications for waste collection systems that include transfer should specify the types of service to be provided and include information on the following strategic elements of the service desired:

Example Service Specification for Residential and Commercial Waste Transfer Service:

"The contractor shall design, construct, and operate facilities to receive, weigh, offload, store, consolidate in top loading trailers, and transfer to the (Designated Processing or Disposal Facility) all residential and commercial wastes collected in the Governorate and delivered by Governorate Designated contractors during the hours of 6:00 a.m. to 6:00 p.m., 7 days per week."

- Types of wastes to be included.
- Categories of transfer station users.
- Desired number and size of transfer stations.
- Hours and days of operation.
- Type of transfer technology (optional).
- Identification of processing and/or disposal facilities to be used.

Service specifications also tell the bidders what work plans are required from them as part of their technical proposal, as well as the work plan requirements for the successful bidder. Typically, a draft work plan, preparation work plan, final work plan are required.

Draft Work Plan

As part of the tender offer, each bidder should be required to submit a draft work plan (DWP) that illustrates his or her understanding of the service requirements and describes exactly how the company intends to perform them. The minimal technical requirement for the DWP should require that bidders address the following:

1. Location of waste transfer vehicle parking areas and maintenance garages.
2. Maps of proposed transport routes from transfer station to processing and disposal facilities.
3. Proposed hours transfer vehicles will operate.
4. Proposed transfer station operating hours.
5. Staffing plan including job descriptions and the number of personnel to be deployed in each position.
6. Plan for recruiting and training labor, equipment operators, and supervisory personnel.
7. Description of driver training and testing program.
8. Lists of transfer station and transport equipment indicating number, type, make, size, and age. If new, require a letter of commitment from the manufacturer guaranteeing ability to meet required delivery schedule.
9. Plans for contract administration and transfer station supervision.
10. Descriptions of record keeping and reporting systems for all information and data required to be submitted.
11. Proposed procedures for communicating with the governorate's contract administration organization and all categories of customers.
12. Proposed transfer and transport equipment sanitation and preventative maintenance program and schedule.
13. Transfer station construction schedule showing completion dates for preparation of the site, acquiring permits, completion of design engineering, construction of all facilities, and start-up of operations.
14. Engineering concepts for construction of the transfer station and proposed transfer system.
15. Plans and method to acquire all construction and environmental permits.
16. Land use map showing vehicle traffic routes.
17. Site layout showing all proposed structures.

18. Environmental mitigation measures including odor, dust, and noise control.
19. Transfer facility operation plan.
20. Description of how the contractor will comply with each of the service specifications and minimum technical requirements.

Preparation Work Plan

The preparation work plan (PWP) should provide schedules for the initiation and completion of all preparation period activities including, but not necessarily limited to, the following:

1. Recruiting and training labor and supervisory personnel.
2. Procuring supplies and equipment.
3. Rehabilitating existing facilities.
4. Constructing new facilities.
5. Implementing project management structure.
6. Implementing information database and record keeping systems.
7. Finalizing transfer station site field data collection and analysis.
8. Preparing and receiving Egyptian Environmental Affairs Agency (EEAA) approval of the final Environmental Impact Assessment (EIA).
9. Preparing a project schedule for obtaining permits, finalizing the transfer station design, and start-up operations.
10. Initiating final transfer station design and engineering drawings.
11. Ordering all equipment and constructing a scalehouse/office building.

Final Work Plan

The final work plan (FWP) is submitted by the successful bidder after the contract is awarded. It should incorporate all of the elements of the DWP and the PWP together with any refinements and modifications discussed and agreed upon between the contracting agency and the contractor prior to execution of the contract.

Minimum Technical Requirements

The purpose of minimum technical requirements or standards is to set conditions relating to "how" the contractor shall perform the specified services. In other words, minimum technical requirements establish guidelines that will ensure that the contractor provides the services in a manner that is compatible with the program design criteria. Minimum technical requirements should clearly, but simply, state what you expect.

Instructions for preparing all the components of minimum technical requirements can be found in Chapter 5. The sections below contain information related specifically to waste transfer.

Sample Minimum Technical Requirement for Transfer Vehicle Loading:

"No vehicle used for transfer of waste shall be loaded in excess of the manufacturer's Gross Vehicle Weight (GVW) rating or in excess of the maximum weight specified by the Egyptian Roads and Bridges Authority."

