

Solid Waste Management Case Study

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Project

Solid Waste Collection, El-Kawther Industrial Zone, Governorate of Sohag

Introduction

The El-Kawther District Council is responsible for waste collection in the recently established El-Kawther Urban and Industrial Development Zone. Waste generation for the District was estimated in 1997 to be 18.5m³ per day and is forecasted to increase to around 103m³ per day given the expected rapid development over the next 5 years.

Most wastes, except high density rejects from the tile and marble factories, had been collected by the District using a 3 ton truck. Collection methods were inefficient and unhygienic, in part due to the high loading height of 1.9m. A total crew of 6 loaders, one driver and one supervisor collect around 16 m³ or roughly 4.5 tons of waste per day, an average labour productivity of only 750 kg/man/day. This compares with a typical European rate, hand loading from bins, of 3,000 kg/man/day. In addition the one truck would not cope with the projected expansion of the area.

After consultation with the factories, the SEAM Project together with the El-Kawther District Council developed a waste collection system, using a combination of vehicles and different size storage bins. Although the initial focus had been on the Industrial Zone there was sufficient capacity to cater for the rest of the District, as well as allowing for the projected increase in waste generation forecasted over the next few years. Segregation of waste at the factory, recovery and recycling of paper and plastics, and awareness raising had been integral parts of the projects implementation



Tractor-Trailer-Container System Used to Collect Waste from Factories

Capital expended by SEAM on equipment was LE245,465. Operating costs are born by the El-Kawther District who also levy an annual waste management fee of 0.014% of the capital costs of the infrastructure and buildings for each factory.

El-Kawther Urban and Industrial Development Zone

The El-Kawther Urban and Industrial Development Zone was established in 1993 to help diversify the economic base of Sohag Governorate. It covers 3,000 feddans including 600 feddans for an Industrial Zone. The remaining 2,400 feddans are in the process of being developed for educational and training institutes, retail and commercial businesses, agricultural research, recreational and residential areas.

The Industrial Zone is being developed in three phases as indicated below. Phase I is largely complete with most infrastructure in place. Infrastructure and buildings are under development for Phase 2 and Phase 3 is about to start.

Phases of Development of the El-Kawther Industrial Zone

	Phase 1	Phase 2	Phase 3
Area (feddans)	75	130	395
No. of Factories Approved	63	66	In planning
% Operational (March 99)	68	25	
Industrial Sectors	Textiles, chemicals, metals, engineering, timber, building materials, food processing and animal feed		

The El Kawther District Council is responsible for solid waste collection throughout the Urban and Industrial Development Zone and had been using the same truck to service all areas.

How Much and What Types of Wastes are Generated?

A survey of 38 factories undertaken in November 1997 indicated that:

- ❖ 71% (27 factories) produced negligible solid waste.
- ❖ 16% (6 factories) produced less than 1m³ solid waste per week.
- ❖ 13% (5 factories) produced between 1-10m³ solid waste per week.

The number of employees in the factories surveyed ranged from 5 to 40 and averaged 16.

Based on this survey and on discussions with the El-Kawther District Council, total waste generation was estimated to be 18.5m³ per day as indicated below.

El-Kawther - Volume of Waste Generated Daily (November 1997)

Sources	Main Waste Type	Estimate Daily Volume (m ³)
Industrial Zone		
Small waste producers	Paper, food wastes, cans, bottles, some steel shaving	4.0
Larger waste producers		
Tomato paste	Organic tomato residues	2.0
Footwear	Rubber offcuts	2.0
Tile and marble factories	High density rejects and offcuts	2.5
Residential and commercial	Food waste and paper	8.0
TOTAL		18.5

With the forecasted expansion of the Urban and Industrial Development Zone, waste generation is expected to increase over the next five years by 6 times for industrial waste and 5 times for non-industrial waste. On this basis, typical daily waste collection by the year 2002 is expected to be:

- ❖ 68m³ of mixed waste for hauling to the dumpsite.
- ❖ 20m³ of waste paper and plastics baled down to around 2 m³ for resale.
- ❖ 15m³ of high density for hauling to the dumpsite.

