



Ministry of Environment



## National Solid Waste Management Program

### PROGRAMME IMPLEMENTATION (LOT A) ASSIUT & ASSIUT GOVERNORATE

## Strategic Masterplan for other Waste Assiut Governorate

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Consulting Engineers  
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# Report

## Strategic Masterplan for other Waste

### Assiut Governorate

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## **List of Annexes**

### **Annex 1-1: AMC / PMU comments (with replies)**

## List of Abbreviations

AMC	Accompanying Measures Consultant
BMZ	German Federal Ministry for Economic Cooperation and Development
CAOA	Central Agency for Organization and Administration
CD	Capacity Development
CDS	Controlled Dump Site
CDW	Construction & Demolition Waste
CPI	Consultant/Consultancy for Programme Implementation
DTL	Deputy Team Leader
EEAA	Egyptian Environmental Affairs Agency
ESIA	Environmental (and Social) Impact Assessment
EGP	Egyptian Pound
EPR	Extended Producer Responsibility
EU	European Union
ESMP	Environmental and Social Management Plan
FC	Financial Cooperation
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
IM	Immediate Measures
IRS	Informal Recycling Sector
ISWM	Integrated Solid Waste Management
IT	Information Technology
KfW	KfW Development Bank
MBT	Mechanical Biological Treatment
M&E	Monitoring & evaluation
MENA	Middle East and North Africa
MoA	Ministry of Agriculture
MoE	Ministry of Environment
MoH	Ministry of Health
Mol	Ministry of Industry
MSW	Municipal Solid Waste
NGO	Non-governmental organization
NSWMP	Egyptian National Solid Waste Management Programme
OECD	Organization of Economic Development and Cooperation
PEA	Project Executing Agency
PM	Person month



PMU	Programme Management Unit
PSC	Programme Steering Committee
RDF	Refuse Derived Fuels
SECO	Swiss State Secretariat for Economic Affairs
SWM	Solid Waste Management
SWMU	Solid Waste Management Unit
TA	Technical Assistance
TC	Technical Cooperation
TC-C	Technical Cooperation Consultancy
ToR	Terms of Reference
WMRA	Waste Management Regulatory Agency

## 1 INTRODUCTION

The document presents a “Strategic Master Plan” for the management of wastes in Assiut Governorate that should be managed wholly or partly outside the system for the management of municipal wastes. The Strategic Master Plan sets out the main considerations and directions for the management of the identified wastes with respect to legal and institutional considerations, technology options, financial considerations and capacity development.

This document has been prepared in the context of the methodology set out in the Terms of Reference for this contract:

Using available information, estimates based on proxy indicators or literature data, the consultant shall carry out an approximate assessment of the types and amounts of the different waste streams generated in the two Governorates. The objective is rather to have an overview of the dimension of the problem than to receive ‘exact’ data. In a second step the consultant shall sketch possible conceptual and technical options on how to deal with the different waste streams. The objective is not to develop solutions ‘ready for implementation’ but to delineate possible paths on

- How (conceptual and technical approach)
- Who (institutions and responsibilities)
- With which means (legally and financially) appropriate solutions should be developed in future.

In order to support the decision-making process, the consultant shall concisely outline the required frame conditions for the sustainable implementation and operation of suitable technologies using maybe generic form-sheets for each waste type. The sheets shall in particular contain proposals and recommendations on:

- SWM policy & legal framework
- Proposed institutional set-up and responsibility split on national, Governorate and local level
- Needed administrative capacities for management and supervision
- Required institutions and capacity development
- Suitable technical and conceptual solutions
- Rough estimates of cost
- Financing of investments
- Bearer of running cost and suitable cost covering instruments

The comments issued on the draft version of present report have been taken into consideration. The Consultant’s replies are compiled in Annex 1-1 of the present final version of the report.



## 1.1 Scope

The scope of this document includes the management of the following waste streams, which together represent the major “non-municipal” wastes that are generated in Assiut Governorate:

- Agricultural wastes.
- Healthcare wastes, including wastes from hospitals and clinics.
- Construction and demolition wastes.
- Non-hazardous industrial wastes.
- Hazardous industrial wastes.

## 1.2 Methodology

The Strategic Master Plan for the management of each waste stream describes the status quo that identifies an estimate of how much waste is generated, who generates the waste, how it is managed, the health and environmental impacts of the current management practice in the Governorate, and the main barriers to improved management. It includes institutional roles and responsibilities to achieve objectives, administrative capacity needs and capacity development requirements. It is meant as preliminary guidance for financing and cost recovery; who will pay the costs and how recovery cost will be achieved. Last but not least it identifies action plans and related timing for achieving the targeted change, together with the entities that will be responsible for the identified actions.

## 2 AGRICULTURAL WASTE

### 2.1 Status Quo

Agriculture waste is generated from agricultural crops; maize and cotton are the most important crops in Assiut. The annual agriculture waste generated is about 409,057 tons<sup>1</sup>. Table 2-1 and Figure 2-1 show the total agriculture waste generated.

