Egyptian Company for Solid Waste Recycling (ECARU)

Environmental Management Plan for 15th of May Compost Plant

Report

Prepared by:

Environics

Management of Environmental Systems

April 2007
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Executive Summary

1. Background

The Egyptian Company for Solid Waste Recycling (ECARU) was awarded the landfilling and processing services contract for the Cairo Southern Zone. The contract included the operation of two composting facilities, one with a capacity of 960 tones/day and the other at a capacity of 640 tones/day, with a total capacity of 1600 tones/day.

ECARU applied to the Carbon Finance Business development Unit (CFBU) for receiving carbon credits as an operator of “landfilling and processing services for southern zone project” in Cairo. In order to proceed with this project, the present Environmental Management Plan (EMP) for the composting facility has been prepared for submittal to the World Bank (WB).

2. Project Description

The composting facility is an integrated component of a project aiming at the management of 2000 tones of solid waste per day. Of this amount, approximately 1500 tones/day, comprising commingled residential and commercial waste materials, are directed to the composting facility for processing and recycling. Only rejects or overflows of the composting facility are directed to the neighboring landfill.

2.1 Site Location

The current site is adjacent to the landfill and far from urban populations and from surface water resources. The site is bounded by relatively large, vacant areas of land to the North, South and East, and by the landfill to the West. The closest activities, aside of the landfill, include El-Koumia Cement company about 500 m to the south and a Cement and Brick production facilities beyond the Autostrad highway.

2.2 Waste Characteristics

Waste received from the South Cairo Zone is composed mainly of two categories of waste, as follows:

- Municipal Solid Wastes with a somewhat low organic matter content, usually less than 25%; and
- Inert Solid Wastes consisting of demolition and construction debris, in addition to a minor part of industrial non-hazardous wastes.

2.3 Composting Facility Components

The 15th of May composting facility includes two composting plants, one with a capacity of 960 tones/day and the other at a capacity of 640 tones/day, with a total capacity of 1600 tones/day.
2.4 Process Description

The facility utilizes the windrow composting technology. The composting process includes the following phases:

- Waste Receiving;
- Sorting of Recyclables;
- Baling of Non-organic Recyclables;
- Treatment of Organic Material by Biological Aerobic process;
- Preparation of the Final Product.

Utilized equipment include receiving and sorting equipment, composting and packaging equipment and handling equipment.

2.5 Workforce

The facility workforce is composed of 220 persons. Of these, 175 are resident at the facility, where suitable accommodation and meals are provided. The site also includes recreational spaces such as a football field.

3. Baseline Environmental Conditions

It includes a description of the main physical, biological and social components at the project area and environs.

3.1 Physical Environment

Climate
The annual mean air temperature is about 19.9 °C and the average annual relative humidity is about 68%. Rainfall is very limited. The average annual rainfall is about 25.5 mm. The dominant winds over the year are with a northern component with an annual mean velocity of 12.27 km/h.

Ambient Air Quality
TSP and PM$_{10}$ recorded levels in the area were found to exceed the guideline limits set by Law 4/1994. Impacts on air quality at the study area are thought to be the result of ongoing industrial activities rather than meteorological conditions.

Noise
Baseline noise measurements were below limits set in the executive regulations 338/1995 of Law 4/94 for day time noise levels in industrial areas.

Regional Topography
The ground surface elevation varies between 75 m above mean sea level in the southeast to 45 m in the western side of the study area.

Groundwater
The limestone formations of the area do not connect to a groundwater aquifer and the proposed site is located beyond the Greater Cairo region aquifer area.
Geomorphology
Geomorphologically, Helwan area and its vicinities consist of five geomorphic units. Those are the structural plateau, the structural plain, the Piedmont plain, the flood plain and the drainage lines.

At the project area, a horizontal plateau (18-21 m high) runs in the median of the area, extending west to east. The plateau is characterized by its extensively eroded horizontal surfaces.

Soils and Geology
The area encompasses two facies, namely; the Cairo facies and the Helwan facies. At the landfill area, the Cairo facies maintains the following formations:

- Mokattem Formations form the lower bed stone and consist of yellowish white limestone and dilomitic limestone;
- Maadi formations form both the intermediate and upper bed layers.

3.2 Biological Environment

The project is located in the Northern Eastern Desert Eocene Plateau, which is that part of the inland desert contiguous to the northern sector of the Nile Valley.

The area is generally composed of a sandy and gravel soil typical of the northwestern Eastern Desert. These habitats are generally poor in species and, overall, the habitats at the site are devoid of any outstanding or unique landscape features

Flora and Fauna

Very few scattered shrubs are present in the environs of the composting plant and landfill, mainly Zilla spinosa and Zygophyllum spp. Invertebrates, rodents and lizards are probably the most numerous animals. Few numbers of birds were also noticed. Avifauna of the area is most likely a mix of desert and Nile Valley species.

The main biodiversity present or expected to be found at the composting site is represented by pest and opportunistic species attracted by the presence of organic waste, such as rats and mice, insects and birds

The area has minimal importance biodiversity. The habitats and species found in the area are widespread in the deserts of Egypt. There are no protected areas near the project site.

3.3 Socio-economic Environment

The composting plant falls at the Southern zone of the Cairo Governorate boundaries. The closest urban activities occur at the 15th May City which is approximately 3.1 Km to the North of the area. For the exception of two
cement facilities west of the site and the composting facilities east of the site, no populations or activities occur near or at the proposed area.

15th of May City
The 15th of May City is one of the first generation urban cities established in 1978 by the Ministry of Housing and New Urban Communities, mainly to accommodate workers at the Helwan industrial zone. The city was developed in accordance to the National Strategy for desert development and construction of new urban communities outside the Nile valley and its Delta. This strategy aimed at geographical spreading of population by attraction of populates and services away from the Nile valley. A thorough description of the city is presented in the current study.

4. Project Alternatives

The “no development” alternative is not recommended because it would mean closing the facility, thus creating jobless conditions, and disposal of waste, including its organic content, without treatment in the landfill.

The facility is already operational and its location is adjacent to the landfill and far from urban populations and from surface water resources. It is well connected by the existing road network to the South Cairo Zone.

Alternative process technologies include In-vessel Composting, Aerated Static Pile Composting or Tunnel Composting. Windrow composting technology was selected by ECARU according to various aspects:
- Availability of large areas of land which is ideally suitable for composting of large volumes.
- Simplicity of the windrow composting technology, which does not require sophisticated equipment.
- Provision of work opportunities as this method is much dependent on manual labor assistance.
- Climate conditions are suitable for aerobic composting technologies.

5. Environmental Impacts and Mitigation Measures

Potential impacts anticipated from the operation of the composting facility in hand were identified based on the analysis of the project’s components and activities, baseline data and literature review.

The project reflects a number of positive impacts, including:
- Income and employment;
- Waste valorization;
- Reduction of greenhouse gas emissions;
- Public health.

The composting site and its neighboring area does not attain the following components. Therefore, they have been excluded from the assessment as irrelevant impacts:
- Groundwater resources
- Surface water resources
- Cultural and archaeological significance
- Protected areas and biodiversity importance

A set of negative impacts has been identified, analyzed and evaluated to assign significance levels to these impacts. Evaluation criteria included magnitude, spatial and temporal extent as well as receptor importance and size. Accordingly, negative impacts were divided into insignificant and significant impacts.

Insignificant impacts included:
- Impacts on terrestrial habitats, flora and fauna;
- Impacts on soil quality; and
- Impacts on local communities.

Significant impacts included:
- Visual impacts;
- Air quality (including dust and gaseous emissions);
- Odors;
- Litter;
- Noise;
- Airborne micro-organisms and bioaerosols;
- Pests;
- Health and safety.

To mitigate the above-mentioned impacts the following measures should be implemented:
- Maintenance of a green belt around the site;
- Cleaning and washing vehicles;
- Cleaning roads and operational areas;
- Maintenance of vehicles;
- Restrict vehicle transport to assigned roads;
- Restrict unnecessary early star-up of engines;
- Cover loads of incoming material;
- Control of delivered feedstock;
- Watering and wetting of compost to avoid dust emissions and maintain humidity;
- Good practice procedures to prevent anaerobic conditions;
- Inspection and maintenance of machinery;
- Incorporate a drainage layer at the base of windrow;
- Fencing the whole site perimeter;
- Collecting scattered litter;
- Supply protective equipment to workers;
- Availability of environmentally safe biocides;
- Provide adequate ventilation in the working environment;
- Provide first aid kits;
- Provide suitable storage to flammable and dangerous materials;
- Prepare a fire fighting plan;
- Provide suitable training to the workforce.
The main sources of impact of the environment on the project are mainly represented by natural air-borne dusts (due to the desertic nature of the area) as well as dusts generated from cement companies.

6. Management and Monitoring Plans

It is the responsibility of the company to assure that operation activities are conducted in a manner which would minimize the potential impacts on the environment and public health of the workers. The facility includes a Health, Safety and Environmental Department. The department is concerned with the staff preventive health, environmental protection, ensuring staff safety against injuries and accidents, and the site against fire and disasters. The department is composed of three divisions, namely the Health, Safety and Environmental Divisions.

6.1 Environmental Management Techniques

The main management techniques required to minimize major impacts, prevent accidents and ensure a good operation of the facility can be divided as follows:
- Minimizing amenity impacts
- Minimizing noise
- Pest management
- Fire management

6.2 Emergency Response Plan

Solid waste management projects need to incorporate safeguards against hazards, which could expose workforce to danger, interrupt the facility operations, or create abnormal pollution problems. Plans have developed to face the following emergency situations.
- Fire;
- Gas emissions and odors due to chemical reactions;
- Explosion of unidentified materials;
- Heavy rains and flash floods;
- Breaking into the site for theft or collecting waste and/or recyclables.

