CHAPTER 15

Solid Waste Management
Privatization Procedural Manual

WASTE REDUCTION AND RECYCLING

SOLID WASTE TECHNICAL ASSISTANCE

Ministry of State for Environmental Affairs

U.S. Agency for International Development

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CHAPTER 15

WASTE REDUCTION AND RECYCLING

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INTRODUCTION

Thousands of communities worldwide have elected to include recycling and other waste reduction techniques as integral components of their integrated solid waste management (ISWM) system to help extend the life of existing landfills and reduce the need for new ones. Available land for solid waste facilities near population centers continues to become more scarce in Egypt. As discarded materials increase in value, waste reduction becomes increasingly important. Waste reduction and recycling are the primary means of reducing dependence on disposal and non-renewable resources. While these practices cannot entirely eliminate the need for disposal, well-designed and aggressively promoted waste reduction and recycling programs can significantly reduce the volume of waste landfilled.

This chapter is intended as a guide for those tasked with implementing programs to reduce the amount of solid waste disposed in their governorate. It addresses the important role of waste reduction as the most direct way to reduce waste at the source. It also describes a planning process that can be used to identify the most applicable program for collecting, processing, and marketing recyclable materials diverted from the planning area waste stream. Special emphasis has been placed on providing needed information to perform the following:

Recycling is defined as:
The process by which waste materials are transformed into new products in such a manner that the original products lose their identity.

Waste Reduction

Waste reduction refers to all means of reducing the amount of waste generated at the source. It can be achieved through a wide range of actions including: customer adoption of new product purchasing and consumption

Labeling and sorting options.

habits; national legislation; product design; and implementation of local programs designed to keep valuable resources out of the waste stream. Cooperation with the commercial, industrial, and institutional sectors is vital in an integrated solid waste management system. The system components include the following:

- Work with factories on product design and packaging to reduce resource use through reusable products and packaging and deposit-refund systems.
- Work with institutions like schools, government offices, and hospitals to consider the disposal implications of their policies and purchasing practices.

Material Recovery Facility sorting line.

- Public awareness campaigns focused on the following:
  - Educating residents on the implications of the products and packaging that they purchase.
  - Promoting neighborhood cleanliness as a means to environmental health.
  - Supporting reduced usage of retail plastic carry bags.
  - Encouraging and educating about composting within the household.
  - Encouraging reuse, recycling, and composting by all waste generators.

Residents and businesses can create less waste by following the directives listed below:

- Avoid disposables. Switch to reusable materials, like cloth napkins at home.
- Buy durable products that are long lasting. A lower cost product that has to be frequently replaced may end up costing more in the long run, and create more garbage.
- Buy products and appliances that are easy to repair. An appliance can often be repaired instead of thrown out.
- Avoid over-packaged products. Some, but not all packaging is necessary.

Waste reduction can also be achieved through re-use. Re-use is defined as the use of a product more than once in its same form for the same or different purpose. Re-use involves giving a product or package a second life instead of throwing it away after just one use. Examples of re-use ideas are shown below:

- Take shopping bags back to the store. Reuse plastic shopping bags or use cloth shopping bags that can be used over and over.
- Give old furniture and clothing to others that can use them.
- Repair rather than replace furniture, electronics, and appliances whenever possible.
- Write and print on both sides of a sheet of paper.

Recycling

Recycling is the most widely known and practiced waste reduction technique. When properly planned and implemented, recycling can divert significant quantities of discarded materials from the waste stream and subsequent disposal.

The benefits of recycling go far beyond just saving landfill space:

- Recycling provides a source of valuable raw materials. Multiple markets exist for paper, metal, cardboard, glass, plastic, and other materials. Collecting and selling these materials likely will not make a profit for your community, but in some cases can reduce your community's waste management costs by creating a revenue stream from waste. Recycling is an integral part of an optimized nationwide integrated waste and resource management strategy.

- Recycling saves resources. Recycling 1 ton of newspaper saves the equivalent of 17 trees. Producing a new aluminum can from a recycled aluminum can reduces production energy requirements by 75 percent. Products made from paper and plastic re-

Planning for a Residential and Commercial Recycling Program can be broken down into the following five steps:

1. Calculate Maximum Recycling Potential.

2. Identify and Assess Recycling Program Options.

3. Compile Findings in an Assessment Report.

4. Evaluate Recycling Program Scenarios.

5. Select Preferred Recycling Program.

6. Implement the Selected Program.

quire significantly less energy when recycled materials are used as feedstock. Recycling helps reduce Egypt's balance-of-payments trade deficit by providing a local source of raw materials for manufacturing. Materials recovered from the waste stream and recycled reduce the need to import raw materials from distant areas of the world.

- Recycling provides new jobs and economic development. Studies have shown that recycling produces approximately nine times as many jobs as landfilling the equivalent quantity of waste. Recycling programs provide employment for people who have difficulty finding work, including physically and mentally challenged workers, and people on public assistance.

- Manufacturing products from recycled materials reduces emissions to the environment.

Commercial businesses and industries have traditionally recycled significant portions of their discards. For example, plastic packaging manufacturers separate and sell plastic scrap as regrind to other manufacturers of plastic products such as garbage bags, and corrugated cardboard boxes used to package products for delivery to retail stores are collected for recycling.

Organized programs for the collection and recycling of a wide variety of discards from residential and small commercial business sources have only been developed and implemented within the last 10 to 15 years. These programs are typically designed and operated in conjunction with municipal waste management systems and are funded through tax revenues or direct user fees. Providing recycling services to residents and commercial businesses in Egypt is the responsibility of the governorates. This chapter is devoted to providing governorate planners with guidance to identify and plan for implementing recycling programs that take into account unique local needs, objectives, and conditions.

Planning for Residential and Commercial Recycling

The promotion of waste reduction at the source is an important strategy that governorates and the national government should continuously work towards. This chapter describes the planning process for identifying the most appropriate program for collecting, processing, and marketing recyclable materials at the local level. It also provides information necessary for the following:

- Evaluating overall recycling potential.
- Identifying viable recycling program alternatives.
- Selecting the most appropriate alternatives based on selected design criteria.
- Creating the required technical documents if the service will be provided by the private sector.

It is important to keep the big picture in mind when establishing a recycling program. The ultimate goal of any recycling program is to produce materials that, after cleaning and conversion to a secondary feedstock, will be marketable to an end-user. In considering the use of post-consumer materials in an operation, an end-user is looking for a feedstock that has properties and costs similar to virgin feedstock. If the recycled feedstock meets end-user specifications, the next consideration usually is the cost of recycled material as compared to the cost of virgin material. If local governments plan and implement cost effective recycling programs, manufacturers can realize significant savings by using recycled versus virgin resources.

Plastic water bottles.

STEP 1:

CALCULATE MAXIMUM RECYCLING POTENTIAL

Every community has a distinct maximum recycling potential (MRP). The MRP is the annual tonnage of recyclable materials in the planning area that can realistically be separated, collected, and processed for recycling. Waste characteristics and the generation of individual recyclable materials vary according to the extent of urbanization, the income level of the area, and the degree of its industrialization and commercialism. The planner must learn who is generating what type of recyclables, in what quantities, and where.

The following actions are required to estimate the MRP of your planning area:

1. Determine Waste Stream Composition.
2. Inventory and Assess Existing Recycling Infrastructure.
3. Identify and Assess Markets for Recovered Materials.
4. Assess Willingness of Residents and Business Owners to Participate and Pay.
5. Estimate Collected Material Quantities.

What recyclable materials are available and in what quantities?

Determine Waste Stream Composition

The first required action to calculate the maximum recycling potential for your planning area is to determine the composition of the waste stream. National waste stream statistics or data produced for another governorate cannot accurately reflect your governorate's waste stream. This information can only be determined by analyzing the waste stream in your planning area.

As described in Chapter 2, identifying types and quantities of waste in the waste stream is one of the first steps in the planning process. Households, commercial establishments, and institutions such as schools, hospitals, and government offices all generate different quantities and types of waste. In addition to knowing the sources of various types of waste, planning for recycling requires knowledge of the following waste characteristics:

- Quantity.
- Composition.
- Density.

Sample recycling bin.

It is necessary for planners to conduct local research to be able to estimate the quantity of recyclables generated. The selection of the appropriate number, size, and type of collection vehicles and processing equipment will be based upon these amounts. The amount of residential solid waste generated varies with family size, type of dwelling, family income, and the ages of family members. The amount of waste generated also varies with consumption and eating habits. Moreover, waste generation and the associated generation of recyclable materials varies from one season to another.

Industrial waste generation is a function of type of industry, number of employees, and size of the industrial plant. Medical waste generation is a function of the type of healthcare facility, and if a hospital, the number of staff and beds. More information concerning industrial and medical waste generation is provided in Chapters 10 and 11.

Overall, residential waste generation increases with household income.

Construction and demolition debris generation is a function of population growth, the local economy, and the level and type of building construction and demolition. More information concerning construction and demolition debris generation is provided in Chapter 9.

Rural Considerations

In rural areas purchasing power is low and life styles are conservative. Organic household waste is often segregated at the source, with food and farm waste fed to animals or used as a soil conditioner. Animal waste, paper, cardboard, and rags are burned in traditional mud ovens. There is very little glass since rural residents buy few goods packaged in glass containers and soft drinks come in returnable bottles. Plastic and scrap metal are sold to peddlers that visit virtually every rural area, often serving as the only waste collection system available. As a result, very little usable waste is discarded, and whatever might be discarded is picked over by animals and scavengers. This leaves only small quantities of relatively low value discards remaining in the waste stream available for recovery through formal recycling programs.

The composition of residential solid waste depends to a large extent on the income level of the population. For example, household eating and cooking habits will vary due to factors such as affluence and culture, and is subject to seasonal variations such as agricultural production cycles, religious feasts, and the presence of tourists who also play a role in types and amounts of generated waste.

These differences in composition mean that different recycling systems (e.g., type and size of storage and set-out containers) may be required for the various sources of recyclables generated.

The density of various residential and commercial waste streams should be determined in kilograms (kg) per cubic meter (m^3). A high proportion of paper and plastics in affluent housing or commercial areas will yield a recycling stream that has a low density. A high proportion of glass and metal will result in a high density. Knowledge of the waste density is needed to ensure that the collection vehicles selected by the service provider for collecting the recyclables have adequate carrying capacity.

Waste stream analyses (sometimes called waste characterization or solid waste composition studies) should be conducted over a 12-month period to account for seasonal and other influences on waste types and quantities generated. There are three basic methods of waste stream analysis:

1. Sampling, sorting, and weighing representative samples randomly selected from the waste stream.
2. Visual surveillance to estimate relative volumes of wastes in broad categories.
3. Review scalehouse data to determine the relative weights of selected streams as well as to indicate seasonal changes in quantity.

Inventory and Assess Existing Recycling Infrastructure

The next required action is to obtain an understanding of the types and level of recycling that already exist in the planning area. "Informal" recycling infrastructure exists at moderate to significant levels in every governorate, urban or rural. The informal sector performs the majority of waste collection and recycling services in many urban governorates. Existing informal recycling will impact current and future quantities of material available for the formal recycling program. Decisions will ultimately have to be made concerning which parts, if any, of the existing recycling infrastructure will be integrated into the governorate's solid waste management system.

Informal recycling targets recovery of the non-organic portion of residential and commercial waste stream. It is driven by socio-economic factors where selling recovered or reused materials provides a livelihood for many low-income residents. Both municipal and private waste collection crews and street sweepers routinely recover plastic and metal. Informal street "roamers" recover plastic from residents and paper and scrap metal from commercial businesses. These roamers and other scavengers routinely search through waste in dumpsters at waste pooling sites or through piles of illegally dumped waste wherever they occur.

