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Solid waste management in Addis Ababa

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THE POPULATION OF Addis Ababa was estimated at 2.63 M in 1993 and growing at a rate of 6 per cent per annum (BCEOM/GKW 1993). Most of the houses in the city are unplanned and very densely sited with average residential densities up to 326 people/ha. These areas have narrow and unmaintained access roads which greatly limits the population that can be served by refuse collection vehicles or who are within reasonable distance of a communal storage facility.

The last major study on solid waste management for the city of Addis Ababa was carried out in 1982 (Norconsult A.S 1982). Updating the population figures in this study provides an estimate of the solid waste production of the city as given in Table 1. From the records kept by the Municipality at the landfill site in 1991 and 1992 the percentage of solid waste collected is between 35 per cent and 40 per cent of that generated. The industrial waste is mostly generated from beverage, food, shoe, textile factories and tanneries.

In 1993 the Addis Ababa Municipality was reformed into Province 14 Administrative Region and the responsibility for solid waste management (SWM) passed to the Health Bureau. This bureau has inherited an ageing fleet of 26 'roll-top' trucks, 4 compactor vehicles and 11 container-hoist vehicles. From discussions with the responsible personnel at the Health Bureau, approximately 25 per cent of these vehicles are nonoperational at any one time. The development and expansion of the SWM system is at present still in the planning stage. However, the arrival in 1994 of 28 new container-hoist vehicles, financed by the World Bank, is expected to improve the collection system.

Collection systems

There are currently four types of collection system: a communal system which requires the delivery of wastes by the householder to a storage confiner; a block collection system where the householder delivers the wastes to the vehicle at the time of collection; a company/institutional system whereby a 4 or 6m³ capacity container is placed in the organisation's compound and emptied for a fee of 11 Ethiopian Birr (EB) (£1.4 1993)/m³. Street cleaning carried out manually using a handcart which is periodically emptied into the nearest communal storage confiner. With the exception of the company/institutional system all other collections are carried out free of charge.

There are 174 containers or skips of 8m³ capacity distributed throughout the city for communal storage. This system is used for low and medium income (<1000 EB/

household/month (£133, 1993)) areas and suffers from the problem of too infrequent emptying with the spillage of waste on the ground creating a health hazard. The block collection system, is operated by the 'roll-top' trucks and compaction vehicles. This collection system is used mainly for high income (>1000 EB/household/mth) areas which have good access roads, as well as for market areas with a high waste generation rate.

Disposal site

There is only one disposal site for the entire city of Addis Ababa. This is sited at Repi, 12km south west of the city centre. This open dumping site is very poorly equipped, with only two ageing bulldozers and one roller compactor. The road to the site is in a very poor condition and becomes virtually unusable during the heavy rains. Hence there are often days when no waste can be collected from the city. Rapid urbanization around the site and the lack of any segregation of different types of waste results in over 100 people, including children, scavenging through the refuse with all the associated health risks. With no engineering control measures contamination of ground water through leaching and surface water through runoff is highly likely, especially during the heavy rainy season in July and August.

To reduce transportation costs at least three new disposal sites are required to serve the expanding city. These should be sanitary landfill sites, designed to minimise any detriment to the environment.

Pilot study

A pilot study was carried out in a residential area, Kebele 29, close to the large commercial market of Merkato. The community of 955 households were participants in an integrated urban development programme by OXFAM (UK) started in 1987. Resource constraints limited the pilot study to 200 households which were, however, representative of the main socio-economic groups within the kebele as described in Table II. In a World Bank report (1990) the subsistence level for the city was assessed to be an income of 236 EB/household/month (£63 1990). In Kebele 29, 87 per cent of the households have an income of less than 200 EB (£53 1990) and therefore represent the most disadvantaged socioeconomic group.

Each householder was interviewed, to seek their participation in the survey and to obtain some information about the household and their existing practises in SWM. The community is served by one 8m³ skip sited at one

corner of the Kebele, too far away from the majority of the population and therefore discouraging community participation. Hence only 28 per cent of the population use this facility. The block collection system is only occasionally used in Kebele 29, serving 12 per cent of the population. The majority of the population (60 per cent) use the river as a dumping place, since its course forms a boundary to the kebele. This practice, however, has a serious detriment to the water quality of the river, which has effectively become an open sewer.

