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# Country report on the Solid Waste Management in **YEMEN**

April 2014



COUNTRY REPORT ON  
THE SOLID WASTE MANAGEMENT IN

# YEMEN



Published in  
April 2014



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Developed with the support of **Eng. Abdusalam Al-Mahdi** and in close cooperation  
with the SWEEP-Net national coordinator **Mr. Mummer Al-Eryani**

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## LIST OF ABBREVIATIONS

<b>CCIF</b>	City Cleaning and Improvement Fund
<b>COCA</b>	Central Organisation for Control and Auditing
<b>CWD</b>	Construction Waste Department
<b>EPA</b>	Environmental Protection Agency, within the Ministry of Water and Environment
<b>GTZ</b>	German Technical Corporation
<b>LAs</b>	Local Authorities
<b>MOLA</b>	Ministry of Local Administration
<b>MPWH</b>	Ministry of Public Works and Highways
<b>MSWM</b>	Municipal solid waste management
<b>NGO</b>	Non-governmental Organisation
<b>SDF</b>	Social Development Fund
<b>SWM</b>	Solid Waste Management
<b>WB</b>	World Bank
<b>YR</b>	Yemeni Riyal



# COUNTRY PROFILE on the solid waste management situation in **YEMEN**

April 2014

## BACKGROUND INFORMATION

Population:	24,5 million (2012)
Municipal Solid Waste (MSW) Generation:	3,8 million tons (2012)
Per Capita MSW Generation:	
- Urban areas	0.6 kg/day
- Rural areas	0.35 kg/day
MSW Generation Growth:	3%
Medical waste generation:	3,916 tons/year (2010)
Industrial waste:	No available data
Hazardous waste:	20,917 tons/ year (2010)
Agricultural waste:	No available data
C&D Waste:	No available data
Waste Tyres:	No available data
e-Waste:	No available data
Packaging Waste:	No available data

## TECHNICAL PERFORMANCE

### Municipal Waste

MSW Collection Coverage:	
- Rural areas	5%
- Urban areas	65%
MSW Final Destination:	
- Composted	0%
- Recycled	6.7 %
- Landfilled	26 %
- Openly dumped	68 %
Number of Dumpsites:	21
Number of Controlled Landfills:	6
Number of Sanitary Landfills:	
- Planned	0
- Under construction	0
- Constructed	0
- Operational	0

### Hazardous and industrial waste

Number of hazardous landfills or plants (Chemical and physical treatment):	None
- Planned	None
- Under construction	None
- Constructed	None
- Operational	None
Types of disposal and treatments for medical waste:	None

## Policy and planning environment

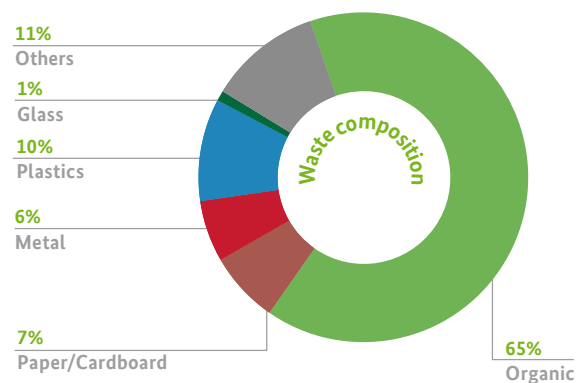
Authorities have agreed on general solid waste principals and policies for Yemen and test them in the field through one or several pilot projects. These policies were further developed into the "National Strategy for Solid Waste Management" for the Republic of Yemen.

## Legal framework

Strategic action number 1 and 2 were concentrated on amendment of the public cleaning law and cleaning funds law in order to be concert with the new improvements and technical requirements in the SWM sector like transferring of tasks and responsibilities to local councils on district level. In view of this, SWMP/ GIZ had studied the amendments of the public cleaning law and cleaning funds law and by-laws in cooperation with the Ministry of Local Administration and committees specialized in cleaning and local authority as well as legislation in order to present these two laws and by-laws to the cabinet for approval.

Currently, the Public Cleaning Law and Cleaning Funds Law are adopted by the Cabinet and passed to Parliament but not yet get approved by Parliament.

The legal requirements for the disposal of waste in landfills are defined in "Law No. 39/1999 on regard of the public cleaning". A by-law for Law No. 39 that further specifies the legal requirements for solid waste disposal has been elaborated as a draft version but has not yet been finally approved.





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## Institutional framework

### Policy and Planning

- Ministry of Local Administration ;
- General Directorate for Solid Waste Management ;
- Environmental Protection Authority.

### Implementation and Operation

- Local Councils (Cleaning Fund).

## Financial & cost recovery arrangements

A decentralized financing mechanism is required to provide funds to the local authorities. SWM services needs decentralized financing system and NOT central financing, even though central financing is still required to finance some major investment in SWM. The result was the Cleaning Fund Law 20/1999 with its amendments.

The aim of this law is to create decentralized financing for the local authorities away from the central government budgeting system.

## Private sector involvement

At present all waste collection, transport and disposal are provided by the Local Authorities. Introducing private sector involvement in solid waste management can potentially improve the waste management services without increasing costs. A key consideration is that there must be sufficient competition, transparency and accountability, as private-sector participation does not, in itself, guarantee effectiveness and low costs.