6.3 Monitoring

The monitoring program provides information for periodic review and adjustment of the environmental management plan, as necessary, to ensure that environmental protection is achieved through early detection of negative impacts. According to law 4/1994, establishments should maintain an environmental register to track all the environmental aspects of their activities. The environmental register will contain all self-monitoring results.

The following table presents the proposed monitoring measures, the criteria/indicators to be monitored and the frequency of monitoring. All costs will incurred by the company.
### Monitoring Measures

<table>
<thead>
<tr>
<th>Monitoring Measures</th>
<th>Criteria/Indicators to be Monitored</th>
<th>Frequency of Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air quality</td>
<td>PM$_{10}$ and TSP</td>
<td>24 hour monitoring, twice a year</td>
</tr>
<tr>
<td>Noise</td>
<td>Noise intensity db(A)</td>
<td>Monthly (Ambient air)</td>
</tr>
<tr>
<td>Terrestrial life</td>
<td>Changes in species composition of the area</td>
<td>Annual</td>
</tr>
<tr>
<td></td>
<td>Type and number of pests</td>
<td>Every three months</td>
</tr>
<tr>
<td>Workers’ health and safety</td>
<td>Medical visual inspection</td>
<td>Monthly</td>
</tr>
<tr>
<td></td>
<td>Medical check-up</td>
<td>Twice a year</td>
</tr>
<tr>
<td></td>
<td>Expiry date of medicines</td>
<td>Each time a medicine is prescribed; Monthly (all stock)</td>
</tr>
<tr>
<td></td>
<td>Expiry date of food</td>
<td>Daily</td>
</tr>
<tr>
<td></td>
<td>Efficiency of safety equipment</td>
<td>Monthly</td>
</tr>
</tbody>
</table>

### 6.4 Staffing and Training

Staffing levels should be high enough to ensure that the facility can comply at all times with all provisions of the environmental protection approval issued by the EEAA. Training of staffing is important to ensure proper implementation and monitoring of mitigation measures. Accordingly, the training plans should be developed in accordance with the management and monitoring programs of the present study.

### 7. Public Consultation and Disclosure

Public consultation in the form of scoping meetings has been conducted on an individual basis with the different stakeholders. These meetings aimed at providing a better understanding for the study requirements, main constraints and concerns and identifying other important stakeholders for that type of development.

Disclosure would include posting an advertisement in the newspaper stating that the EIA/EMP is available at the company headquarter for whoever is interested. The company would assign a person responsible for meeting interested people and providing them with all the requested information.
1. **Introduction**

This section presents a brief description of the proposed project and the purpose of its intended development. It also describes the scope and objective and methodology adopted for the completion of this study.

1.1 **Background**

The government of Egypt has, during the last years, issued Prime Minister Decree for the privatization of the solid waste management sector in the country. The privatization started with Alexandria governorate and expanded to cover Cairo, Giza and several other governorates. In Cairo, the Cairo Cleaning and Beautifying Authority (CCBA) is responsible for the solid waste management system in the governorate. As a result CCBA represents the Cairo governorate to contract the new solid waste system.

The Cairo Governorate, which generates 10000 tones of municipal solid waste per day, has been divided into four zones, namely; North, South, East and West. Three zones (North, East and West) have undergone the privatization plan, three international tenders were organized and three contracts were signed between the Cairo Governorate, represented by CCBA, and the awarded companies. Each of the awarded companies was obliged by the contract to perform all solid waste management activities, i.e. collection, transportation, treatment and disposal.

After two years of performance level monitoring of the three operating companies, the governorate divided the Southern Zone activities into three contracts, one for collection and transportation of wastes, the second for landfilling and processing of wastes and the third for medical waste treatment. The governorate saved the opportunity for local companies to compete with international companies for project awarding. The Egyptian Company for Solid Waste Recycling (ECARU) was awarded the landfilling and processing services contract. The contract was signed on 19/6/2004, was officially effective on 1/12/2004 and included the following:

1. Operation of two composting facilities, one with a capacity 960 tones/day and the other at capacity of 640 tones/day, with a total capacity of 1600 tones/day


Under an agreement between ECARU and Cairo Governorate, as represented by CCBA, CCBA is responsible for collection and transport of solid waste, while ECARU is responsible for processing and final disposal of the collected waste.

An EIA for the 15th of May Landfill has been prepared in October 2006 and presented to the EEAA. The project was approved on 25 December 2006.
The composting plant was operational before the construction and operation of the landfill. It was listed as an intermediate project (Category B) in accordance to both the EEAA and the WB classifications. According to the EEAA requirements, Form B was filled and presented to the EEAA. The project was approved by the EEAA in September 2005 (Annex A).

ECARU applied to the Carbon Finance Business development Unit (CFBU) for receiving carbon credits as an operator of “landfilling and processing services for southern zone project” in Cairo. In order to proceed with this project, ECARU prepared and submitted to the World Bank (WB) an Environmental Management Plan (EMP) for the composting facility.

After the WB review of the draft EMP, different comments were raised. Accordingly, ECARU has requested Environics to review the EMP and the WB comments, in order to update the EMP for the composting plant to cover the WB requirements.

### Purpose of the Project

#### Integrated Waste Management

For years Cairo has been suffering from a malfunctioning solid waste system which depended mainly on efforts of CCBA, usually limited because of lack of funding, as well as some of the traditional zabaleen who are licensed by the authority.

The privatization of the solid waste system is a key stone towards reaching an integrated environmentally sound solid waste management system. As depicted by the Cairo Governorate, the proposed composting facility aims at the safe treatment of solid wastes collected from South Cairo Zone, which encompasses the following 8 districts;

- El-Sayeddah;
- El-Khalifah (including Mokattem area);
- Masr El-Kadeemah;
- El-Basateen (including Dar El-Salam);
- Maadi (including Torah);
- Helwan (including Maa'sara);
- 15th May City; and,
- Tebbin.

Composting forms an important part of a comprehensive, integrated waste management system that emphasizes resource conservation through source reduction, recycling and reuse. It is also complementary to other parts of an integrated waste management system, including landfilling.

Waste management aims at:
- Reducing the amount of waste that society produces;
- Making best use of the waste that is produced; and
Choosing waste management practices which minimize the risks of harm to human health and of immediate and future damage to or pollution of the environment.

Moreover, waste sorting and composting, as part of the integrated waste management system, is an important means of generating revenue from a source that, otherwise, would be lost.

Eligibility to Clean Development Mechanism

Decomposition of organics in the absence of oxygen yields biogas, a mixture of approximately 65% methane and 35% carbon dioxide (Mata-Alvarez, 2003).

Accordingly, methane is one of the targeted gases by the Kyoto Protocol. By lowering the methane emissions, the project would be eligible to be registered as “Clean Development Mechanism (CDM). Therefore, an important objective of the project is to reduce the organic contents of the waste to be landfilled, hence decreasing biogas emissions.

According to the contract with Cairo Governorate, 20% of the waste should be composted and the rest should go to the landfill, thus generating methane from anaerobic decomposition.

To be eligible for CDM, the project aims at composting 100% of the organic content of the waste, thus significantly reducing methane emissions that would have been generated from anaerobic decomposition. As, CH₄ has 21 times the warming potential of CO₂, hence it is measured as “CO₂ equivalent”. ECARU would get Certified Emission Reductions (CER) for each ton of reduced CO₂ equivalent. The CERs are internationally marketable.

Scope of the Report

According to previous contacts for a similar project (EIA for a composting plant in Saudi Arabia), the WB proposed the following Table of Contents for the EMP (email of Dr Ahmed K. Mostafa, on 14 December 2006):

- Introduction
- Project description
- Brief description of alternatives
- Description of the environment likely to be affected by the project
- Environmental Management Plan, to include expected impacts, mitigation measures and monitoring activities
- Consultation and disclosure

The WB emphasized on the fact that they would be particularly interested in the socio-economic issues and affected population, in addition to public consultation in the form of scoping meetings with the different stakeholders.
Review of the EMP prepared by ECARU showed that it did not include the following WB requirements:
- Description of the project environment
- Description of alternatives
- Consultation and disclosure

Moreover, the impact assessment section, related mitigation measures and the monitoring plan were not well defined and did not include the level of details requested by the WB.

Therefore, the scope of the present report is the preparation of an EMP covering the WB requirements, to include the missing sections and update the incomplete sections. The EMP was also restructured to follow the format proposed by the WB.

Accordingly, a full description of the baseline information of the site including the physical, biological as well as social environments is included. A “scoping” exercise that involved bringing together all generic impacts related to the project in relation to details of the project and of the receiving environment was carried out. Analyses of these data result in the exclusion of some irrelevant impacts and in the identification of project-specific impacts. Significant impacts are then identified and thoroughly investigated together with measures to mitigate potential negative impacts. A monitoring plan was designed to ensure proper environmental performance.

Special emphasis was given to Public Consultation, in the form of scoping meetings with the different stakeholders, which is one of the main WB requirements. On the other hand, a public disclosure meeting was not requested, unless contentious issues arise. Accordingly, the latter activity is not included within the scope of the present report.

Objective of the Report

The objective of the present EMP is to identify the impacts of the project on the environment and vice-versa and, if needed, mitigate these impacts with appropriate mitigation measures. Moreover, the EMP aims at maintaining an appropriate environmental performance and insure that all impacts are effectively controlled. Accordingly, it includes a set of mitigation, monitoring and institutional measures to be taken into consideration during operation of the composting plant to eliminate adverse environmental and social impacts, offset them or reduce them to acceptable levels. Further, the EMP is also intended to satisfy the environmental requirements according to the World Bank guidelines.

