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SOLID WASTES PROBLEMS IN ADEN

by

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This is a very broad subject indeed and one may easily cover hundreds of pages of interesting material. However, I will try to be brief and leave details for personal discussion.

In the Middle East, such problems of handling (Collection and Disposal) of refuse and their respective probable solutions may vary from country to country and also from town to town perhaps within the same country.

In Aden, although the Cleansing Department of the Aden Municipality has only recently been established, in 1962, it has evidently revolutionized and challenged the old primitive, unhygienic methods of handling solid wastes. In the first instance, establishing a big Department consisting of nearly 700 labourers, 36 drivers, 20 supervisors, few clerical staff and only three senior officers, particularly when we had to start from scratch, e.g. individual personal files, job cards, identity departmental cards, time sheets, various forms for various purposes had to be prepared, legislation, registers, office accommodation and office furniture, mustering depots and sub-depots;

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introduction of technical improvements in the actual systems and processes, new vehicles and equipment, etc., what a task to be accomplished successfully within a relatively short period of time. The Council demanded this and offered on the other hand every facility from the financial and administrative procedural aspects, for the Council realized that rate payers have suffered enough from the passive policies of utilizing medieval systems of storage, collection, transportation and disposal. Such services were, prior to the formation of the Cleansing Department, rendered by the Public Health Department who had neither the time nor the know-how to make radical changes in the field of Public Cleansing.

It has certainly cost us a great deal to translate the planned works on paper to practical actions seen, felt and appreciated by all rate payers, thus giving the Council considerable pride and status particularly so far as public relations are concerned. Indeed, we have not as yet recovered from the long, tedious and laborious efforts made to change the system by:

a) Fact finding (in the form of work studies),

b) introducing new techniques on experimental bases, and

c) extending such techniques and methods to cover a wider range, give it the maximum publicity and follow it up closely to detect any snags and put them right.

STORAGE

For the last sixty years refuse used to be temporarily stored in communal masonry dustbins of an average capacity of about 20 cu.yds. These used to [illegible] at every street corner and some on the footpath at the centre of streets. being uncovered and emptied once or twice weekly, they became fly, vermin and even animal attraction centres.

Such a system was [illegible] first to be replaced.

Every householder, shop-keeper and restaurant proprietor was required to provide a dustbin/dustbins for the temporary storage of his refuse. Legislation in this regard was formed and implemented. The By-Laws read as follows:

Refuse Storage By-Laws, 1963

In exercise of the powers vested in it by Section 97 of the Municipal Ordinance, the Municipal Council has made the following By-Laws:

Citation. 1. These By-Laws may be cited as the Refuse Storage By-Laws, 1963.

Definition. 2. These By-Laws unless the context otherwise requires:
"Council" means the Council of the Aden Municipality;
"Cleansing Superintendent" means the Officer from time to time performing the duties of Cleansing Superintendent, Aden Municipality or any officer authorized to act on his behalf;
"receptacle" means a containing vessel for storing refuse.

Duty to provide dustbins. 3. (1) If any dwelling or premises is at any time without any receptacle for refuse the Council may serve a notice on the occupier requiring him or her, within a period of not less than seven days, to be specified in the said notice to provide such receptacle of such description as is approved by the Cleansing Superintendent, and to be placed in a convenient position for the purpose of the collection of refuse.

Penalty for failure to comply with the notice. (2) Any person upon whom a notice has been served under paragraph (1) of these By-Laws who fails to comply with any requirements of such notice shall be guilty of an offence and shall on conviction be liable to a fine not exceeding fifty shillings and to a further fine not exceeding ten shillings for every day during which such non-compliance continues after the date of the conviction.

Cost & Expenses of installation of a receptacle by Council. 4. If any occupier fails to provide a receptacle as required under By-Law 3 of these By-Laws, the Council may install such a receptacle and shall recover for cost and expenses incurred in that behalf together with departmental charges from the occupier and notwithstanding any action taken by the Council under By-Law 3 of these By-Laws.

Such a task involved a good deal of administration in the way of issuing notifications, follow up, importing proper metal dustbins with tight fitting lids,

stocking them in order to facilitate sale to members of the public who normally hasten to ask about the place where such containers are sold. This system of storage was simultaneously introduced along with the house-to-house refuse collection system.