## Options for improvement

Draft the necessary laws and legislations for public cleaning to identify the SWM work for Yemen and to identify the roles and responsibilities of the different authorities. Aim of this law is to clarify the framework required in providing SWM services and define responsibilities.

Public cleaning and cleaning fund Laws should be approved and proceed with their implementation.

## Role and competence of local authorities

The Local Authorities (LAs) have the responsibility for providing SWM services.

Training for the municipalities and an awareness program should be implemented in the near future, in order to improve local authorities' competence.

Training workshops for trainers as well as national municipality staff should be considered, depending on best practices and guidebooks that have been prepared on SWM.

Establish pilot projects for LAs to create practical examples in order to build know how.

## Climate adaptation and mitigation strategies

Nothing has been done to date.

## EXECUTIVE SUMMARY

This country report updating is drafted in accordance with the structure provided by SWEEP-Net. In addition, it should be noted that the preparation of the contents of this report adopts primarily all the important references related to SWM in Yemen.

This report is focusing on clarifying the current situation and the current progress of implementation by reference to what has been done and what still needs to be implemented in order to identify the scope of intervention, which can be performed by the regional network.

Yemen's population in 2012 is approximately 24.527 million, 28.85% of them live in urban areas compared to 71.15% in rural areas. The MSW generation was about 3.8 million tons in the year 2012. Only 35% of generated waste is officially collected and only about 20% of the collected wastes are landfill disposed of in 21 controlled or semi-controlled sites. For many years, millions of tons have been remaining uncollected within neighbourhoods or around the villages. This waste requires removal to landfill sites. In areas serviced, the coverage of SWM services varies from over 65% in the two main cities, to less than 20% in many governorates.

There is no composting activity. Hazardous and special wastes are collected and disposed non-hazardous municipal wastes.

The recycling industry is new to Yemen and began with recycling plastic, metals and glass. There are recycling plants scattered around the country in major cities like Sana'a, Taiz, Aden and Hodeidah.

The process begins with the street cleaners and trash collectors who gather plastic, metal and other waste from streets, homes and other places and then sell them to waste yard owners. These junkyard owners then sell the recyclable materials to larger merchants, who sell them to factories for recycling.

# 1 .INTRODUCTION

## 1.1. SOCIO-ECONOMIC AND POLITICAL SITUATION

For some time Yemen has been contending with political, social, security, and economic crises in an uncertain regional environment, leading to destabilization, and extreme hardship and displacement for many of its citizens. As at 2011, Yemen was the poorest country in MENA with 42% of its population living in poverty, mostly in rural areas.

Facing a massive youth revolution wave with limited access to domestic or regional labour and product markets over the past year Yemen has endured multiple escalating political crises and violence culminating recently with challenges to the overall structure and governance of the state.

Continuing unrest reflects long standing fragility fuelled by tribal and regional divisions exacerbated over the past few decades by declining petroleum and water resources, poor governance, and the impact of the global food crisis<sup>2</sup>.

## 1.2. SOLID WASTE FACTS AND FIGURES

At present, a few large Yemeni cities have planned landfills, but otherwise open dumping is the common form of waste disposal in the cases where the waste is collected. The drawbacks to the majority of dumpsites throughout Yemen include the following problems:

- The dumpsite location was selected without consideration of the hydrogeological or topographical suitability of the site ;
- No preparatory works or site engineering has been done on the dumpsites ;
- There is no access control, no permanent staff for site management and no landfill machinery assigned to the site ;
- Soil or sand cover is not used and the placement of the waste in the landfill is not planned and not methodical ;
- There is often air pollution from fires on the dumpsites ;
- There is a very limited budget (if any) for the operation of the controlled landfills.

### Facts on SWM in Yemen

- Most of the people in Yemen don't know what happens to their garbage after it is collected ;
- Lack of seriousness in the performance of SWM works ;

<sup>2</sup>- Joint Socio Economic Impact Assessment in Yemen (landell-mills).

- Appointed persons do not have any scientific qualifications in leadership positions in SWM, decision makers set their relatives in sensitive positions, which reflects negatively on the level of progress and development ;
- Lack of commitment to the implementation of policies, plans and guidelines has led to the deterioration of the situation significantly ;
- Run of the very young or the elderly in cleaning activities ;
- Low efficiency of SWM operations ;
- No or only limited waste collection in many towns/cities; no waste collection services in rural areas ;
- Lack of demand for labour in the field of hygiene and limiting it to a certain segment and limited areas ;
- Lack of attention to appearance, and using the business suit for the purpose of begging ;
- Instability for cleaning workers in spite of installing a large number of them mostly in governorates of Yemen, as a result of the political crisis ;
- Installing workers has resulted in deterioration of the provision of services in the most main cities ;
- Delayed repair of equipment in the central workshops ;
- The large number of accidents as a result of stress and excess speed and neglecting putting warning signs ;
- Speed depreciation and rising costs for maintenance ;
- The great diversity of equipment, parts, and purchase individual and lengthy procedures ;
- The inability to do maintenance workshop overall ;
- The increasing number of equipment and the expansion of the needs and requirements of maintenance and the high cost of operation and maintenance and low operating efficiency.