Methodology

The World Bank requirements were followed for the completion of this study. The study encompassed both desktop studies and field surveys, as follows:
Literature Review, Data Collection and Review of Baseline Information

This was conducted in order to characterize the existing environmental and socio-economic settings within which the project operates and may potentially impact.

In this report the environment is characterized under the broad headings: the physical, biological, and socio-economic components.

The physical environment included climatic data from the nearest, relevant meteorological stations, reviews of soil geological, geomorphological and seismic conditions, a description of the surface water and groundwater hydrology of the project area and surrounds, ambient air quality of the project area and its air shed and ambient noise levels.

Biological environment included flora, fauna and the presence of sensitive or otherwise valuable habitats.

The social environment included a description of land use, adjacent communities (15th of May City), community structure, employment, affected communities, customs and livelihood, etc.

The baseline data are very recent and were obtained from the EIA for 15th of May Landfill (Environics, 2006), which is adjacent to the composting plant and is part of the integrated waste management system.

Relevant Environmental Laws and Regulations Compilation

The relevant laws and regulations that the project should abide by were compiled and analyzed to identify the framework of the development.

Process Description

This included a study of the components and activities associated with the sorting and composting facilities. These components as well as the production process are described in detail in Section 2 of this report.

Site visit

These included a reconnaissance visit to the project site to identify specific sensitivities that should be thoroughly studied on a more detailed level.

Interviews and Scoping Meetings

Meetings with different stakeholders were conducted on individual basis (including municipality, concerned agencies, local communities,
etc). These meetings aimed at providing a better understanding of the study requirements, and identifying key stakeholders for that type of development. They also assisted in the understanding of the potentialities and constraints of the study area.

- **Assessment of Potential Impacts**

Based on the thorough examination of the baseline information as well as the components of the project, the environmental aspects of the project and associated impacts were identified for the operation and post-closure phases of the project. Impacts of the environment on the project were also identified.

The identified impacts were analyzed to assess the significance of positive and negative impacts and were further classified as irrelevant, insignificant or significant impacts. Mitigation measures were devised for significant impacts.

- **Management and Monitoring Plan**

The basic principles for the management plan for operation of the facility were formulated in order to maintain an appropriate environmental performance and insure that all impacts are effectively controlled. It consists of a set of mitigation, monitoring and institutional measures to be taken into consideration during operation of the composting plant to eliminate adverse environmental and social impacts, offset them or reduce them to acceptable levels. The plan also includes the actions needed to be taken to implement these measures.


7. **Legislative and Regulatory Considerations**

Law 4/1994 and its executive regulations set forth the overall framework for the protection of the environment. According to this law, the site chosen for any project should be appropriate to its activity and an environmental impact assessment (EIA) should be prepared with the application for license of a project.

According to the EEAA Guidelines for Egyptian Environmental Impact Assessment (1996), the project falls within Category “B” which requires the fulfillment of Form B. The form was submitted to the Competent Administration Authority (CAA), Cairo Cleaning and Beautifying Authority (CCBA), as a representative of Cairo Governorate. CCBA sent the form to the EEAA for its review. The EEAA approved the project in September 2005.

Following are the laws and regulations relevant to this development.

7.1 **Site Location**

Based on the executive regulations of law 4/1994 amended by decree 1741 for 2005 (29 October 2005), Article 38 identifies the site requirements and the necessary approvals. It stipulates that local bodies, in agreement with EEAA, shall allocate places where solid garbage shall be dumped, treated or burned according to the provisions of this article.

The article stipulates that locations assigned to receive waste shall be at a minimum distance of 1.5 kilometers from residential areas and at a lower contour level.

Article 39 gives requirements concerning collection and transportation of garbage and solid waste.

7.2 **Noise**

Article 42 of law 4/1994 and article 44 of its executive regulations give the maximum allowable limits for sound intensity.

7.3 **Air Quality**

Article 36 of law 4/1994 and article 37 of the executive regulations give the maximum allowable limits for pollutants in exhaust gases from machines, engines and vehicles.

Article 35 of law 4/1994 and article 34 of the executive regulations give the maximum allowable limits for ambient air pollutants.

Article 40 of law 4/1994 and article of its executive regulations give the maximum allowable limits for the concentrations of pollutants resulting from burning of fuels.
Work Environment

Article 43 of law 4/1994 identifies the necessary precautions to ensure a safe and healthy work environment.

Record Keeping

Article 22 of law 4/1994 stipulates that the owners of establishments shall keep written records of the environmental impact of their establishment’s activities (Environmental Register).
Project Description

The composting facility is an integrated component of a project aiming at the management of 2000 tones of solid waste per day. Of this amount, approximately 1500 tones/day, comprising commingled residential and commercial waste materials, are directed to the composting facility for processing and recycling. Only rejects or overflows of the composting facility are directed to the neighboring landfill. The remaining amount, 500 tones/day, comprise inert industrial and demolition wastes that are directly conveyed for disposal. Neither the composting facility nor the landfill accept any hazardous, liquid, medical, chemical, flammable, explosive or radioactive wastes.

Waste collection and transportation is conducted by the Cairo Cleaning and Beautifying Authority (CCBA); as such, is not addressed in this study.

Being an integrated component of a larger solid waste management project, the basic objective of the proposed project is to:

“Maximizing Waste Recycling Minimizing Landfilling”

Waste recycling/processing reduces the quantity of materials requiring disposal, as well as, reduces the organic content of these materials. As such, minimal quantities of leachate and landfill gases are generated.

Site Location

The current site (Figure 3.1) fulfills the EEAA requirements, as well as contractual requirements. It is adjacent to the landfill and far from urban populations and from surface water resources.

The site is bounded by relatively large, vacant areas of land to the North, South and East, and by the landfill to the West. The closest activities, aside of the landfill, include:

- El-Koumia Cement company loading belt, located about 500 m to the south; and,
- A Cement and Brick production facilities fall to the west beyond the Autostrad highway.
Figure 3.1: Satellite image showing the location of the composting plant and main landscape components
Waste Characteristics

Table 3.1 presents actual recorded waste quantity and composition data obtained from 18 months of practical operation of both the composting facilities and the temporary landfill (used before construction and operation of the current landfill). Analysis of this data indicates that wastes received from the South Cairo Zone is composed mainly of two categories of waste, as follows:

- Municipal Solid Wastes (MSW): consist of street sweeping, and commingled residential and commercial wastes. As a result of Zabalin collecting a great volume of the generated domestic wastes, MSW received were found to attain a somewhat low organic matter content, usually less than 25%.

- Inert Solid Wastes (ISW): consist of demolition and construction debris of high specific weights, in addition to a minor part of industrial non-hazardous wastes.

The two streams are treated differently. The MSW stream is directed to the composting facilities for recycling and processing. From the composting facilities, only primary screening inert wastes, presorting and fine screening rejects are directed to the landfill for disposal. On the other hand, the second waste stream (ISW) is directly disposed of at the landfill.

Based on this Normal Operation Scheme (Table 3.2, Figure 3.2), the landfill does not assimilate any fresh garbage. However, the necessity for Emergency Operation Schemes (Table 2.3) arises from the occurrence of the following conditions:

- Temporary shutdown of composting facility for maintenance or upgrade (Figure 3.3); and,

- Municipal solid waste delivered exceeds processing capacity, 1600 tones/day, of the composting facility (Figure 3.4).

The landfill design criteria encompasses environmentally sustainable disposal of received wastes under normal and emergency operation conditions. Two types of disposal cells, namely; Type A and Type B cells have been designed for the assimilation of wastes as follows:

Type A Cells: These have been designed for the assimilation of all non-fresh garbage waste materials (i.e., inert waste and waste rejected from the composting process).

Type B Cell: These are used under emergency cases for the disposal of fresh garbage with an appreciable amount of organic matter content.
Table 3.1: Waste quantity and composition data as obtained from 18 months of operations (Source: ECARU, July 2006)