Minimal technical requirements should be established for each of the following elements of providing waste transfer services in conjunction with waste collection:

- Site design plan.
- Environmental controls.
- Facility design and operation.
- Waste transfer vehicles.
- Waste transfer personnel.
- Record keeping and reporting.

Issues to address in each service element and suggested wording for each are provided below.

Site Design Plan

A site plan showing the layout of the transfer station site's major features, including access points, roadways, buildings, parking lots, utilities, surface water drainage features, fences, adjacent land uses, and

landscaping should be required to ensure that the bidder is proposing transfer facilities that are adequate to provide transfer services in compliance with all technical specifications.

Site design plans should show the following features:

- **Buffer areas:** Require the contractor to incorporate adequate open space, landscaping, trees, berms, and walls that reduce impacts on the surrounding area.
- **Buildings**: Including entrances and exits for vehicles and people.
- **Holding area:** An area that will not impede transfer operations should be required for inspecting and screening incoming loads and holding inappropriate waste loads or materials for removal.
- **Parking areas:** The site plan proposed by the bidder should be required to include sufficient parking for all employees, visitors, and transfer vehicles.
- **Queuing areas:** Queues can develop at the inbound scales, the unloading area, and the outbound scales. Queuing space should be clearly identified, and queues should not extend across intersections.
- **Road entrances and exits:** Including acceleration/ deceleration lanes on public streets, and access points for waste arriving and departing from the transfer station. They should provide for separate access for visitors and employees so that these vehicles do not have to compete with vehicles using the facility.
- **Scalehouse:** You should require that all incoming and outgoing loads be weighed and recorded on scales accurate to the nearest 50 kilograms (kg).
- **Traffic flow routes on site:** Require the contractor to endeavor to eliminate sharp turns, intersections, and steep ramps.

Environmental Controls

Obtaining transfer services that minimize environmental impacts requires careful oversight of contractor planning, design, and operation. The minimum technical requirements suggested below focus on both environmental and public nuisance issues and suggests best practices to reduce their impacts. Clear and strict minimum technical requirements can address and mitigate potential impacts on the surrounding natural environment and the community. Sample minimum technical requirements that address traffic, noise, odors, air emissions, vectors, and litter are discussed below.

1. Air Emissions: Air emissions at transfer stations result from dusty wastes delivered to the transfer station, exhaust (particularly diesel) from mobile equipment such as trucks and loaders, driving on unpaved or dusty surfaces, and cleanup operations such as sweeping. You can minimize air emissions by requiring the contractor to comply with proper design and operating procedures, including:

- Paving all traffic carrying surfaces.
- Keeping paved surfaces and tipping floors clean, and ensuring any sweeping operations use sufficient water to avoid stirring up dust.
- Installing misting systems to suppress dust inside the building or using a hose to spray dusty wastes as they are unloaded and moved to the receiving vehicles. (In rural areas, small stations might not have a readily available water supply, or might have to rely on a portable water supply for housekeeping needs.)
- Minimizing idling of equipment by turning off engines when not in use.
- Cleaning truck bodies and tires to reduce tracking of dirt onto streets.

2. Litter Control: In the normal course of facility operations, stray pieces of waste are likely to become litter in and around the facility. If you do not have or do not enforce regulations to cover collection vehicles, the litter problem will be prevalent on routes leading to the station. Dry, light materials such as plastic grocery bags can be blown from vehicles, or from the tipping area to the area outside the facility. Design and operation considerations that you should require of the contractor to control litter include:

- Conducting all waste handling and processing activities in areas that are at least partially enclosed, if possible.
- Orienting the transfer building with respect to the predominant wind direction so it is less likely to blow through the building (or tunnel) and carry litter out.

- Strictly enforcing load covering requirement to reduce litter from waste trucks. Give the transfer station operator the authority to decline uncovered loads and institute surcharges to provide incentives for users to cover their loads.
- Providing windbreaks to deflect wind away from waste handling areas.
- At small rural stations, providing containers with lifting lids that are normally closed.
- Minimizing horizontal ledges where litter can accumulate.
- Providing skirts (usually wide rubber belting or strip brushes) that close the gap between the bottom of the chute and the top of the receiving container at stations that employ chutes and hoppers to contain waste as it is deposited in trailers and drop boxes.
- Installing fencing and netting systems to keep blowing litter from escaping the transfer site. This is particularly necessary at small or rural facilities that are likely open-sided or that lack an enclosing building.
- Conducting regularly scheduled litter patrols to collect trash on site, around the perimeter, on immediately adjacent properties, and on approach roads and the hauling route(s).
- Cleaning the tipping floor regularly and maintaining good housekeeping practices. This will minimize the amount of loose material that can be blown outside.