Table 2-1: Total agriculture waste generated

Agriculture waste	ton/year
Maize (summer)	175285
Maize (yellow)	81780
Sugar cane	16408
Cotton	15006
Wood trees	750
Oranges	18100
Citrus	21064
Grapes	11271
Mango	10569
Other Fruits	40860
Palm Dates	2730
Sugar Beet	15234
<b>Total</b>	<b>409057</b>

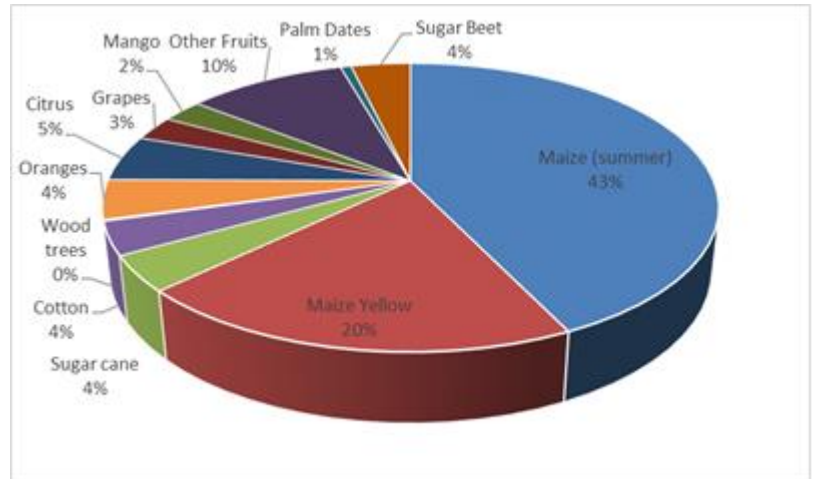


Figure 2-1: Percentage of agriculture waste generated

The above table shows that maize (summer and yellow) represents the highest amount of waste generated, with a total of 63% (43% and 20% respectively).

### 2.2 Health and Environmental Impacts

Current management practices such as the burning of wastes have negative effects on the environment (e.g. air pollution) and impacts human health (e.g. respiratory problems linked to particulate matter).

The key issues of current waste collection systems are that they are not adapted to the collection of small quantities of materials from a large number of generators, the lack of financial incentive to collect materials, and low levels of awareness of technology options available to utilize the wastes.

<sup>1</sup> Directorate of Agriculture in Assiut

## 2.3 Roles and responsibilities

This chapter covers institutional roles and responsibilities to achieve objectives, administrative capacity needs and capacity development requirements. Table 2-2 shows the roles and responsibilities of the related entities.

Table 2-2: Roles and responsibilities

Entity	Roles and responsibilities	Administrative capacity needs	Capacity development priorities
<b>Ministry of Agriculture (MoA)</b>	Manage and facilitate productive potential of agricultural sector	Develop and maintain database on agricultural waste. Provide data/information on agricultural wastes and investment opportunities	Organizational and financial frameworks for agricultural waste utilization
<b>Waste Management Regulatory Agency (WMRA)</b>	Develop and implement policy frameworks, and set up a national strategy to promote recovery of agricultural wastes	Propose policy options and strategies to promote organizational frameworks and technology applications to collect/utilize agricultural wastes	Propose policy mechanisms to promote greater use of agricultural wastes
<b>Egyptian Environmental Affairs Agency (EEAA)</b>	Develop policy objectives through effective implementation strategies, including monitoring and enforcement.	Develop operational strategies to maximize utilization of agricultural wastes.	Develop a compliance toolkit that targets achievement of policy objectives through non-regulatory and regulatory actions
<b>Governorate (SWMU)</b>	Develop and implement a legal framework to address local priorities and opportunities. Encourage the private sector to process agriculture waste.	Take control over waste collection and disposal systems to prevent disposal of agricultural wastes.	Organizational capacity to supervise proper management of agricultural waste for materials recovery and energy generation. Promote other actions to link agricultural wastes to existing organic materials processing facilities
<b>Private Sector</b>	Invest in and/or operate systems to collect and/or process agricultural wastes	Available and acceptable financing opportunities Reliable and predictable regulatory and contract frameworks	Case studies/examples of effective and appropriate agricultural waste projects

## 2.4 Suggested Solutions

### Objective

Promote recovery of wastes for composting, energy generation and manufacturing of products.

### Key policy actions to achieve objectives

- Develop financial frameworks to support collection of wastes and link to appropriate infrastructure.
- Establish standards to achieve collection of high quality, uncontaminated agricultural waste materials.

## 2.5 Financing and Cost Recovery

Preliminary (estimated) capital cost to improve agricultural waste management in Assiut Governorate (approx. 20.5 million EGP).

### Cost recovery

#### Who pays?

- Waste Producer
- End-user pays market price for products or energy developed from waste.

### Cost recovery mechanism

Payment based on:

- 1) Quantity (weight)/quality of material delivered to collection system or processor;
- 2) Value of product or energy developed from the waste

## 2.6 Action Plan

No	Action	Responsibility	Assiut Governorate																	
			2018	2019	2020	2021	2022													
1	Review/enhance legal framework	WMRA	■	■	■															
2	Promote frameworks to utilize agricultural wastes	EEAA, MoA, SWMU	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
3	Develop database on agricultural waste	MoA	■	■	■															
4	Provide data/information on opportunities to use waste	MoA, WMRA	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
5	Develop case examples of investment in waste use	MoA	■	■	■															
6	Ensure agricultural waste does not enter disposal	SWMU, EEAA	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
7	Capacity building	MoA, MWRA	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	

There is a wide variety of potential applications of agricultural wastes. The most common include the application of wastes directly to the land, composting, or used as energy source. In some cases, agricultural wastes may be used as animal feed. Potential applications of agricultural wastes are described below.

### **Direct Application to the Land**

Agricultural wastes (e.g. fruit and vegetable wastes) that are high in moisture and low in fibre may be applied directly to the land. These types of wastes break down rapidly and return nutrients directly to the soil. Best results may be obtained when these wastes are ploughed into the soil and not left on the surface. Simple processing of wastes (e.g. chopping or cutting the wastes into pieces) speeds up the breakdown of the wastes and promotes a rapid incorporation of the wastes into the soil.

### **Composting**

Composting is an aerobic process for managing organic wastes, including agricultural wastes. Agricultural wastes are arranged into a pile. The waste breaks down over time as a result of natural decomposition processes. The speed of decomposition is optimized through careful management of moisture and oxygen levels within the pile, and may be further increased if manure is mixed into the agricultural wastes.