<table>
<thead>
<tr>
<th>Month</th>
<th>Total Incoming Wastes (tones)</th>
<th>MSW to Composting (tones)</th>
<th>ISW to landfill (tones)</th>
<th>Facilities Rejects to landfill (tones)</th>
<th>Total Wastes to Landfill (tones)</th>
<th>Average Percent of Facilities Recycling (%)</th>
<th>Percent of Total wastes to landfill (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec - 2004</td>
<td>8508.08</td>
<td>6381.06</td>
<td>2127.02</td>
<td>2694.96</td>
<td>4821.98</td>
<td>75</td>
<td>57</td>
</tr>
<tr>
<td>Jan - 2005</td>
<td>13819.64</td>
<td>9138.095</td>
<td>4680.84</td>
<td>1928.47</td>
<td>6609.31</td>
<td>66</td>
<td>48</td>
</tr>
<tr>
<td>Feb - 2005</td>
<td>11492.46</td>
<td>8566.715</td>
<td>2925.745</td>
<td>3519.835</td>
<td>6445.58</td>
<td>74.5</td>
<td>56</td>
</tr>
<tr>
<td>March - 2005</td>
<td>11588.83</td>
<td>9952.58</td>
<td>1636.45</td>
<td>3952.92</td>
<td>5589.37</td>
<td>86</td>
<td>48</td>
</tr>
<tr>
<td>April - 2005</td>
<td>11655.18</td>
<td>9520.76</td>
<td>2134.42</td>
<td>4183.28</td>
<td>6317.7</td>
<td>82</td>
<td>54</td>
</tr>
<tr>
<td>May - 2005</td>
<td>13182.49</td>
<td>9658.2</td>
<td>3524.29</td>
<td>4007.86</td>
<td>7532.15</td>
<td>73</td>
<td>57</td>
</tr>
<tr>
<td>June - 2005</td>
<td>14642.86</td>
<td>11080.01</td>
<td>3562.85</td>
<td>3822.835</td>
<td>7385.685</td>
<td>76</td>
<td>50</td>
</tr>
<tr>
<td>July - 2005</td>
<td>15039.71</td>
<td>12146.785</td>
<td>2892.925</td>
<td>4260.805</td>
<td>7153.73</td>
<td>81</td>
<td>48</td>
</tr>
<tr>
<td>August - 2005</td>
<td>14405.46</td>
<td>11441.025</td>
<td>2975.38</td>
<td>4630.595</td>
<td>7605.975</td>
<td>79</td>
<td>53</td>
</tr>
<tr>
<td>Sept - 2005</td>
<td>14837.59</td>
<td>9982.385</td>
<td>4855.205</td>
<td>4348.82</td>
<td>9204.025</td>
<td>67.3</td>
<td>62</td>
</tr>
<tr>
<td>Oct - 2005</td>
<td>12082.35</td>
<td>8239.475</td>
<td>3842.875</td>
<td>3822.6</td>
<td>7665.475</td>
<td>68</td>
<td>63</td>
</tr>
<tr>
<td>Nov - 2005</td>
<td>11409.69</td>
<td>8911.93</td>
<td>2497.76</td>
<td>3729.135</td>
<td>6226.895</td>
<td>78</td>
<td>55</td>
</tr>
<tr>
<td>Dec - 2005</td>
<td>14904.17</td>
<td>10523</td>
<td>4381.165</td>
<td>4631.05</td>
<td>9012.215</td>
<td>71</td>
<td>60</td>
</tr>
<tr>
<td>Jan - 2005</td>
<td>12865.42</td>
<td>9184.76</td>
<td>3690.31</td>
<td>4221.635</td>
<td>7911.945</td>
<td>71</td>
<td>61</td>
</tr>
<tr>
<td>Feb - 2005</td>
<td>10556.51</td>
<td>8086.89</td>
<td>2469.62</td>
<td>3567.85</td>
<td>6037.47</td>
<td>77</td>
<td>57</td>
</tr>
<tr>
<td>March - 2005</td>
<td>13342.17</td>
<td>9927.37</td>
<td>3414.8</td>
<td>3666.985</td>
<td>7081.785</td>
<td>74</td>
<td>53</td>
</tr>
<tr>
<td>April - 2005</td>
<td>13219.39</td>
<td>9668.389</td>
<td>3461</td>
<td>3537.86</td>
<td>6998.86</td>
<td>74</td>
<td>53</td>
</tr>
<tr>
<td>May - 2005</td>
<td>13813.44</td>
<td>9265.745</td>
<td>4542.645</td>
<td>3790.65</td>
<td>8333.295</td>
<td>67</td>
<td>60</td>
</tr>
<tr>
<td>June - 2005</td>
<td>13797.24</td>
<td>8819.81</td>
<td>4977.43</td>
<td>3473.69</td>
<td>8451.12</td>
<td>63.9</td>
<td>61</td>
</tr>
<tr>
<td>Total</td>
<td>245162.7</td>
<td>180494.984</td>
<td>64592.73</td>
<td>71791.835</td>
<td>136384.565</td>
<td>73</td>
<td>55</td>
</tr>
</tbody>
</table>
Table 3.2: Anticipated waste composition and quantities under normal operation conditions (Source: ECARU, July 2006)

<table>
<thead>
<tr>
<th>Waste Characteristics</th>
<th>Percent Composition</th>
<th>Landfill Disposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inert Solid Waste (500 tones/day)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction/demolition wastes</td>
<td>60%</td>
<td>Landfill (Cells Type A)</td>
</tr>
<tr>
<td>Industrial non-hazardous wastes</td>
<td>40%</td>
<td>Landfill (Cells Type A)</td>
</tr>
<tr>
<td><strong>Total ISW landfilled amount</strong></td>
<td><strong>500 tones/day</strong></td>
<td></td>
</tr>
<tr>
<td>Municipal Solid Waste (1500 tones/day)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inert Wastes to Landfill</td>
<td>25%</td>
<td>Landfill (Cells Type A)</td>
</tr>
<tr>
<td>Commingled Waste to Composting facilities</td>
<td>75%</td>
<td>Composting</td>
</tr>
<tr>
<td><strong>Commingled Waste to Composting Facilities</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Organic content wastes to composting</td>
<td>50%</td>
<td>Composting</td>
</tr>
<tr>
<td>Presorted waste (Inert to Landfill)</td>
<td>35%</td>
<td>Landfill (Cells Type A)</td>
</tr>
<tr>
<td>Fine Screening rejects</td>
<td>10%</td>
<td>Landfill (Cells Type A)</td>
</tr>
<tr>
<td>Sorted Waste to Recycling</td>
<td>5%</td>
<td>Composting</td>
</tr>
<tr>
<td><strong>Total MSW landfilled amount</strong></td>
<td><strong>882 tones/day</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Overall Landfill Waste Materials</strong></td>
<td><strong>1382 tones/day</strong></td>
<td></td>
</tr>
</tbody>
</table>

Table 3.3: Anticipated waste composition and quantities under emergency operation conditions (Source: ECARU, July 2006)

<table>
<thead>
<tr>
<th>Waste Characteristics</th>
<th>Percent Composition</th>
<th>Disposal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Condition 1: Temporary Shutdown of Composting Facility</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inert Solid Waste (500 tones/day)</td>
<td>100%</td>
<td>Landfill (Cells Type A)</td>
</tr>
<tr>
<td>Municipal Solid Waste (1500 tones/day)</td>
<td>100%</td>
<td>Landfill (Cells Type B)</td>
</tr>
<tr>
<td><strong>Overall Landfill Waste Materials</strong></td>
<td><strong>2000 tones/day</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Condition 2: Exceeding Composting Capacity (1600 tones/day) by X tones/day</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inert Solid Waste (500 tones/day)</td>
<td>100%</td>
<td>Landfill (Cells Type A)</td>
</tr>
<tr>
<td>Municipal Solid Waste (1600 + X tones/day)</td>
<td>25% of 1600 tones/day</td>
<td>Landfill (Cells Type A)</td>
</tr>
<tr>
<td></td>
<td>100% of X</td>
<td>Landfill (Cells Type B)</td>
</tr>
<tr>
<td></td>
<td>75% of 1600 tones/day</td>
<td>Composting</td>
</tr>
<tr>
<td><strong>Commingled Waste to Composting Facilities</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Organic content wastes to composting</td>
<td>50%</td>
<td>Composting</td>
</tr>
<tr>
<td>Presorted waste (Inert to Landfill)</td>
<td>35%</td>
<td>Landfill (Cells Type A)</td>
</tr>
<tr>
<td>Fine Screening rejects</td>
<td>10%</td>
<td>Landfill (Cells Type A)</td>
</tr>
<tr>
<td>Sorted Waste to Recycling</td>
<td>5%</td>
<td>Composting</td>
</tr>
<tr>
<td><strong>Total MSW landfilled amount</strong></td>
<td><strong>940 + X tones/day</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Overall Landfill Waste Materials</strong></td>
<td><strong>1440 + X tones/day</strong></td>
<td></td>
</tr>
</tbody>
</table>
Figure 3.2: Waste quantity and composition scheme under normal operation conditions

Figure 3.3: Waste quantity and composition scheme under composting facility shutdown emergency condition
Wastes > 2000 tones/day

Inspection / Weighing / Directing

Over 1600 X tones/day

ISW 500 tones/day

MSW 1600 tones/day

Mixed Inert Wastes 400 tones/day

Composting Facilities 1200 tones/day

Presorted Reject 420 tones/day

Screening Rejects 120 tones/day

Landfill (Cell – A)

Figure 3.4: Waste quantity and composition scheme under exceeding composting capacity (1600 tones/day) by X tones/day
Composting Process

Composting is the aerobic, or oxygen requiring, decomposition of organic materials by micro-organisms under controlled conditions. During composting the microorganisms consume oxygen while feeding on organic matter. This generates heat, carbon dioxide and water vapor, which are released into the atmosphere. Composting reduces both the volume and mass of the raw materials while transforming them into a composted organic material.

![Composting diagram]

**Figure 3.5: The Composting process (Environment Agency, 2001)**

Composting can occur at a rapid rate when optimum conditions that encourage the growth of micro-organisms are established and maintained. The most important composting conditions are (Environment Agency, 2001):

- The raw materials should be appropriately mixed to provide nutrients needed for microbial growth and activity, which includes a balanced supply of carbon and nitrogen.
- There should be sufficient moisture to permit biological activity without hindering aeration.
- Oxygen should be at levels that support aerobic organisms.
- Temperatures should encourage active microbial activity from thermophilic microorganisms.

The rate at which materials compost and the qualities of the final composted organic material are largely dependent on the initial selection and mixing of raw materials. Many aspects of composting are highly variable and the process occurs using many materials and over a wide range of conditions.
Composting Facility Components

The 15th of May composting facility includes two composting plants, one with a capacity 960 tones/day and the other at capacity of 640 tones/day, with a total capacity of 1600 tones/day. The facility comprises the following components:

- Receiving and sorting area
- Aerobic composting windrows area
- Final product store area
- Administration and laboratory building
- Sorting building
- Service building
- Gate and security building
- Equipment shed
- Cars shed
- Electronic weigh bridge unit
- Weigh monitoring and electrical board building
- Packaging materials building
- Gates and fences
- Workshop building

A layout of the composting facility is presented in Annex B.

Process Description

The facility utilizes the windrow composting technology. A description of the process carried out at the facility, starting from the receipt of raw material and ending with the packing of the final product and disposal of refuse, is herein presented.

Phase 1: Waste Receiving

Collection trucks enter the plant after weighing (Figure 3.6) and waste is dumped onto the tipping floor (Figure 3.7).