Although the co-operation of all members of the public was not readily given, yet we were not as much enthusiastic in enforcing the law as we were to encourage and urge the public not to deposit their wastes indiscriminately or use the old communal dustbin sites, and that they should keep their refuse in a properly covered container until the municipal collecting vehicle called for collection. The problem was that the public were not accustomed to keep even their daily output of wastes within their premises; and it was (and still is in some places) a job to persuade them to keep their wastes until the vehicle called and the situation was worse on Fridays. We have found it very difficult to convince the public (particularly householders) to keep their refuse until Saturday morning; as we, fortunately/unfortunately, make six times collections in a week. After the demolition of the communal masonry dustbins, the streets looked tidier, assisting in street litter and fly control. It is only two years after the introduction of this system that we started enforcing the law for the provision of dustbins. We started with trade premises, shops and restaurants, thus giving more time allowance to householders. However, some form of storage facilities was made; some brought out their wastes in old three-gallon pails, some in open kerosene tins, some in small plastic dustbins and some deposited it on the street just after sunset when the street sweepers and cleansing supervisors are off work.

The question may be asked: what storage facilities were provided for street sweepings? Indeed, street sweepings do not consist only of empty cigarette packets, cigarette ends, light paper, etc., but of everything one can think of. Therefore almost all street sweepers have been provided with street orderly trucks which when full are either emptied into the refuse collecting vehicle on the route or into bulk containers, conveniently sited, properly fenced and watched by a labourer whose job is to tidy up the area, compress the refuse in the containers, prevent careless dumping by street sweepers, and not to allow the

storage was also used in places like hospitals, markets, slaughterhouses, cow stables and by other private concerns. They are galvanized cylindrical containers of 3/4 to 1 1/4 cu-yds. capacity, equipped with castors (rigid and swivel) to facilitate manoeuverability. They are lifted hydraulically by a bin lifter: Austin/Gibson vehicle specially designed for the purpose. After emptying, these containers are washed by pressurized hoses and spraved with disinfectant. This is a very economical, efficient and hygienic system of storage.

The storage of wastes is the most difficult one of the entire problem of solid wastes handling, mainly because its successful accomplishment depends, to a large extent, on the degree of co-operation given by the public and their awareness of its importance. The Department has unfortunately very little to contribute towards the successful achievement of this system except perhaps in the way of enforcing the storage by-laws for the provision of dustbins, but whether such dustbins are used or abused will again depend on the householder himself However, constant Health Education programmes are shown on the TV to assist in this regard.

COLLECTION

This service was adversely affected when the waste disposal area was moved to a very long distance, about 27 miles (round haul) from the farthest collection point. The Department's fleet consisted, then, of about 28 mechanical horses (scammel scarabs) and three dozen trailers of 12-14 cu.yds. capacity with no absolute form of mechanical compaction. Besides, the average density of Aden refuse is assessed to be 3 cwt/cu.yd. In other words the total weight of say one trailer full 12 cu.yds. is well below 2 tons. It takes four men about one hour to load one trailer of 12-14 cu.yds. and one hour and 45 minutes for the poor mechanical horse to travel to the disposal area and back, allowing for punctures, engine overheating and such other breakdowns which are inevitable considering the adverse climatic conditions and the real purpose for which such mechanical horses are designed (to be fair to the manufacturers). Such vehicles are designed to work within a mile radius. It is very expensive to transport refuse that distance in 12-14 cu.yds. capacity trailers. This brought about an enormous increase in the cost of refuse collection per ton.

