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Author: Dr. Kunitoshi Sakurai, Advisor in Solid Wastes, CEPIS

Subject: Evaluation of existing solid wastes management - Sanitation Service Authority, Barbados

Background

The Sanitation Service Authority requested the assistance of CEPIS for the purpose of evaluating existing solid wastes management. The following terms of reference were specified:

1. To observe and evaluate existing solid wastes management in the following areas:
   (a) Proper use of collection vehicles and preventive maintenance
   (b) Use of local materials and equipment
   (c) Personnel management and public relations
   (d) Other relevant solid wastes management procedures.

2. To formulate proposals and recommendations for the solution of identified problems.

Analysis of the Situation

By the Sanitation Service Authority Act of 1974, the Sanitation Service Authority has been vested with responsibility for the removal of refuse from any premises and the sweeping of streets. To fulfill these responsibilities, the SSA employs a staff of approximately 350 persons (excluding those in charge of cemeteries, public baths and conveniences) and possesses a fleet of approximately 60 refuse collection vehicles. The refuse collection service of the SSA covers all parts of the island
And all inhabitants are provided at least once a week with collection services. However, SSA's refuse collection services can be remarkably improved. The productivity of the services is 0.6 tons of refuse collected per worker per working day. According to a survey which this consultant conducted, the average productivity of 53 Japanese cities in 1972 was 1.137 tons of refuse collected per staff person per working day.

This low productivity is brought about by the following main factors:

(a) Improper storage method: The majority of refuse containers in use on the island are 55-gallon oil drums. These containers are too heavy and unsafe to handle, but still better than the many places called dump spots where the loose garbage not only needs to be shoveled by lorry loaders but also causes unsightliness and unhealthiness. Such shovel operation is time-consuming and lowers the productivity of the service.

(b) Improper street sweeping method: The present method of street sweeping and the removal of the swept-up material is not satisfactory. There is a lengthy delay between the time when streets are swept and when the swept-up materials are removed, which causes part of such material to be blown back on the streets. Finally, the removal of the swept-up material, which is done by lorry loaders using shovels, is not only time-consuming but also dangerous in heavy traffic.

(c) Poor vehicle conditions: Preventive maintenance and general repairs are carried out by a transport foreman with a staff of nine workers at the City Depot. However, the refuse collection services provided by the SSA are frequently affected by simultaneous mechanical failure to a number of vehicles. During our visit about 30 percent of the SSA's vehicles were out of order including two mechanical road sweepers. This high-rate breakdown is due to the age of vehicles and to the difficulty in getting repair parts. Additionally, the high loading height of refuse collection vehicles contributes to reduce productivity with the sole exception of the Hail Compactors which have an appropriate loading height. The situation is even worse in the case of the 30 cu yd open trucks which were originally supposed to be used at the pulverization plant but are occasionally used as substitutes to the broken down vehicles. Furthermore, the tipping operation of 55-gallon oil drums to these open trucks is very inefficient and unsafe.

(d) Narrow lanes and streets: There are numerous narrow streets and lanes in the St. Michael district, where about 70 percent of refuse collected by the SSA is generated. Some of these are inaccessible to the collection vehicles. In the city center area, the SSA is using pushcarts to collect the refuse in these narrow streets, such operation is not only unproductive but also unseemly. The refuse collection in Barbados must be aesthetically admissible in order not to affect its touristic industry. In the residential area, there are many dump spots at the entrances of these narrow lanes and the lorry loaders must shovel the loose garbage from them. To improve the
sanitation conditions and the refuse collection efficiency, the SSA began to use 2 cu yd metal refuse bins (skiffs). These skiffs are located at points as close as possible to alleys and gaps that are inaccessible to collection vehicles and are emptied by Hafl Compactors. The skiffs are working fairly well, but it is no easy task to find suitable locations for them and sometimes the lack of public cooperation turns the skiffs into new dump spots.