Figure 3.6: Truck weighing
Figure 3.7: Waste unloading
Presorting of waste is carried out by four sorting laborers in order to remove the bulk materials, including:
- Rubber tires
- Batteries
- Large textile such as carpets, blankets, etc
- Cardboard sheets and boxes, which are baled.
- Agricultural residues to be milled in a hammer mill (Figures 3.8 and 3.9).

Trucks carrying hazardous waste, such as hospital, industrial, or chemical wastes are not accepted.

Loaders carry the waste to feeding conveyors (Figure 3.10).

The closed bags are torn open by a bag breaker installed on the feeding conveyor. The distance between the bag breaker knives and the feeding conveyor controls the height and, consequently, the rate of waste flow.
Phase 2: Sorting of Recyclables

1. The waste is then transferred to the sorting conveyors (Figure 3.11). Each conveyor includes 8 stations for the recyclables that are manually sorted. Each station is specialized in sorting and removing one of the following materials:
   - Plastic bags (two stations)
   - H.D. plastic bottles
   - PET bottles
   - Textiles
   - Paper and cardboard
   - Glass
   - Iron and metals

![Figure 3.11: Sorting conveyors](image)

2. A magnetic belt is installed before the last station to remove steel objects.

3. Each type of recyclables is collected and transferred by cross-recyclable conveyors to collecting rooms.

4. Aluminum and steel objects are transferred to a collecting bin, and baled by a special hydraulic baler.

5. Rejects are separated from the material by fixed Trommel screen and collected by reject collecting conveyor.

Phase 3: Baling of Non-organic Recyclables

1. Different recyclables are baled (cardboard, paper, textile, plastic bottles) in bale press, and tied in bales (80 cm X 80 cm, 50-70 cm height) (Figure 3.12).

2. Metal recyclables are pressed in a metal press in cubes of 50 cm X 50 cm, 20-25 cm height (Figure 3.13).
Phase 4: Treatment of Organic Material by Biological Aerobic process

1. The organic matter is collected from trommel screens by collecting a conveyor where post-sorting of glass and any other non-organic matter is performed. The material is then transferred by an inclined conveyor to the distributing conveyor to feed dump truck to be transferred to the windrows area.

2. Water is added while turning the windrows to keep the humidity always at 60%, a level which speeds up the digestion and maturation.

3. The windrows (Figure 3.14 and 3.15) are turned twice a week by special turning machines to provide the oxygen necessary for the digestion process, as well as to mill and increase the homogeneity of the residues to expand area exposed to microbe digestion.

Figure 3.14: Windrows
Phase 5: Preparation of the Final Product

1. Skid steer loaders feed compost to the screening units where fine products are separated (Figure 3.16).

2. Fine compost is packed in sacks or sold as bulky.

3. The part of over size refuse is added once more to the windrows as it works as an initiator and activator to the compost and the remaining is transferred to the landfill.

4. The periodic analysis is run during to the fermentation and maturation phases to ensure the quality of the compost.

5. The remaining reject is transferred to the landfill (Figure 3.17).

Utilized Equipment

Receiving and Sorting Equipment

Equipment used for feeding, slicing, screening and baling MSW are presented in the following table (Table 3.4):
Table 3.4: Receiving and sorting equipment

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Facility 40 ton / hr</th>
<th>Facility 60 ton / hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weighbridge</td>
<td>WB2</td>
<td>2</td>
</tr>
<tr>
<td>Feeding conveyor</td>
<td>IC2A</td>
<td>3</td>
</tr>
<tr>
<td>Bag breaker</td>
<td>SL2A</td>
<td>3</td>
</tr>
<tr>
<td>Sorting conveyor</td>
<td>SC2A</td>
<td>3</td>
</tr>
<tr>
<td>Over belt magnet</td>
<td>OM2</td>
<td>3</td>
</tr>
<tr>
<td>Fixed trommel screen</td>
<td>FS2</td>
<td>3</td>
</tr>
<tr>
<td>Recyclables collecting conveyor</td>
<td>RC2</td>
<td>6</td>
</tr>
<tr>
<td>Organic collecting conveyor</td>
<td>OC3</td>
<td>1</td>
</tr>
<tr>
<td>Organic distribution conveyor</td>
<td>DC2</td>
<td>1</td>
</tr>
<tr>
<td>Reject collecting conveyor</td>
<td>RJ2</td>
<td>1</td>
</tr>
<tr>
<td>Metal baler</td>
<td>MB2</td>
<td>1</td>
</tr>
<tr>
<td>Light recyclable baler</td>
<td>RB2</td>
<td>2</td>
</tr>
<tr>
<td>Bales Carriage</td>
<td>BC2</td>
<td>8</td>
</tr>
</tbody>
</table>

Composting and Packaging Equipment

Equipment used for shredding, turning, water addition, screening and bagging compost are presented in Table 3.5.

Table 3.5: Composting and packaging equipment

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Facility 40 ton / hr</th>
<th>Facility 60 ton / hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hammer mill</td>
<td>HM</td>
<td>1</td>
</tr>
<tr>
<td>Compost turning machine</td>
<td>CM14</td>
<td>2</td>
</tr>
<tr>
<td>Mobile trommel screen</td>
<td>MS2</td>
<td>2</td>
</tr>
<tr>
<td>Water addition unit</td>
<td>WA2</td>
<td>2</td>
</tr>
<tr>
<td>Bagging machine</td>
<td>BG2</td>
<td>1</td>
</tr>
</tbody>
</table>
Handling Equipment

Equipment used for shredding, turning, water addition, screening and bagging compost are presented in Table 3.6.

Table 3.6: Handling equipment

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Facility 40 ton / hr</th>
<th>Facility 60 ton / hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dump truck</td>
<td>DT</td>
<td>1</td>
</tr>
<tr>
<td>Trailer</td>
<td>TR2</td>
<td>8</td>
</tr>
<tr>
<td>Tractor</td>
<td>TT</td>
<td>8</td>
</tr>
<tr>
<td>Skid steer loader</td>
<td>SL</td>
<td>8</td>
</tr>
</tbody>
</table>

Workforce

The facility workforce is composed of 220 persons. Of these, 175 are resident at the facility, where suitable accommodation and meals are provided. The site also includes recreational spaces such as a football field (Figure 3.18). Tournaments and other recreational activities are organized by the administration and carried out during breaks.

The site team responsibilities are presented in Table 3.7.

Figure 3.18: Workers playing football during break time
Table 3.7: Site team responsibilities

<table>
<thead>
<tr>
<th>Title</th>
<th>Responsibilities</th>
</tr>
</thead>
</table>
| Project General Manager       | Set general policies and strategic plans of the project and participate with other departments in setting implementation plans; fully responsible for the recycling project in the southern area of Cairo Governorate.  
                              | Set draft budget and mobilize required resources.  
                              | Set work plans and follow up implementation with various departments.  
                              | Supervise and evaluate performance of all subordinates.  
                              | Coordinate with Cairo Cleaning and Beautification Authority for approval before making any change or development in the site, or dealing with the surrounding community.  
                              | Follow up implementation of contract signed with Cairo Cleaning Authority, and ensure compliance with conditions and achievement of objectives.  
                              | Take necessary measures to ensure proper operation at the site in accordance with conditions of contract and performance indicators.  
                              | Take necessary actions for safe disposal of wastes and prevent any pollution; study and respond to complaints immediately.  
| Coordination and Follow-up     | Coordinate with Ministry of Environment to obtain approval for environmental impact to establish and operate the composting plants.  
                              | Coordinate with Cairo Public Authority for Cleaning and Landscaping to follow up contract implementation.  
                              | Coordinate with concerned governmental entities to face emergencies and disaster (i.e., district council, police and fire fighting dept.).  
                              | Follow up and analyze any news in the media about the Company (Contractor), and deduce conclusions and learned lessons.  
                              | Follow up and analyze any news in the media about other companies working in the field, and deduce conclusions and learned lessons.  
                              | Establish, review and update a site on the internet.  
                              | Participate in social gatherings of the company staff or related entities.  
| Financial Manager              | Lead the financial team including accountants, auditors, purchases representatives, and storekeeper.  
                              | Participate in developing budgets for sites.  
                              | Implement instructions for approval of daily expenses.  
                              | Produce financial reports and data (daily, weekly, monthly, and annually).  
                              | Follow up inventory records (product, spare parts, and production requirements) in terms of balance, withdrawing and addition.  