Designing the Waste Collection System

Based on consultations with the factories and the El-Kawther District Council the new waste management service was designed to:

- ❖ Establish a cost-effective system for the collection of all wastes presently generated.
- ❖ Provide sufficient capacity to allow for an increase in the waste to be collected from 18.5m³ to 103m³ per day, as the El Kawther District expands rapidly.

- ❖ Segregate waste at source in the factories.
- ❖ Recover and recycle paper and plastics.
- ❖ Improve working conditions for waste collectors.

In designing a reliable waste collection system it was recognised that:

- ❖ The system should not be dependent on a single collection vehicle, as downtime of 20% should be allowed for servicing and breakdowns. Downtime will be small in the first year but will escalate as equipment ages.
- ❖ The existing 3 ton truck will eventually be phased out because of efficiency and hygiene problems but could be used as a back up.
- ❖ A tractor-trailer-container system could be readily maintained and could be further supported by the spare capacity within the Districts existing three 65hp tractors.



100L and 170L Bins, Manufactured in Akhmim Workshop, and Provided to the Factories for Waste Segregation

What Equipment is Required?

Equipment was provided for the storage, segregation, collection, and transfer of waste and for the recovery and recycling of paper and plastics. A combination of truck, tractor, trailer and container system was developed as indicated below.

Storage of Waste

- ❖ 100L bins for putrescibles and 170L bins for paper and plastics were manufactured locally in the Akhmim workshop and provided to each factory for waste segregation. Maximum bin weight when full is 40kg, which is within the capacity of 2 men to lift. Putrescibles are collected daily and paper bins are collected when full. The collection frequency has been adjusted for each factory to suit the amount of waste generated.
- ❖ 6m³ containers are provided to factories and institutions that produce larger quantities of medium density waste.
- ❖ 3m³ containers are provided to the producers of high density waste (e.g. tile and marble factories).

Collection and Transfer of Waste

- ❖ An 8 ton Isuzu waste collection truck with a capacity of 7m³ was provided for use in the industrial, commercial and residential areas. Refuse is hand loaded at the front and pushed back with a hydraulic press plate.
- ❖ A 65 hp tractor and trailer is used to collect and transfer the 3m³ and 6m³ containers. Tractors are cost effective for short haul distances, the dumpsite being only 3km away.
- ❖ A low loading trailer with a capacity of 4.5m³ and a low loading height and pulled by a tractor can be used in conjunction with the Isuzu truck for hand loaded collection.



8 ton Isuzu Truck Used to Collect Waste from Industrial, Residential and Commercial Areas

Recycling of Paper and Plastic

- ❖ A waste paper trailer, with fully enclosed mesh sides, is used to collect and transfer paper and plastics.
- ❖ A paper press was provided with 15 ton press power that produces compacted bales of 50x70x80cm. An area in the District workshop has been prepared for paper baling operations.



Waste Paper Trailer Used to Collect Paper and Plastics for Recycling

In addition a Jawa motorcycle has been provided to facilitate supervision of the waste collection.

How Will the System Operate?

Wastes are segregated by the factories in the two bins provided. Paper and plastics are collected when the bins are full and transferred to the paper press for baling. Putrescibles are collected daily. For the larger producers of medium density waste 6m³ containers are provided and collected when

full. For the high density waste producers, 3m³ containers are provided and collected every 1-3 days. Waste is collected daily from the rest of the El-Kawther District.

The District collects waste in one shift, employing 6-8 people. All wastes are dumped at a site in the desert, approximately 3km away.

At present there is surplus equipment capacity. However, rapid future development is likely to result in more than a 5-fold increase in the volume of waste by the year 2002. Planning for this increase will result in the following collection system.

Collection of the Expected 68m³ per day of Mixed Waste

Of the 68m³ it is expected that 40m³ will be collected by hand loading and the remaining 28m³ will be collected in large containers using the container pick up system. The Isuzu truck should be capable of collecting the 40m³ in 6 loads with one shift of 3-4 employees. If necessary, the low loading trailer will provide back up.