(e) **Long haul distance:** The hauling is an unproductive operation and the short hauling time is desirable to attain the sufficient use of collection vehicles. The haul distance from St. Michael to the Oldbury Dump is approximately 14 miles and the mean time of round trip is 1-1/4 hours. At this time the average number of trips to and from the landfill site is two per vehicle per day. Hence, each refuse collection crew is consuming approximately 2-1/2 hours each day to this unproductive hauling operation. In this condition to make three trips is practically impossible. In order to restrict these long hauls the SSA is now constructing a pulverization plant scheduled to begin its operation next January at a site called Workmans in the central parish of St. George. The entire St. Michael area is within 8 miles of the plant. By using this plant as destination point almost all refuse collection crews in the city will have the capability of making three trips a day. The introduction of the Pulverization Plant will also improve the condition of the landfill site. The sanitary conditions of the Oldbury landfill site is not very satisfactory because in Barbados it is very difficult to get enough cover soil due to its geological characteristics. At the landfill site there are some odor problems, fly infestation, animal feeding and scavenger problems. These problems will be fairly well overcome by pulverizing the refuse prior to the landfiling operation. This consultant visited the city of St. Catharines, Ontario, Canada and confirmed that pulverized refuse did not produce any problems without cover soil. The temperature condition is better in Canada than in Barbados, therefore the experience in Canada is not directly applicable to Barbados. However, according to the experiences in the United States and Japan, there are a lot of hammer troubles in pulverization plants. Therefore the appropriate considerations should be made beforehand in order to avoid these troubles.

(f) **Poor management information system:** Above all the mentioned factors, the lack of a proper management information system is hindering the achievement of an efficient refuse collection service. Until this time there has been no weighing device which is a fundamental tool to assess the productivity of each vehicle. And until April there had been no staff on the landfill site to check the movement of vehicles. Hence, some vehicles go to the landfill site with half load and make only one trip a day. This lack of proper assessment tools causes a poor supervision of the refuse collection operation and weak incentives for crews to achieve an efficient service. The present form of the daily collection activity report is also inadequate in giving the necessary information to assess each vehicle's productivity, and to carry out a proper preventive maintenance. However, the management of the SSA seems to be strongly efficiency-minded and is planning a revision of this form. It has also posted, starting this April, a landfill supervisor to check the movement
of collection vehicles and is going to install a weighbridge in the pulveriza-
tion plant, which will allow for the first time to discuss the productivity with concrete figures. To make best use of these improvements and adequate solid wastes management information system must also be installed.

Conclusions and Recommendations

The conclusions and recommendations have been separated for reasons of convenience and emphasis into the following categories:

- Storage
- Street sweeping
- Collection
- Pulverization plant
- Landfill
- Preventive Maintenance
- Personnel management

1. Storage

(a) In the residence areas of high income families, the 55 gallon oil drums should be gradually removed and compulsory use of 20-35 gallon plastic containers should be introduced. The use of light plastic containers will make the refuse collection operation more efficient and safe. The areas should be carefully selected and before the introduction of compulsory usage an intensive campaign should be carried out to educate the people about proper refuse storage methods.

(b) In the residence areas of low income families, the refuse should be stored in 55 gallon oil drums or 2 cu yd metal bins, since the acquisition of plastic containers is beyond the financial means of low income households. No loose garbage should be collected by the SSA except from the areas where the placement of appropriate containers is physically impossible. In these areas, the SSA should deliberately put oil drums or metal bins according to each case. In some narrow alleys it is physically impossible to find the appropriate places to site these containers but there are also many areas where the dump spots can be replaced by these containers. The extensive use of 2 cu yd metal bins has also the advantages of being locally produced and easily maintained. After the placement of appropriate containers and the intensive educational program on proper storage methods, no loose garbage should be collected by the SSA. The manager of the SSA should prosecute people for specific violations of storage and collection rules.