Informal sector workers in Egypt have been reluctant to be integrated into the formal waste management system. However, integrating the informal sector into the process will likely result in lower recycling program costs and improved long-term service. The informal sector has access to significant experience, labor, and equipment assets. When these assets are integrated into the formal recycling program, they can improve the productivity of those assets and optimize total materials diverted for recycling.

Recycling collection vehicle.

A complete inventory of the existing infrastructure to assess the extent and complexity of the infrastructure will include investigating and quantifying the following components:

- Recyclable material collection and transportation (including waste collection).
- Manual waste sorting for recyclable material recovery.
- Preparing separated materials for market.
- Recyclable material traders.
- Recyclable material conversion.
- End users of recovered materials (from small workshops to large industries).

Planners can obtain basic information regarding the existence of individuals and businesses in the activities listed above from governorate solid waste or Cleansing and Beautification Departments, environmental and waste-oriented Non-Governmental Organizations (NGOs), and the Egyptian Environmental Affairs Agency (EEAA). A comprehensive inventory and assessment will require original research as it is unlikely that these organizations will have conducted such a survey or have reliable information on the quantities of materials recycled.

Identify and Assess Markets for Recovered Materials

Recyclable materials separated from the waste stream become commodities, similar to virgin materials. Program planners must understand the many factors affecting the commodities markets and the prices paid for these materials. Domestic production capacity, imports, consumption, energy and transportation costs, changing technology, new product opportunities, available substitute materials, and other factors affect the markets for recyclable materials. Factors affecting international markets include these same forces plus foreign trade tariffs, currency exchange rates, trade policy and programs, and other political forces.

Materials should not be included in the recycling program unless there are an adequate number of stable markets that will buy the collected and processed materials. Markets for these materials not only provide a source of income to offset the costs of the collection and processing service provider, but also impact collection and processing requirements. Therefore, confirming the existence and understanding the role of viable markets must be undertaken early in the recycling program planning process. It cannot be postponed until decisions concerning collection and processing have been made.

Two types of markets should be investigated: intermediate and final. Intermediate markets include processors, traders, and brokers of material. In general, intermediate markets handle a variety of materials that they purchase from private, commercial, or industrial sources. They accumulate, process, store, and transport the recyclable materials to final markets.

Final markets range from workshops to manufacturing facilities that convert recyclables into new products. These markets usually handle only one material to produce one type of product (i.e., glass bottles, metal cans, newsprint, etc.). Specialized local markets may exist as well.

Once a list of potential markets has been compiled, these markets should be surveyed to determine the type and quantity of materials that they can accept. The survey should also establish the following:

The support and participation of residents and businesses in the recycling program is critical to its success.

- Prices paid.
- Material specifications.
- Assistance available for processing.
- Pickup and delivery requirements and restrictions.
- Storage restrictions.
- Availability of short or long-term contracts.

Finally, recycling programs must be flexibly designed to handle fluctuating markets and uncertain outlets for materials. Therefore, market analysis will be both a planning and ongoing activity, as program sustainability requires the ability to respond to inevitable market oscillations.

Assess Willingness of Residents and Businesses to Participate and Pay

It is essential to be aware of and understand the attitudes and behavior of citizens and other stakeholders expected to participate in the selected recycling program. This requires asking them questions that will provide a realistic assessment of their willingness to participate. The planning team should, at a minimum, seek the following feedback from residents and business owners:

- Their knowledge and opinions of waste reduction and recycling.
- Their expectations for the level of service and results.
- Their ability and willingness to co-operate in the planning and implementation of expanded or more formal recycling programs.
- Their preferred level of service (i.e., user requirements regarding material separation, set-out requirements, collection frequency, etc.).
- Their ability and willingness to pay for the service.
- The basis and method of payment and payment cycle.

The efficient recovery of large volumes of high-quality recyclable materials depends on citizen involvement. Although there is typically latent support for recycling, not all residents and businesses can be expected to support it. If ambivalent attitudes or objections to recycling can be identified and characterized, planners can design programs that can overcome them.

One way to gauge public interest in and support for recycling is to survey residents and businesses about their attitudes toward waste disposal and recycling. In Egypt, telephone surveys can be administered to a representative cross-section of waste generators in the planning area. Responses received can then be tabulated, analyzed, and used to guide program design, program funding, public education.

Another way to assess local attitudes toward recycling is to conduct focus group research. Focus groups are a recognized, small group, survey technique in which a moderator asks a series of open-ended questions to a small sample of individuals (generally 10 to 25) who are either chosen at random or demographically representative of the planning area population. This survey approach enables moderators to gather qualitative data that are not easily gathered through more traditional phone or mail survey techniques. Though the results are rarely statistically valid, focus groups do provide more detailed information about a wider range of issues than multiple choice or true-false questions. Moderators can structure questions to assess knowledge levels at the start of a session and monitor how quickly the group's knowledge level rises during the course of the session.

Another important component of a community outreach plan is the development of a citizen's advisory committee or task force. Such citizen groups

Appropriately designed and highly promoted recycling programs in Western Europe and the United States achieve participation rates of 70 to 90 percent. Similar rates should be achievable in most communities in Egypt.

can include local civic and business leaders (and others who have influence) as well as local technical experts. Advisory committees can serve as valuable allies during the program planning process through the following activities:

- Building consensus.
- Involving stakeholders in the decision-making process.
- Soliciting public input, harnessing local resources.
- Educating possible opponents about the importance and value of recycling.
- Shaping public opinion.

Estimate Collected Material Quantities

In the process of gathering data on waste stream composition, you will estimate the percentage of each potentially recyclable material presently being discarded in the waste stream after accounting for diversion through existing recycling efforts. Estimating the total quantity of each recyclable material that will actually be set out for collection requires answering several questions. By answering the following questions, the governorate will be able to make informed decisions about what materials to collect, whether to use source separation or commingled collection, what types of storage/set-out containers and collection vehicles to use, the collection and processing systems design, and how much the system will cost.

1. **How many dwelling units and businesses will actually participate in the recycling program on a regular basis if there are separation requirements at the source?**

All recycling programs, with the exception of mixed waste collection and processing require a change in behavior by the generator. The percentage of dwelling units or businesses that actually "participate" (i.e., adopt the required behavior in the recycling program in any given time period, usually at least once a month) by setting out material as requested is defined as the participation rate. Appropriately designed and highly promoted recycling programs in Western Europe and the United States achieve participation rates of 70 to 90 percent. Similar rates should be achievable in most communities in Egypt. The following factors are likely to increase participation rates:

- Ongoing promotion, education, and feedback of results.
- Making participation in the program "convenient" (i.e., making recycling easy).
- Program consistency.
- Provision of specialized storage/set-out containers.
- Neighborhood support.
- Maintaining similarity between the collection systems for waste and recyclables.

2. **What portion of the recyclable material generated will actually be kept separate (i.e., captured for collection from the participating dwelling units and businesses)?**

The percentage of the recyclable material generated at a participating dwelling unit or business that the generator actually separates, stores, and sets out for collection is known as the capture rate. Capture rates are always less than 100 percent because not all participants always separate all of their recyclables. Occasionally, some regular participants throw some of their recyclables in with the waste.

Achieving and maintaining high capture rates requires many of the same ingredients as maintaining participation rates. Capture rates are typically higher for items that are more easily prepared for recycling (e.g., aluminum and plastic beverage containers that require no cleaning after being emptied).

3. **How often will residents and businesses set out their recyclables containers at the designated collection point?**

The percentage of all eligible participants that actually set out recyclable materials on any given collection day is defined as the "set-out rate". Estimating the expected set-out rate is important, as it determines the volume of material to be collected per dwelling unit or business, the number that can be serviced per load, and ultimately the total number of trucks required. Factors that affect set-out rates include:

- The separation requirements (If recyclables are left mixed with waste and no separation is required, then set-out will, by default, be the waste set-out rate).
- The number and types of material collected.
- The frequency of collection.
- The day(s) of the week that collection is provided.
- Size of the storage/set-out containers.
- Size and availability of recyclables storage capacity within dwelling units and businesses.

4. **What quantity (volume) of recyclable material will be placed in the container?**

Multiplying the number of set-outs on a given collection route by the volume of material in the container at each set-out will determine the total volume of material to be collected each day. Average recyclable material densities are provided in Table 15.1 to help you determine the average volume set out at each residence or business.

Table 15.1: Recyclable Material Density

Recyclable Material	Density (kg/m3)
Plastic bottles	18
Glass	380
Steel Cans	72
Aluminum Cans	30
Aseptic packaging	18
Paper	300

Once you have answered all the above questions you can calculate the MRP, which is an estimate of the total quantity of each type of material that you can reasonably expect to collect in a year (kg/yr), using formula in Figure 15.1.

Figure 15.1: Formula for determining the MRP

Kg/yr of each recyclable material =
(number of generating units) x (generation rate) x (participation rate) x (capture rate)

If you ultimately decide to collect recyclables and waste from residents and businesses without separating the recycled materials, and instead separate recyclables from the mixed waste at a sorting facility, the MRP will be the quantity of recyclables separated out of the waste stream at the facility.

STEP 2:

IDENTIFY AND ASSESS RECYCLING PROGRAM OPTIONS

The next step in the planning process is identifying and assessing recycling system options that have the potential to achieve the program and service goals established through the process defined in Chapter 2. This step involves making preliminary choices of strategic element options that take into account earlier policy decisions regarding compliance with laws and regulations, service recipients to be included, geographical boundaries, and funding.

Step 2 is the process of identifying potential options for the following program strategic elements:

- Point of collection.
- Included recyclable materials.
- Source-separation requirements.
- Storage/set-out container type.
- Collection method.
- Collection frequency.
- Material processing.

Applying design criteria can facilitate selection of potentially applicable options. Typical recycling design criteria should address:

- Cost effectiveness (cost/benefit).
- Health and safety.
- Environmental compatibility.
- Diversion effectiveness (optimizing recyclable materials diversion for recycling).
- Public acceptance/participation.
- Efficiency (ratio of productive output of labor and material resources compared to input).
- Material value/marketability.

The relative importance of these design criteria will vary depending on planning area demographics, expectations of the service users, and objectives of government officials. Cost effectiveness will be a priority in every case. Planners are strongly encouraged to calculate reasonable estimates of cost effectiveness for individual scenarios selected in Step 4 by applying the financial management and full cost accounting techniques described in Chapter 3.

Consider General Conditions

Planners should take into account the general conditions of the planning area when identifying and reviewing recycling program strategic element options. In Egypt, it is likely that some if not all of the following general conditions will apply:

- Low labor costs and shortages of capital indicate that solutions should minimize capital expenditures and maximize manual labor.
- A waste stream dominated by organic waste.
- A complex informal sector that is very active in collection, separation, and recycling of select recyclable materials diverted from the waste stream.
- Significant mixing of hazardous waste with solid waste.
- High proportions of the urban population with low levels of education combined with low awareness in the community of the health and environmental hazards of waste.
- Inadequate infrastructure (institutional and technical).

In addition to the design criteria, these general conditions should be kept in mind during the preliminary assessment of the options available for each recycling program strategic element. They should serve as a basis for identifying various combinations of strategic elements that form scenarios with the potential to meet recycling program goals.

Assess Point of Collection Options

The first strategic decision is where to collect the recyclable materials (i.e., the point of collection). In general, there are three point of collection options:

1. At the door: At the door of each dwelling unit or commercial business, also known as Door-to-Door (DTD) Collection.
2. Outside the building: Outside and adjacent to the building along a street or alleyway, also known as Building-to-Building (BTB) Collection.
3. Drop-off Centers (DOC): A centralized collection point typically located on public property no more than a specified reasonable distance from any resident or business.

In general, the trend worldwide in residential waste collection has been to move away from on-property collection. Many factors contribute to this trend and include the following:

- Reduced collection time per dwelling unit (or business), saving time and money.
- Reduced carrying by collectors, resulting in fewer injuries.
- Reduced crew-size requirements, resulting in reduced labor costs.
- Entry onto private property is eliminated, resulting in fewer possibilities for complaints by residents.