## 2. NATIONAL MUNICIPAL SOLID WASTE MANAGEMENT POLICIES

The local authorities are responsible for the development of a Municipal Solid Waste Management plan, must select the agency that will actually make this plan and subsequently implement it. This is most likely to be the local cleaning fund and/or the solid waste management department. Political support and goodwill is crucial to the development and the ultimate success of any waste collection system and therefore strong support is needed from the local leaders. The local authorities must guide the solid waste management plan through all stages of preparation, to ensure that the initiative is both managed effectively and provides a maximum benefit to the population.

### 2.1. POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

Strategic action number 1 and 2 were concentrated on amendment of the public cleaning law and cleaning funds law in order to be concert with the new improvements and technical requirements in the SWM sector like transferring of tasks and responsibilities to local councils on district level. In view of this, SWMP/GIZ had studied the amendments of the public cleaning law and cleaning funds law and by-laws in cooperation with the Ministry of Local Administration and committees specialized in cleaning and local authority as well as legislation in order to present these two laws and by-laws to the cabinet for approval.

Currently, the Public Cleaning Law and Cleaning Funds Law are adopted by the cabinet and passed to parliament but have not yet been approved by parliament.

The legal requirements for the disposal of waste in landfills are defined in "Law No. 39/1999 on regard of the public cleaning". A by-law for Law No. 39 that further specifies the legal requirements for solid waste disposal has been elaborated as a draft version but has not yet been finally approved.

### 2.2. STRATEGIES, ACTION PLANS AND INITIATIVES

All solid waste management activities in Yemen should be based on the national strategy for Solid Waste Management 2009 – 2013, that aims to improve the health and environmental conditions by upgrading the efficiency, effectiveness and coverage of SWM services in all Yemeni cities. **Unfortunately, the political crisis in Yemen led to a complete paralysis in the process of implementation of this strategy and its investment program.**

The simplest procedure for establishing a waste collection system is to base the planning on the size of population to be served. To achieve this, the first step is to define the geographical boundary of the urban area that has to be served by the waste management system. Hereafter the size of the population to be served must be determined. Once the size of the population, the requirements to equipment and costs can be estimated.

The main purpose is to show that costs are considerably affected by performance; improved performance will result in lower cost. For example, if a waste collection vehicle is operated in two shifts, then it will collect more tonnes of waste and thereby reduce the costs on a per tonne basis through utilising the investment cost. A key issue is how to minimise the fixed costs per tonne of waste collected, as salaries, overheads and assets can represent over 70% of total costs in some cases. A more detailed cost estimation study is

required based on an operation plan which shows exactly all equipment with specifications required and detailed staffing structure in addition to real distances travelled by each truck.

### 2.3. PLANNING AND INVESTMENTS

As a result of the political crisis in Yemen during the last two years, the SWM sector didn't face improvements. More specifically, no changes have been noticed in the efficiency of collection, in transfer and recycling, in rehabilitation of existing controlled dumpsites and the establishment of new sanitary landfills. A means to improve the current situation of SWM would be to plan from the beginning and rearrange the collection and transfer system, as follows:

- Waste collection routes must be planned to maximise efficiency by minimising transportation distances, and to ensure an equitable distribution of workloads amongst crews. Vehicle productivity may be increased by selecting and planning routes so that the quantity of daily collected waste is maximised ;
- The selection of collection vehicles is a key issue in controlling capital and operating costs. Non-compactor trucks are a sound technical practice for solid waste collection under the following circumstances:
  - The waste is generally relatively dense ;
  - Labour force is relatively inexpensive ;
  - The maintenance facilities are of a poor standard and lack skilled staff ;
  - There is a small investment capital and a low budget for operation ;
- Tipper trucks also have an advantage when relatively small quantities of waste are collected per unit, the same also applies to residential "house to house" collection. When waste is collected from large containers, compactor trucks can offer several advantages: To collect 660 or 1,100 litres of waste using a mechanical hoist, so that the containers are rapidly emptied can quickly fill a compactor truck and allow it to proceed to the landfill. This allows the truck to make a number of trips to the landfill in a day, resulting in a very efficient operation, for a high productivity, where a truck can collect a large quantity of waste in a work day, leading to low costs per tonne of waste collected ;
- Compactor trucks must be purchased with caution, as they are costly and more difficult and expensive to maintain. Frequently, imported or high-technical collection vehicles cannot be repaired locally, resulting in the «cannibalizing» of parts from other vehicles that could otherwise have been repaired.

### 2.4. MONITORING

Establishing a monitoring system for the trucks, installing and operating a truck weighbridge at transfer stations and at the landfills, introduction to new container system, as well as design improvement measures are required to guarantee the success of every SWM monitoring system.

To monitor a waste collection system, it is very important to be able to measure the quantity of collected waste. For any town with more than 50,000 inhabitants, a weighbridge is essential, so that all trucks delivering waste to the landfill can be weighed.

With a weighbridge, it is possible to measure the performance of each individual truck, as well as the performance of each particular waste collection zone or district. This data can then be compiled into daily, monthly and annual reports for the management.

A weighbridge also allows private customers to be billed by weight when waste from a single source is delivered to the landfill. For small cities or towns with less than 50,000 inhabitants a weighbridge is

not required, but all truck arrivals at the landfill must still be recorded, together with an estimate of the volume of waste the truck is hauling.