(c) Big refuse sources such as markets, schools, hospitals and hotels should use 2 cu yd metal bins as containers. This consultant observed many huge heaps of loose garbage in hospitals and hotels. These improper storage method caused fly infection, odor and unproductive collection operation. To these hotels the metal bins should be given on a rental basis. In order to pick up the refuse stored in these bins effectively, collection routes of Heil Compactors should be reappraised taking into consideration the location of bins.
(d) Appropriate refuse storage procedures should be taught in every school and the SSA supervisors should be actively used as instructors. Bad habits concerning procedures of storing refuse are prevailing thus creating possible health hazards and unproductive collection operation. Proper use of appropriate containers is not sufficiently achieved and many people put their refuse for collection regardless of collection timetables. These bad habits must be corrected. The most fundamental correction measure is the inclusion of a public health subject into the school curriculum. School boys and girls will be the best target for public relations activities by the SSA.

2. Street sweeping

(a) Attractive litter baskets should be placed at strategic locations in downtown Bridgetown. These baskets should be scheduled to be emptied daily by the men on the night routes. Presently there are no litter baskets in the island. This lack of proper receptacles is discouraging public cooperation to the island’s embellishment. Financial help for the purchase of litter baskets should be asked from local groups such as the Chamber of Commerce, etc. Such activities will give them a feeling of involvement and responsibility for solid wastes control.

(b) The SSA should recommend to the Transport Board that eating and drinking should be prohibited on the Board’s Buses. The passengers travelling in buses by the Transport Board contribute heavily to the littering of streets from the buses. Especially snow-cone plastic containers are becoming a widespread and unsightly nuisance. The attachment of removable litter receptacles (5 gallon plastic container) to bus stop poles may be useful.

(c) The use of mini refuse collectors should be expanded and the present manual street sweeping operation should be gradually replaced by mini refuse collector operation. A mini refuse collector to be used in the cleaning of streets and sidewalks in Bridgetown was designed by the manager of the SSA and built by the welder in the mechanical workshop. This mini collector was put into service on a trial basis this March. The initial results indicate that the collector would improve the cleanliness of the city as there is no delay between the time of street sweeping and the removal of the swept-up material. The use of plastic bags (three bags per mini collector per day, 0.4 Barbados dollars per each bag) with this mini collector will also improve swept-up material collection efficiency by eliminating time-consuming shovel operations. The cost of plastic bags will be easily recovered by the saving of labor costs, for example wage of lorry loader is 24.5 Barbados dollars per day. Mechanical sweepers are not advisable because of the unsuitable street conditions (many parking vehicles and gutters) and the difficulty in obtaining repair parts. On the other hand mini collectors can be locally produced and easily maintained. In addition to this, the use of mini collectors does not cause cutdowns in employment.
3. **Collection**

(a) **An adequate information system should be installed to control the movement of collection vehicles.** The present management information system of the SSA is very poor to achieve a proper use of collection vehicles. Without a way to weigh vehicles and with so many different types of vehicles, the job of determining what is required of a collection crew in a day is very difficult. Therefore, some compactors return to the Depot before 11 o'clock in the morning (the assigned working time is from 6 am to 2 pm) when a breakdown occurs in another area.

Based upon the planned introduction of such fundamental tools as a weighbridge in the pulverization plant and a revised form of daily collection activity report, an adequate information system should be installed. For the SSA a simple, non-computerized system is advisable. Annex 1 provides guidelines for the installation of this information system. The proposed system in the Annex should be modified to meet local conditions through the discussion of all supervisors and the transport foreman.

(b) **Rerouting should be done based upon the performance appraisal of each collection crew.** By the introduction of the above mentioned information system it becomes possible to appraise the performance of each collection crew. Based upon this appraisal, the routes in which the collection vehicles are not used to their full potential should be lengthened. The standard trips in the city area should be increased to three per vehicle per day after the start-up of the pulverization plant. On the other hand, all residential pick-up work should be reduced to a twice a week collection. These measures will leave some vehicles in reserve and the SSA's ability to replace a vehicle that is temporarily withdrawn from service for mechanical repairs will improve remarkably. The responsibility of performance appraisal and rerouting should be laid on supervisors, and the management should evaluate periodically their achievements. Good marks in this evaluation should be one of the important factors for the promotion of supervisors.

(c) **All vehicles should be refueled at the end of each working day.** For this purpose, fueling facilities should be installed at strategic locations. Some vehicles in the city area are fueled at the beginning of each working day wasting very useful time before the morning traffic congestion. By the installation of fueling facilities it becomes possible to perform this job even after the night operation.