3. Noise: Transfer stations can be a significant source of noise, which might be a nuisance to neighbors. Heavy truck traffic and the operation of heavy equipment are the primary sources of noise. Even off-site traffic noise in the station's vicinity will be perceived as noise from the station itself. Where applicable, require the contractor to include the following facility design and operations practices to help reduce noise.

- Maximize the utility of perimeter site buffers, particularly along site boundaries with sensitive adjoining properties.
- Orient buildings so the site topography and the structure's walls buffer adjacent noise-sensitive properties from direct exposure to noise sources.
- Use sound-absorbent materials on any building walls and ceilings.
- Shut off idling equipment and queuing trucks.
- Minimize traffic flows adjacent to noise sensitive property.
- Arrange the facility layout to eliminate steep uphill grades for waste-hauling trucks.
- Face any building openings such as entrances away from noise-sensitive adjoining property.
- Consider alternatives for beeping backup alarms, such as strobe lights and proximity detectors.
- Confine noisy activities within specified buildings or other enclosures. For example, enclose hydraulic power units associated with compactors and rams in areas with acoustic silencing materials.
- Maintain mufflers and engine enclosures on mobile equipment operating within the transfer station. Also insist that operators of waste collection vehicles keep their equipment, including the muffler systems, in good repair.
- Conduct activities that generate the loudest noise during selected hours, such as the morning or afternoon commute hours, when adjoining properties are unoccupied or when off-site background noise is at its highest.

4. Odors: Food waste, and certain green wastes such as grass have a high potential for odor generation, especially during hot weather. Thus, transfer stations handling these wastes need to address odor management based on current and projected adjacent land uses. You should require that odors be managed by the contractor through implementation of good facility design and operating procedures, including:

- Increasing the distance between the odor source and the downwind receiver where possible.
- Taking into account the prevailing wind direction to determine building orientation and setback to adjacent properties.
- Orienting the building and its doorways with respect to odor-sensitive neighboring property.
- Designing floors for easy cleanup, including a concrete surface with a positive slope to drainage systems. Eliminating crevices, corners, and flat surfaces, which are hard to keep clean and where waste residue can accumulate.
- Sealing concrete and other semi-porous surfaces to prevent absorption of odor-producing residues.

- Using water sprays along the walls of the pit to suppress dust.
- Minimizing onsite waste storage, both in the facility and in the loaded trailers, by immediately loading odorous or potentially odorous wastes into transfer trailers and quickly transferring them to the disposal site.
- Incorporating odor neutralizing systems.
- Removing all waste from the tipping floor or pit at the end of each operating day, and then cleaning those areas to remove remaining residues.
- Using enclosed trailers whenever possible if loaded trailers must sit on site temporarily before transfer.
- Practicing "first-in, first-out" waste handling practices so wastes are not allowed to sit on site for long periods of time.
- Keeping building catch basins, floor drains, and drainage systems clean so odor-causing residues do not build up.
- Treating drainage systems periodically with odor-neutralizing and bacteria-inhibiting solutions.
- Practicing other "good housekeeping" measures, including regularly cleaning and disinfecting containers, equipment, and other surfaces that come into contact with waste.

5. Traffic: Some specific design and operation features that you should require of the contractor to reduce the environmental impacts of transfer traffic include:

- Designating haul routes to and from the transfer station that avoid congested areas, residential areas, and any other sensitive areas.
- Adding offsite directional signs, pavement markings, and intersection signals.
- Providing acceleration and deceleration lanes that allow vehicles to enter and leave the flow of offsite traffic smoothly, reducing congestion and the likelihood of accidents.
- Using right turns to enter and leave the station site and minimizing left turns to reduce congestion and the risk of accidents off site.
- Providing adequate onsite queuing space so lines of customers and transfer vehicles waiting to enter the facility do not interfere with offsite traffic.
- Using compaction equipment to maximize the amount of waste hauled in each transfer trailer, thus reducing the number of loads leaving the site.