If the goal is to maximize participation and material recovery, experience has shown that collection systems that mimic the waste collection system (point and frequency of collection) and maximize convenience yield the highest diversion. In this step, the planner should consider the following and select one or more of the collection options below for comprehensive evaluation in Step 4.

Recycling bins in public space.

- **Door-to-Door:** Collection at the door is the preferred option if there is a feasible way to fund the relatively high cost over the long term. Most communities have found that convenient collection results in maximum participation. Much of the informal recycling that presently takes place in Egypt occurs via collection of recyclables (often mixed with waste) at the door of the generator (residence or business). Capturing recyclables at the point of generation significantly reduces the scavenging that occurs when materials are left in public places for collection. Generators of recyclables simply place materials in plastic bags or small plastic recycling bins outside the door for collection and removal at the appointed time.

- **Building-to-Building:** Collection from containers placed outside and adjacent to buildings is an acceptable point of collection option. This collection option is typically chosen if access to individual dwelling units and businesses is difficult. It requires an adequate number of containers and frequent service. Use of plastic bags and conventional waste storage containers (trash cans) should be avoided if possible. The most suitable container to use is a “rollout cart”, especially designed for the purpose. A

Rural Considerations
In view of the overall lower per capita income, housing density, and waste generation levels, the practical applicability of collection of recyclables at the door or at each building in rural areas is limited. Collection of recyclable materials from centralized drop-off centers would appear to meet the needs and expectations of the majority of rural and semi-rural village dwellers. However, to motivate and facilitate usage, centralized collection points must be adequate in number and conveniently located for all users.

rollout cart provides adequate capacity, has a lid that protects the recyclables from weather and pest-related problems, and facilitates cost-effective collection.

Scavengers pose a potential problem when the collection point is outside the building. Scavenging of discarded materials that can be reused or sold for monetary gain is widespread and an inherent part of the social, cultural, and economic system of Egypt.

- **Drop-off Center:** While most cost effective, the collection of recyclables from drop-off centers is fraught with significant problems that make it difficult to achieve other design goals. Separate bins may be required for each type of recyclable material if there is no local processing (sorting) capacity. The system depends on generators carrying their own waste to the collection point, often judged by targeted users to be "too far away", and then possibly having to do some separation of materials into designated bins.

  With this system, recyclables may end up being deposited indiscriminately as waste at points more convenient for the generator. Recyclable materials left at any drop-off center that is not staffed or secured on a permanent basis would very likely be scavenged by the existing informal recycling sector.

  Unless there are no funding mechanisms available to support other options or building density prevents access by collection vehicles, drop-off centers should be the option of last resort.

Selecting appropriate points of collection is easier if you first divide the planning area into sub-areas based on housing density and street width, and then apply the design criteria listed in Table 15.2. While it is best to strive for a universally applicable point of collection, it may not be practical if some options are precluded by inadequate street width. For example, since dense housing areas with narrow unpaved streets preclude the use of conventional collection vehicles, neither BTB nor drop-off center service is applicable, since they require conventional collection trucks with mechanical dumping systems. In these types of areas, only DTD service is appropriate. Accordingly, the planner needs to develop a good estimate of the total road length, by road width and pavement types, as well as the number of dwelling units and businesses by sub-area so that bidders have sufficient information to develop their work plans and bids.

Material Recovery facility.

Table 15.2: COMPATIBILITY OF POINT OF COLLECTION OPTIONS WITH DESIGN CRITERIA

Design Criteria	Point of Collection Option		
	Door-to-Door	Building-to-Building	Drop-off Centers
Material value & Marketability	Good - less chance of contamination.	Fair - potential contamination from waste placed in recyclables container.	Poor - higher risk of material contamination.
Cost Effectiveness	Most costly due to higher labor requirement - but also most effective.	Moderate cost - low effectiveness.	Least cost - but not effective.
Health and Safety	Most injuries to labor due to climbing stairs and then ascending with a load.	Manual labor and injury risk reduced significantly, especially with use of rollout carts.	More health and safety risks to service users and service crews than collecting at buildings.
Environmental Compatibility	Most environmentally sound - controls materials at the source; highest recovery.	Somewhat environmentally sound - but lower level of resources likely to be recovered.	Potential for negative environmental impact - greatly reduced resource recovery.
Effectiveness	Extremely effective if residents participate - must put recyclables outside door within restricted hours.	Only effective if material is not scavenged from rollout carts - more potential for contamination.	Not effective; residents unlikely to make extra effort to participate - high scavenging potential.
Public Acceptance/ Participation	Very high - most convenient.	Moderate convenience - less participation.	Low acceptability and participation - inconvenient for most residents.
Efficiency	Not efficient from productivity standpoint - requires most labor and equipment resources per kg recovered.	More efficient - reduces labor and truck requirements, but lower participation and scavenging may reduce overall efficiency.	Low cost - but also low benefit. Participation and recovery far lower.

Assess Options for Recyclable Materials to be Included

The second strategic decision is to identify materials to include in the recycling program. Not all of the recyclable materials generated by residents and businesses can be easily or cost effectively accommodated in the conventional recycling system. Depending upon the findings of the waste composition analysis in Step 1, the list of recyclable materials to consider in Step 2 is likely to include the following:

- Paper (newspaper, paperboard, cardboard, writing paper, envelopes, magazines, etc.).
- Plastic (bottles and plastic items).
- Glass.
- Aluminum.
- Ferrous metals (cans and scrap).
- Other non-ferrous metals.
- Textiles.
- Green wastes.

The recycling planner must make decisions addressing if and how each of these materials will be integrated into the collection system.

- **Paper**: After organics, paper is typically the most common item in both the residential and commercial waste streams ranging from 10 to 25 percent of the total. Approximately two-thirds of the total will be some type of paper and one third qualifying as corrugated cardboard or paperboard.
- **Plastic**: Plastic is presently the most commonly recycled material from residential wastes in most countries. Recyclable plastic items include food, beverage, soap, and cosmetic bottles, and some plastic items such as toys, vases, and artificial flowers. Plastic film (bags) is also recycled when available in large enough quantities. Plastics are sorted by type and color, washed, crushed or granulated, and then melted into plastic pellets or sold to end-use markets.
- **Glass**: Glass bottles comprise approximately 2 to 6 percent of the typical municipal waste stream in Egypt. All soft drink bottles are reusable after washing and sterilization. Other glass bottles can be separated by color and sold to glass bottle manufacturers where they are crushed, mixed with other glass cullet, and melted prior to being remanufactured into new bottles or other products such as ashtrays and decorative items.
- **Aluminum**: Aluminum usually comprises less than 1 percent of the residential waste stream in Egypt, but is worth considering for inclusion due to its ease of separation and high market value. Scrap aluminum is melted and combined with virgin aluminum in new aluminum products. Separately collected aluminum can scrap can be used in the production of new beverage containers.
- **Ferrous Metals**: Ferrous cans (often referred to as "tin" cans) and other ferrous scrap items (pots and pans) are also present in the waste stream in Egypt at less than 1 percent of the total. Although their value is relatively low, they are easily separated and marketed. Ferrous scrap is used with virgin steel in the production of many steel products.
- **Textiles**: Textiles may be present in the residential waste stream in Egypt at levels ranging from approximately 1 to 6 percent,

Scavenging scene in Egypt.

Rural Considerations
The need for integrating recyclables collection into rural waste collection systems is not as compelling as in urban areas. As discussed in the earlier section describing the characteristics of rural waste, most recyclable materials that are generated are likely to be diverted from the waste stream and reused or sold for recycling by the relatively prevalent number of peddlers and scavengers that work in rural areas.

Full recycling bin.

depending upon the existing level of textile collection by roamers and scavengers Textile reclamation recovers and processes old clothes, curtains, quilts, blankets and many other textile products that are discarded as waste. Textiles from the garment industry have markets as fiber for making felt or sound insulation. Post consumer used textiles can be shredded and used in making stuffing for inexpensive mattresses or pillows. Some worn, but absorbent textiles are regularly used as wiping clothes or towels in commercial and industrial applications.

- **Green Waste** (Yard Waste): Green waste consists of grass clippings, shrub and tree trimmings, and other wastes resulting from landscape care and gardening. In most governorates there will not be enough green waste available to justify separate collection and processing. However, green waste could be collected with the organic (wet) fraction of wastes from households in a wet/dry collection system as described in the discussion of Material Processing Options. More information is available on recycling alternatives for green wastes in Chapter 14, Composting.

Not all types of recyclable materials found in reasonable quantities in the waste stream and with acceptable markets (see Step 1) can be easily accommodated in an affordable collection system. The recycling planner must decide if and how each of the previously identified recyclable materials can be integrated into the collection and processing system. The decision will depend largely on the goals of service users and government officials and their willingness to pay.

Though the addition of each recyclable material will increase total collection system costs, it may reduce unit costs per kilogram collected. Therefore, excluding integration of a material into the residential and commercial collection system design without calculating the incremental cost associated with each is not advisable. While some recyclable materials collected may not meet some of the design goals, they should all be seriously considered for inclusion in the collection system due to the consequences associated with their omission. For example, the exclusion of one low value, but common material may decrease the quantities of other recyclables that generators are willing to recycle.

The decision to include or exclude each material should be based ultimately on a comparison of the total cost of collection, sorting, processing, and transportation with the market value of the material. A final decision can be based on a comparison of the net cost (cost–revenue) to the cost of collection and disposal.

The materials to be collected should be the same for the entire planning area. This will facilitate customer education via mass media and eliminate confusion that would be associated with collecting different materials in different areas. It is preferable to include any material that can be collected at a reasonable cost and has multiple markets. However, the customers must have both the willingness and the ability to pay.

Assess Options for Material Separation Requirements at the Source

Material separation requirements at the waste source (generator) in recycling programs in Europe and the U.S. vary widely from no separation to separating each material that is to be collected in the program. Due to abundant and low-cost labor in Egypt that can be (and has been) used to separate collected recyclable materials, the following three levels of separation at the source are worthy of consideration.

1. No separation: Recyclables are left mixed with waste for subsequent separation from the waste and from each other at one or more centralized processing facilities.

2. Separation of "dry" waste from "wet" waste set out separately in plastic bags for collection.
   - The dry waste includes all of the conventional recyclable materials that would be handled at a processing facility.
   - Wet wastes include fruit and vegetable trimmings, wet paper, green wastes and any other material that can be composted (See Chapter 14).

3. Separation of targeted recyclables from the waste into a single stream by:
   - Placing all targeted recyclables in a plastic bag and setting it out to be collected simultaneously with waste.
   - Placing all recyclables in a separate rigid container, typically called a recycling bin, for separate collection.

The advantage of either of the first two schemes is that they can be easily integrated into the waste collection system. In either case there would be no need for a separate collection system or a separate service provider. One service provider would collect all of the material at the same time. Chapter 8 provides specific information about both of these systems.

Participation rates are greatest for separation schemes that require the least amount of work for the generator, although some motivational strategies have been successful in achieving high participation with methods that place more demands on the generator. In addition to being the easiest for the generator, no separation (mixed waste) is also the easiest and least costly for the collector, but is hardest and the most costly for the processor.

Participation in a no-sort system is, by default, nearly 100 percent. However, the challenges to the processor should not be underestimated. In non-segregated systems, the waste, including organics—which is a large part of the total waste stream and are putrescible—must be processed simultaneously to separate out the usable components, and then each component must be upgraded to meet market specifications.

Summarized results of comparing the generator separation options to the design criteria are illustrated in Table 15.3.

Existing recycling system in many parts of Egypt.