Environics  April 2007
<table>
<thead>
<tr>
<th>Title</th>
<th>Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality Control Manager</td>
<td>Report to project general manager.</td>
</tr>
<tr>
<td></td>
<td>Control production processes, monitor quality and improve quality of compost.</td>
</tr>
<tr>
<td></td>
<td>Develop lab procedures for all composting processes.</td>
</tr>
<tr>
<td></td>
<td>Follow up periodic lab tests to monitor quality of compost.</td>
</tr>
<tr>
<td></td>
<td>Participate in calculating standard costs of compost.</td>
</tr>
<tr>
<td></td>
<td>Visit Company’s composting facilities periodically to monitor and report on quality, research and development.</td>
</tr>
<tr>
<td>Fixed and Mobile Equipment</td>
<td>Report to maintenance and vehicles manager.</td>
</tr>
<tr>
<td>Maintenance Supervisor</td>
<td>Set and supervise implementation of preventive maintenance plan for equipment.</td>
</tr>
<tr>
<td></td>
<td>Supervise technicians e.g. mechanics, tire repair person, car electrician, and welder.</td>
</tr>
<tr>
<td></td>
<td>Give explicit instruction on how to deal with machines to prevent malfunctions due to misuse.</td>
</tr>
<tr>
<td></td>
<td>Be responsible for repair of all equipment.</td>
</tr>
<tr>
<td></td>
<td>Comply with safety regulations.</td>
</tr>
<tr>
<td>Accountant</td>
<td>Report to the financial manager.</td>
</tr>
<tr>
<td></td>
<td>Carry over all documents concerning works done prior to current date.</td>
</tr>
<tr>
<td></td>
<td>Hand over documents related to amounts cashed.</td>
</tr>
<tr>
<td></td>
<td>Prepare, review, and code cash orders.</td>
</tr>
<tr>
<td></td>
<td>Prepare and code settlements.</td>
</tr>
<tr>
<td></td>
<td>Enter documents into registers.</td>
</tr>
<tr>
<td>Storekeeper</td>
<td>Report to financial manager.</td>
</tr>
<tr>
<td></td>
<td>Prepare inventory records, ledgers, item cards.</td>
</tr>
<tr>
<td></td>
<td>Organize the stores on proper basis to facilitate issuing and receiving items.</td>
</tr>
<tr>
<td>Personnel Specialist</td>
<td>Report to the administrative affairs manager.</td>
</tr>
<tr>
<td></td>
<td>Maintain payroll records, social insurance, leaves, disciplinary actions, attendance and time sheets.</td>
</tr>
<tr>
<td></td>
<td>Prepare payroll lists.</td>
</tr>
<tr>
<td>Housing and Nutrition Specialist</td>
<td>Report to administrative affairs manager.</td>
</tr>
<tr>
<td></td>
<td>Participate in contracting with caterers.</td>
</tr>
<tr>
<td></td>
<td>Prepare daily, weekly, and monthly nutrition program and housing for staff.</td>
</tr>
<tr>
<td></td>
<td>Prepare plans for coordinating the site internally and externally.</td>
</tr>
<tr>
<td></td>
<td>Identify kind of meals that contain all necessary nutrients for staff.</td>
</tr>
<tr>
<td>Title</td>
<td>Responsibilities</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Industrial Safety Officer</td>
<td>Report to administrative affairs manager and operations manager. Train staff on usage of safety equipment. Ensure safety equipment is in good working order and safety regulations are complied with. Participate in setting security plans.</td>
</tr>
<tr>
<td>Security Guard</td>
<td>Report to administrative affairs manager and industrial safety officer. Organize entry and exit at the site gate. Comply with the security plan to secure all sites (personnel, facilities, equipment and machines, stores, and documents). Supervise night security at the site.</td>
</tr>
<tr>
<td>Doctor</td>
<td>Report to financial/administrative manager and project manager. Maintain medical records for staff. Conduct periodic examination on staff. Conduct tests and analysis on staff. Medications and injections to protect staff against contagious diseases.</td>
</tr>
<tr>
<td>Nurse</td>
<td>Report to the doctor. Assist the doctor with maintaining medical records. Assist the doctor with medical checkups. Fixing bandage for injuries and wounds; give proper injections after approval from doctor.</td>
</tr>
<tr>
<td>Weigher</td>
<td>Report to financial/administrative manager and plant manager. Record data about all loads incoming into the facilities. Prepare a total daily itemized statement in a special register. Prepare monthly statements about totals of daily materials.</td>
</tr>
<tr>
<td>Sorting Worker</td>
<td>Report to sorting supervisor. Separate large masses (e.g. carpets, tires, concrete masses, metals). Put aside debris of plants and trees that can obstruct operations. Comply with safety regulations.</td>
</tr>
<tr>
<td>Press Operator</td>
<td>Report to supervisor. Operate iron presses. Prepare and inspect presses before and after operation and make work place ready.</td>
</tr>
<tr>
<td>Equipment Operation Supervisor</td>
<td>Report to plant manager. Report to plant manager any remarks observed during work. Be familiar with crushing machines. Assign operation team to work properly.</td>
</tr>
</tbody>
</table>

*Environecs  April 2007*
<table>
<thead>
<tr>
<th>Title</th>
<th>Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment Operator</td>
<td>Report to operation supervisor. Operate and stop fixed equipment. Follow up and ensure proper functioning of equipment during operation.</td>
</tr>
<tr>
<td>Packaging Machine Operator</td>
<td>Report to equipment operation supervisor. Operate and stop fixed equipment (packaging compost). Follow up and ensure proper functioning of equipment during operation.</td>
</tr>
<tr>
<td>Mechanical Maintenance Technician</td>
<td>Report to maintenance supervisor. Repair and maintenance of equipment according to preventive maintenance plan. Oiling and greasing equipment.</td>
</tr>
<tr>
<td>Loader Driver</td>
<td>Report to operation manager. Maintain loader/crane in good working order and comply with driving and operation instructions.</td>
</tr>
<tr>
<td>Tire Welder</td>
<td>Report to mobile equipment maintenance head. Repair tires of mobile equipment inside the site.</td>
</tr>
<tr>
<td>Welder</td>
<td>Report to maintenance manager. Periodic maintenance, periodic welding, and prepare requirements for turning machine blades.</td>
</tr>
<tr>
<td>Lab Chemist</td>
<td>Report to quality control manager in terms of preparing sampling program, analysis and quality tests for compost. Maintain lab equipment. Maintain chemicals for lab tests and re-order used quantities.</td>
</tr>
</tbody>
</table>
4. Baseline Environmental Conditions

This section presents a description of the main physical, biological and social components at the project area and environs.

4.1 Physical Environment

The physical environment is composed of a complex of non animate elements which can, directly or indirectly, interact with the project activities and result in negative impacts. A description of these elements is provided below.

4.1.1 Climate

According to meteorological records, shown in Table 4.1, and maps of the Climatic Atlas of Egypt (1996), the climatic features of the project area are characterized by the following:

- The annual mean air temperature is about 19.9 °C and the average monthly temperature reaches its maximum value in July and August (26.9 °C) and its minimum value in January (11.2 °C).

- The average annual relative humidity is about 68%, and the average monthly relative humidity reaches its maximum value in December (81%) and its minimum value in May (53%).

- Rainfall is very limited. The average annual rainfall is about 25.5 mm. The majority of possible rainfall is limited to three months (December to February), with the highest in December. Annual rainy days are very few, and storms can occur only occasionally and are usually of short duration.

- The dominant winds over the year are with a northern component with an annual mean velocity of 12.27 km/h. The dominant winds over the winter season trend SSW, S, and SW. The affecting dominant winds over the summer period are multidirectional and trend NNW, N, and NNE. In transitional periods (spring and autumn), the winds trend dominantly in N and NNE directions.
Table 4.1: Meteorological records

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Daily Temperature (°C)</td>
<td>11.2</td>
<td>12.5</td>
<td>15.4</td>
<td>19.2</td>
<td>23.3</td>
<td>26</td>
<td>26.9</td>
<td>26.7</td>
<td>24.3</td>
<td>22.0</td>
<td>18.0</td>
<td>12.3</td>
<td>19.9</td>
</tr>
<tr>
<td>Mean Daily Relative Humidity (%)</td>
<td>79.0</td>
<td>72.0</td>
<td>67.0</td>
<td>60.0</td>
<td>53.0</td>
<td>56.0</td>
<td>62.0</td>
<td>68.0</td>
<td>72.0</td>
<td>73.0</td>
<td>78.0</td>
<td>81.0</td>
<td>68.0</td>
</tr>
<tr>
<td>Average Wind Speed (km/h)</td>
<td>7.6</td>
<td>8.6</td>
<td>9.8</td>
<td>9.9</td>
<td>10.5</td>
<td>10.5</td>
<td>9.7</td>
<td>9.6</td>
<td>9.4</td>
<td>8.2</td>
<td>7.4</td>
<td>6.8</td>
<td>9.0</td>
</tr>
<tr>
<td>Prevailing Wind Direction</td>
<td>SSW</td>
<td>SSW</td>
<td>NE</td>
<td>NE</td>
<td>NE</td>
<td>NNE</td>
<td>NW</td>
<td>NNW</td>
<td>N</td>
<td>NE</td>
<td>NE</td>
<td>SW</td>
<td></td>
</tr>
<tr>
<td>Monthly Rainfall (mm)</td>
<td>4.5</td>
<td>4.0</td>
<td>3.5</td>
<td>2.0</td>
<td>1.5</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>2.5</td>
<td>2.5</td>
<td>5.0</td>
<td>Total:25.5</td>
</tr>
</tbody>
</table>

Source: Egyptian Meteorological Authority, 1996
The wind roses, shown in Figure 4.1, represent the percentage ratio of the frequencies of occurrence of wind (the length of the column) blowing from certain direction. The different parts (with different colors and widths) of the column represent the wind speed range in knots. The number in the circle represents the percentage ratio of calm wind frequency multiplied by 10.

Table 4.2 gives the distribution of wind direction along the year.

Table 4.2: Distribution of wind direction throughout the year

<table>
<thead>
<tr>
<th>Wind Direction</th>
<th>Velocity (Km/hr)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calm Wind</td>
<td>0.00</td>
<td>4.04</td>
</tr>
<tr>
<td>North</td>
<td>9.76</td>
<td>13.79</td>
</tr>
<tr>
<td>North-east</td>
<td>13.82</td>
<td>50.70</td>
</tr>
<tr>
<td>East</td>
<td>11.78</td>
<td>1.30</td>
</tr>
<tr>
<td>South-east</td>
<td>5.87</td>
<td>0.87</td>
</tr>
<tr>
<td>South</td>
<td>8.79</td>
<td>4.02</td>
</tr>
<tr>
<td>South west</td>
<td>12.80</td>
<td>7.82</td>
</tr>
<tr>
<td>West</td>
<td>14.52</td>
<td>5.26</td>
</tr>
<tr>
<td>North-west</td>
<td>13.05</td>
<td>12.20</td>
</tr>
</tbody>
</table>
Figure 4.1: Mean monthly wind roses recorded at the Cairo station  
(Egyptian Meteorological Authority, 1996)
4.1.2 Ambient Air Quality

Data compiled through both desktop studies (literature review) and onsite monitoring was utilized to describe ambient air quality at the project area.