6. Vector Control: Vectors are organisms that have the potential to transmit disease. Vectors of concern at transfer stations include rodents, insects, and scavenging birds. Much of the concern surrounding vectors is associated with general nuisance factors. You can greatly reduce the presence of vectors by requiring the contractor to incorporate a few basic design elements and operational practices, including:

- Installing bird-deterrent measures, such as suspended or hanging wires to keep birds out of structures, and eliminating horizontal surfaces where birds can congregate.
- Removing all waste delivered to the facility by the end of each day.
- Cleaning the tipping floor daily.
- Routinely inspecting the facility for potential vector habitat, and taking corrective action when needed.
- Using commercial vector control specialists as necessary.

Facility Design and Operation

To ensure that the transfer system operator will meet all of the performance criteria, the contracting agency should develop minimum technical requirements for design, construction, and operation of all transfer facilities. Suggested minimum technical requirements for each issue to be addressed are provided below.

1. General: State in unambiguous terms that the contractor is responsible for design, permitting, construction, and operation of all facilities and systems required to perform the transfer of all acceptable wastes from the governorate to the designated processing or disposal facility.

2. Access Control: For the safety and protection of both the general public and the contractor's personnel and equipment require that transfer stations be surrounded by a combination of fencing (or other structural barrier) and gate(s) that prevent uncontrolled access and vandalism to the facility. Furthermore, require that fencing, barriers, and gates be maintained in proper working order at all times. The

contractor should also be required to restrict admission to its employees, subcontractors, and designated contracting agency staff or their consultants.

3. Emergency Event Record: The contractor should be required to maintain an emergency event record that contains the following information for each occurrence of fire or accident causing property damage or personal injury:

- Date and time of the emergency event.
- Person recording the emergency event.
- Location of the event.
- Type of emergency event.
- Description of actions taken.
- Person who authorized the actions.
- Person(s) who performed the actions.
- Remedial measures taken to prevent further occurrences.

4. Emergency Event Response Plans: Transfer station operators should be prepared for emergencies and should be required to include emergency procedures in their FWP. At minimum, the following emergency events should be anticipated and addressed:

- Power failure. The plan should address how to record user information and load transfer trailers during a power outage. At larger transfer stations you should require the contractor to have backup power generators so at least some operations can continue during a power failure.
- Unavailability of transfer vehicles. The plan should address what to do if weather conditions, road closures, or traffic prevent empty transfer vehicles from arriving at the transfer station. The plan should also address when the transfer station should stop accepting waste deliveries if the waste cannot be hauled out in a timely manner.
- Unavailability of scales. The plan should describe record keeping procedures in the event that scales are inoperable.
- Fire. Fire response and containment procedures should address fires found in incoming loads, temporary storage at the transfer station, compaction equipment, transfer vehicles, and other on-site locations. Require facilities to have fire hoses and other fire suppression equipment in the area such as water cannon on a washer truck that can be used to contain small fires until the fire department arrives.
- Spill containment. Spills can occur from waste materials or from vehicles delivering waste. For example, hydraulic compaction system hoses on waste collection trucks can break. Spill containment plans should address spill identification, location of spills, deployment of absorbent materials, and cleanup procedures. For large spills, the plan should also address preventing the spill from entering storm drains or sewers.
- Discovery of hazardous materials. Hazardous materials plans should include methods to identify and isolate hazardous materials, temporary storage locations and methods, and emergency phone numbers.
- Injuries to facility employees or users. The plan should include first aid procedures, emergency phone numbers, and routes to nearby hospitals.

Emergency response plans should also include a list of emergency contacts, including daytime and evening phone numbers for facility management, facility staff, emergency response teams, and regulatory agencies.

5. Facility and Equipment Maintenance: Since Egyptian experience has demonstrated that inadequate maintenance of equipment has been a root cause of failure of government-provided waste management services, it is critical that the contractor be required to perform continuous preventative maintenance to optimize equipment utility and expected life.

It is in the interest of the contractor to maintain all equipment. It is also in the interest of the contracting party to minimize any risk of service interruption due to the failure of the contractor to give equipment maintenance the critical attention that it deserves. To that end, the contractor should be required to submit accurate records of repair in a monthly operations report, showing maintenance of all equip-

ment in safe and operable condition. Moreover, the contractor should maintain all facilities in a way that does not negatively impact daily operations or site security. You should list the equipment that the contractor should maintain in good working condition and capable of performing their intended function. As a minimum this equipment will include:

- Buildings and other structures including, and not limited to, perimeter fencing, gates, paved surfaces, unpaved surfaces, drainage structures and yard piping, wash-down water collection and storage facilities, utilities, and truck scales.
- Stationary equipment including, and not limited to, waste handling, consolidation and storage equipment.
- Mobile equipment including, and not limited to, skid steer loaders, front end loaders, and transport trucks.
- Waste storage and transport containers and transfer vehicles.