Composting of agricultural wastes is undertaken as a commercial activity in Egypt. However, the availability of agricultural wastes to commercial (or other) composting operations is limited by poor collection systems. Compost manufactured from agricultural waste brings extensive benefits to agricultural soils, including the addition of structure, the retention of water, and the release of moisture for plants. Compost has particular value with regard to reclaiming desert soils for agriculture.

### **Energy**

Agricultural wastes may be used to generate energy. There are two main options:

1. A wide variety of agricultural wastes, including corn (maize), can be managed through anaerobic processing. Anaerobic processing may also be used to manage manure. Some agricultural wastes require more time than others to process. Methane is the output of anaerobic treatment; a high calorific-value gas that can be recovered for energy use either directly (e.g. burning for heat) or indirectly (e.g. to drive a generator to create electricity).

Some anaerobic processes can be undertaken at a scale as small as an individual household, or at a commercial scale. Capital costs for most processes are high; operating costs are low but an effective operation depends on careful control of feedstock.

2. Refuse-derived fuel (RDF). Agricultural wastes may be directly burned for their fuel value. Wastes require collection and (typically) mechanical processing so that they have a form that minimizes transportation costs, and can be readily used at a thermal energy facility. Processing may require simply chopping the wastes to an acceptable dimension, or may require additional steps (e.g. pelletizing). In principle, all dry agricultural wastes may be considered for RDF, but the most attractive candidates are wastes that are dry and have a high energy value.

### Animal Feed

Agricultural wastes may potentially be used as animal feed. Different agricultural wastes have different possibilities in this regard, depending on:

- **Nutritional value.** Different agricultural wastes vary widely in their nutritional value, and wastes that have low nutritional value are not attractive as a food source for animals.
- **Digestibility.** Fibrous agricultural wastes (e.g. corn) may not be easily digested by animals, and this will reduce their ability to metabolize the nutrients that are contained in the waste.

In some cases, a simple treatment can bring about chemical changes in the waste material that can improve the nutritional value.

### Cotton Waste

Cotton waste has excellent potential as a substitute for hay, or as a bulking ingredient in higher protein supplements for lactating cows and growing calves. In addition, the high water retention capacity of cotton waste, combined with its sufficient carbon to nitrogen ratios and low heavy metal content, make cotton waste viable for direct land application and for composting.

Cotton stalks may be useful as animal feed. Alternatively, cotton stalks may be composted or converted to cellulose or charcoal. Charcoal produced from cotton stalks is used in the food industry for refining sugar cane, making soft drinks and purifying water for drinking.

### **3 HEALTH CARE WASTE**

#### **3.1 Status Quo**

The total number of healthcare facilities (Governmental, educational, clinics, and other private facilities) is 4,097, and the total health care waste generated in Assiut Governorate is about 4,375 kg/day. In 2017, the total amount of medical waste was 1,310 kg/day from hospitals (government and private), 2,494 kg/day from all health care facilities without beds (government and private), and 571 kg/day from all other<sup>2</sup> facilities.

##### **3.1.1 Health care facilities in Assiut**

###### **A. Hospitals (Bed Capacity)**

There are a total of 47 governmental hospitals in Assiut with a total of 2,398 beds. Table 3-1 shows the distribution of governmental hospitals based on beds capacity<sup>3</sup>.

###### **B. Other Categories of Hospitals (Bed Capacity)**

There are a total of 70 other hospitals in Assiut, with a total 1,618 beds. Table 3-2 shows the distribution of other hospitals based on beds capacity<sup>4</sup>.

###### **C. Healthcare Facilities (without beds)**

There are a total of 704 healthcare facilities without beds in Assiut. Table 3-3 shows the distribution of healthcare facilities<sup>5</sup>.

###### **D. Other Healthcare Facilities (without beds)**

There are a total of 5,745 other healthcare facilities without beds in Assiut. Table 3-4 shows the distribution of other healthcare facilities<sup>6</sup>.

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<sup>2</sup> Integrated Health Care Waste Management Plan in Egypt 2014-2019

<sup>3</sup> Integrated Health Care Waste Management Plan in Egypt 2014-2019

<sup>4</sup> Integrated Health Care Waste Management Plan in Egypt 2014-2019

<sup>5</sup> Integrated Health Care Waste Management Plan in Egypt 2014-2019

<sup>6</sup> Integrated Health Care Waste Management Plan in Egypt 2014-2019

**Table 3-1: Governmental hospitals**

Assiut	General Hospitals			Specialty Hospitals and branches												All MOHP hospitals and branches
	Public hosp.	Central hosp. A	Central hosp. B	Ophthalmic/ Eye clinics and branches	Maternity and children's hosp.	Brain and neurosurgery Hosp.	Psychiatry hosp. and branches	Geriatric hosp.	Special. Hosp.	Skin and leprosy hosp. and branches	Chest hosp.	Tumours centres	Kidney hosp.	Fever hosp. and branches	Tropical branches	
No.	3	7	1	11	2	-	4	-	-	2	1	-	-	5	4	40
Bed	663	800	54	102	101	-	129	-	-	3	166	-	-	378	2	2,398

**Table 3-2: Other hospitals**

Assiut	Specialized Medical Centres Amana hospitals				Health Insurance Org. hospitals	Educational hospitals and institutes	Curative Establishment hospitals	All MOHP-related hospitals	All MOHP hospitals and branches	University hospitals	Public Sector's hospitals	Police and prison hospitals	Private hospitals	Other hospitals	All hospitals
	Uni- or Multi-Specialty centres	Tumours Centres	One-Day surgery	Total											
No.	-	-	-	-	1	-	-	1	40	4	-	-	45	-	90
Bed	-	-	-	-	202	-	-	202	2,398	2,584	-	-	1,116	-	6,300