The gravity of this problem was soon realized and further ordering for mechanical horses was stopped, and the Department put up to the Council proposals for "Vehicle Replacement Programme" staggered over a period of four years to suit the Municipal financial position. The new vehicles were recommended and eventually purchased, rear loading large capacity vehicles equipped with built-in compression mechanism. At first we purchased Gibson bodies mounted on Austin commercial chassis, capacity 20/30 cu.yds. i.e. 20 cu.yd. of air space and takes 30 cu.yds. of compressed refuse; that is to say such vehicles have a compression ratio of 1 1/2 : 1. They did help a great deal, as the labourers and the vehicle spend more time collecting refuse rather than wasting time on travel to and from the disposal area. Later on we purchased about five pakamatics made by Shelvoke & Drewry Engineers. These are considered the Rolls Royce of refuse collection vehicles. They are expensive initially and operationally; but they are very suitable for our existing conditions. They have the same capacity of cubic space i.e. 20 cu-yds. but have a greater compression of 2 1/2 : 1, (i.e. 20/50 cubic yards) and they take 50 cubic yards of refuse each load. Comparing such vehicles with those trailers of 12-14 cu.yds. used formerly, the difference is indeed obvious. More time is spent collecting refuse, a decent load is obtained each trip, more reliable and efficient service is rendered to maintain regularity, to secure public confidence and enjoy good public relations. This programme of vehicle replacement has not, with regret, been completed owing to the Municipal financial position which started deteriorating in 1965. Nevertheless, the service of refuse collection at all Municipal areas is regular and efficient. The house-to-house refuse collection system as already detailed in "Storage" is a privileged service i.e. emptying individual refuse bins at the door step. Considering the nature of refuse (particularly domestic refuse), the facilities of storage and the average size of dustbin, and the main problem of climate being very hot, thus causing rapid putrefaction of waste foods, etc. and the general attitude of the public being unwilling to keep even their daily output of waste, the Department finds it inconvenient but rather unavoidable to render six collections per week, and in markets, cow stables and hospitals twice daily including public holidays.

However, it should not be overlooked that the present service, though efficient, is not economical. The alternative which is, in my opinion, the right and only solution for this problem of far distant disposal area, is the installation of a simple transfer loading station sited at a reasonably central point, consisting of a large reception house with a few appertures through which refuse will be pushed by a tractor and bulldozer into bulk haulage vehicles down below. These vehicles will have capacities of 72 100 pounds or 120 cu.yds. and would be equipped with a built-in compression mechanism. They will conveniently travel to and from the disposal area, and a bigger fleet (in number) of smaller vehicles could be easily operated, thus achieving almost full time refuse collection, less traffic problems (as compared with the large capacity vehicles) to suit the back narrow streets of Aden with the parked cars becoming more of a problem these days. Such a fleet of small vehicles will cost much less to buy or replace and maintain than the large capacity rear/continuous loading compression vehicles.

It is true that the cost of installing the simple transfer station, including mechanical equipment will be within the region of £ 115 000, but in the long run it certainly pays. At any rate such schemes are never expected to have executive consideration as the financial situation has been worsened. The scheme was put up to the Council by me in 1965, following my study tour in the U.K.; it was approved in principle but kept in abevance, until a time when the Municipal financial position improves.

Collection of trade refuse is also being effected and legislation for recovery of charges is being sanctioned and enacted. These By-Laws are as follows:

Removal of Refuse By-Laws, 1965

In exercise of the powers vested to it by Section 97 of the Municipal Ordinance, the Municipal Council has made the following By-Laws:

Citation. 1. These By-Laws may be cited as the Removal of Refuse By-Laws, 1965.

Definition.

2. In these By-laws unless the context otherwise provides:
"Council" means the Council of the Aden Municipality.
"Cleansing Superintendent" means the Officer from time to time performing the duties of Cleansing Superintendent Aden Municipality or any officer authorized to act on his behalf.
"Refuse" means all kinds of refuse and includes domestic refuse, trade refuse and industrial wastes.
"Domestic refuse" means refuse produced at a house and arising from the necessities of life, i.e. eating, drinking, including such refuse produced in like manner but at premises other than dwelling houses.
"Trade refuse" means the refuse as a result of a trade or being the by-product of a trade, manufacture of business or of any building materials.
"Industrial waste" means the by-product or outcome of industrial processing or trade such as used oil from service garages, waste oil from soap factories and such other dangerous waste fluids that are not permitted to be drained along Municipal sewers.
"Standard size bin" means a bin having a volume of 2 1/2 cubic feet.

Removal of refuse.

3. (i) The Cleansing Superintendent or any other duly authorized officer acting on behalf of the Council may undertake the free removal of domestic refuse within the allowable amount, i.e. a standard size bin removed three times weekly.

(ii) Any refuse in excess of the allowable amount shall be chargeable at the rate of 125 fils per cu.yd. per collection.

(iii) Any person who requires the availability or regular or casual service of removal of refuse in excess of the allowable amount may on written application being made to the Cleansing Superintendent giving the latter adequate notice to arrange for the required service, enter into an agreement for the same.

(iv) Where the refuse from any premises consists of both trade and domestic refuse, the contents of one standard size bin, or its equivalent, from such premises, shall be regarded as being within the allowable amount of domestic refuse.