6. Facility Operating Schedule: A transfer station's operating hours must accommodate the collection schedules of vehicles delivering waste to the facility. The decision on operating hours should take into consideration the local setting of the transfer station, including neighboring land uses, as well as the operating hours of the disposal facility receiving waste from the transfer station.

Operations often extend beyond the "open for customers" hours, however, as workers load waste into transfer vehicles, clean the facility, and perform equipment maintenance. Depending on the location of the operation, you should specify when transfer trucks may leave the site. If operators maintain an inventory of empty transfer containers and vehicles and loaded containers and vehicles on site, they should only be hauled off site on a schedule considering traffic on area roadways, neighborhood impacts of truck traffic, and the hours the disposal facility receives waste from the transfer station. You should limit the overnight storage of waste in the transfer station or even in transfer trailers.

7. Fire Control and Suppression: To protect property and worker health and safety, require that all buildings be constructed of fire resistant/retardant materials. Also require that the contractor install and maintain fire suppression equipment. The facility should also be equipped with telephone service to call for emergency fire control assistance.

8. Fire Control Plan: The contractor should be required to develop a Fire Control Plan. The plan should include instructions for workers on fire suppression and evacuation plans, and inspection schedules for the fire suppression system and fire extinguishers. All scheduled inspections, or the failure to conduct a scheduled inspection, should be reported in the monthly operations report (MOR). Require that all contractor and subcontractor personnel shall receive annual training in fire suppression and evacuation procedures.

9. Fuel Leak Recovery: You should require the contractor to handle fuel leaks or spills in an environmentally responsible manner. In the event of a fuel leak from a collection/transport vehicle or from facility equipment, the contractor should be required to isolate the spill area and apply a commercial absorbent product to the spill. The collected material should be containerized, and disposed in accordance with applicable environmental regulations**.** All spills should be recorded by the contractor in the environmental control record book. The cleanup should be documented and the spill and cleanup reported in the MOR.

10. Health and Safety and Emergency Response Manual: For the protection of transfer station personnel require the contractor to develop a Health and Safety and Emergency Response Manual that contains instructions for responding to foreseeable emergencies including fire, medical emergency, vehicle accident, and environmental hazards. Also require that all contractor and subcontractor personnel be provided with the health and safety and emergency response manual and receive annual training in health, safety, and emergency response procedures.

11. Monthly Safety Inspections: The transfer station operator should be required to conduct a monthly safety inspection of the entire facility and inspect the condition and upkeep of all required personal protective equipment in use.

12. Personnel Safety: The transfer station operator should be required to provide emergency first aids kits at all workstations. All workers should be provided and required to wear personal protective equip-

ment including, and not limited to, steel toe shoes, hard hats, safety glasses, and/or facemasks as appropriate, and ventilation masks. Personal protective equipment requirements should be defined in the health and safety and emergency response manual for each worker activity.

13. Proven Technology: To ensure that governorate's waste transfer objectives are achieved, require that the contractor use only proven transfer technology. The technology should have been in successful commercial operation for at least 3 years, and have been employed successfully in at least three transfer stations of similar size. A list of these transfer stations should be supplied with the bidder's tender offer.

14. Transfer System Capacity: The pre-qualified bidder should be made responsible for verifying any waste quantity information contained in the RFT. The contractor should determine the optimum design capacity of the transfer system based on the contractor's own assessment of the data, and his or her projections for increases in waste generation over the term of the contract. The design capacity should be based on nominal and peak generation of waste in the governorate, and have both an 8-hour and 24-hour operating capacity.

15. Vaccination Requirements: All employees involved in waste transfer operations should receive and maintain all commonly available vaccinations for any disease that may be transmitted through needles or other items typically found mixed in solid waste. The contractor should also be required to maintain an employee vaccination log, and the log should be available for inspection.

Waste Screening

Some types of wastes are not appropriate for handling at a transfer station. These unacceptable wastes might be difficult to handle, dangerous, or prohibited at the processing and disposal facility. Transfer station operators should be required to screen for unacceptable materials before, during, and after collection vehicles unload. If wastes are refused at a transfer station, require the operator to give the driver a preprinted fact sheet that describes why and suggest alternative management methods.