**Table 3-3: Healthcare facilities without beds**

Assiut	Primary healthcare Services								School health		Family Planning			Environmental Health					Rabies treatment centres	Physiotherapy centre	TOTAL MOHP HCFs
	Family health units	Family health centres	Rural health units	Rural health centres	Health offices	District and comprehensive clinic	Urban health centres	Mother and child care	General health	Dental health	Fixed urban	Fixed rural	Mobile clinics	Env. Health units	Pre-marital investigation	Commission committees	Food handler examination	Drug analysis labs			
	120	25	43	8	14	11	10	11	156	-	70	172	14	15	6	1	12	-			



**Table 3-4: Other Healthcare facilities without beds**

Assiut	MOHP- Table 2A	Private clinics (registered)	Dental clinics (registered)	Laboratories	Pharmacies (2)	Dialysis machines (Registered)	All Healthcare Facilities
	704	1,841	226	377	2,437	160	5,745

### 3.1.2 Estimated Quantities of Healthcare Waste Generated

Table 3-5 shows an estimation of total waste generated in hospitals and health care facilities<sup>7</sup>.

**Table 3-5: Total waste generated.**

Assiut	Hospitals and their branches						Healthcare Facilities- HCFs other than hospitals			All Hospitals and HCFs	Contingency- 15%	Estimated HCW quantity- Kg/day
	MoH	MoH-related	University	Private	Public Sector, and others	All hospitals	MoH and related HCFs	Private HCFs	All HCFs			
	277.53	35.01	604.01	113.55		1,309.75	532.8	1,960.4	2,493.6			

<sup>7</sup> Integrated Health Care Waste Management Plan in Egypt 2014-2019

### 3.1.3 Healthcare waste treatment

The main treatment technology used in Assiut is incineration, and of the 17 incinerators only 9 are working with low efficiency. The total daily waste treated is 2,075 kg/day, which represents 44% of the generated waste, and the rest is disposed of in open dumpsites. Table 3-6 shows the total number and capacity of hazardous healthcare treatment technologies available in Assiut<sup>8</sup>.

Table 3-6: Number and capacity of hazardous healthcare treatment facilities

Assiut	Incineration facilities				Steam Sterilization (with shredding)				Total
	MOH		Non-MoH		MoH		Non-MoH		
	work	not	work	not	work	not	work	not	
Capacity	900	400	-	-	150 L/h = 22.5 Kg/h	-	100 L/h = 15 Kg/h	-	1,337.5
No.	9	4	4	-	-	-	-	-	17
Capacity	900	375	800	-	-	-	-	-	2,075

### 3.1.4 Healthcare waste transportation

The total number of vehicles conveying hazardous healthcare waste in Assiut is 8<sup>9</sup>. Table 3-7 shows the number of vehicles.

Table 3-7: Number of vehicles

Assiut	MoH – various brands						Total
	Chevrolet	Aveco	Fantom	Esozo	Toyota	Sub-total (1)	
	4	2	-	-	2	8	

## 3.2 Health and Environmental Impacts

### 3.3 Facts

Health, environmental and other problems caused by inadequate management practices risk the spreading of disease either directly or by attracting of vermin, rodents and other disease-carrying organisms.

Main issues are inadequate source segregation, collection, treatment, and disposal infrastructure, and the absence of separation of hazardous from non-hazardous health care waste (all health care waste is therefore considered hazardous).

<sup>8</sup> Integrated Health Care Waste Management Plan in Egypt 2014-2019

<sup>9</sup> Integrated Health Care Waste Management Plan in Egypt 2014-2019

### 3.4 Roles and Responsibilities

This chapter covers institutional roles and responsibilities to achieve objectives, administrative capacity needs and capacity development requirements. Table 3-8 shows the roles and responsibilities for the related entities.

Table 3-8: Roles and responsibilities

Entity	Roles and responsibilities	Administrative capacity needs	Capacity development priorities
<b>Ministry of Health (MoH)</b>	<b>At Central Level</b> Include health care waste management in sector budgets. Ensure health care facilities implement/operate proper health care waste management systems.	<b>At Central Level</b> Capacity to create, coordinate and monitor health care waste management systems <b>At Local Level</b> Capacity to plan health-care waste management systems. Capacity to tender, select and manage health care waste management contractors	<b>At Central Level</b> Technical planning and implementation of health care waste management. <b>At Local Level</b> Administrative supervision of health-care waste management reporting, trouble-shooting and maintenance of proper health care waste management systems.
<b>Waste Management Regulatory Agency (WMRA)</b>	Establish regulatory standards for health care waste management with the cooperation with MoH, and activate the health care manual issued in 2015	Coordinate with the Ministry of Health and any other project working in the same area.	Policy and implementation alternatives for health care waste management
<b>Egyptian Environmental Affairs Agency (EEAA)</b>	Monitor and enforce legislation.	Management and reporting of monitoring records. Procedural capacity for monitoring and enforcement.	Technical capacity to monitor health care waste treatment facilities and report data and findings Procedures for monitoring and enforcement
<b>Governorate (SWMU)</b>	Encourage the private sector to process health care waste.	Control over waste collection and disposal systems to prevent disposal of health care wastes.	Organizational capacity to supervise proper management of health care waste.
<b>Private Sector</b>	Invest in and/or operate collection and/or treatment systems.	Documentation of proper health care waste management.	Operational capacity to implement health care waste management system/technology

### 3.5 Suggested Solutions

#### Objective

- Separation of hazardous from non-hazardous health care wastes.
- Phased implementation of effective storage, collection and disposal for all hazardous health care waste, beginning with hospital wastes and including definition, and separation of hazardous wastes.

#### Key policy actions to achieve objectives

Specification of standards for health-care waste management, supported by planned sector investment, operational budgeting, and effective enforcement.