Recovery of charges under Section 62 of the Municipal Ordinance. (Cap.102)

4. If the applicant fails to pay for the service applied for when provided, the Council shall recover the cost and expenses incurred in that behalf together with departmental charges from the applicant in the same manner as provided in Section 62 of the Municipal Ordinance (Cap.102).

DISPOSAL

This is the only service that the Department is still studying to improve. Priority in order of importance as far as the local conditions are concerned was given to collection.

The system is crude on-site incineration. Vehicles tip their refuse near the round end of a round-about of about 70 yards radius, formerly dozing of refuse off the ridge was manual and the number of labourers was forty. Two Massey Fergusson tractors were purchased and the service was mechanized thus reducing 36 men out of 40. Tyre punctures were minimized by covering the tyres with armoured "Rud" chains made in Germany. However, the system remains the same; after the refuse is dozed (now mechanically) around the sides of the round-about, labourers, before going home, set fire to it and it keeps burning over night. The main advantage of this system, next to its being cheap, is the fact that it constitutes no potential public health nuisance. The tip is constantly hot with a temperature of bevond 200° Fahrenheit. Lack of rain tends to help to keep the temperature constant. However, the disadvantages are innumerable:

a) During the monsoon winds, it sometimes becomes impossible for the tractor driver and his assistant to work, for the heavy smoke blows right into their eyes.

b) When the tractor breaks down for more than a week, the system fails. The round-about becomes full, messy, most untidy, thousands of flies, smell and real eye-sore. Vehicles coming to tip their refuse find no space and tend to pass on sharp pieces of glass and other refuse causing excessive punctures.

c) The smoke increases at night time and tends to blow towards a neighbouring village and the Federation Headquarters. Complaints have, in fact, been received in this respect. However, the disposal area was sited

long before surveying the Federation Headquarters on the present spot.

Investigations were made early last year to seek a suitable system for the disposal of part or all the refuse.

After a detailed study based on the following:

a) The overall financial situation of Aden State which is apparently not promising and as such may not permit such schemes to be piloted on smaller scales.

b) The availability of the raw material. The material required to suit the proposed system is available and constitutes say 60% of the total output of refuse - this is indeed an encouraging percentage.

c) The degree of utilization of the end product. The product is expected to be extensively used, however it is envisaged that revenue to cover even part of the total cost cannot be expected, and

d) Suitability of other systems than the one proposed, as far as the local conditions are concerned. As a matter of fact there is one method which could be classified as suitable and also cheaper, however the end product may not be as useful as that of the proposed system.

In considering the above facts, it was found that the proposed system is composting. Taking (b) above, 60% of the total output of refuse may well be classified as compostible. The object of the preliminary investigation of the original material is to ascertain whether it guarantees a final product containing sufficient humus forming substances. We must, however, make a distinction between two different possibilities.

- Composting with the sole purpose of converting refuse into a harmless product - humus - which can be dumped even on areas covering ground water.
- Composting with a view to turn out a saleable product which can be used for soil improvement.

In the first case it will be sufficient to examine whether the refuse is compostible, whether it can be converted into an inodourous and perfectly hygienic compost by means of an aerobic process and with a phase of increased temperature.

The following three groups of refuse are in principle compostible:

(a) domestic refuse, including bulky refuse and garden and market waste,
(b) sewage sludge,
(c) industrial refuse of organic nature.

No great difficulty is encountered when examining refuse belonging to groups (a) and (b) with regard to its fitness for composting during the process of putrefaction, however, owing to its chemical and physical composition, industrial waste can complicate the analysis and the composting process. Various factors, such as a one-sided chemical composition, an unfavourable physical structure or toxic contents, may hinder putrefaction. Therefore in many cases, certain industrial residues must first undergo a grinding process and then be mixed with domestic refuse and sewage sludge or even receive an admixture of nutrients in the form of mineral fertilizers.

The valuation of refuse is more complicated when the intention is to convert it into a very saleable product fit for general use, because a high standard of chemical and physical quality must be set for this product.

The chemical quality (contents in organic matter, nutrients, trace elements, etc.) depends only from the composition of the original material and not from the composting process. Compost, as an organic product for soil improvement, must increase the humus content of an impoverished soil and maintain it in a good soil. Compost must therefore have the highest possible contents in humus forming substances.