At the transfer station, screening for unacceptable wastes should start at the scalehouse. Employee training on identifying and managing suspect materials should be required. Scalehouse operators should interview customers about types of waste they have and from where the waste was collected. A list of common unacceptable items should be posted, and operators should ask if any of the items are present in the load. Visual inspections can also help identify unacceptable wastes.

Some unacceptable wastes might not become apparent until the unloading process. Operators should be required to observe waste unloading and examine suspected unacceptable wastes.

Regardless of screening efforts, transfer station operators should expect that some unacceptable wastes will be discovered after the responsible party is gone and should set aside an area for safe temporary storage until appropriate disposal is feasible, and develop a step-by-step plan to follow when unacceptable waste is discovered.

1. Waste Storage: For protection of health, safety and the environment you should require that all incoming waste be processed within 24 hours of delivery. All waste stored on site should be processed by the end of each operations day. Waste should be stored in a secure manner and location that provides protection from theft, vandalism, inadvertent human or animal exposure, and wind. They should also be managed in a way not to provide a breeding place or food for insects or rodents, and not generate noxious odors. There should be no overnight storage of waste in the receiving area.

2. Weighing and Materials Classification System: The contracting agency needs to know exact quantities of waste received, recovered and disposed in order to calculate the diversion rate required of the collection contractor. Therefore all transfer stations must be equipped with a permanent vehicle weighing system where all incoming and outgoing wastes can be weighed and recorded. The vehicle weighing system should be capable of weighing vehicles up to 60 tons and in increments no greater than 50 kg.

Waste Transfer Vehicles

To ensure that the contractor utilizes transfer vehicles that meet the contracting agency's technical, economic, service quality, health, safety, environmental, and aesthetic performance criteria, the RFT should include minimum technical requirements for the following:

1. Ancillary Equipment: Minimum technical requirements should include an article addressing the need to equip every transfer vehicle with safety and emergency response accessories. It should require at a minimum that each transfer vehicle be equipped with the following:

- A fire extinguisher.
- A first aid kit.
- An audible backup warning device that activates each time the vehicle backs up.
- Two-way communication with the contractor's transfer supervisor and contractor's dispatch/maintenance office.
- Flares, flags, and wheel chock blocks for use when breakdowns occur on public streets.

2. Appearance: It is important for the contractor to maintain the appearance of the transfer vehicles. Clean, freshly painted vehicles send a message to the public that waste management is a public service that is beneficial to a clean environment and a higher quality of life. The contractor should be required to paint all transfer vehicles at least once every 3 years.

3. Dedicated Fleet Inventory: The contracting agency will want to have a record of all of the transfer vehicles that the contractor intends to deploy in case of complaints from citizens and businesses concerning vehicle operation. This will also provide assurance that the number and type of vehicles is adequate. No later than 30 days prior to service commencement, and annually thereafter, the contractor should provide a list of the equipment to be used specifying the year, make, model, identification number, and Gross Vehicle Weight (GVW) of each transfer vehicle.

4. Maintenance: Transfer vehicles have many moving parts that require preventative maintenance to be functional. Egyptian experience has demonstrated that inadequate maintenance of mobile equipment has been a root cause of failure of government-provided waste management services. Even new vehicles require continuous preventative maintenance in order to function in a safe and operable condition over the expected useful life of the vehicle. It is in the interest of the contractor to maintain all equipment. It is also in the interest of the contracting agency and the ratepayers that it represents to minimize any risk of service interruption caused by failure of the contractor to give vehicle maintenance the critical attention that it requires. To that end, the contractor should be required to submit accurate records of repair in a monthly operations report, documenting maintenance of all waste transfer vehicles in a safe and operable condition.

5. Marking and Identification: Transfer vehicles used by the contractor should have appropriate signage and markings to facilitate identification by traffic police, employees at processing and disposal facilities, and the general public. It is recommended that all vehicles used in either the supervision or provision of transfer service have highly visible lettering 10 centimeters (cm) or greater in height lettering on each side of the vehicle body indicating the name and telephone number of the contractor, identification of the contracting agency, and vehicle identification numbers (numbered consecutively). The contractor's business name should not contain the name of the contracting agency or implying ownership by it. In addition, all waste transfer vehicles should have the carrying capacity, in cubic meters (m^3) and GVW, of the vehicle identified in numbers at least 12 cm in height displayed in the upper front corner of the left and right sides of the body.