Table 15.3: COMPARISON OF MATERIAL SEPARATION REQUIREMENT OPTIONS

Design Criteria	No Separation	Single Stream	Two Stream (Wet/Dry)
Cost Effectiveness	Least costly collection; most costly processing.	Low collection cost; high processing cost.	High collection cost; moderate processing cost.
Health and Safety	Least health problems for generators; many processing health and safety issues.	Processing labor injury and health risk reduced.	More risk of injury to generators; less to processing facility workers.
Environmental Compatibility	Most environmentally compatible; low resource use for high resource recovery.	Environmentally compatible; but more resources used to collect less.	Most resources devoted to recycling; least recovery.
Diversion Effectiveness	High diversion potential; all waste is processed.	Moderate effectiveness: easy to participate.	High: all waste processed; all organics recovered.
Public Acceptance and Participation	Close to 100 % participation is automatic.	Material separation requirements may discourage participation.	Separation requirements based on logic facilitate participation.
Efficiency	Efficient collection as no separate trucks are required; with low cost labor processing is also efficient.	Less efficient: separate truck fleet required; extensive processing still required.	Separate or split body collection vehicle makes less efficient collection; Processing more efficient than single stream.
Material Value and Marketability	Poor: high material contamination.	Moderate: some contamination.	Best: organics separation improves material quality.

Assess Method of Collection Options

Methods to collect recyclable materials from any point of collection fall into the following three categories:

1. **Manual collection:** Collection crew drivers and/or laborers move recyclables in the storage/set-out containers from the point of collection to the collection vehicle. Then they are manually emptied into the collection vehicle without the benefit of any mechanical loading equipment. Use of manual collection limits individual storage container capacity and weight (full) to no more than 200 liters and 20 kg.

   Using manual collection, there are options of placing recyclable materials in the truck body in the same form as they were set out by generators, or to perform some level of separation. When generators have separated their recyclables from their waste, the two most commonly practiced options are to separate each recyclable material into designated compartments on the truck, or merely separate fiber (paper, cardboard, and textiles) from containers (glass, metal, and plastic) into designated compartments.

2. **Semi-automated collection:** Requires the use of specialized storage/set-out containers that may be manually moved (typically rolled) to the collection vehicle (or the collection vehicle to the

Glass sorting at material recovery facility.

container if too large to move) for mechanical (hydraulic) dumping. Storage containers may range from 150 liters to 10 cubic meters in capacity.

3. **Fully-automated collection:** Eliminates the need for any manual labor through the use of specially designed collection vehicles that are equipped with hydraulic/mechanical systems to move and dump the storage container without the vehicle operator getting out of the vehicle. Containers may range from 150 liters to 8 cubic meters in capacity.

There is often a direct relationship between other recycling program strategic elements and the method of collection. For example, if the point of collection is at the door of dwelling units located in an apartment building, then the method of collection must be manual. In turn, there is a relationship between the container type and method of collection (e.g., rollout carts require semi-automated collection).

On the other hand, if the decision for point of collection is made first, and it is adjacent to a building, one could conceivably choose between semi-automated or fully automated collection. However, due to relatively low cost of labor, and the numerous impediments such as parked cars, trees, sign posts,

Table 15.4: COMPATIBILITY OF COLLECTION METHOD OPTIONS WITH DESIGN CRITERIA

Design Criteria	Method of Collection		
	Manual	Semi-Automated	Automated
Cost Effectiveness	Very costly - especially in multi-story buildings.	Cost effective - far less labor required, mechanical dumping lowers cost.	Cost effective under right conditions - not widely applicable in urban areas.
Health and Safety	Highest risk of injury to labor due to climbing, lifting and carrying required.	Reduced manual labor; elimination of lifting reduces back and other injury risk.	No lifting or exposure to waste; almost no risk of injury.
Environmental Compatibility	Higher resource recovery - increased number of trucks required results in more fuel use.	Environmentally sound - but less material recovery than at the door.	Minimal use of energy resources - but also minimal material recovery. Littering from scavengers.
Diversion Effectiveness	Most effective, but at high financial and personnel expense.	Moderately effective if scavenging is controlled.	Not effective in maximizing diversion.
Public Acceptance and Participation	Very high - most convenient.	Likely to be high.	Not very acceptable and will discourage participation.
Efficiency	Inefficient use of publicly funded labor - requires significant labor and equipment resources.	Moderately efficient - moderate cost and modest benefits.	Cost is low, but so is benefit gained. Not efficient.
Material Value and Marketability	Good - have quality control by the collector at the source.	Fair - limited quality control during collection.	Poor - no quality control by collection crew.

Paper conveyor at material recovery facility.

overhead utility lines, curbs, and the restricted widths of many streets, fully automated collection is unlikely to be practical in most urban areas in Egypt.

Finally, if the point of collection is a state-of-the-art centralized drop-off center, using large covered metal or plastic bins for storage of separated recyclable materials, the choice is limited to semi-automated or fully automated collection. Manual collection should not be considered for emptying the contents of any storage container with more than 200 liters used for building-to-building and drop-off centers.

Sample results of subjecting method of collection options to program design criteria are summarized in Table 15.4.

Assess Options for Storage/Set-out Containers

Several types of containers may be suitable for storage and set-out of recyclables. However, container selection is dictated by the method or point of collection. Any of the following containers may be suitable for storage of residential and commercial recyclables, depending on the method and/or the point of collection:

- **Plastic Bags**: Suitable for storing recyclables inside at the point of generation, but should only be used outside if the point of collection is at the door.
- **Plastic Rigid Containers**: Only rigid plastic containers manufactured specifically to hold recyclables should be used if the point of collection is outside the building. While round containers are an option, shallow rectangular plastic containers approximately 50 to 80 liters in size, typically referred to a "recycling bins", are preferable as they facilitate the transfer of material into the collection vehicle.
- **Rollout Carts**: One specialized type of rigid container is a "rollout cart." A rollout cart is a specially designed plastic container with two wheels that can be rolled from the storage location to the collection vehicle and dumped mechanically, thus requiring a semi or fully automated method of collection.
- **Bins**: Drop-off centers may be desirable for use in rural areas or required in cases where street widths or surface conditions preclude the use of conventional collection vehicles. The only functionally and environmentally acceptable type of storage container to use at drop-off centers is a plastic or metal "bin" that can be mechanically (hydraulically) lifted and emptied into the collection vehicle.

Selection of the most appropriate type of container for storage and set out of recyclable materials is dictated largely by choice of the method or point of collection. Table 15.5 provides a summary of sample results of evaluating the compatibility of each type of storage container with recycling program design criteria.

Rural Considerations
Centralized drop-off centers are likely to be selected as the preferred point of collection in most rural areas. In such cases, the 1 to 6 cubic meter bins or "dumpsters" will require the use of semi-automated collection vehicles (i.e., trucks equipped with hydraulic winches or cylinders to lift and empty bin contents).

Rural Considerations
The most appropriate type of recyclable material storage container will be dictated largely by the collection point and method used. In the majority of cases where centralized drop-off centers are selected as the point of collection, the only acceptable choice is the use of specialized metal or plastic bins. In such cases, service users should be encouraged to accumulate and deliver their recyclable materials in plastic bags to reduce the potential for scavenging once the bags are placed in the bins.

Table 15.5: COMPATIBILITY OF TYPES OF STORAGE/SET OUT CONTAINERS WITH DESIGN CRITERIA

Design Criteria	Type of Storage/Set-out Container			
	Plastic Bag	Rigid Plastic Container	Rollout Cart	Bin
Cost Effectiveness	Cost effectiveness for collection is somewhat offset by extra cost in processing recyclables.	Moderate cost for container; facilitates collection and separating recyclables at truck.	Cost effective under right conditions - carts last 10 years; reduce collection costs.	Cost effective as collection work is minimized - bins last 10 years.
Health and Safety	Risk of injury to collectors from sharps in bags.	Potential for back injury if container is overloaded - repetitive lifting reduces worker longevity.	No lifting or exposure - minimal risk of injury to user or service provider.	Potential safety risk to users if not staffed and to collection workers if bin mishandled when unloading.
Environmental Compatibility	Uses more natural resources (if plastic bags are disposed) - potential source of litter.	Environmentally sound - container use reduces litter potential and reuse saves resources.	Environmentally sound - cart life saves resources; proper use eliminates litter.	Not environmentally sound - large potential for overflow and negative impacts on the environment.
Diversion Effectiveness	With at-the-door service, will facilitate generator storage and set-out of materials.	Effectiveness similar to bags.	Less effective - inconvenient for generators to participate.	Not effective - not convenient for users, and material exposed to scavenging.
Public Acceptance and Participation	Will encourage generator participation.	Not high acceptance - public in Egypt is used to using plastic bags.	Very high in limited application in Egypt - likely to be well received.	Poor - not convenient.
Efficiency	Facilitates collection - but impedes processing efficiency and cost.	Somewhat efficient - moderately effective at a moderate cost.	High efficiency - efficient to use; mechanical dumping increases productivity.	Somewhat efficient - low cost, but minimal benefit.

Drop-off center.

Rural Considerations

Collection frequency in rural areas will be largely dictated by the number and size of Drop-off Centers sited in the planning area. In view of the types of materials being stored, there is no compelling reason to service storage containers more than twice weekly. The planning team should make every effort to estimate storage capacity needs that will accommodate twice-weekly collection without compromising aesthetic and environmental design goals that would occur if containers were to overflow

Assess Collection Frequency Options

The next strategic decision to assess is how often recyclables should be collected. The needs of the recyclables generators in terms of storage capacity requirements and storage space available must be considered, as well as the program design criteria. Collecting recyclables at the same time as waste is collected will motivate participation in the program. The following collection frequencies are likely to be relevant in Egypt:

- **Twice Weekly**: Recyclable materials should be collected at least twice weekly in Egypt. Once-a-week collection is not enough due to the limited storage space of residents and businesses.
- **Three Times Weekly**: Collecting residential and commercial recyclables three times per week is adequate to accommodate even the most limited storage constraints.
- **Six Times Weekly**: Collection may also be offered 6 days per week, with Friday being the day off. While this level of service is convenient for generators, it is costly. If you choose a system with no separation requirements by the generator, and this is the waste collection frequency, then this collection frequency is, by default, justified.
- **Daily Collection**: If the users can afford to pay for it, daily collection is likely to be preferable to collection six times per week. If you choose a system with no separation requirements by the generator, and this is the waste collection frequency, then this collection frequency is, by default, justified.

Residential and commercial recyclables should be collected as often as residents and businesses can afford, as total diversion of recyclables will correlate highly with frequency. Recyclables should be collected on the same day as waste with the same frequency to facilitate and maximize participation.

Table 15.6 provides a summary of the results of evaluating the compatibility of each collection frequency option with recycling program design criteria.

Assess Material Processing Options

After recyclable materials are collected they must be processed before they can be sold to specific material recyclers. The degree of processing required is largely determined by the following:

- The degree and quality of separation of the recyclables delivered to the processing facility.
- The contamination of materials delivered to the processing facility.
- The secondary materials market specifications and material end uses.

Additional factors such as demographics, collection practices, disposal costs, end-use markets, and most importantly, the desires of the customers being served, will impact the choice of processing facility used to most effectively process the material.

Paper feed at material recovery facility.