### 3.6 Financing and Cost Recovery

The higher Committee for Health and Environment affiliated to the Ministry of Health has identified the value of treatment and disposal of one kg of health care waste at about 5 EGP. This means that the preliminary (estimated) cost to improve health care waste management in Assiut Governorate is approx. 5 million EGP annually if managed by the private sector. If managed through the Directorate of Health the preliminary (estimated) capital cost about lies at around 10.3 million EGP.

#### Cost recovery

#### Who pays?

Health care facilities that produce the waste

#### Cost recovery mechanism

Health-care budgets

### 3.7 Action Plan

No	Action	Responsibility	Assiut Governorate															
			2018	2019	2020	2021	2022											
1	Establish sector waste management standards	MoH, WMRA	█															
2	Strategic plan for health care waste management system	MoH		█	█	█												
3	Establish administrative/ reporting framework	WMRA, EEAA			█	█	█											
4	Invest in treatment technology	MoH, WMRA				█	█	█										
5	Monitor/enforce legal requirements	EEAA						█	█	█	█	█	█	█	█	█	█	█
6	Capacity building	MoH, MWRA	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█

Source segregation in health care facilities is an important first step towards proper management of healthcare waste (HCW).

Approximately 70% of health care waste is general non-hazardous waste, and can be managed in the same way as household waste provided it is separated from - and managed separately from - hazardous HCW.

The most important of hazardous wastes in terms of their quantity and their potential impact on public health and the environment are infectious and pathological wastes, and sharps. Based on technology availability today, the technologies that have the greatest potential for treating these wastes in the region are considered to be:

- Double chamber incinerators.
- Autoclave treatment

The central function of these technologies is to be able to achieve a high level of sterilization of infectious waste, including sharps, and pathological waste. However, the capital costs associated with these technologies and their operating costs vary widely, as does the reliability of their performance. Traditionally, incineration of hazardous HCW has been undertaken, but this is now being phased out by the Government of Egypt.

Advanced autoclave technology is emerging as a preferred alternative to the incineration of hazardous HCW. The technology brings the advantages of reliably high performance, moderate capital and operating cost and no emissions to cause concern in local communities.

The organization of treating hazardous HCW has an important impact on costs. Treatment facilities that are dimensioned to serve several hospitals can be located at either a single hospital that serves a regional waste treatment function, or at a central location in a district. This approach reduces costs as compared to the transportation of all wastes to a treatment centre that is located at a waste disposal site.

## 4 CONSTRUCTION AND DEMOLITION WASTE

### 4.1 Status Quo

It is very difficult to determine or to estimate construction and demolition waste at National level, sufficient data have not been available to estimate construction and demolition waste.

### 4.2 Health and Environmental Impacts

Health, environmental, and other problems caused by unsightliness is inconsistent with tourism development values.

Main barriers to improved management of the waste are a weak regulatory and enforcement framework, absence of facilities/infrastructure for productive management, and absence of incentives for productive management.

### 4.3 Roles and Responsibilities

This chapter covers institutional roles and responsibilities to achieve objective, administrative capacity needs and capacity development requirement. Table 4-1 shows the roles and responsibilities for the related entities.

Table 4-1: Roles and responsibilities

Entity	Roles and responsibilities	Administrative capacity needs	Capacity development priorities
<b>Waste Management Regulatory Agency (WMRA)</b>	Establish regulatory standards for construction/demolition waste to be managed at licensed/permitted locations; require permits for development to include requirements for waste management; require developers to implement the waste management requirements of the permit.	Coordination with Ministry of Local Development, Governorate entities and other public entities with development/construction responsibilities.	Policy options for management of construction/demolition waste. Policy coordination with other public entities.
<b>Egyptian Environmental Affairs Agency (EEAA)</b>	Monitor and enforce legislation.	Supervision of monitoring/enforcement activities, reporting monitoring and enforcement actions, and implementation of enforcement procedures.	Monitoring procedures for construction/demolition waste, preparation of construction/demolition waste monitoring reports, establishing procedures for enforcing construction/demolition waste management.

<b>Governorate (SWMU)</b>	Issuance of development permits to include provisions for management of construction/demolition waste, and provision of sites in each district for management of construction/demolition. Encourage the private sector to process construction/demolition waste.	Control over waste collection and disposal systems to prevent disposal of construction/demolition waste. Procedures for issuance of development permits to include provision for management of construction/demolition waste.	Provision of templates that integrate construction/demolition waste management with development permits. Opportunities for processing/reutilization of construction/demolition waste.
<b>Private Sector</b>	Invest in and/or operate collection and/or treatment systems.	Proper supervision of contractors to ensure that construction/demolition waste management requirements are implemented. Utilization of processed construction/demolition waste in development projects.	Operational capacity to implement health care waste management system/technology

#### 4.4 Suggested Solutions

##### Objective

Collect wastes to maximize productive uses and create employment.

##### Key policy actions to achieve objectives

- Establish construction and demolition waste facilities,
- Require construction and demolition wastes to be delivered to a processing facility,
- Link waste management obligations of the developer to the permit that allows development
- Enforce legal obligations.

#### 4.5 FINANCING AND COST RECOVERY

Preliminary (estimated) capital cost about 20.5 million EGP.

##### Cost recovery

##### Who pays?

Waste Producer

## Cost recovery mechanism

Waste management costs included in cost of development projects.