Weighbridges are sensitive tools and proper programmed maintenance is very important. The practical solution is to have a maintenance contract with the supplier (private sector) and this is available in Yemen.

The goal of monitoring is that the private sector gets involved to ensure a consistent and satisfactory service. Inspectors should be very familiar with the requirements of the contract.

For the Local Authority, penalties should be imposed in accordance with the contract and with the aim of improving the performance of the service provider. Penalties should not be imposed to hurt the contractor or increase the Local Authority's revenues.

## 2.5. FISCAL, FINANCE AND ECONOMICAL STEERING INSTRUMENTS

There is only relatively limited verifiable information of the budgets for the public cleansing operational and investment budgets available.

The operational & capital budget for 19 cleaning & improvement funds for the year 2007 was as follows:

The following describes the MSW fee system:

**Table 1: operational and capital budget for 19 cleaning & Improvement funds (2007)**

Operation budget financed by cleaning funds	38,546,000 US\$
Operation budget financed by ministry of finance	5,545,000 US\$
Investment budget financed by foreign donors	1,202,000 US\$
Investment budget by local donors	1,918,000 US\$
The total budget for SWM	47,201,000 US\$

The cost of tipper trucks and compactor trucks is a major element of both capital and operating costs in a waste collection system. Good productivity for these costly vehicles is therefore essential, as this allows for a maximum of service coverage and to minimise the overall costs per tonne of waste collected. The following steps should be taken to maximise productivity:

- The vehicles should be operated for as many hours as possible every day, preferably in (at least) two shifts ;
- The vehicles should be filled to their maximum capacity as rapidly as possible.

The only instrument required to apply and achieve this target is to select qualified managers for managing cleaning funds and cleaning departments in Yemen.

## 2.6. PRIVATE SECTOR PARTICIPATION POLICY

The government of Yemen has previously in several instances tried to privatise solid waste collection. These efforts in Sana'a, Hodeidah and Mukallah were based on the hired contractor leasing equipment and facilities from the local authority. Unfortunately, these efforts were not successful and all those companies failed because of the following reasons:

- The selected contractors lacked technical capability and experience within solid waste management ;

- The contractual agreements were very brief, incomplete and without a clear specification of the necessary services ;
- There was no performance monitoring by the local authorities ;
- Payments to the contractors were made in an unreliable manner by the public sector.

At present all waste collection, transport and disposal are provided by the local authorities. Introducing private sector involvement in solid waste management can potentially improve the waste management services without increasing costs. A key consideration is that there must be sufficient competition, transparency and accountability, as private-sector participation does not, itself, guarantee effectiveness and low costs.

Problems can arise when privatization process is poorly conceived and regulated and, in particular, when competition between suppliers is lacking. This will normally lead to an inefficient waste collection service that is too costly for the services that are provided. Likewise, the tardy payments from the local authorities will undermine the contractor's commitment to provide a good service and may even cause the contractor to bankruptcy. Therefore it is essential that the local authorities have a strong will and commitment to pay the Contractor in a timely manner.

## 2.7. PUBLIC AWARENESS, EDUCATION AND COMMUNITY PARTICIPATION

A year ago, Sana'a has been swimming garbage for more than a week since the city's garbage collectors and truck drivers went on strike, requesting better salaries and permanent contracts. In addition, they were seeking for appreciation for their work in a culture that looks down on them and a society that deliberately makes their work harder. As the trash was building up, residents were increasingly trying to burn the mounts of garbage causing another environmental hazard yet. The problem was the indifference that locals had towards this issue. They knew that collectors were on strike, almost every household continued to pile garbage onto the heaps of already rotten trash. The only beneficiaries were the street cats and dogs taking advantage to feast on the trash, tearing open plastic bags and dragging garbage across the streets. This could be a lesson for the people of Yemen and a very good stimulus to increase public awareness about solid waste management; a lesson about appreciating those invisible heroes without whose work our life would literally sink into a sea of garbage.

Inhabitants are usually opposed to having containers placed close to their home, making it difficult to find suitable locations for the containers. This is because the inhabitants distrust the authorities and fear that the containers will not be emptied on a regular basis. Hence the containers often have to be placed at some distance from people's homes; and residents who have to walk too far to the container sites or who refuse to cooperate will dump their waste in streets and or in drains. The system is dependent on the citizens to bring their waste to the waste containers.

Poor waste management practices cause a lot of hygienic and health problems for inhabitants in surrounding areas. Furthermore, unmanaged garbage will also contaminate surface water and ground water. Dumpsites also represent a safety issue through fires, potential collapses of the waste heaps and they are a danger to anybody who settles on or close to an old dumpsite land.

People need to learn how to manage their daily consumption and the amount of waste they produce. It's time to think about the environment before they use plastic bags or throw out such huge amounts of garbage. But most importantly, these garbage collectors men and women deserve far better treatment and people should learn to give them the respect and thanks they deserve.



## 2.8. NATIONAL CAPACITY BUILDING AND TRAINING INITIATIVES

Training workshops for trainers as well as national municipality staff should be considered, depending on best practices and guidebooks that have been prepared on SWM (2010).

Upgrading courses material, principles, and skills of the responsible personnel in SWM department is required, because most of managers lack of experience and education. So, it is recommended more courses to be held to improve managers' skills in administration sciences (finance and administration).