The tractor-trailer-container system requires 2-4 workers and would be capable of moving the 28 m³ of container waste in around 6 loads. This should be managed in one shift.

Overall, it is estimated that the Isuzu truck and the tractor with a low loading trailer will together have a single shift daily capacity of around 60-70m³ of wastes, or up to 130m³ of waste on a double shift.

Collection of the Expected 15m³ of High Density Wastes

High density waste will be stored in 3m³ containers and collected using the tractor-trailer system. Approximately 5 loads per day will be transferred and ultimately a second shift will be required to handle these wastes.



3m³ Container Placed Outside the Tile Factory for Storage of High Density Waste

Collection of the Expected 20m³ of Paper and Plastics

It is estimated that by the year 2002 there will be the potential to recycle 20 m³ or 2 tons of paper, cardboard and plastic materials per day. There is also likely to be further potential to recycle steel cans and other lightweight steel scrap. Paper wastes are presently collected and transported to the District workshop where a paper press has been installed. Paper is then baled and sold for recycling.

How were the Factories Involved?

Prior to implementation, visits were made to most factories that were in operation at the time. Their views were incorporated into the design of the system and their cooperation was sought in the segregation of waste.

Information leaflets were prepared and disseminated. An awareness workshop was also held for all main stakeholders in the El-Kawther District to discuss the new system and their respective roles.

What was the Capital Cost?

The capital cost of the equipment was funded by SEAM and cost LE245,465. A breakdown of costs is given below.

Capital Costs for Waste Collection and Transfer Equipment

Item	Number	Unit Price (LE)	Total Cost (LE)
100L steel bins	50	120	6000
170L steel bins	44	146.5	6446
6m ³ containers - uncovered	4	3,400	13,600
6m ³ containers covered	2	4,000	8,000
3m ³ containers	3	2,500	7,500
8 ton Isuzu waste collection truck	1	110,000	110,000
65hp tractor	1	45,000	45,000
Low loading trailer	1	14,750	14,750
Container haulage trailer	1	9,000	9,000
Waste paper trailer	1	3,000	3,000
Paper press	1	17,750	17,750
Jawa motorcycle	1	4,419	4,419
TOTAL			245,465

Additional costs were also incurred for preparation of the baling area, uniforms and community awareness campaign.

All labour, fuel, maintenance and other operating costs were born by the El-Kawther District Council. The Council also raises an annual waste management fee equivalent to 0.014% of the capital costs of the infrastructure and buildings for each factory. Charges are in the range LE200-400 per year per factory.

CONTACTS

More information on this project and the SEAM Project, are available from:

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The SEAM Project

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Solid Waste Management

Improving solid waste management had been identified as a high priority in the Governorates of Dakahleya and Sohag. The SEAM project developed a strategic approach to tackle the problem and funded projects that showed tangible benefits of improved waste practices.

Solid Waste Strategies

To address the issue of solid waste management, an assessment of the current waste practices has been undertaken in the Governorates of Dakahleya and Sohag. Information was collected on the type and quantity of waste generated, the present collection, separation, treatment and disposal practices as well as the institutional and social dynamics.

A strategic approach to deal with the solid waste problems was developed and priority issues identified.

Solid Waste Demonstration Projects

Solid waste demonstration projects were undertaken in both Governorates to address priority issues that had been identified in the waste strategies. Four demonstration projects were implemented covering areas of waste collection, transfer and disposal, maintenance, dumpsite remediation, recycling and composting. In all cases solutions were sought that:

- Are practical and affordable.
- Improved the efficiency of previous practices.
- Adapted the most cost effective technology to suit the purpose.
- Strengthened local capacity.
- Developed local manufacturing capability.
- Addressed sustainability issues.
- Involved the community.

As a result of the demonstration projects:

- 23,000 tons of municipal waste are collected each year.
- 45,000 tons of waste each year are recycled and converted to compost rather than being disposed to dumpsites.
- 115,000 people living in four low income urban and rural communities in Sohag and Dakahleya Governorate now benefit from improved waste collection and disposal services.
- Fires extinguished, odour and litter minimised at 2 municipal solid waste dumpsites.