Table 15.6: COMPATIBILITY OF SERVICE FREQUENCY OPTIONS WITH DESIGN CRITERIA

Design Criteria	Collection Freqency			
	Twice Weekly	Three Times Weekly	Six Times Weekly	Daily
Cost Effectiveness	Most cost effective.	Less labor, but more storage capacity (containers) needed.	Costly.	Cost similar to six times per week.
Health/Safety	Longer storage time increases public and worker health risks.	No obvious health/safety risks.	Minimal health risks.	Minimal health risks.
Environmental Soundness	Uses least natural resources - more illegal dumping and litter likely.	Environmentally sound - less resource use than for more frequent collection.	Excessive use of fuel and other natural resources.	Excessive use of fuel and other natural resources.
Diversion Effectiveness	May not be effective if residents forget collection days. May result in litter.	Effectiveness is limited as difficult to schedule and for residents to remember. May result in litter.	Not effective - collector must collect twice as much material on first day of week.	Most effective as materials can be set out for collection and be removed every day.
Public Acceptance and Participation	Low - residents may be reluctant to store recyclables if no outside storage.	Not user friendly schedule - may cause confusion.	Acceptable - but residents might want daily collection instead.	Excellent due to convenience and high level of service.
Efficiency	Very efficient for collectors, but not residents.	Somewhat efficient - moderately effective at a moderate cost.	Not efficient as excessive resources required for collection.	Not efficient as excessive resources required to for collection.
Material Value and Marketability	Contamination may result from lack of storage.	Contamination may result from lack of storage	Good - increased collection reduces need for mixing.	Good - increased collection reduces need for mixing.

The types of processing facilities that would be compatible with the previously described material separation options fall into three categories:

- Dry Material Recovery Facility (DMRF): for processing all wastes other than organics. Also requires composting facility for organics.
- Single Stream Processing Facility (SSPF): for all recyclables separated from waste by the generator, but mixed together in one stream.
- Mixed Waste Processing Facility (MWPF): for sorting recyclables out of the mixed waste stream (also known as a Dirty MRF).

The type of processing facility is dictated by the separation required of the customers (See earlier discussion of generator separation requirement options). The following scenarios are possible:

- If you do not want to ask residents and businesses to do any separation, then a mixed waste processing facility will be needed.
- If you ask customers to separate all of their recyclables and set them out all together in a separate plastic bag or recycling bin

Roll-out carts.

for collection then you will need to have all of the recyclables sorted at a single stream processing facility.

- If you ask customers to separate their waste into wet (organic) and dry fractions then, in addition to the processing facility for the dry fraction you will need the service provider to construct and operate a composting facility for all of the organics (See Chapter 14 for guidance on how to procure a private sector contractor for this service).
- In general, as you increase separation requirements on customers the cost of collection will increase and the cost of processing will decrease. Conversely, as you reduce separation requirements at the point of generation, collection costs will decrease and processing costs will increase. Thus, in Step 4, it is extremely important that you develop several different collection/processing scenarios that allow you to calculate the net impact on total program cost.

When defining the processing services to be included in a new recycling program, keep in mind that the overriding objective of processing is to add value to the recycled materials. The following considerations will affect the marketing of recyclable materials:

- Market needs.
- Demand for specific types and forms of individual materials.
- Quality specifications.
- Market location.
- Market agreements.

Table 15.7 provides an example of the results of evaluating the compatibility of each material processing option with recycling program design criteria.

Table 15.7: COMPATIBILITY OF MATERIAL PROCESSING OPTIONS WITH DESIGN CRITERIA

Design Criteria	Processing Option		
	Dry Material Processing	Single Stream Processing	Mixed Waste Processing
Cost Effectiveness	Moderate processing cost.	High processing cost.	High processing cost.
Health and Safety	Processing labor injury and health risk is small.	Moderate health and safety risks for processing facility workers.	More health and safety risks to processing facility workers.
Environmental Compatibility	Minimal emissions to the environment; low resource usage.	Moderate emissions to the environment; high process equipment energy use.	Most emissions to the environment; most energy use for processing.
Diversion Effectiveness	Moderate effectiveness.	High diversion effectiveness.	Highest diversion effectiveness.
Market Value and Marketability	Good - separation of organics reduces contamination.	Best - non-recyclable materials minimized; no organics.	Poor - material will be contaminated with broken glass and organics.
Efficiency	Moderate efficiency; moderate volume processed.	High efficiency; high material volume processed at moderate cost.	High efficiency due to high volume processed.

STEP 3:

COMPILE FINDINGS IN PRELIMINARY ASSESSMENT REPORT

The findings from the previous steps in this chapter should be compiled and summarized in an assessment report. This report should be 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 recycling program options that may rectify those problems.

The document should include the following components:

- A summary of findings from the MRP assessment.
- An explanation of the identified obstacles and constraints to including certain recyclable materials and meeting desired service levels.
- Descriptions of problems, gaps, and impediments to implementing a recycling program that meets identified community goals.
- An explanation of identified opportunities for a recycling program.
- Preliminary recommendations of potentially viable options for each strategic element that appear worthy of inclusion in recycling program scenarios in Step 4.

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

Drop-off center.

STEP 4:

EVALUATE RECYCLING PROGRAM SCENARIOS

The next step in the planning process is the comprehensive evaluation of the potentially viable strategic element options identified in Step 2 and scrutinized in Step 3. Step 4 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 for each of the strategic elements selected in Step 2 for review, revision, and approval in Step 3. Changing any one of the strategic elements produces a new scenario that needs to be separately evaluated. Making final decisions concerning strategic elements in the recycling program must take into account policy decisions and service objectives made earlier in the planning process, as well as the planning team design criteria.

As in Step 2, the decision making process can be facilitated by applying program design criteria. These may include, but not necessarily be limited to, the following:

- Cost effectiveness and affordability.
- Health and safety.
- Environmental compatibility.
- Diversion effectiveness.
- Public acceptance and participation.
- Efficiency.

The relative importance assigned to each of these design criteria in the scenario evaluation will vary depending on the input received from governorate officials and expectations of the service users. It is likely that affordability and diversion effectiveness will be a priority. Accurate evaluation of the affordability design criteria of cost effectiveness will require the application of full cost accounting principals and financial management tools described in detail in Chapter 3. Diversion effectiveness will be a function of the impact of each strategic element choice on participation of residents and businesses.

Develop Preliminary Cost Estimates

Once the decisions for all the recycling program strategic elements have been made for the planning area, then full cost accounting techniques should be applied to each potentially applicable recycling program scenario using the approach described in Chapter 3. This step must consist of developing preliminary system cost estimates for both government and private provision of recycling program services.

The model requires the planner to seek out and develop a great deal of data for input. To use the model for the purpose of calculating a preliminary cost estimate for each scenario (combination of strategic elements) please see Chapter 3.

Bales of paper at a material recovery facility.

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 viable improvement options analyzed by the planning team. 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 5: SELECT PREFERRED RECYCLING PROGRAM

Once the cost of each potentially viable recycling program scenario has been calculated the final decision making process can begin, which consists of the following tasks:

- Calculate rates/tariffs and evaluate cost recovery methods.
- Solicit final round of stakeholder input.
- Governorate officials select preferred recycling program that is most compatible with design goals.

Calculate Rates/Tariffs and Evaluate Cost Recovery Methods

The governorate needs to know if and how it will be able to pay for the recycling program. 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 scenarios include the following:

- Conducting a "willingness to pay" survey.
- Developing tariff models.
- Examining "cost recovery" options.
- Selecting 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 collecting fees from service users.

Solicit Final Stakeholder Input

Once the planning team has calculated how much each of the recycling program scenarios will cost each user group category, it will be better able to make informed decisions about the preferred program. 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 recycling program and accompanying fee recovery systems.

Governorate Officials Select Preferred Collection System

Internal deliberation on the input received from the planning team and the general public can now take place among the appropriate governorate officials. An informed decision can now be made which will have the highest probability of achieving recycling program design goals, while being affordable to the majority of families and businesses in the governorate. In the event that officials select to change one or more of the strategic elements of a system scenario, the scenario should be subjected to Step 4 before receiving final approval.

Baled plastic bottles at material recovery facility.

STEP 6: IMPLEMENT THE SELECTED PROGRAM

The planning team is now ready to begin the task of implementing the selected recycling program. If the governorate has decided to contract with the private sector for provision of recycling program services then the following tasks must be undertaken:

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

Establish the Program Funding Mechanism

The governorate must be able to pay for the recycling services 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.

Recycling programs are generally part of an overall ISWM system, in which case no separate fee system is needed. However, as much information as possible about how the recycling 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. The RFT provides great detail about the required services and typically becomes a part of the contract between the governorate and the selected contractor. It is extremely important to prepare this document carefully to ensure that the long-term contract relationship is properly formu-

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 plan would include detailed descriptions in personnel and operating instruction manuals of how the services are to be performed by governorate employees.

Specialized recycling basket for dwelling unit.

lated and that the responsibilities and risks are appropriately assigned between the parties.

An RFT generally consists of the following:

- An Invitation for Bidders.
- A Draft Contract.
- General Contract Conditions.
- Appendices to the General Conditions containing the Technical Specifications.
- Bidder's Price Form Schedules.
- Tender Offer Form Letter.
- Other documents as appropriate.

Comprehensive instructions on how to prepare an RFT as well as selecting and executing a contract with the successful bidder are provided in Chapter 5. Specific instructions on how to prepare technical specifications for the appendices of an RFT for recycling services are discussed in Appendix A to this chapter.

Develop and Implement a Means of Contract Administration and Monitoring

The governorate must develop an organizational structure to administer and monitor the contract and contractor operations. 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.

Contract monitoring and administration of a solid waste services contract requires a dedicated unit. Chapter 6 guides governorate officials and administrators through the process of developing and implementing the organization and infrastructure to monitor solid waste management service contracts.

Develop Public Awareness and Communications Campaign

A public awareness and communications campaign is critical to the successful implementation of any policy decision. This is particularly true when it requires the support of the public and behavioral changes from constituencies. Recycling policy and program success is totally dependent upon resident and business participation. Optimization of participation requires a comprehensive and professionally developed long-term plan to build public understanding, support, and use of the recycling program.

A public awareness campaign should ensure that the public understands the new recycling program and explain who will do what, when, and how. Implementation plan developers should refer to Chapter 7 for a description of how to manage a general public awareness campaign. It describes the steps that must be conducted to implement a successful public awareness campaign. It also 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.

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 in general is provided in Chapter 5. Information specific to a recycling program that needs to be addressed in the technical specifications is included in this appendix.

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 recycling programs should specify the types of service to be provided and include information on the following strategic elements of the service desired:

- Types of recyclables to be included.
- Source of the waste materials.
- Quantities to be collected.
- Material separation requirements at the source.
- Point of collection.
- Collection service frequency.
- Type of recyclables storage/set-out container to be serviced.
- Material processing.
- Environmental and health and safety requirements.

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, a preparation work plan, and a 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 minimum technical

Examples of Service Specifications

Door-to-Door (DTD) Collection Service: The daily collection of recyclable materials placed by occupants of individual dwelling units in recycling bins, and transfer of these recyclable materials to the (designated processing facility) by the contractor.

Building-to-Building (BTB) Collection Service: The collection of recyclable materials placed by occupants of buildings in rollout carts one time per week, and delivery of all recyclable materials collected to the (Designated Processing Facility) by the contractor. The service also includes procurement, distribution, sanitation, and maintenance of all rollout carts required.