In addition, it is important the personnel that handles hazardous healthcare waste to receive thorough training. They must know the hospital or institution's procedures, packaging types, personal protection measures, first aid, and how to respond in case of accidents or damaged packaging. Placing posters on the walls of all nurses' stations instructing how the waste should be sorted and handled.

For the capacity building, it's most important to prepare a program to stimulate and promote partnerships for investment in solid waste management in Yemen between Yemeni and regional or inter-national companies and provide support to identify the expertise and successful experiences gained in other countries.

## 2.9. CAPACITY BUILDING REQUIREMENTS

The most important requirements are to provide financial and technical support to carry out the necessary training mentioned above.

## 2.10. NATIONAL INITIATIVES MULTI STAKEHOLDER EXCHANGE

No national initiatives multi stakeholder exchange.

## 2.11. CASE STUDIES, BEST PRACTICES AND LESSONS LEARNT

No case studies, best practices or lessons learnt during this period.

## 2.12. UPCOMING INITIATIVES

No upcoming initiatives.

## 3. INDUSTRIAL & HAZARDOUS WASTE MANAGEMENT

At present, the total volume and composition of industrial hazardous waste in Yemen is unknown. Most of hazardous waste is mixed with ordinary waste and dumped in open dumpsites or directly into sewage.

### 3.1. LEGAL AND INSTITUTIONAL FRAMEWORK

No institutional or legal framework for Industrial and hazardous waste management in Yemen.

### 3.2. STRATEGIES AND PLANNING

The Yemeni Environmental Protection Authority EPA alleges that most of Yemen's plants aren't committed to observing environmental regulations. «Although most factories aren't committed to EPA laws, they [still] are considered friends to the environment because they must work to protect it from large problems". Currently, there are four recycling factories in Yemen for batteries - which contain toxic chemicals - and metals that produce dangerous toxic by-products. One of these Factories was committed to environmental rules; however, because abiding to environmental laws increased significantly the cost of the factory, the owners ceased to observe environmental rules.

The General Investment Authority licenses most recycling factories and laboratories without consulting the EPA regarding possible environmental side effects or protective environmental measures<sup>2</sup>.

In order to make all factory owners to obey existing laws, a database with the basic data for all these factories is required to be constructed.

Completing the implementation of the remaining strategic action regarding to institutional hazardous Waste Management (strategic action no.3):

- A list of hazardous substances is prepared and agreed ;
- Legislation on hazardous industrial wastes is adopted ;
- Responsibilities for hazardous waste management on national and local levels are defined ;
- A survey is undertaken to identify and register the sources of these hazardous wastes and to estimate quantities.

### 3.3. FINANCING

No data available.

### 3.4. COLLECTION, TREATMENT AND DISPOSAL

No hazardous waste landfills or plants are in place.

2 - Yemen Times /Ali Al-Dobhani,/ director of Toxic and Hazardous Waste in EPA

### 3.5. PRIVATE SECTOR INVOLVEMENT

Most of the private sector companies treat their waste by their own way, no governmental monitoring system among these kinds of treatments.

### 3.6. CASE STUDIES, BEST PRACTICES AND LESSONS LEARNT

No case study is available.

### 3.7. UPCOMING INITIATIVES

To establish a hazardous waste management system is necessary to estimate the on-going generation of hazardous waste amounts and categories.

To treat the organic hazardous wastes that are in sludge or solid form, as well as those that are mixed with water, requires a specialized hazardous waste treatment facility. With time, such a facility should be established by the government of Yemen, presumably under the direction of the EPA. The products from such treatment, in the form of liquids, sludges and drummed waste, could be incinerated at a cement kiln equipped with suited feeding systems to introduce the waste into the kiln. This is an environmentally sound solution to disposing of organic hazardous wastes and much less costly than building a dedicated hazardous waste incinerator.

## 4. MEDICAL WASTE MANAGEMENT

The general public can be infected by hazardous healthcare waste either directly or indirectly through several routes of contamination. The dumping of hazardous healthcare waste in open areas is a practice that can have major adverse effects on the population. "Recycling" practices are not uncommon and, particularly, the reuse of syringes is certainly the most serious problem in a number of countries. The World Health Organisation estimates that over 23 million infections of hepatitis B and C and HIV occur yearly due to unsafe injection practices (reuse of syringes and needles in the absence of sterilization).

At hospitals, the waste generation rate of hazardous healthcare waste varies according to a number of factors: In Yemen the hazardous health care waste generation rates at hospitals are likely to vary between 0.1 and 0.2 kg/bed/day. These rates are based on the number of patients staying overnight in a hospital. So, for a 500 bed hospital in a big city in Yemen, where all beds are occupied (with just one patient per bed), the daily waste generation rate is approximately 0.2 kg/bed/day \* 500 beds = 100 kg/day. In rural areas, the waste generation rate for a hospital or clinic is likely to be about 0.1 kg/bed/day.

There is an acute shortage of treatment facilities for hazardous healthcare waste, making it difficult to render this waste stream safe. The handling of hazardous healthcare waste poses a considerable risk to the safety of both patients and staff within many facilities. In addition, when it is mixed with the ordinary waste, the infectious waste also creates a risk for both waste collectors and scavengers. Therefore, it is essential that the handling of these wastes as well as their treatment to be improved.