6. Operator Requirements: The contracting agency is the guardian of the safety of the general public. It has the responsibility and authority to minimize the risk that waste transfer vehicle drivers might pose to public safety. To that end, establishment of minimum requirements regarding the licensing and driving skills of the contractor's transfer vehicle operators are warranted. The requirement should ensure that the contractor use only personnel specifically trained in the safe and efficient operation of transfer vehicles. In addition, all vehicle operators should be required to have all required permits and licenses. The contractor should be required to provide documentation of compliance with this requirement and evidence that all transfer vehicle operators have been provided vehicle operation and safety training

and have passed a written examination and driving test no later than 10 days prior to commencement of transfer operations.

7. Registration, Licenses, and Insurance: The contractor should be required to use transfer vehicles registered, inspected, insured, and in compliance with all local ordinances and national laws pertaining to motor vehicle ownership and operation. This will reduce the risk of the contractor having improperly equipped vehicles on the road that could be a threat to public safety and general welfare. It will also ensure that the contractor has insurance to cover any property damage or injury to any motor vehicle operator or pedestrian.

8. Reserve Equipment: To minimize the risk of interruption in service the contractor needs to have an adequate level of transfer equipment in reserve at all times. To achieve this goal the contracting agency should require that the contractor have available at all times, reserve equipment which can be put in service within four hours of any breakdown so that no interruption in regularly scheduled transfer service occurs. Such reserve equipment should be required to correspond in size and capacity to the equipment normally used by the contractor.

9. Safety/Daily Vehicle Inspection: As an additional means of reducing the risk of contractor use of transfer vehicles that are unsafe or not fully functional, the contractor should be required to inspect vehicles daily. In addition, the contractor should be required to take out of service any vehicle that does not pass inspection. Daily inspection reports should be made available to the contract administration agency upon request.

10. Sanitation: In addition to maintaining the appearance and mechanical functions, the contractor should be required to regularly wash and sanitize transfer vehicles to minimize odors and insect propagation, and to protect worker and public health. To that end, the contractor should be required to wash the interior of the cargo area of all vehicles used for the purpose of transporting waste with water and a disinfectant and deodorizing cleaning agent. This should be performed at a minimum of weekly, and/or according to the schedule submitted as part of the final work plan. In addition, the contractor should be required to wash all exterior surfaces of transfer vehicle chassis and body with water and a detergent a minimum of one time per every 2 weeks.

11. Transfer Vehicle Body Requirements: The contractor should be required to only utilize vehicles with bodies that were manufactured for the purpose of consolidating, storing and transporting waste. Thus, the area of the transfer vehicle body used for the storage of waste should be watertight, entirely covered during transport, and prohibit spillage of any solids or liquid waste materials, oil, grease, or other substances onto the ground or exterior body of the vehicle. In the event that any waste materials are dropped or spilled during transfer, the vehicle operator should be required to clean it up immediately.

12. Transport Vehicle Garage and Parking: A minimum technical requirement is needed to ensure that transfer vehicle maintenance and parking facilities meet environmental standards and do not create potential health or safety hazards. The contractor should be required to provide written notification to the contract administrator as to the parking location of all transfer vehicles 30 days prior to the first day of service and annually thereafter. No contractor vehicles should be stored on any public street or other public property. Also, if transfer vehicles are kept within contract service area boundaries overnight, they should be parked and be maintained on private property within a building or fenced yard.

13. Transport Vehicle Loading: Overloaded transfer vehicles increase equipment maintenance costs, pose a threat to public safety, and contribute unnecessarily to the deterioration of streets and roads. To prevent the contractor from overloading transfer vehicles, the minimum technical requirement should not allow loading in excess of the manufacturer's GVW rating or in excess of the maximum weight specified by the Egyptian Roads and Bridges Authority.

Waste Transfer Personnel

To ensure that the contractor trains and deploys transfer personnel in a manner that meets all of the contracting agency's economic, technical, health, safety, environmental, and aesthetic performance criteria, the RFT should contain minimum technical requirements that address each of the personnel related concerns described below.

1. Competence and Skills: It is in the interest of the contracting agency and the public to ensure that the contractor employs personnel that are competent and skilled for their particular job position. This can be conveyed to the contractor through a minimum technical requirement that requires the contractor (including any subcontractors) to only utilize management and administration staff, field supervisors, drivers, equipment operators and laborers that have met certain training requirements appropriate for their respective trades, e.g., in transfer and transportation of wastes.