(d) **The SSA should try again the Cushman Type Scooters to negotiate narrow lanes in downtown Bridgetown.** The SSA failed several years ago to put into operation three Cushman Type Scooters which were handed over to it by the Ministry of Health and National Insurance, due to a failure of negotiations with the worker's union on whether or not one man should drive and load the Scooter Collector. However, to improve the efficiency and sightliness of refuse collection in the downtown area the replacement of pushcarts by scooter type collectors is indispensable. The surplus workers due to this replacement
should be given other jobs in the SSA such as a junk automobile collection
task force and a litter basket installation task force. If this replacement
is impossible, the pushcarts should be made lighter by the use of rubber
tires.

(e) A task force for the weekend service should be organized. There are
many complaints relating dead animals, specifically dead dogs, that
remain on the streets between Friday night and Mondays. This causes not
only a public health hazard but also an unpleasant scene. To sustain its
thriving tourist industry the organization of a task force to provide weekend
services for such emergencies is indispensable. Surplus workers due to the
above mentioned recommendations, b) and d), can be transferred to this task
force.

4. Pulverization plant

(a) The SSA should assign a Superintendent to the pulverization plant with
a background in electro/mechanical engineering. According to the
experiences in the United States and Japan, there are frequent hammer troubles
in pulverization plants. When the pulverization plant breaks down, the long
hauling to the Oldbury Landfill site has to be resumed and the management of
the SSA has to operate again without means to weigh the vehicles. Therefore
the SSA must prevent these troubles with anticipation. One countermeasure is
the assignment of an appropriate superintendent capable of dealing with these
problems. Knowledge and professional experience in electro/mechanical
engineering should be included as minimum qualifications in the job description.
Another countermeasure is the placing of manual separators before the pulveriza-
tion process. Manual separation of glass bottles will decrease remarkably the
wearing of hammers and the domestic market will be available for these recovered
glass bottles.

(b) The pulverization plant should be well-lit so that the collection
vehicles can unload smoothly and safely at night. In some city areas,
daytime congestion and a limited number of vehicles create the need for night-
shift collection. Therefore consideration should also be given to the
efficient use of nightshift collection vehicles. Good illuminations for the
entrance way, weighbridge, unloading floor and exit way will improve the
efficiency of nightshift collection.

(c) The SSA should carry out a feasibility study of a composting plant as
a resource recovery project. By the introduction of the pulverization
process, many resource recovery operations become technically feasible.
However, in a small island country like Barbados, the scarce availability of
a market for the recovered resources precludes the economic feasibility of
most of these resource recovery operations. For instance, the amount of glass
cullet, paper and ferrous metals recovered from pulverized refuse would be too
small to export to overseas markets. The compost production from pulverized
refuse is one of the few operations which may be able to find an appropriate
domestic market. The compost, if it is finely shredded and removed of glass
and metals, will be useful as a soil conditioner in cane fields which are
abundant in Barbados. The site of a composting plant must be near the
pulverization plant in order to avoid unnecessary hauling operations. A proper location becomes possible only when both plants are examined and planned together. Therefore the SSA should carry out a feasibility study of this composting plant as soon as possible. It is advisable for the SSA to request PAHO's help on this matter on a short-term consultancy basis. Annex 2 provides information about another method (bailing) to dispose of pulverized refuse, but this consultant is of the opinion that bailing is too expensive to be applied in Barbados.

5. Landfill

After the start-up of the pulverization plant, the Oldbury Landfill site should not receive garbage from the city area. Due to existing limestone substrata with very shallow top-soil, it is very difficult to get enough cover soil to provide daily cover of compacted refuse. Hence the problems of insect infestation and odors are making this landfill site unhealthy. To improve the sanitation condition of this landfill site, the garbage from the city area should be shut out. Adding to this the working face of the landfill should also be narrowed to use the limited cover soil effectively. Both countermeasures will become possible after the start-up of the pulverization plant. Annex 3 provides a check list for the evaluation of sanitary landfills. This check list must be useful to find out the areas where improvements of landfill are needed.