The estimation of the generated medical waste in Yemen is 3,917 tons/year (2010).

### 4.1. LEGAL AND INSTITUTIONAL FRAMEWORK

Waste management and treatment options should first protect the healthcare workers and the population and minimise indirect impacts from environmental exposures to HHCW.

Because of the political crisis, the situation got worse than before.

The Ministry of Public Health & Population is responsible for ensuring that all generated hazardous healthcare waste is properly handled and treated.

The Environmental Protection Authority (EPA) under the Ministry of Water & Environment defines healthcare waste as a hazardous waste.

### 4.2. STRATEGIES AND PLANNING

There is still the need to complete the implementation of the remaining strategic action regarding to Medical Waste Management (strategic action no.3)

- Standards and financing mechanism for transport, treatment and disposal of health care waste are defined ;
- A code of practice for waste segregation and handling within healthcare establishments is prepared, approved and distributed to all healthcare establishments ;
- Training courses are conducted in selected hospitals to familiarize the staff with the new code of practice.

Naturally, the quantities of waste will vary from source to source: In a hospital, the waste per bed per day differs from ward to ward, and the amount of hazardous healthcare waste will depend on any particular specialisation of a hospital. Therefore, for any detailed planning, the waste generation rates must be established through field verification. When examining the waste generation rates, it is essential to ensure that the waste separation is done correctly at the ward level. In hospitals where ordinary waste is unintentionally mixed with the infectious waste, the hazardous healthcare waste quantities will be considerably larger; this can lead to an incorrect basis for the detailed planning.

### 4.3. FINANCING

As it is mentioned in the last report, the total investment requirements (2010- 2013) for Hazardous Health Care Waste Management is to achieve:

100% capacity to deal with hazardous health care waste, the following investments have been estimated:

**Table 2: Estimated investments to achieve acceptable hazardous healthcare waste management**

1,000,000 USD	
Hardware	6.8
Soft Costs	1.4
Contingency	1.6
Total	9.8

## 5. GREEN WASTE & AGRICULTURAL WASTE

Green waste is biodegradable waste that can be composed of garden or park waste, such as grass or flower cuttings and hedge trimmings, as well as domestic and commercial food waste. The differentiation green identifies it as high in nitrogen, as opposed to brown waste, which is primarily carbonaceous. Green waste is often collected in municipal curbside collection schemes or through private waste management contractor businesses and subject to independent audit. Biogas captured from biodegradable green waste, which can be used as biofuel. In Yemen green and agricultural waste is being dumped in landfill with ordinary waste.

### 5.1. LEGAL AND INSTITUTIONAL FRAMEWORK

NONE

### 5.2. STRATEGIES AND PLANNING

NONE

### 5.3. FINANCING

NONE

### 5.4. COLLECTION, TREATMENT AND DISPOSAL

NONE

### 5.5. PRIVATE SECTOR INVOLVEMENT

NONE

### 5.6. CASE STUDIES, BEST PRACTICES AND LESSONS LEARNT

NONE

### 5.7. UPCOMING INITIATIVES

NONE

## 6. PACKAGING WASTE

Recycling often seems to be a forgotten issue in Yemen although it is estimated that, in 2006 in four large Yemeni cities, over 90,000 tonnes of recyclables were recovered and exports of recycled plastic amounted to more than US\$ 10 million. Recycling is an important aspect of the comprehensive approach to SWM, therefore government bodies should encourage the private and informal sectors and NGOs to become more involved in this sector.

Indeed, several countries, including United Arab Emirates, Morocco, and Yemen, are so fed up with plastic packaging polluting their environments that they have pledged to ban non-biodegradable plastics from entering the country.

Findings of investigations commissioned by the GTZ Project.

### 6.1. LEGAL AND INSTITUTIONAL FRAMEWORK

NONE

### 6.2. STRATEGIES AND PLANNING

NONE

### 6.3. FINANCING

NONE

### 6.4. COLLECTION, TREATMENT AND DISPOSAL

NONE

### 6.5. PRIVATE SECTOR INVOLVEMENT

NONE

### 6.6. CASE STUDIES, BEST PRACTICES AND LESSONS LEARNT

NONE

### 6.7. UPCOMING INITIATIVES

NONE

## 7. CONSTRUCTION & DEMOLITION WASTE

In Yemen, construction waste is a type of solid inert wastes, which is being resulted of demolition of construction works such as infrastructure projects, building, debris, maintenance and rehabilitation works and roads. Quantities of such wastes are different than solid waste in respect of size or density or composition. Most of these wastes contain some components like sands, gravels, sandstones, concrete works, and some ingredients that inserted in the building process like wood, glass, iron and metal.

### 7.1. LEGAL AND INSTITUTIONAL FRAMEWORK

According to Public Cleaning Law number 39/1999; MoPWH is responsible for collecting and disposing of construction waste.

### 7.2. STRATEGIES AND PLANNING

If a local council of a big city is willing to improve the construction waste management within its borders, it has the permission to issue a resolution from governorate local councils to establish a construction waste department (CWD) within the governorate's Cleaning Fund for this city and to establish CWD branches in small towns, that Cleaning Fund of this city is responsible to apply waste management services in. The aforementioned resolution should identify the reception areas for disposing of construction wastes. These areas should be stated in the permits when issued. Reception areas for disposing of construction wastes should not be as landfills unless there is enough size for disposing of such wastes with the possibilities of utilizing them in constructing of the internal roads in the landfills.