Going back to the basic points on which the study was conducted and in particular (a) - the overall financial position of Aden State, we have a given statistical data that the present unit cost of refuse disposal per ton by the conventional method - crude on-site incineration - is only three shillings. Therefore if the proposed method is composting and assuming that say only 100 tons are to be handled daily and assuming a rough estimate of cost - 23 shillings per ton by composting - then there will apparently be a difference of at least one sterling pound per ton per day i.e. one hundred pounds daily or £ 3 000 per month or £ 36 000 per year. This is only the anticipated operational cost

let alone the initial installation cost - so the answer to this proposed scheme, at this stage, is a big NO.

Considering the other alternative, which is relatively cheaper than composting i.e. controlled tipping.

I do not dispute that fact that controlled tipping can offer an entirely satisfactory method of refuse disposal when carried out in accordance with the standard requirements. This method has the advantage that it is the cheapest available method, requiring little in the way of capital equipment. One might, therefore, be permitted to pose the question why give consideration to an alternative and more costly method of disposal? A considerable number of authorities which have long practised controlled tipping are now experiencing problems for one or more of the following reasons:

(1) The decreasing availability of suitable sites within reasonable proximity to our towns and cities, due to the rapid expansion and urbanization of the areas immediately surrounding them.

(2) The gradual change in the aesthetic standards of the general public, and a greater sense of hygiene, both brought about by continued legislation on the part of the health authorities, which have resulted in controlled tipping as a method of disposal being less acceptable to the public, particularly when it occurs in the vicinity of their own homes. Even in some rural areas, difficulty is nowadays experienced in obtaining planning permission for controlled tipping sites and it is more frequently a condition that such permission be granted on the understanding that the Ministry of Health precautions are rigidly enforced.

(3) The pronounced changes which have occurred in the components of refuse during recent years, the continued trend towards lighter densities and increased bulk has resulted in a reduction in the life expectancy of existing sites, with marked rise in the cost of refuse transportation. A conservative figure for the land requirements for controlled tipping may be taken to be 7 acre/feet per 10 000 population per year. I consider that these changes in the composition of refuse have made it an increasingly difficult material

to handle on tipping sites from the aspect of wind blown paper, fire hazards, and its increasingly high factor of consolidation.

(4) The lack of a suitable and adequate material for covering purposes, which has resulted in widespread discontinuation of the use of intermediate cover until the final application of top soil. I do not subscribe to the view that cover is unnecessary after "back blading" the tip surface with an angle-dozer. Although this procedure may go part way to solving the problem of covering the surface as operations proceed, suitable cover material is essential to the satisfactory operation of any controlled tipping scheme. Tipping at a depth of 6 ft., the cover requirement is likely to be in the region of 1/8 the total volume of refuse, depending on site conditions, etc.

I am aware that many excellent land reclamation schemes have been carried out by various local authorities, but I would hasten to add that I am also fully aware of the many appalling examples of uncontrolled dumping which frequently are described as controlled tipping schemes, and which give ample support to the statement that this method of disposal is the most widely applied, the least understood and the most frequently abused. I personally feel that there has been a general decline in the standard of controlled tipping operations, resulting in this method being the subject of considerable criticism. The tendency in recent years has been for refuse disposal to be governed by consideration of cost, with insufficient attention paid to the standard of efficiency, and this necessary but unglamorous aspect of municipal activity cannot be operated without incurring considerable expenditure.

Even in the event of assuming to consider this system - **controlled tipping** - to replace the conventional method, I still doubt very much if the proposition will find consideration or even appreciation, because there is some capital expenditure required for the mechanical aids and at least a difference of three shillings in the operational cost of disposal per ton. For example, if 200 tons are to be handled daily, then difference x output per day x 30 x 12 = total difference per day.

$$3 \times 200 \times 30 \times 12 = £\ 10\ 800$$

I am not going to touch on mechanical incineration because of its unsuitability from the point of view of: a) cost and b) the useless end product - clinker - so far as Aden conditions are concerned. As there is no absolute scope for salvage, separation of refuse becomes an unnecessary expensive process.

Pulverisation is also not a practical proposition considering a) the nature of Aden refuse, b) the cost being higher than controlled tipping and slightly lower than composting and c) the end product is not as good as the compost.

I hope that this quick and general review of Aden conditions in regard to solid wastes disposal will meet with your request.