6. Preventive maintenance

(a) Daily vehicle condition reports should be steadily checked by supervisors and any disorder should be reported daily to the transport foreman by the supervisors. The present form of the daily collection activity report is completely inadequate to give the necessary information to carry out proper preventive maintenance. Therefore the management of the SSA is now planning the revision of this form.

The draft of this revised form is appropriate. In this revised form there is a daily vehicle condition report and on the reverse side a daily collection activity report. The information in this daily vehicle condition report should be fully used by the transport foreman to carry out effective preventive maintenance.

(b) A management information system should be installed to evaluate each vehicle’s performance. The age and condition of some of the SSA’s vehicles necessitate costly and frequent repairs to ensure their roadworthiness. The SSA should give urgent consideration to the possible replacement of these vehicles. However, to assess the necessity of this replacement quantitatively, each vehicle’s performance evaluation is indispensable. This evaluation includes as its items: total miles, hours down, hours down per total hours, repair and maintenance cost per hour, fuel cost per hour and total cost per hour. Much of the necessary data is already collected or is easily obtainable, but the system which facilitates orderly and efficient accumulation and transmission of all relevant data is missing. Annex 1 presents a guide to the installation of this information system.
(c) The number of collection vehicle types should be decreased as much as possible to ensure the stock of enough repair parts. In a small island country like Barbados the acquisition of repair parts is very troublesome. Sometimes it becomes very costly and time-consuming, and too many different vehicle types can make the situation even worse. Therefore for future purchases, consideration should be given to the standardization of collection vehicles. The selected type should meet the operational requirements of Barbados. For example, the wider use of 2 cu yd metal refuse bins will require vehicles that can handle them. At present only the Heil Compactors can do it. The SSA should also take other factors into account such as vehicle stability (loaded and unloaded), turning radius, loading height and vehicle height in the unloading position to be sure there is overhead clearance in the pulverization plant. The loading heights of existing vehicles are too big except those of the Heil Compactors. The Heil Compactor can load more refuse than other compactors and its packer blade is less troublesome than the Alley Cat Compactor. Therefore among the existing compactors in the SSA Heil Compactors seem to be the best type of standardized vehicle.

7. Personnel Management

(a) The SSA should strengthen its training programs. Training should be centered on supervisors because they are the key persons to achieve efficient sanitation service. Supervisors are now required by the management to attend a training course at the Barbados Institute of Management and Productivity. However, besides this training course, on-the-job training is absolutely necessary. Collaboration of the previously mentioned management information system by the management and all the supervisors will prove useful for on-the-job training of supervisors. Training programs for other employees should also be strengthened, specially safety training.

(b) The SSA should have safety programs. Most lorry loaders of the SSA are wearing hard hats, safety shoes and gloves. However, there are practically no safety programs in the SSA. Refuse collection has the highest injury rate of all occupations with the exception of logging. Collectors have an accident frequency rate nine times higher than industrial workers. Therefore the SSA is required to conduct an aggressive, regular, safety training program for all supervisors and employees. It should cover such things as driver training, equipment handling, first aid, and general safety. Special programs for collection employees should include careful instruction in lifting and carrying, precautions in working around collection vehicles, and fire fighting. As an example, collection vehicle drivers must be warned that back-ups cause approximately 80 percent of vehicle accidents, and at least one person on every route should have completed a first aid course. The cost of such safety programs will be easily recovered by the prevention of accidents. Accidents are very expensive and its indirect cost include: 1) lost time of injured employees; 2) lost time of other employees assisting the injured; 3) lost time of supervisors helping the employee, determining the cause of the accident, and arranging for a replacement; 4) damage to equipment; 5) interference with schedules and production; and 6) increased compensation, insurance rates, and settlements. Information on procedures for establishing safety programs could be obtained contacting:
Among the previous recommendations, the installation of an adequate management information system needs the least cost, provides the biggest benefit, and enables the maximum use of existing staff and vehicles. All other recommendations should be carried into effect on the basis of this one.

Annexes