After issuing the resolution on the establishment of CWD, a governorate Cleaning Fund should do the following:

- Form the specialized department of construction waste collection ;
- Identify tasks and responsibilities ;
- Identify fees of collection (YR/m<sup>3</sup>) ;
- Open a bank account for CWD ;
- Provide proper vehicles in respect of quality and quantity for operation process during the establishment period with the possibility of hiring vehicles from the private sector when needed.

### 7.3. FINANCING

MoPWH's Office Branches had used a mechanism of providing construction permits for debris or reconstruction or rehabilitation and maintenance in condition that the beneficial should collect his generated construction wastes and pay a refundable amount as guaranty with approximately 500 YR (US\$ 2.3)/ m<sup>3</sup>. This mechanism was not successful and didn't limit or control the problem, in which it should be cancelled and looking for a new mechanism.



CFs shouldn't obsess the overall revenues of CWD, however, revenues should be divided as follows:

- 60 % for salaries, wages, fuel, oil, maintenance and spare parts ;
- 40 % should be deposited in a bank account for purchasing of used and new vehicles.

#### 7.4. COLLECTION, TREATMENT AND DISPOSAL

According to Public Cleaning Law number 39/1999, MoPWH branches are responsible for collecting and disposing of construction waste as well as for issuing construction permits. However, because MoPWH branches cannot cover all city areas, because of limited budget, it is highly recommended to establish CWD, so as to move forward with the proper management of construction waste. A prerequisite to achieve that is coordination between Cleaning Funds and MoPWHs branches.

A construction or debris permit shouldn't be issued until the cost estimations and calculations of waste collection, transport and disposal is finalized by CWD.

#### 7.5. PRIVATE SECTOR INVOLVEMENT

There is no private sectors involvement, except in case of renting trucks from the private sector to transfer the construction waste to the landfill.

#### 7.6. CASE STUDIES, BEST PRACTICES AND LESSONS LEARNT

Aden new mechanism for dealing with construction wastes.

Aden Province had set up a new specialized department within the Province Cleaning Fund entitled «Construction Wastes Department 'CWD'» in 2007. It had been agreed and coordinated with MoPWH's Aden Office Branch and Aden CF that CWD was the responsible party for collection and transportation of waste construction as a new mechanism instead of the old one. CWD had conducted the following:

- Identification of reception areas of construction wastes disposal ;
- Identification and decision of the fees as 500 YR/ m<sup>3</sup> against collection and supervision like the city secretariat of Sana'a ;
- Recruited 8 civil engineers and distributed them on the working areas for estimating and calculation of costs for of collection and transport ;
- Identification of new work mechanism ;
- Provision of proper vehicles for construction waste collection and transport. Even if these vehicles are not sufficient, the CWD manager could hire additional vehicles from the private sector ;

DWC had achieved touchable successes and purchased vehicles from its own financial revenues during the past years. However, CWD has several vehicles but it is still incapable to fulfill all orders in which it hired additional vehicles from the private sector.

#### 7.7. UPCOMING INITIATIVES

No upcoming initiatives.

## 8. WASTE TYRES

This issue especially looks at the possibility of using scrap tyres as a fuel in cement kilns, but also considers the possibilities for using hazardous wastes (such as spent solvents and waste oils) and fuel derived from municipal solid waste.

### 8.1. LEGAL AND INSTITUTIONAL FRAMEWORK

No legal or institutional frame work.

### 8.2. STRATEGIES AND PLANNING

A modern cement kiln producing 1,500,000 tonnes per year requires 110,000 tonnes of heavy fuel oil annually. Hence all scrap tyres discarded annually in Yemen would only cover about 14% of one large cement kiln's energy requirements. Given that there are seven cement plants in Yemen, scrap tyres can only provide a modest fuel substitution unless scrap tyres are imported from neighbouring countries.

### 8.3. FINANCING

In a similar vein, one tonne scrap tyres can be delivered to a cement kiln for \$100 to \$200 depending on location. One tonne of heavy fuel oil (value around 130 Rials/litre or \$640 per tonne) can be replaced by 1.36 tonnes of scrap tyres. Hence using 10,000 tonnes per year of scrap tyres as an alternative fuel would save a cement kiln approximately 3 million dollars annually, when any required investments and additional labour costs are excluded. It is likely that one or several cement kilns will be using scrap tyres as an alternative fuel within the near future.

### 8.4. COLLECTION, TREATMENT AND DISPOSAL

To ease the transportation of whole tyres, these can be baled, thereby greatly reducing the volume of the tyres. The solution is to have equipment to cut every scrap tyres into 4 to 8 pieces and then pack these tightly together. Again this ensure higher loading during transport and also eases the handling of the scrap tyres.

### 8.5. PRIVATE SECTOR INVOLVEMENT

It can be assumed that every time a tyre is imported by the private sector (the only role for the private sector at the moment) into Yemen, this will be used to replace a used tyre on a vehicle. Therefore, the import data for tyres should give an excellent indication of the number of scrap tyres generated every year within the country. For 2009, the Ministry of Planning and International Cooperation (Central Statistical Organisation) reported that Yemen imported tyres as follows:

- 857,272 new pneumatic tyres of rubber for motor cars ;
- 749,340 new pneumatic tyres of rubber for buses or lorries.