2. Driver Training and Licenses: Transfer vehicles may be large and hard to maneuver, thereby posing a potential danger to public safety if not operated by a well-trained and experienced driver. To minimize the risk to the public all drivers of transfer vehicles should be required to carry valid Egyptian licenses appropriate for the class of vehicle that they are driving. In addition, the contractor should be required to certify that all drivers have been provided training appropriate to equip them with the skills needed to safely operate waste transfer vehicles under the local conditions.

3. Field Supervision: To facilitate governorate communication with the contractor and to ensure adequate management of all transfer and transport personnel it is essential that a minimum ratio of supervisors to workers be specified. The contractor should be required to provide the names of all supervisors in writing to the contract administrator. Finally, each supervisor should be required to be present in his or her assigned area of responsibility and have radio communication with the contractor's office and all transfer vehicles under supervision during all operating hours.

4. Scavenging: Transfer station employees will be tempted to scavenge usable or recyclable materials that they observe in loads delivered to the transfer station. Scavenging reduces compliance with productivity and diversion goals, and is dangerous. Require the contractor to forbid any employee from scavenging any materials at any point in the transfer and transportation process.

5. Uniforms and Safety Equipment: Requiring the contractor to provide uniforms and safety equipment for all transfer personnel has the multiple purposes of protecting worker health and safety, minimizing direct contact with waste, ensuring worker cleanliness, and providing a means of projecting a positive image of the service to the public. The contractor should be required to provide all employees with a specified number of uniforms, hats, gloves, work boots, reflective vests, and other protective clothing adequate to maintain their appearance, health, and safety. Transfer station personnel that are directly involved in screening waste should also be equipped with ear protection, air filtration masks and puncture resistant gloves. All uniforms and safety equipment should be subject to review and approval by the contracting agency.

Record Keeping and Reporting

Detailed operating records enable facility managers and the governorate to ensure that the waste transfer system is operating efficiently and in accordance with contract specifications. To ensure adequate record keeping and reporting you should include minimum technical requirements that address each activity in the manner suggested below.

1. Record keeping: Medium and large transfer stations should be required to record the following information as part of their routine operations:

- Incoming loads: date, time, company, truck number (i.e., company fleet number), weight (loaded), weight (empty), origin of load.
- Outgoing loads (typically transfer trucks): date, time, company, and driver name, truck number (i.e., company fleet number), weight (loaded), weight (empty), type of material (e.g., residential and commercial waste, industrial waste, C&Ds), destination of load.
- Facility operating log: noting any unusua-l events during the operating day.
- Accidents or releases: details any accidents or waste releases into the environment.
- Maintenance records for mobile and fixed equipment.
- Employee health and safety reports.
- Employee training and operator certification documentation.

2. Monthly Operations Reports (MORs): Requiring the contractor to prepare and submit monthly reports that address all aspects of transfer operations is the best way to maintain complete and up-to-date working knowledge of contractor activities and performance. On-going review and analysis of these reports provides an ideal mechanism for both the contractor and the contracting agency to identify trends and potential problem areas and expedite remedial measures that improve overall service.

Rural Considerations

Some transfer station operators, particularly at smaller facilities, should only be required to record some of the above items. In order to avoid the cost of installing and operating a scale, some small and medium-size transfer stations could be allowed to estimate load volume (as measured in cubic meters) instead of weighing loads (in tons). When loads cannot be easily viewed (such as with packer trucks), m^3 are generally based on the vehicle's capacity.

Monthly reports must be timely to maximize their utility, and therefore should be submitted within 15 days of the end of the month being reported on. The information to be required in each monthly waste transfer report and summary annual reports should include the following:

- Tons of waste received, transferred and delivered daily for each waste category.
- Monthly tonnage of waste received, diverted for recycling, and disposed (including receipts for any recyclable materials sold).
- Accurate records of vehicle and equipment repairs, including:
    - Vehicle identification number.
    - Date and mileage.
    - Nature of repair.
    - Compliance with preventative maintenance schedules submitted as part of the contractor's final work plan.
    - Signature of the maintenance supervisor that the repair has been properly performed.
- Summary report of daily transfer vehicle inspections.
- An updated inventory of all vehicles used for waste transfer services including the make, type, year, license number, and ownership.
- An updated list of names of all supervisory personnel assigned to each transfer function.
- A description of problems encountered and proposals for increasing service efficiency and achievement of service objectives.