### 4.6 Action Plan

No	Action	Responsibility	Assiut Governorate																				
			2018			2019			2020			2021			2022								
1	Specify legal requirements	WMRA	■	■	■																		
2	Develop administrative procedures	WMRA, EEAA, SWMU			■	■	■																
3	Identify processing sites/ procure equipment	SWMU					■	■	■														
4	Develop monitoring/ enforcement templates	EEAA, SWMU					■	■	■														
5	Monitor/enforce legal requirements	EEAA								■	■	■	■	■	■	■	■	■	■	■	■	■	■
6	Capacity building	MWRA, SWMU	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

Construction and demolition waste is widely used in the Governorate as a filler material to raise the level of ground for construction projects. These wastes are well-suited for this purpose:

- They are inert (except for wood). Therefore, they do not degrade, or create gas or leachate.
- They can be compacted to suit the needs of construction projects.
- They form a stable base for construction.

Other applications of construction and demolition waste include:

- Plastics may be recycled or used as RDF.
- Construction and demolition waste may be crushed and used as landfill cover.
- Concrete and brick can be crushed to meet general or specific specifications for use as aggregate or in concrete; in some countries, the use of aggregate manufactured from concrete and brick is widely used in road construction.
- Wood can be chipped and used as a bulking agent to facilitate composting of household (or other) organic materials, or may be used as a refuse-derived-fuel.
- Glass can be crushed and used to promote drainage, or used in asphalt (where it has been shown to increase the life of asphalt) or paint (where it increases reflectivity and improves visibility of e.g. road markings). Construction glass has different qualities as compared to glass packaging and may not be recyclable through those infrastructures.

#### Successful story:

The Arab Contractors established a treatment facility for recovering construction and demolition waste in 6 of October city with a capacity of 100 tons/day, and with a capital investment reaching up to 30 million EGP. The biggest obstacle facing the factory is marketing and a low demand for their products. A policy action is needed from the municipality to commit companies in buying a specific percentage of these product, thus encouraging the private sector to invest.



## 5 NON-HAZARDOUS INDUSTRIAL WASTES

### 5.1 Status Quo

Non-hazardous Industrial waste quantities (and types of waste) vary widely according to the different types of industry.

Sufficient data have not been available to estimate non-hazardous waste generation by the industry within the time frame for this document.

Figures on National level indicate that the industrial sector accounts for around 40% of Egypt's GDP, and comprises about 65,000 industrial enterprises. In 2012, it was roughly estimated that 6 million tonnes of industrial waste were generated across Egypt<sup>10</sup>.

The lack of reliable industrial waste management data is a serious weakness. Without data it is impossible to understand the potential hazards of handling the different types of waste, to design appropriate transport, treatment, and disposal systems, and to set the procedures and precautions required for waste collection and disposal.

Despite the absence of detailed statistics, most industrial waste in Assiut is known to be generated by its key industries such as cement, metallurgy, food, and chemical/pharmaceutical industries. However, whilst large scale industries are significant generators of industrial waste, small-scale industry, small workshops, garages, and very small production units are also collectively large industrial waste generators.

- Cement production
- Electric power generation
- Food production and related by-products
- Iron and steel manufacturing
- Non-ferrous metal manufacturing and foundries
- Plastics and resin manufacturing
- Pulp and paper manufacturing

Many industries in Assiut have little or no pollution control, with the obsolete technologies that prevail, leading to inefficient production processes and significant pollution. The usual practice of co-mixing industrial wastes with MSW reflects, in part, a lack of appropriate facilities for handling hazardous industrial wastes.

Wastes are being disposed either within or nearby industrial complexes, in nearby desert areas, or transported to public dump sites and mixed with municipal waste<sup>11</sup>. Non-hazardous industrial waste tends to be either stored on site, or disposed in dump sites owned by the industry. Collection operators may or may not be licensed, and informal recyclers may come to take waste that has a market value. Companies do not tend to keep any records on the amount generated or its composition.

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<sup>10</sup> Country Report on Solid Waste Management in Egypt, SWEEP-NET, Nile Centre, GIZ, April 2014.

<sup>11</sup> "Review of Status and Actual Practices of Industrial Waste Management in Egypt", Shadia Elshishini, Cairo University, May 2015

## 5.2 Health and Environmental Impacts

The disposal of wastes in dumpsites or into the environment contributes to negative environmental effects (e.g. impacts on air quality from burning waste), and related public health effects (e.g. respiratory problems linked to particulate matter).

Main barriers to improved management of the waste is the cost of transportation to disposal sites, and a lack of monitoring and enforcement of regulatory requirements.

## 5.3 Roles and Responsibilities

This chapter covers institutional roles and responsibilities to achieve objective, administrative capacity needs and capacity development requirements. Table 5-1 shows the roles and responsibilities for the related entities.

Table 5-1: Roles and responsibilities

Entity	Roles and responsibilities	Administrative capacity needs	Capacity development priorities
<b>Waste Management Regulatory Agency (WMRA)</b>	Establish regulatory standards for industrial waste to be managed at licensed/permitted facilities. Strengthen legal framework and national strategy to require tracking of industrial non-hazardous wastes.	Supervision of waste tracking system in cooperation with the Ministry of Industry.	Options and experience in legal frameworks for tracking non-hazardous industrial wastes.
<b>Egyptian Environmental Affairs Agency (EEAA)</b>	Monitor and enforce legislation. Follow up on the EIA approval issued for transportation and disposal entities.	Supervision of monitoring/enforcement activities, reporting monitoring and enforcement actions, and implementation of enforcement procedures.	Monitoring procedures for Industrial waste and tracking system.
<b>Governorate (SWMU)</b>	Encourage the private sector to process non-hazardous industrial waste. Fee-based acceptance of non-hazardous industrial wastes at publicly disposal sites.	Financial and planning capacity to integrate industrial non-hazardous wastes into a waste management system.	Creation and implementation of planning and financial frameworks that accommodate private sector wastes and fees.
<b>Private Sector</b>	Contract with the industry to transport non-hazardous wastes. Comply with tracking	Capability to manage a waste services contract and to participate in a waste tracking system.	Contract management and implementation of a waste management tracking system.

	requirements. Get EIA approval for transportation.		
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## 5.4 Suggested Solutions

### Objective

- Maximize recovery of wastes
- Ensure proper management of residual wastes

### Key policy actions to achieve objectives

- Establish legal responsibility of generator to ensure proper management of wastes
- Introduce tracking systems to ensure disposal of wastes at licensed facilities (and not at an unregulated, intermediate location).