Any tyre that is rethreaded will be reused on a vehicle and therefore not require the import of a new tyre. Hence, the number of imported new tyres should be practically identical to the number of tyres discarded.

## **8.6. CASE STUDIES, BEST PRACTICES AND LESSONS LEARNT**

No case study or best practices in this field.

## **8.7. UPCOMING INITIATIVES**

No upcoming initiatives.

## 9. OIL & LUBRICANTS WASTE

Hazardous waste, in the form of 1,500 tonnes per year of lubrication oil, is already burned as fuel at Bajil cement kiln (Hodiedah governorate). The lubrication oil is an inexpensive fuel and easy to mix with the fuel oil. With increasing fuel costs, other cement kilns (if they are not already doing so), will certainly also endeavour to burn waste oils or spent solvents in an effort to reduce the cost of the fuel used in their cement production.

### 9.1. LEGAL AND INSTITUTIONAL FRAMEWORK

No legal or institutional framework.

### 9.2. STRATEGIES AND PLANNING

A hazardous waste management strategy should be prepared, the SWM strategy include the following:

- The treatment and disposal of waste lubricating oil and food processing wastes are the subject of a separate strategy component ;
- An effective inspection and monitoring system is essential for good management of hazardous industrial wastes ;
- These measures are laying the foundation for safe management of special wastes, but do not provide complete solutions to the problems. It is believed that it would not be realistic to expect that more can be achieved during the period of the current SWM Strategy.

### 9.3. FINANCING

None

### 9.4. COLLECTION, TREATMENT AND DISPOSAL

Cement kilns, given their very high operating temperatures and long gas residence time, are eminently suited for treating organic hazardous wastes.

### 9.5. PRIVATE SECTOR INVOLVEMENT

No available data.

### 9.6. CASE STUDIES, BEST PRACTICES AND LESSONS LEARNT

No case study or best practices.

### 9.7. UPCOMING INITIATIVES

No upcoming initiatives.

## 10. E-WASTE

During last twenty years several offers of investment from foreign companies to set up plants for waste recycling and energy generation have been made, but all of these offers were not economically and environmentally feasible and that is the situation until now.

### 10.1. LEGAL AND INSTITUTIONAL FRAMEWORK

NONE

### 10.2. STRATEGIES AND PLANNING

NONE

### 10.3. FINANCING

NONE

### 10.4. COLLECTION, TREATMENT AND DISPOSAL

NONE

### 10.5. PRIVATE SECTOR INVOLVEMENT

NONE

### 10.6. CASE STUDIES, BEST PRACTICES AND LESSONS LEARNT

NONE

### 10.7. UPCOMING INITIATIVES

NONE

## 11. INTERNATIONAL FINANCIAL ASSISTANCE PROGRAMMES (BI-, & MULTINATIONAL)

There is no international financial assistance since the Japanese support (bulldozers, landfill compactors) of 2011.

## 12. INTERNATIONAL ASSISTANCE PROGRAMMES (BI-, & MULTINATIONAL)

There is no international technical assistance support since Solid Waste Management Project-SWMP-GIZ has been suspended in July 2011.

## 13. NEEDS ASSESSMENT FOR CAPACITY DEVELOPMENT UNTIL 2015

In all Yemeni cities, the cleaning funds have limited resources and are in general not able to afford large investments in equipment and infrastructure, therefore alternative funding is required also, standards and criteria for solid waste management equipment are required, too.

Because of its positive and tangible impact in the capacity development, reactivation of the German technical support via the solid waste management project would be a great assistance for Yemen.

## 14. CONCLUSION & RECOMMENDATION FOR SWEEP-NET ASSISTANCE

SWEEP-Net has an important role in Yemen by supporting the new general directorate for SWM in MoLA. It has a good experience in how to integrate and involve the private sector in SWM, and it is desirable to assist Yemen in this field. There are no waste treatment, no clean energy mechanisms, and no private sector companies providing SW services at all in Yemen, so the role of SWEEP-Net is to introduce such activities to Yemen and that will be done with the following actions:

- Continue supporting the general directorate for SWM to coordinate between the national and local levels ;
- Supporting the implementation of the national strategy for solid waste management in Yemen that identifies tasks and responsibilities of all levels ;
- Assisting in reformulate the public cleaning law and cleaning funds law in concert with the current situation utilizing the SWMP/GIZ long period of experiences in this field ;
- Necessary of the government contribution as much as possible in supporting of the local authority concerning cleaning particularly the orientation process of the central support as well as donors to invest in constructions like sanitary landfills ;
- Assisting in decentralize the cleaning funds process, which contributes in making cleaning activities more successful ;
- Improve the administrative performance for cleaning funds through unifying the account system for all CFs ;
- Availability of the political protection and abstract support for CFs because if they collapse, consequently cleaning services will be collapsed too ;
- Develop CFs revenues and improve the operation efficiency in order to finance the cleaning activities and expand to other towns ;
- Supporting the field training (on the job training). For the cleaning staff it has created a capable staff and experienced in processing of cleaning activities.

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The regional solid waste exchange of information  
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