The proposed location falls 3.1 Km south of the 15th of May City, it is bounded by cement production, brick production, temporary landfill and composting facilities and main roads. Literature findings indicate that air quality at the area has been impacted over the years, mainly, by the ongoing cement production facilities. Generally, activities associated with these facilities contribute to deterioration of ambient air quality through increased levels of suspended particulate matters of different size fractions, morphologies and chemical compositions. Previous studies conducted at the vicinity of the study area shows that air quality has been impacted by high levels of PM$_{10}$ (CAIP, 1999). Ambient PM$_{10}$ levels where monitored for the period starting October 1998 to September 1999 at the 15th of May city. The values recorded ranged between 77.8 and 531.5 $\mu$g/m$^3$, yielding an annual average of 164.7 $\mu$g/m$^3$ which exceeds the limit set in Law 4/1994 (150 $\mu$g/m$^3$) by approximately 10%. Observations made during site surveys indicated the validity of literature findings. Large amounts of bypass airborne cement dust were found accumulating at different areas within the study area.

Moreover, the landfilling activities encompass frequent earthworks, which result in the release of dusts. In addition to literature findings, onsite ambient air quality monitoring was conducted during the preparation of the EIA for 15th of May Landfill (Environics, 2006) to measure background levels of Total Suspended Particulates (TSP) and Thoracic Particulate Matter (PM$_{10}$). At this time, a temporary disposal site was operational and the actual landfill was not operational yet.

Both parameters were monitored at one location (Figure 4.2) within the study area. The location was selected on the basis of site accessibility and limitations and to enable the reflection of impacts induced by neighboring activities. Monitoring was conducted using active high volume samplers with selective filters for a continuous period of 24-hours, as described in Table 4.3.
Figure 4.2: Air and noise monitoring locations
### Table 4.3: Ambient air quality monitoring details and results

<table>
<thead>
<tr>
<th>Parameter</th>
<th>TSP</th>
<th>PM$_{10}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>Start 28/05/2006</td>
<td>29/05/2006</td>
</tr>
<tr>
<td>Date</td>
<td>Stop</td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>Start 11:30</td>
<td>11:30</td>
</tr>
<tr>
<td>Time</td>
<td>Stop</td>
<td></td>
</tr>
<tr>
<td>Location</td>
<td>North 29°47' 50.4''</td>
<td>031°21' 12.3''</td>
</tr>
<tr>
<td>Location</td>
<td>East</td>
<td></td>
</tr>
<tr>
<td>Recorded Value</td>
<td>(μg/m$^3$) 494</td>
<td>328</td>
</tr>
</tbody>
</table>

As illustrated in Table 4.3, both TSP and PM$_{10}$ recorded levels were found to exceed the guideline limits set by Law 4/1994 by 51 and 53 %, respectively. Furthermore, monitoring results suggest that suspended particulates, at the study area, are mostly attributed to PM$_{10}$, as it forms approximately 66 % of TSP. Onsite monitoring results accredit literature findings indicating that air quality at the study area is impacted by high levels of particulate matter. It is important to note in this regard that monitoring was conducted during the summer season (low wind speeds). As such, impacts on air quality at the study area are thought to be the result of ongoing industrial activities rather than meteorological conditions.

#### 4.1.3 Ambient Noise

Onsite noise level measurements were conducted to assess noise quality at the proposed location and to serve as baseline levels for future monitoring activities. Measurements were carried out during daytime as the highest intensity of noise levels are anticipated to occur during these hours. A sound meter type Testo 816 with high accuracy (Class 2L) was used to measure the ambient noise level at six locations to cover the study area boundaries and determine high noise intensity areas/activities. Table 4.4 presents a description of the monitoring locations and the noise levels recorded.

Results indicate that for the exception of Location 5, all baseline noise measurements were below limits set in the executive regulations 338/1995 of Law 4/94 for day time noise levels in industrial areas. The increased noise intensity recorded at Location 5 may be attributed to earthworks that were ongoing at close proximity but have now been terminated. Therefore, noise levels at this location are expected to have decreased.
### Table 4.4: Noise monitoring details and results

<table>
<thead>
<tr>
<th>Time</th>
<th>LM</th>
<th>Location</th>
<th>Reading (dB(A))</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:50</td>
<td>1</td>
<td>N: 29°48’03.7” E: 031°21’18.2” Elev: 60.9 m</td>
<td>50.5</td>
<td>At the landfill entrance gate (north-east of the composting plant), sources of noise include: a low traffic side road leading to the composting facility.</td>
</tr>
<tr>
<td>11:25</td>
<td>2</td>
<td>N: 29°47’50.4” E: 031°21’12.3” Elev: 61.2 m</td>
<td>61.5</td>
<td>Within the landfill area (east of the composting plant), close to the plots western boundary, sources of noise include: a main road, NW, with frequent traffic.</td>
</tr>
<tr>
<td>12:00</td>
<td>3</td>
<td>N: 29°47’46.0” E: 031°21’04.7” Elev: 61.6 m</td>
<td>63.8</td>
<td>At the south western boundary of the landfill, sources of noise include; traffic on the unpaved road used by disposal trucks to deliver wastes to temporary cells, the western main road (approximately 100 m from monitoring point).</td>
</tr>
<tr>
<td>12:10</td>
<td>4</td>
<td>N: 29°47’39.7” E: 031°21’16.8” Elev: 67.4 m</td>
<td>74.8</td>
<td>At the southern plot boundary of the landfill (south-east of the composting plant), sources of noise included: construction activity and traffic of the temporary disposal cells.</td>
</tr>
<tr>
<td>12:25</td>
<td>5</td>
<td>N: 29°47’59.0” E: 031°21’24.4” Elev: 72.9 m</td>
<td>58.0</td>
<td>At the northeastern plot boundary of the landfill (north-east of the composting plant), sources of noise include, side road leading to composting facility.</td>
</tr>
<tr>
<td>12:50</td>
<td>6</td>
<td>N: 29°47’50.6” E: 031°21’35.1” Elev: 74.9 m</td>
<td>64.5</td>
<td>At the eastern plot boundary, main sources of noise include: composting facility ongoing operation activities, heavy machinery was in operation for the installation of the water pipe network.</td>
</tr>
</tbody>
</table>

4.1.4 **Regional Topography**

The ground surface elevation varies between 75 m above mean sea level in the southeast to 45 m in the western side of the study area. The average slope of the ground surface within the proposed site reaches 6 cm/km from West to East.

4.1.5 **Hydrogeology and Groundwater**

A flow direction map for the area is illustrated in Figure 4.3.
This map schematizes the drainage lines which affect the study area. It indicates that there is limited areas of run-on towards the eastern and the southern boundaries of the landfill area.

A field investigation was conducted and a test well was drilled at the landfill site to a depth of 200 m below ground level. No groundwater was encountered up to the drilled depth.

Assessment of literature and field data suggests that rock formations at the project site comprise of Eocene limestone that extend to extreme depths, approximately 800 m, below ground level. Based on this assessment it is found that these limestone formations do not connect to a groundwater aquifer and that the proposed site is located beyond the Greater Cairo region aquifer area.

4.1.6 Geomorphologic Features

Geomorphologically, Helwan area and its vicinities consist of five geomorphic units. Those are the structural plateau, the structural plain, the Piedmont plain, the floodplain and the drainage lines (Abdel Daiem, 1971).

At the project area, a horizontal plateau (18-21 m high) runs in the median of the area, extending west to east. The plateau is characterized by its extensively eroded horizontal surfaces.
The whole area reveals fine forms of mechanical deposition. It is mostly formed of shales and clay rocks of thicknesses ranging between 13 – 15 m. Rocks are occasionally supplanted with replacements of limestones and marls. Additionally, extended traces of sands and sandstones exist within the area. Rock stratification is regular and mostly all the rocks are well bedded. Generally the area possesses conformable succession.

### 4.1.7 Soils and Geology

The area encompasses two facies, namely; the Cairo facies and the Helwan facies.

At the landfill area, the Cairo facies maintains the following formations:

- Mokattem Formations form the lower bed stone and consist of yellowish white limestone and dilomitic limestone;
- Maadi formations form both the intermediate and upper bed layers. In the intermediate layer they comprise of alternating yellow grey shale and marl, and at the upper bed they attain grey limestone and marl.

On the other hand the Helwan facies maintains the following formations:

- Wadi Hoff formations consisting of shale and basal limestone;
- Wadi Gharawi formations consisting of limestone, marl, sandy shale and shale.

### 4.2 Biological Environment

A description of the biological components of the study area hinterland is provided below.

#### 4.2.1 Project Hinterland

The project is located in the Northern Eastern Desert Eocene Plateau, which is that part of the inland desert contiguous to the northern sector of the Nile Valley. The Eastern Desert Eocene Plateau is a component of the wider Eastern Desert ecosystem. The Eastern Desert extends between the Nile Delta and Valley and the coastline of the Red Sea.

Several sub-ecosystems may be recognized in the Eastern Desert such as the inland desert, which extends from the eastern fringes of the Nile Delta and Valley to the Red Sea Mountains eastwards. Numerous wadis flowing to the Nile Valley drain the mountains (EEAA/UNEP, 1993).

The part of the Eastern Desert to the north of Lat. 28° N where composting plant is located, is referred to as the Maaza plateau by Abu El-Izz (1971). It is a limestone plateau dissected by several wadis that drain westwards to the Nile Valley.
4.2.2 Ecology of the Project Area

A field reconnaissance was carried out in the area, before the establishment of the adjacent landfill. Accordingly, a disturbed desert habitat was recognized. It is located in an area affected by neighboring highly polluting industries such as cement factories and brick factories located southeast of the area.