Earlier in their six year development programme, OXFAM had tried to improve the SWM system in the community. They issued each household with a 100 litre container made from an old oil drum. These containers were painted and marked with the household number. The idea was that by providing these large primary storage containers households would be encouraged to dispose of their solid waste within their compound before carrying to the communal container. However, within a week of issuing these containers it became obvious that the residents considered these clean watertight containers to be far too valuable for the collection of rubbish. Instead the containers are used for washing clothes and fermenting barley.

Sampling procedure

Black plastic bags, 0.5m square, were supplied to each household for collecting their solid waste. The sampling programme took place over seven consecutive days commencing 29th July 1993. The sampling procedure generally followed recognised practice (Flintoff 1984). The weighing device readily available was a spring balance type with a capacity of up to 50kg. This relatively small capacity, together with an absence of any lightweight wood made the recommended 500 litre box too heavy to weigh. Instead 64 litre boxes were used. These proved to be a more appropriate size in view of the relatively small sample size and the very low level of waste generation.

It was not possible to collect samples from about 25 per cent of the households. This was due to the householder not being at home or the household waste not having been put in the collection bag provided.

Results of sampling

A summary of the results of the sampling work is shown in Tables III and IV.

A comparison of the average generation rates measured in the pilot study with other studies on SWM in Addis Ababa is shown in Table V. The reason why the pilot study results are at the lower end of the range of rates may be due to the extreme poverty of the study area, and a reluctance of the people to send all their waste to be analysed.

The reason for the high percentage of grasses and food wastes in the study area is the cultural practice of using grasses to cover the mud floors of the houses in general and also during the daily coffee ceremony. Such type of

wastes are very suitable for either composting or the manufacture of briquettes for fuel, both of which need only require low cost technology. The composting option is unlikely to be sustainable at a community level in me capital city, where the transportation costs to agricultural land will be high. The composting would need to be undertaken by the formal sector at processing sites on the outskirts of the city adjacent to agricultural land. The manufacture of briquettes for fuel is more promising for community participation, as there is a large market within the city. Their use as an alternative to firewood is especially important in view of the severe deforestation in the region. Further research is required to assess the sustainability of these two options. The extremely low amounts of salvageable constituents reflect the small amount of goods passing through each household and the minimal amount of packaging materials used for these goods.

The average density of the solid waste collected in the study area was 230 kg/m³ from a range of 180 - 380 kg/m³ and is considerably lower than the value of 500 kg/m³ given by Norconsult. The densities from the pilot study were measured prior to the disposal of the wastes into the communal storage containers. Hence the increase in density reflects the consolidation that takes place in the containers during storage and transportation. These densities compare to values of 570 kg/m³ for an Indian city and 277 kg/m³ for Ibadan, Nigeria. (Holmes 1984).

It is very interesting to note that in a socioeconomic survey of the city carried out by the Addis Ababa Water Supply and Sewerage Authority in 1990, 52.3 per cent of households have an income of less than 200 EB (£53 1990)/month. Hence the solid waste from the study area is representative of the type of waste generated by about half of the households in the city.

Conclusions

The study highlighted the inadequacies of Addis Ababa's existing solid waste collection system, which collects less than 40 per cent of the waste generated. This lack of coverage is due to the rapid unplanned growth of the city and severe resource limitations. The existing disposal site is an environmental hazard and should be replaced by three new sanitary landfill sites.

The high proportion of grasses and food wastes (70 per cent), suggests that much of the waste from Addis Ababa could either be composted and used as a fertilizer or manufactured into briquettes for fuel as an alternative to firewood for cooking. Further study is needed to explore the sustainability of these two options.

Improvements in the collection and treatment of solid waste could be initiated by a community based, low technology approach. The sale of briquettes to a large readily available market would provide the financial incentive for the sustainability of this approach.

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Table I. Estimated solid waste production of Addis Ababa 1993

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Table II. Division of population of Kebele 29 into socio-economic group by income levels

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Table III. Generation rates by socio-economic group in Kebele 29

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Table IV. Constituents of wastes by socio-economic group in Kebele 29

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Table V. Comparison of generation rate in Kebele 29 with previous studies

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