## 5.5 Financing and Cost Recovery

Preliminary (estimated) capital cost of about 10.3 million EGP.

### Cost recovery

#### Who pays?

Waste Producer

#### Cost recovery mechanism

- Payment to service provider against invoice for service
- Fees paid to owner of treatment/disposal facilities based on quantity of waste treated/disposed. Waste management costs included in cost of development projects.

## 5.6 Action Plan

No	Action	Responsibility	Assiut Governorate																				
			2018			2019			2020			2021			2022								
1	Establish regulatory standards, and amend legal framework to require waste tracking	WMRA	■	■	■																		
2	Design waste tracking system tools	WMRA, EEAA, SWMU			■	■	■																
3	Implement waste tracking system	SWMU					■	■	■														
4	Monitor waste tracking system	EEAA, SWMU								■	■	■	■	■	■	■	■	■	■	■	■	■	■
5	Capacity building	MWRA, SWMU	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

As far as possible, non-hazardous industrial wastes should be recovered in order to capture material and energy of the waste. Traditionally, the following options may be considered:

- Recycling
- Composting
- Energy recovery

Uses for various types of non-hazardous industrial wastes have been identified in recent years, and relevant aspects are addressed below, together with the disposal of residual materials.

### Traditional Options for Recovery of Non-Hazardous Industrial Wastes

#### Recycling

Many waste materials that are generated by industry are similar to those that are generated by households, and can be recycled in similar ways. Cardboard, paper, metals, glass and plastics, for example, can all be recycled through the same infrastructure that is used to recycle these materials from households. Industries may however generate larger quantities of these materials. Therefore, these materials should be separated at source by the industry.

#### Composting

Organic materials that are generated by the industry may be suitable for composting. Sugar processing industries – in particular – generate large quantities of organic material that is suitable for composting. These materials should be separated at source.

#### Energy Recovery

Combustible materials may be recovered for their energy value. This may be an attractive option for combustible materials that do not have sufficient value in the recycling market. The most common opportunities for the recovery of materials for energy value include low value plastics (e.g. film plastics) and low-grade paper/cardboard.

### **Recent Relevant Initiatives**

Recent relevant initiatives for the reutilization of specific non-hazardous industrial wastes include the following:

#### **Sugarcane Waste**

The waste from sugarcane processing may be palletized and sold as animal feed. However, a recent innovation exploits the cellular structure of sugarcane (including sugarcane waste) to create a cellulosic product that is characterized by both high strength and high viscosity.

The product is used in the manufacture of items as varied as paint, cosmetics, composite materials in the aerospace sector, and concrete.

#### **Disposal of Non-Hazardous Industrial Wastes**

Non-hazardous industrial wastes may be disposed of in the same disposal facilities as municipal wastes.

## **6 HAZARDOUS INDUSTRIAL WASTES**

### **6.1 Status Quo**

Hazardous industrial waste quantities vary widely according to the different types of industry.

Sufficient data has not been available to estimate non-hazardous waste generation by the industry within the time frame for this document.

There is some information on the industrial hazardous waste generated in Alexandria and the 10<sup>th</sup> of Ramadan Industrial Zone, but there is no credible information available from other industrial zones. Moreover, there is a general absence of information regarding treatment and disposal practices.

Close to 50% of all industrial activity is concentrated in the Greater Cairo area, with an estimated industrial hazardous waste generation of around 80,000 tonnes per year; approximately 40% in Alexandria, and the remainder in the Delta/Upper Egypt, with an estimated industrial hazardous waste generation of around 30,000 tonnes per year, and estimated industrial hazardous waste generation of around 1,500 tonnes per year in Assiut.

Weaknesses in monitoring and enforcement mean that industry is able to manage waste as it wishes, often without any concerns about the occupational, health and safety and environmental consequences. Industry acts with impunity because the penalties are very low (much lower than the cost of investing in compliance).

EEAA inspectors have no direct authority to withdraw a license; rather they may issue a fine and an inspection report with all non-conformities via the EEAA General Director to the competent licensing authority, which is then free to decide whether or not to take action. EEAA also sends the inspection report with all non-compliances to the respective industry who again may or may not take compliance action. In practice, the monitoring and enforcement system does not actually deliver meaningful sanctions that are taken seriously by industry.

Technically, there are no standards and thresholds for hazardous waste, which means that regardless of the concentration of a certain hazardous component, the whole amount of waste is regarded as hazardous. Therefore, the systems for monitoring and control lack technical specificity, as well as professional capacity, resources and meaningful sanctions.

### **6.2 Health and Environmental Impacts**

Health, environmental, and other problems may arise from the contamination of land where hazardous wastes are deposited; there is a high potential for widespread contamination of surface water and groundwater. There is also a high potential for severe public health impacts when people are in contact with hazardous wastes.

Main barriers to improved management of hazardous waste are an inadequate legal framework, inadequate accountability of stakeholders, insufficiently developed institutional framework, lack of monitorable/enforceable controls, absence of sector strategy, insufficient treatment facilities, lack of capacity.

### 6.3 Roles and Responsibilities

This chapter covers institutional roles and responsibilities to achieve objective, administrative capacity needs and capacity development requirements. Table 6-1 shows the roles and responsibilities for the related entities.