Drop-off Center Collection Service (DOC): The collection of recyclable materials placed in recyclables bins with a minimum size of 1 cubic meter and a maximum size of 6 cubic meters, at sites to be designated by the governorate in the DOC service sectors, and transfer to the (designated processing facility.) The service also includes procurement, distribution, sanitation, and maintenance of bins.

requirement for the DWP should require that bidders address the following for recyclable material collection services:

1. Location of recyclable materials collection vehicle parking areas and maintenance garages.
2. Maps of proposed recyclable material collection routes.
3. Proposed route time schedules.
4. Plan for distribution, sanitation, and maintenance of recycling bins or bags, rollout carts and bins.
5. Lists of collection equipment indicating number, type, make, size, and age.
6. Proposed collection vehicle sanitation and preventative maintenance program and schedule.
7. The DWP for design, construction, and operation of recyclable material processing facilities should include detailed written description of the design, construction, and operation of each processing facility that addresses:
8. Proposed processing facility operating hours.
9. Description of scalehouse weighing procedures and record keeping.
10. Facility type, number of processing lines, equipment specifications, and availability of equipment.
11. Calculations that document the daily and annual design capacity and average and peak daily flow rates for incoming recyclable materials and outgoing residue (wet weight and volumetric).
12. Process flow diagrams summarizing equipment sizing, labor requirements, process rates, and storage capacity for each of the following activities: recyclable material receiving, sorting, volume densification, storage, and shipping.
13. Narrative descriptions describing the design and operations for each of the following stages: recyclable material receiving, processing, storage, and shipping.
14. Complete documentation that the processing technology and equipment will achieve the required processing rates.
15. Details relating to storage, transportation and disposal of residue including potential hazards/toxicities.
16. The method of wash-down water control, treatment, and disposal.
17. Contingency plans detailing corrective or remedial actions to be taken in case of equipment breakdown, delivery of unacceptable materials, environmental contamination, and emergency events.
18. Description of regular and periodic facility and equipment maintenance activities.
19. Description of occupational health and safety, emergency response, continuing education and any other training programs.
20. Schedule for accepting and rehabilitating any existing facilities, or developing new facilities.
21. Job descriptions and the number of personnel to be deployed in each position.
22. Plan for recruiting and training labor, equipment operators, and supervisory personnel.
23. Lists of processing equipment indicating number, type, make, size, and age.
24. Manufacturers' literature for all recyclable material processing equipment proposed for usage indicating if equipment is currently available, and if not, when it will be available.
25. Plans for contract administration, and plant and field supervision.
26. Descriptions of record keeping and reporting systems for all information and data required to be submitted.
27. Proposed procedures for communicating with the governorate's contract administration organization.
28. Description of how the contractor will comply with each of the service specifications and minimum technical requirements.
29. Processing facility 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.
30. Engineering concepts for construction of the processing facility and proposed processing system.
31. Plans and method to acquire all construction and environmental permits.
32. Land use map showing vehicle traffic routes.
33. Site layout showing all proposed structures including the following:
    - Incoming scalehouse and office.
    - Material receiving.
    - Material storage.
    - Material sorting.
    - Sorted material volume reduction or other handling.

- Residue storage.
- Residue shipping.
- Wash-down water drainage and storage.
- Maintenance shop.
- Vehicle parking.
- Employee facilities.
- Visitor and public education facilities

- Environmental mitigation measures including odor, dust, and noise control.
- Processing facility operation plan.

Preparation Work Plan

The preparation work plan 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. Procurement of supplies and equipment.
3. Rehabilitation of existing facilities.
4. Construction of new facilities.
5. Implementation of project management structure.
6. Implementation of information database and record keeping systems.
7. Final recycling collection route design and scheduling.
8. Delivery of recyclable material storage containers where required.
9. Development and dissemination of public information materials.
10. Finalize processing facility site field data collection and analysis.
11. Prepare and receive EEAA approval of the final Environmental Impact Assessment (EIA).
12. Prepare a project schedule for obtaining permits, finalizing the processing facility design, and start-up operations.
13. Initiate final processing facility design and engineering drawings.
14 Order all processing facility equipment and construct a scalehouse/office building.

Final Work Plan

The final work plan is submitted by the successful bidder after the contract is awarded. It should incorporate all the elements of the draft work plan and the preparation work plan together.

Sample Minimum Technical Requirement

"Collection Vehicle Loading. No vehicle used for collection of recyclable materials shall be loaded in excess of the manufacturer's gross vehicle weight rating or in excess of the maximum weight specified by the Egyptian Roads and Bridges Authority."

Minimum Technical Requirements

The purpose of the 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 each of 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 a recycling program.

Recyclable Material Collection Vehicles

To ensure that the contractor utilizes collection 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 collection vehicle with safety and emergency response accessories. It should require at a minimum that each recyclable material collection vehicle be equipped with the following:

- A fire extinguisher.
- A first aid kit.
- A shovel and broom for the removal of any materials spilled on streets or sidewalks.
- An audible backup warning device that activates each time the vehicle backs up.
- Two-way communication with contractor's collection 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 collection vehicles. Clean, freshly painted vehicles send a message to the public that recycling 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 collection vehicles at least once every 5 years.

3. **Collection Vehicle Garage and Parking:** A minimum technical requirement is needed to ensure that collection vehicle maintenance and parking facilities do 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 collection 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 collection 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 when not in use.

4. **Collection Vehicle Loading:** Overloaded collection vehicles increase maintenance costs, pose a threat to public safety and contribute unnecessarily to the deterioration of streets and roads. To prevent the contractor from overloading vehicles, the minimum technical requirement should not allow loading 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.

5. **Dedicated Fleet Inventory:** The contracting agency will want to have a record of all of the vehicles that the contractor intends to employ in the collection of recyclables. This will provide assurance that the number and type of vehicles is adequate, and for the agency to have on record in case of complaints from citizens and businesses concerning vehicle operation. 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 GVW of each recycling collection vehicle.

6. **Maintenance:** Recyclables collection vehicles have many moving parts and are subjected to almost as much punishment as a waste collection vehicle. Egyptian experience has demonstrated that inadequate maintenance of waste collection vehicles has been a root cause of failure of government-provided waste collection service. 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. While it certainly is in the interest of the contractor to maintain the equipment, it is also in the interest of the contracting party and the ratepayers that it represents to do everything in its power to minimize any risk of service interruption caused by failure of the contractor to give vehicle 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 budget, documenting maintenance of all recyclables collection vehicles in a safe and operable condition, to minimize the threat to worker and public health and safety, and to reduce vehicle impact on the surrounding environment.

7. **Marking and Identification:** Collection vehicles used by the contractor should have appropriate signage and markings to facilitate identification by customers, traffic police, and employees at transfer and processing facilities. It is recommended that all vehicles used in either the supervision or provision of recyclables collection service have highly visible (greater than 10 cm) lettering on each side of the vehicle body indicating the name and customer service 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 recyclables carrying vehicles should have the carrying capacity, in cubic meters and GVW, of the vehicle identified in numbers at least 12 centimeters in height displayed in the upper front corner of the left and right sides of the body.

8. **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 recyclable material collection vehi-

cle drivers might pose to public safety. To that end, establishment of minimum requirements regarding the licensing and driving skills of the contractor's collection vehicle operators are warranted. The requirement should ensure that the contractor use only personnel specifically trained in the safe and efficient operation of collection 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 no later than 10 days prior to commencement of collection operations and evidence that all collection vehicle operators have been provided vehicle operation and safety training and have passed a written examination and driving test.

9. **Recyclables Collection Vehicle Body Requirements:** The contractor should be required to only utilize vehicles with bodies that were manufactured for the purpose of consolidating and storing recyclables. Thus, the area of the collection vehicle body used for the storage of recyclables should be watertight 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 recyclable materials are dropped or spilled during the contractor's operations, he or she should be required to clean it up immediately.

10. **Registration, Licenses, and Insurance:** The contractor should be required to use collection 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.

11. **Reserve Equipment:** To minimize the risk of interruption or delays in service delivery the contractor needs to have an adequate level of collection 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 2 hours of any breakdown so that no interruption in regularly scheduled collection service occurs. Such reserve equipment should be required to correspond in size and capacity to the equipment normally used by the contractor to perform the recycling collection service.

12. **Safety/Daily Vehicle Inspection:** As an additional means of reducing the risk of contractor use of collection vehicles that are unsafe or not fully functional, the contractor should be required to inspect vehicles daily before they leave the yard. 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.

13. **Sanitation:** In addition to maintaining the appearance and mechanical functions, the contractor should be required to regularly wash and sanitize collection 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 collecting and transporting any recyclable materials 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 collection vehicle chassis and body with water and a detergent a minimum of one time per every 2 weeks.

Recyclable Material Storage/Set-out Containers

If the contractor is to provide any type of storage container, it is logical to include the provision of storage containers as part of the service specifications. These will likely be recycling bins or bags for door-to-door service, rollout carts for building-to-building service, or bins for Drop-off Centers. In those cases, the system planner will want to ensure that the contractor procures and supplies containers that meet the contracting agency's economic, technical, health, safety, environmental, and aesthetic performance criteria. To achieve system objectives, the RFT should include minimum technical requirements that address the following storage container concerns.

1. **Body Material and Construction**: The contractor should provide storage containers that are made from materials that are functional, durable, and weather resistant. Rollout carts should be rotationally molded from first quality plastic resin certified to contain ultraviolet stabilization compounds and meeting a minimum Environmental Stress Cracking Resistance (ESCR) rating exceeding 1,000 hours. Bins for DOCs should be manufactured from plastic or steel.

2. **Casters, Wheels, and Axles:** In addition to handles, bins for drop-off centers smaller than 3 cubic meters must be equipped with casters or wheels to improve their movement by users or service crews. Wheels and axles are used on rollout carts and casters are used on small bins. Rollout carts must have two wheels. Each wheel should have a minimum diameter of 20 cm, a tread width of at least 4 cm, have a locking device to secure them to the cart axle, and be manufactured from natural rubber or polymeric compound. Each wheel should be rated for the maximum load rating of the rollout cart and should not deform plastically when subjected to the rated load of the cart. Wheel retainers should be plastic coated steel. Axles should be a minimum of 1.5 cm diameter galvanized steel and pass through the rollout cart body outside of the area for recyclables storage. No bolts or rivets should be used for mounting axles.

   There should be four casters with a minimum of two that are mounted to swivel 360 degrees. Two casters should have locking mechanisms to prevent movement except by the service crew. Swivel mounted casters should have grease fittings. Each caster must be capable of supporting loads of 300 kg for each cubic meter of bin volumetric capacity. No casters should be required on bins with capacities greater than 3 cubic meters.

3. **Color:** A color should be specified that is aesthetically acceptable to the contracting agency. The most commonly selected colors for rollout carts and bins in major cities around the world are green and blue, often associated with environmental awareness campaigns.

4. **Compatibility:** Each type of storage container specified must be compatible with the type of collection vehicle that the contractor intends to use. Rollout carts should be compatible with commercially available American National Standards Institute (ANSI) Type B, or equivalent, hydraulically operated semi-automated lifting mechanisms with a dumping cycle time of no more than eight seconds. ANSI standards are available on the internet. Bins should be required to be compatible with commercially available rear or front-loading collection vehicle lifting mechanisms.

5. **Distribution Plan:** The contracting agency needs assurance from the contractor that storage containers will be delivered to service users in a timely and cost effective manner. To accomplish this goal the contractor should be required to submit a distribution plan with the company's tender offer for any containers that the company is to provide. The requirement should specify the time period in which all containers are to be delivered, allowing a reasonable amount of time for delivery, but not too far in advance of the date that collection service is scheduled to start.

6. **Finish Surfaces:** For rollout carts, the contracting agency should require that interior surfaces be smooth with a semi- or high-gloss finish to minimize accumulation of residue on interior cart walls. Exterior surfaces should be suitable for hot stamping appropriate information and instructions for users on the lid and body and be free of sharp edges and corners, protrusions, or other structures that could pose a nuisance or hazard to users. Bins that the contractor is required to provide for DOCs should have a rust-inhibitive, corrosion resistant coating.

7. **Handles:** Handles should be required on all storage containers to facilitate their safe movement both by users and the contractor's collection crews. Recycling bins should have at a 1.0 cm lip around the entire perimeter of the container. Rollout cart handles should be at least 2.5 cm in diameter and equal the width of the cart. Handle mounts should be either an integrally molded part of the cart body or, if bolt-on handles are used, they should be designed such as to prevent them from working loose over the active life of the cart. Metal bins should be equipped with metal handles at least 2.5 cm diameter in diameter and 12 cm in length on the rear and both sides of the bin.

8. **Identification and Marking:** All storage containers should have identification numbers and other markings to reduce potential theft, facilitate contractor inventory control, and aid contract monitoring. Markings also should include easily read and understandable information regarding usage.

   Rollout cart lids should have a suitable area for affixing an appropriate label for education and/or other information. The governorate logo, a serial number (sequentially numbered), the production batch number and date, the maximum load weight rating (in kg) and the rollout cart type (per clause 4.2.1f of ANSI Z245.330-99, available on the internet) should also be hot-stamped on the lid.

   Bins should have a smooth, seamless decal area on the front of a size not less than 15 cm by 25 cm

for affixing the governorate logo and the contractor's customer service telephone number. In addition, each bin should have labels illustrating materials to be contained; prominently in both Arabic and English letters a minimum of 8 cm in height.

9. **Lids:** Lids are essential for all containers that remain outside of a building to ensure that recyclables stay in the container and that waste material, animals, and other pests are kept out. At the same time, lids should be lightweight in order to facilitate opening and closing by a variety of users. Rollout cart lids should be manufactured from the same material as the body of the cart; rotate at least 270 degrees with no interference; be watertight when closed, be snug fitting, and overlap the cart rim. The lid should also be configured to ensure that it will not warp, bend, slump, or distort to such an extent that it no longer fits the cart body properly or becomes otherwise unusable. Bin lids should be lightweight plastic or aluminum, watertight and self-draining, prevent rain entry when closed, be attached securely, but able to be rotated 270 degrees for dumping.

10. **Lifting and Emptying:** All rollout carts and bins supplied by the contractor should be equipped with attachment points that facilitate safe lifting and complete emptying of all contents. Rollout carts should be equipped with attachment points that make it compatible with standard semi-automated bar locking lifters. The upper lift point should be integrally molded into the body of the cart. The lower bar should be 2.5 cm galvanized steel, rotate freely a full 360 degrees on its own axis, and be designed to withstand over 10 years of lifter attachment.

11. **Maintenance:** To ensure the preservation and long life of storage containers and to minimize customer inconvenience, the contracting agency should require that the contractor monitor, control, sanitize, and otherwise maintain them over the life of the contract. Bins should be washed at least once every 3 months and rollout carts should be washed at least annually or according to the schedule and plan submitted by the contractor with his or her Tender Offer.

12. **Minimum Load Rating:** Since recyclable material containers are often filled with heavy materials such as glass or newspaper, the system planner should require that the contractor provide containers that will accommodate such materials without being damaged. The minimum load ratings for rollout carts should be 50 kg, 100 kg, and 150 kg for 120, 240, and 360-liter carts respectively. The minimum load rating for bins should be set at 300 kg for each cubic meter of capacity.

13. **"Nestability":** It is in the interest of the contracting agency to specify that storage containers be "nestable"; i.e. can be stacked inside each other to a specified extent, in order to reduce shipping, storage, and distribution costs. Most recycling bins, rollout carts and bins are nestable. The rollout carts should be designed such that each fully assembled cart will nest inside any other of the same design to a minimum of six fully assembled carts. This will substantially reduce shipping costs and the number of trucks and personnel required to deliver carts to the service area.

14. **Ownership:** To provide added incentive to maintain storage containers at the highest practicable level, and to reduce potential liability to the governing body, ownership should remain with the contractor. The governing body should be given the option to purchase the storage containers at the end of the contract period at a price to be specified in the service contract.

15. **Replacement:** Some storage containers will need to be replaced from time to time over the contract period due to irreparable damage or theft. The contractor should be required to replace within in a specified time period, and at his or her own expense, any container that has been removed from its designated location or that is not fully functional and cannot be repaired. Replacement should be required within two days of notification from the governing agency.

16. **Standards of Design:** To assure that the contractor supplies rollout carts that have been designed according to industry standards, the minimum technical requirement for containers should specify that containers meet all relevant sections of ANSI Z245.30 –1999 and Z245.60 –1999, or equivalent. These are available on the internet. Rollout carts should be designed such that all materials flow freely out of the cart when dumped by a semi-automated bar-locking lifting mechanism (ANSI Type B, or equivalent). Bins should be designed such that any type of recyclable material flows freely out of the cart when mechanically lifted and dumped into a collection vehicle.

17. **Volumetric Capacity:** The purpose of the minimum technical requirement for volumetric capacity is to ensure that the contractor provides adequate storage capacity. It should be specified in terms of the minimum volume requirement (in liters/day) per dwelling unit. A minimum of 4 liters per dwelling unit per day should be required. However, it is advisable to conduct research in the planning area as described in Step 1 to obtain the most reliable estimate of storage capacity needs, and then set a standard that allows for peak periods of recyclable material generation. Recycling bins are available in sizes from 40 to 60 liters. Standard rollout carts are available with 120, 240, and 360-liter capacities. Bins typically are available in 1-cubic meter increments between 1 and 10 cubic meters. However, bins with capacities greater than 6 cubic meters are difficult for residents to use due to the excessive loading height and should be avoided.

18. **Warranty:** To minimize service interruption, inconvenience to customers, and total system costs the system planner should specify that the contractor supply storage containers that have the longest practicable useful life.

    Recycling bin and rollout cart useful life should be a minimum of 10 years for all parts of the cart. The warranty should not be prorated over the cart life, and should specifically provide for no-charge replacement of any component parts that fail in materials or workmanship for a period of 10 years after placed in service. Any failure under warranty should require replacement with a newly manufactured cart, which should be defined to be the body of the cart, wheels, lid handles, and other ancillary features and fasteners.

    Bin useful life should be a minimum of 10 years. As for the rollout carts, the warranty should not be prorated over the bin life, and should specifically provide for no-charge replacement of any component parts that fail in materials or workmanship for a period of 10 years after placed in service. Any failure under warranty should require replacement with a newly manufactured bin, which should be defined to be the body of the bin, casters, lids, handles, and any other ancillary features and fasteners.

Recyclable Material Collection Service User Requirements

Users of the recycling program must comply with certain requirements relating to the storage, separation, and set-out of their recyclables for collection. When the point of collection is at the door of each dwelling unit and the collection method stipulates use of plastic bags, the occupant should be required to provide them. To allow bidders to structure bids that are cost effective, the bidders need to be aware of the responsibilities and requirements of the service users. The following issues relating to service user requirements should be addressed in the minimum technical requirements section of the RFT.

1. **Abuse of Containers:** Specifications are needed to assure the contractor with protection of both the container and its cover from abuse by users or the public in general. Local ordinances should include penalties for theft of, or damage to, privately owned containers by any private citizen. Correspondingly, the contractor should be required to replace any rigid plastic or metal container that is damaged or rendered functionally unusable by any employee.

2. **Acceptable Recyclable Materials:** The types of "acceptable recyclable materials" that residents and businesses are allowed to place in the storage container and any preparation requirements must be clearly specified. Preparation requirements may include rinsing/washing bottles and cans, removing caps, and separating paper from containers.

3. **Set-out Requirements:** Requirements addressing when and where storage containers may be placed outside for collection should be specified so that the contractor will be able to develop the most cost effective service plan. If the point of collection is outside the building or at a DOC, the storage container is always at the collection point and users may be allowed to place recyclables in them at any time. If the point of collection is at the door of individual dwelling units, occupants should be required to place containers within 1 meter of the door no earlier than 12 hours, and no later than 1 hour, before the scheduled collection time.

4. **Storage/Set-out Container Specifications:** Specifications for recyclable material storage containers to be purchased and used by residents and businesses are necessary to protect public health and the environment, and to facilitate the work of the contractor. Container specifications that define a "suitable container" should address the following:

- Container material.
- Capacity.
- Maximum loaded weight.
- Closure.

Plastic bags are acceptable for occupants of dwelling units to use if the point of collection is at the door of the dwelling unit. If plastic bags are allowed, users should be required to close or tie them securely at the top prior to set out. Bag size should be limited to 80 liters and the full weight should not exceed 15 kg.

Recycling bins made of plastic and with a capacity of 40 to 60 liters is an acceptable alternative to plastic bags for at the door service. They will be more costly to service than bags, but will reduce the cost of processing.

Use of rigid plastic or metal containers in conjunction with plastic bags is acceptable, and is in fact a preferred practice to minimize nuisance problems with animals or other pests. Container size should be limited to 120 liters and loaded weight to 25 kg. Rigid containers should have sloping sides, tightly fitting covers with graspable handles, and two handles to facilitate handling by the collector.

Collection Personnel

To ensure that the contractor trains and deploys collection 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, and laborers that have met certain training requirements appropriate for their respective trades, e.g., in collection and processing of recyclables respectively.

2. **Demeanor:** The collection personnel employed by the contractor will have considerable contact with those who use and provide the funding for the service. Long-term support for the service will be far more dependent upon the demeanor of the field personnel than on the performance of the contractor's upper management. Therefore, it is essential that the contracting agency convey the importance of worker demeanor and public diplomacy to the contractor through a minimum technical requirement that requires workers be trained by the contractor to maintain positive interaction with residents, business owners, and governorate representatives.

3. **Driver Training and Licenses:** Collection 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 collection 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 collection vehicles under the local conditions.

4. **Field Supervision:** To facilitate governorate communication with the contractor and to ensure adequate management of all collection personnel in the field it is essential that a minimum ratio of supervisors to work crews be specified. The contractor should be required to provide the names of all field supervisors in writing to the contract administrator. Finally, the field supervisor should be required to be present in his assigned area of responsibility at all times that crews are working, and have radio communication with the contractor's office and all collection vehicles under his or her supervision.

5. **Uniforms and Safety Equipment:** Requiring the contractor to provide uniforms and safety equipment for all collection and processing 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. Thus 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. Processing facility personnel that are directly involved in sorting of materials 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.

Recyclable Material Collection Practices

The minimum technical requirements should include a section addressing collection practices to ensure that the contractor conducts all collection activities in compliance with the service specifications and in a manner that does not negatively impact the general public. The section on recycling collection practices should specify the minimum technical requirement listed below.

1. **Access to Private Property:** With the exception of providing collection services at dwelling unit doors, the contractor's employees should not be allowed to trespass or litter, cross property to adjoining premises, or meddle or tamper with property that does or should not concern them.

2. **Conditions for Not Providing Service:** In those instances where dwelling unit occupants or commercial business owners do not comply with service user requirements, the contractor should not be obligated to provide service. However, in every such case, the contractor should be required to leave a notification form specified by the contracting agency that informs the resident or business of the exact reason why service was not provided. In addition, the contractor should be required to report all such instances of user non-compliance to the contracting agency.

3. **Fees and Gratuities:** Fees that residential and commercial customers pay through general tax revenues or surcharges on utility bills should be sufficient to cover the cost of the service. Service users should never have to pay the contractor's employees for any service. Therefore, it is essential that the contracting agency require that the contractor not permit any employee, agent, or subcontractor to offer special service beyond the scope of the contract, or to request, solicit, demand, or accept, either directly or indirectly, any compensation or gratuity for services that fall within the scope of the contract.

4. **Property Damage:** Maneuvering large collection vehicles in heavy traffic and the negotiation of narrow roads create significant risk of damage to public and private property. To minimize this risk, the contractor should be held responsible for all costs associated with the repair and replacement of damaged property of any kind that can be ascribed to the actions of its equipment, employees, or agents. Moreover, collection crews should be required to immediately report any incident that might have caused damage to third party property to the field supervisor, who shall in turn inform the customer and contracting agency within 8 hours of such occurrence.

5. **Public Safety and Convenience:** To minimize safety hazards, inconvenience, and annoyance of the general citizenry it is important for the contractor to conduct work without disturbing the public. To achieve this objective the contractor should be required to take all practicable steps to minimize obstruction to pedestrians and motor vehicle operators during the performance of all aspects of the recycling service.