Table 6-1: Roles and responsibilities

Entity	Roles and responsibilities	Administrative capacity needs	Capacity development priorities
<b>Waste Management Regulatory Agency (WMRA)</b>	Develop/adopt an enhanced legal framework.	Application of the waste hierarchy, sector strategy development.	Sector policy and legal options. Lessons learned elsewhere.
<b>Egyptian Environmental Affairs Agency (EEAA)</b>	Monitor and enforce legislation. Follow up on the EIA approval issued for the transportation and disposal entities.	Hazardous waste monitoring and tracking. Sector education and enforcement strategies.	Hazardous waste management facility planning. Design/implementation of monitoring/tracking systems. Education and enforcement.
<b>Governorate (SWMU)</b>	Encourage the private sector to process and treat hazardous industrial waste. Support the implementation of hazardous waste collection/storage systems.	Monitoring local priorities for hazardous waste management. Hazardous waste emergency response plan.	Hazardous waste monitoring. Emergency plan preparation and implementation readiness.
<b>Private Sector</b>	<b>Generators:</b> Ensure proper management of hazardous wastes. <b>Facility Operators:</b> Invest in/operate treatment facilities.	Reporting to regulatory entities. Financial management to ensure environmental security of operations.	Certification of proper operation of facilities. Monitoring and reporting of operations.

### 6.4 Suggested Solutions

#### Objective

Recovery of material and energy value where feasible; environmentally safe disposal of remaining materials; ensure proper management of residual wastes.

#### Key policy actions to achieve objectives

Enhanced legal framework that assigns enforceable responsibilities to stakeholders.

## 6.5 Financing and Cost Recovery

Preliminary (estimated) capital cost of about 10.3 million EGP.

### Cost recovery

#### Who pays?

Waste Producer

#### Cost recovery mechanism

Fee for service

## 6.6 Action Plan

No	Action	Responsibility	Assiut Governorate																				
			2018			2019			2020			2021			2022								
1	Develop sector strategy	WMRA, MoI	■	■	■																		
2	Develop enhanced regulatory framework	WMRA			■	■	■																
3	Strengthen institutional framework	WMRA, EEAA				■	■	■															
4	Prepare emergency response plan	EEAA, SWMU				■	■																
5	Monitor waste tracking system	EEAA, SWMU						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
6	Capacity building	MWRA	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■



## **7 OTHER SPECIFIC PRIORITY WASTES**

### **7-1 E-WASTE**

Some efforts have been made in recent years to kick start professional waste management and recycling systems, and to recover valuable metals like platinum, indium etc., but these are in their infancy and face significant hurdles. Information regarding e-waste is scarce. In addition to a lack of data on quantities and types of e-waste generated, other problems facing e-waste management include lack of legal framework, placing responsibilities on producers of electronic goods placed on the Egyptian market, and a lack of consumer awareness of the environmental impacts of these wastes.

### **7-2 TIRES**

It is estimated that around 210,000 tonnes of used tires are generated annually in Egypt. This amounts to over 5 million waste tires. Management practices consist of re-treading, burning to recover the metal wire, recycling and use as alternative fuel. Approximately 100,000 tonnes of tires, just under 50% of the total, are unaccounted for. Large generators tend to sell used tires in public auctions. In these auctions, industry operators tend to only succeed in buying tires that cannot be reused or retreaded as the Informal Recycling Sector (IRS) offers a better price to get all the waste and further sells the low-quality tires to the recycling industry. There are no standards for tires that can be reused or retreaded, leading to accidents caused by low quality products sold especially by the IRS. Export duties restrict the export of scrap metal wires.

## Annex

### Annex 1-1: AMC / PMU comments (with replies)

**Table 1 Compatibility with Terms of Reference (ToR) – Strategic MP for other wastes/ Assiut**

Key Requirements of the ToR	AMC-Remarks	PCI - Replies
Approximate assessment of the types and amounts of the different waste streams generated in the Governorate	Identified waste types and their annual amount: <ul style="list-style-type: none"> <li>• Agricultural wastes: 409,000 t/a</li> <li>• Healthcare wastes: 1,596 t/a</li> <li>• Construction and demolition wastes: N/A</li> <li>• Non-hazardous industrial wastes: N/A</li> <li>• Hazardous industrial wastes: N/A</li> </ul>	Strategic Master Plans for other wastes have been updated, including estimated figures for non-hazardous and hazardous waste. See chapters 5 and 6
Sketch of possible conceptual and technical options on how to deal with the different waste streams (how, who, with which means)	Done	No Reply
Preparation of generic form sheets outlining required framework conditions for the sustainable implementation and operation of suitable technologies	Done	No Reply
SWM policy & legal framework	Done	No Reply
Proposed institutional set-up and responsibility split on national, Governorate and local level	Done	No Reply
Needed administrative capacities for management and supervision	Done	No Reply

Required institutions and capacity development	Done	No Reply
Suitable technical and conceptual solutions	Done	No Reply
Rough estimates of cost	Done	No Reply
Financing of investments	Done	No Reply
Bearer of running cost and suitable cost	Done	No Reply
Presentation of the required decisions on	Done	No Reply

**Annex 1-1: AMC / PMU comments (with replies)**

**Table 2 Suitability and comprehensibility of the content - Assiut**

Review Criteria	AMC-Remarks	PCI -Replies
Clear description of the objectives of the report and its place within the entire project	OK	No Reply
Clear description and analysis of the problem/ central issue	<p>Only five waste types have been considered for the master plan. Further specific waste types most probably generated in the Governorate are missing:</p> <ul style="list-style-type: none"> <li>Hazardous household waste</li> <li>Waste tires</li> <li>Bulky waste</li> <li>Waste electrical and electronic equipment</li> <li>Sludge from waste water treatment</li> <li>Slaughterhouse waste</li> </ul>	Strategic Master Plan for other wastes haven been updated including estimated figures for those type of wastes mentioned in the AMC comments. See chapter 7
Clear description and assessment of options available for the solution of problems	OK	No Reply