6. **Scavenging:** Collection crew employees will be tempted to scavenge recyclable materials that they collect. Scavenging reduces compliance with productivity and diversion goals, is dangerous, and projects a negative image of the job and the contractor. Require the contractor to forbid any employee from placing any recyclable materials inside or outside collection vehicles except in the cargo area of the vehicle. Moreover, require the contractor to prohibit collection crews from offloading any materials while on collection routes or during transfer of materials to designated facilities.

7. **Spillage:** Materials spilled and not picked up by the contractor's collection crews sends a negative message to the public regarding the governorate's commitment to high quality service. While the contractor should not be responsible for cleaning up material around any of the storage containers when it is placed there by the customer, the contractor must be held responsible for removing any spillage of recyclable materials that occurs due to the action of the contractor's collection equipment and/or personnel.

8. **Street Usage Rights:** The contractor should be granted the right to use the streets for the purpose of providing recyclable material collection services specified in the contract, but should not be

granted exclusive use of such streets. The contractor must observe all local ordinances relating to obstructing streets, keeping passageways open and protecting same, and obey all laws and ordinances controlling or limiting those engaged in recycling service provision. When the contractor's vehicle blocks the passage of other vehicles, the contractor's vehicle should be required to pull aside at the first opportunity and allow waiting vehicles to pass.

Customer Service and Complaint Handling

The contractor should be required to offer a system that facilitates receiving, recording, and resolving inquiries and complaints from all categories of service users. To optimize customer usage the system must be widely publicized and easy to use. To ensure the implementation of a system that meets these objectives, the contracting agency should establish requirements for each of the following related issues.

1. **Communications Equipment Requirements:** The contractor should be required to equip the customer service office with enough telephone lines to be able to answer all calls in less than 1 minute, even during peak hours. The office should be equipped to transmit complaints to field supervisors through the use of two-way radio or cellular telephone communications. The office should also be equipped with facsimile equipment to facilitate transmission of written communication with the organization responsible for contract administration.

2. **Complaint Handling:** The ability and commitment of the contractor to expeditious resolution of all complaints is essential to maintaining the financial and behavioral support of service users. As a first step the contractor should be required to record in a bound book all complaints, noting the name and address of each complainant, date and time of complaint, nature of complaint, and nature and date of resolution. The contractor should also be required to compile a summary statistical table of the complaint record in a form satisfactory to the contracting agency, which should reserve the right to examine it at any time.

3. **Complaint Resolution:** The logistics and timelines associated with resolution of complaints need to be specified in the minimum technical requirements. The contractor should be required to respond to all customer complaints within, at most, 12 hours. If a complaint involves a failure to collect recyclable materials from any customer as required in the contract, the contractor should collect the material in question within 12 hours of notification, provided it has been prepared for collection in accordance with the service user requirements.

4. **Hours of Service:** To maximize customer convenience the customer service office should be open during all hours that calls might be expected regarding the service. If the contractor is providing service during night time hours, then the office should be staffed 24 hours on each day that service is provided. Fewer hours might be acceptable if all service is provided within one or two daytime shifts only. However, it is better to err on the side of too many rather too few hours in order to maintain customer support and satisfaction.

5. **Staffing:** The office should be staffed with a number of trained personnel adequate to ensure that customers are able to reach a qualified customer service representative within two minutes of calling.

6. **Unresolved Complaints:** Provisions also need to be prescribed in the event of reports from contracting agency monitors or customers that a complaint has not been resolved to the customer's satisfaction. In this case, the contractor should submit a detailed report outlining the nature of the complaint and the resolution or actions taken to resolve the complaint. If, in the opinion of the contracting agency the proposed resolution or actions taken are insufficient to satisfactorily resolve the claim, it should require the contractor to carry out a process to satisfactorily resolve the complaint.

Reporting

Requiring the contractor to prepare and submit monthly reports that address all aspects of recyclables collection 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.

Monthly operating reports (MOR) must be timely to maximize their utility, and therefore should be sub-

mitted within 15 days of the end of the month being reported on. The information to be required in each monthly recyclable materials collection report and summary annual reports should include the following:

- Total number of collection vehicles put in service and personnel deployed each day.
- Total number of man-hours and truck hours employed each day.
- Number of places (dwelling units, buildings, DOCs) where recyclables were collected from each day.
- Tons of recyclables collected daily.
- Monthly tonnage of recyclable materials collected, diverted for recycling, and disposed (including receipts for all recyclable materials sold).
- Number of notices of non-collection left daily; with addresses and description of problem.
- Summary of customer service office staff hours worked daily.
- A complaint record enumerating customer complaints received daily.
- Description of resolution for each complaint.
- Disposition of all recyclables collected; amounts collected, transferred, recovered, and disposed.
- Updates to the database of DTD, BTB, and DOC storage containers (rollout carts and bins) listing repairs, replacements and additions.
- Number of times each drop-off center is serviced.
- Lists of containers (rollout carts and bins) receiving maintenance or sanitation service.
- Accurate records of 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 vehicle inspections.
- An updated inventory of all vehicles used for all collection services including the make, type, year, license number, and ownership.
- An updated list of names of all supervisory personnel assigned to each type of recyclable material collection service.
- A description of problems encountered and proposals for increasing service efficiency and achievement of service objectives.
- A description of all cases of property damage and personal injury that have occurred while providing services, including a copy of the accident or incident report filed with the company or with the appropriate authorities.
- A description of any violations of national local laws, decrees, or ordinances.

Recyclable Material Processing Design and Operation Requirements

To optimize recovered material value and meet all of the contracting agency's performance criteria the contractor needs to meet minimum technical requirements for design, construction and operation of the material processing facilities. Suggested minimum technical requirements to accomplish this objective are described below.

1. **Access Control:** For the safety and protection of both the general public and the contractor's personnel and equipment require that facilities 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 the processing facility to its employees, subcontractors, and designated contracting agency staff or their consultants.

2. **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 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 to prevent further occurrences.

3. **Environmental Control Plan**: The contractor should be required to prepare an environmental control plan defining the appropriate environmental control testing procedures and standards for process air emissions, vented air, effluent, wash-down water, odors, noise, etc. The environmental control plan should describe the remedial actions to be taken whenever environmental control standards are not met.

   The environmental control plan should be capable of being approved by the governorate and the EEAA. The contractor should conduct all testing activities specified in the environmental control plan and the environmental testing results, and remedial activities conducted, if any, should be included in the monthly operations reports.

4. **Environmental Standards:** Require that the processing facility meet all local and national air emission requirements, and all other local and national public health and safety standards.

5. **Facility and Equipment Maintenance:** Very few types of equipment have more moving parts that are subjected to continuous exposure to abrasive materials than a recyclable materials processing machinery. Since Egyptian experience has demonstrated that inadequate maintenance of equipment has been the root cause of failure of government-provided waste management services, it is critical that the contractor be required to perform continuous preventative maintenance in order to function in a safe and operable condition over equipment expected life.

   While it certainly is in the interest of the contractor to maintain the equipment, it is also in the interest of the contracting party to do everything in its power 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 budget, showing maintenance of all processing equipment in safe and operable condition, and to minimize the threat to worker health and safety.

   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, recyclable material processing, consolidation, and storage equipment.
   - Mobile equipment including, and not limited to, skid steer loaders, front-end loaders, fork lifts, and recyclable material residue transport trucks.
   - Recyclable material residue storage and transport containers.

6. **Fire Control and Suppression:** To achieve worker health and safety criteria require that all buildings be constructed of fire resistant/retardant materials. Also require that the contractor install and maintain a fire suppression system including fire extinguishers and that the facility be equipped with a fire alarm directly connected to a rapid response fire fighting squad. The facility should also be equipped with telephone service to call for emergency medical assistance.

7. **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 MORs. Require that all contractor and subcontractor personnel shall receive annual training in fire suppression and evacuation procedures.

8. **First Aid Kits:** The processing facility operator should be required to provide emergency first aids kits at all workstations. All workers should be provided and required to wear personal protective equipment including, and not limited to, steel toe shoes, hard hats, safety glasses and/or face-masks 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.

9. **Fuel Leak:** You should require the contractor to handle fuel leaks 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.

10. **General:** State that the contractor is responsible for design, permitting, construction, and operation of the processing facility.

11. **Health and Safety and Emergency Response Manual**: For processing facility personnel protection 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.

12. **Hours and Days of Operation:** Delivery of recyclable materials to the processing facility should occur only during hours and on days established by the contracting agency. The treatment facility should be open to receive recyclable materials at least during all hours that those materials are collected in the planning area.

13. **Incoming Materials Record:** The contractor should maintain a record of all incoming recyclable materials received at all processing facility(s). For each incoming load, the contractor should record in the incoming materials record the category of materials, the source, the tare weight, date, and time. The record should be in a form acceptable to the contracting agency.

14. **Litter Control:** To ensure that the processing facility does not contribute to neighborhood litter the contractor should be required to inspect the entire perimeter of the facility daily and collect all litter.

15. **Location of Activities:** In order to control contractor activities require that all recyclable materials processing performed under the contract takes place only at the approved processing facility(s).
16. **Monthly Safety Inspections:** The processing facility 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.

17. **Outgoing Materials Record:** The contractor should maintain a detailed record of all recovered materials and waste residue leaving a processing facility in order to facilitate calculation of the diversion rate. For each outgoing load require the contractor to record in the outgoing materials record, the destination, the tare weight, date, and time.

18. **Processing Facility Capacity:** The pre-qualified bidder should be made responsible for verifying the recyclable material generation information contained in the appendix. Based on the contractor's own assessment of the data and projections for increases in recyclable material generation over the term of the contract, the contractor shall determine the optimum design capacity of the processing facility. The design capacity should be based on nominal and peak generation of recyclable materials in the governorate, and have both an 8-hour and 24-hour operating capacity.

19. **Proven Technology:** To ensure that governorate recycling program objectives are achieved the contractor should use only proven sorting and material handling technology in processing recyclable materials. The technology should have been in successful commercial operation for at least 5 years,

and should have been employed successfully in at least three processing facilities of similar size. A list of these processing facilities should be supplied with the pre-qualified bidder's response to the RFT.

20. **Recyclable Material Education Program**: The contractor should be required to develop and implement a processing facility education program that can be used to educate visiting school classes and other interested parties about the role that processing plays in the overall recycling program. The contractor should be required to submit the program to the contracting agency for review and approval. To promote use of the visitor facilities the contractor should be required to employ a full time recycling education coordinator.

21. **Recyclable Material Residue Disposal:** The contractor should be responsible for transporting recyclable material residue resulting from processing to a designated disposal facility during its normal operating hours.

22. **Recyclable Material Residue Storage:** Processed recyclable material residue should be removed from the processing facility to a designated disposal facility within 24 hours of generation.

23. **Spill Control Records**: 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.

24. **Treatment Standards:** Require that the processing technology be effective to recover a minimum of 20 percent of mixed waste, 50 percent of wet/dry waste, including composting of the wet portion, and 25 percent of single stream waste.

25. **Unacceptable Materials:** Give the contractor the right to exclude any vehicles that deliver any unacceptable materials to the processing facility. If unacceptable material is unloaded or dumped at the processing facility, the contractor should be required to immediately load the material back into the delivering vehicle and require the vehicle to leave the processing facility.

26. **Vaccinations**: All employees involved in the recyclable material processing 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 with recyclable materials. The contractor should also be required to maintain an employee vaccination log, and the log should be available for inspection.

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

28. **Weighing and Materials Classification System:** The contracting agency needs to know exact quantities of recyclable materials received, recovered and disposed in order to calculate the diversion rate required of the contractor. Therefore all processing facilities must be equipped with a permanent vehicle weighing system where all incoming Recyclable materials, recovered materials, and waste residue 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 10 kg.

SOLID WASTE TECHNICAL ASSISTANCE

Ministry of State for Environmental Affairs

U.S. Agency for International Development

Egyptian Environmental Policy Program