The site is generally composed of a sandy and gravel soil typical of the north-western Eastern Desert. These habitats are generally poor in species and, overall, the habitats at the site are devoid of any outstanding or unique landscape features.

Flora

Very few scattered shrubs are present in the environs of the composting plant and landfill, mainly *Zilla spinosa* and *Zygophyllum* spp. The thin natural vegetation cover and low abundance of species indicates the extreme aridity of the location.

Fauna

Based on the field visit, it can be presumed that only a few animals inhabit the project site due to the aridity of the environment, scarcity of vegetation, lack of habitat complexity and neighboring disturbing activities. Invertebrates, rodents and lizards are probably the most numerous animals. Few numbers of birds were also noticed during the survey. Avifauna of the area is most likely a mix of desert and Nile Valley species.

According to literature, the following table (Table 4.5) provides a list of species potentially present in the area (EEAA/UNEP, 1993; Hoath, 2003).

However, it is unlikely that any of these animals occur in significant numbers. Larger mammals, such as foxes and jackals, might possibly reside in outlining areas and cross the site to feed at night in the Nile Valley.

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fan-footed Gecko</td>
<td><em>Ptyodactylus guttatus</em></td>
</tr>
<tr>
<td>Bosc’s Lizard</td>
<td><em>Acanthodactylus boskianus</em></td>
</tr>
<tr>
<td>Egyptian Dabb Lizard</td>
<td><em>Uromastix aegyptius</em></td>
</tr>
<tr>
<td>Common Chameleon</td>
<td><em>Chamaeleo camaeleon</em></td>
</tr>
<tr>
<td>Jan’s Desert Racer</td>
<td><em>Coluber rhodorhachis</em></td>
</tr>
<tr>
<td>Innes’ Cobra</td>
<td><em>Walterinnesia aegyptia</em></td>
</tr>
<tr>
<td>Horned Viper</td>
<td><em>Cerastes cerastes</em></td>
</tr>
<tr>
<td>Common Name</td>
<td>Scientific Name</td>
</tr>
<tr>
<td>----------------------</td>
<td>------------------------------</td>
</tr>
<tr>
<td><strong>Birds</strong></td>
<td></td>
</tr>
<tr>
<td>Cream-colored Courser</td>
<td><em>Cursorius cursor</em></td>
</tr>
<tr>
<td>Crowned Sandgrouse</td>
<td><em>Pterocles coronatus</em></td>
</tr>
<tr>
<td>Desert Lark</td>
<td><em>Ammomanes deserti</em></td>
</tr>
<tr>
<td>Black-tailed Desert Lark</td>
<td><em>Ammomanes cincturus</em></td>
</tr>
<tr>
<td>Scrub Warbler</td>
<td><em>Scotocerca inquieta</em></td>
</tr>
<tr>
<td>Brown-necked Raven</td>
<td><em>Corvus ruficollis</em></td>
</tr>
<tr>
<td><strong>Mammals</strong></td>
<td></td>
</tr>
<tr>
<td>Cairo Spiny Mouse</td>
<td><em>Acomys cahirinus</em></td>
</tr>
<tr>
<td>Golden Spiny Mouse</td>
<td><em>Acomys russatus</em></td>
</tr>
<tr>
<td>Lesser Egyptian Gerbil</td>
<td><em>Gerbillus gerbillus</em></td>
</tr>
<tr>
<td>Greater Egyptian Gerbil</td>
<td><em>Gerbillus pyramidum</em></td>
</tr>
<tr>
<td>Golden Jackal</td>
<td><em>Canis aureus</em></td>
</tr>
<tr>
<td>Red Fox</td>
<td><em>Vulpes vulpes</em></td>
</tr>
</tbody>
</table>

### 4.2.3 Biodiversity at the Composting Site

The main biodiversity present or expected to be found at the composting site is represented by pest and opportunistic species attracted by the presence of organic waste, such as rats and mice, insects and birds. During the site visit, several Cattle Egrets (*Bubulcus ibis*) were noticed on accumulated waste (Figure 4.4).

![Figure 4.4: Cattle Egrets (*Bubulcus ibis*) on accumulated waste](image)
4.2.4 Biodiversity Importance

The area has minimal importance biodiversity. The habitats and species found in the area are widespread in the deserts of Egypt. Of the few species at the site and its vicinity, no globally threatened species were recognized.

4.2.5 Nature Conservation

There are no protected areas near the project site. The closest protected areas are Maadi Petrified Forest and Wadi Degla Protected Area.

4.3 Socio-economic Environment

The composting plant falls at the Southern zone of the Cairo Governorate boundaries. The closest urban activities occur at the 15th May City which is approximately 3.1 Km to the North of the area. For the exception of two cement facilities west of the site and the composting facilities east of the site, no populations or activities occur near or at the proposed area.

4.3.1 General Overview of 15th of May City

The 15th of May City is one of the first generation urban cities established in 1978 by the Ministry of Housing and New Urban Communities, mainly to accommodate workers at the Helwan industrial zone. The city was developed in accordance to the National Strategy for desert development and construction of new urban communities outside the Nile valley and its Delta. This strategy aimed at geographical spreading of population by attraction of populates and services away from the Nile valley.

The city is located south east of Helwan and approximately 35 km from Cairo, with a residential area of approximately 8804 feddans\(^1\). It comprises of a residential area (6429 feddans), an assigned northern extension area dedicated for private construction by individuals (2095 feddans) and a southern industrial area (280 feddans). The city is planned to include all services (educational, commercial, social, health, sports, entertainment, etc). The geographical distribution of these services is hierarchical, in which each group of buildings (Megawra) has its services center, each 6 Megawra have their services center and each 17 Megawra have their services by-center. In addition, the city has a main service center containing the central and major buildings for all available services, such as the Governmental Organizations Complex and the other services which are not available at Helwan such as cultural center, public library, theater and a museum. Furthermore, the city include a main service area (50 feddans) for light and small industries. This area is divided into 190 pieces each of an area ranging from 300 m\(^2\) to 2000 m\(^2\), and includes several industrial activities and services such as cars services, furniture manufacturing workshops and stores.

\(^1\) 1 feddan = 0.42 hectares
4.3.2 Population

According to “The Consultancy Studies for Water and Sanitation Plans Modernization for the Republic Cities, Second Phase Studies Report for 15th of May, October 2003” the current population of 15th of May City reached 150,000 person, while the maximum population is estimated at 250,000 person, with a population density 150 person/feddan. The current study indicated that 98.71% of a chosen sample are of ages ranging between 25-65 years old. Among these the category of (35-49 years) accounted for 55.2% of the sample. High lifetime mean of 15th of May citizens attributes to the oldness of this city, since it is one of the first axial oldest cities.

The average family’s individuals is 5.2 person/family indicating that 3.64 persons are supported. This is considered a relatively high average, putting pressure to water consumption and sanitation usage. This pressure resulted in water shortage in 15th of May City, which is considered the main problem in the city.

<table>
<thead>
<tr>
<th>Table 4.6: Current population and the proposed trends</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current population (person)</td>
</tr>
<tr>
<td>Saturation population (person)</td>
</tr>
<tr>
<td>Ratio of current population to saturation (%)</td>
</tr>
<tr>
<td>Percent of annual population increment distribution</td>
</tr>
<tr>
<td>Annual population increment (person/year)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Average of annual population increment percent (%)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

- Rapid development: is based on 100% capacity of population increment of the repelling areas
- Moderate development: is based on 75% capacity of population increment of the repelling areas
- Slow development: is based on 50% capacity of population increment of the repelling areas

The study revealed that Greater Cairo is the first source of emigrants to 15th of May City, because it is the closest governorate (12 km from Helwan). The Northern Governorates account for the second source of emigrants (12%) from Gharbia, Sharkia and Menoufya, while the Upper Egypt Governorates account for 5.64% from Sohag, Fayoum and Assiut. Table 4.6 shows the current population and its proposed trends and Table 4.7 shows the population growth of the city until year 2001.

<table>
<thead>
<tr>
<th>Table 4.7: Population growth in 15th of May City</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
</tr>
<tr>
<td>30/6/1982</td>
</tr>
<tr>
<td>30/6/1987</td>
</tr>
<tr>
<td>30/6/1992</td>
</tr>
<tr>
<td>30/6/1997</td>
</tr>
<tr>
<td>31/10/2001</td>
</tr>
</tbody>
</table>

Source: available data from Development Agency of 15th of May City.
4.3.3 Education

Educational services in 15th of May city include 42 nursery school, 24 basic education school, five high school, one commercial secondary school and one industrial secondary school. It is planned to construct 10 nursery schools, five basic education schools and two high schools. Table 4.8 shows the number of students for each educational level in the city, while Table 4.9 gives the number of students and schools for the Azhar educational system.

In addition to the basic and secondary education, high education service is also provided.

Table 4.8: Number of schools and students for the year 2000/2001

<table>
<thead>
<tr>
<th>Educational Stage</th>
<th>Number of Students</th>
<th>Number of Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nursery</td>
<td>634</td>
<td>-</td>
</tr>
<tr>
<td>Primary</td>
<td>8100</td>
<td>-</td>
</tr>
<tr>
<td>Preparatory</td>
<td>6046</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>14780</strong></td>
<td><strong>16</strong></td>
</tr>
<tr>
<td>High school</td>
<td>3111</td>
<td>2</td>
</tr>
<tr>
<td>Industrial secondary education (3 years)</td>
<td>2907</td>
<td>2</td>
</tr>
<tr>
<td>Training schools</td>
<td>212</td>
<td>1</td>
</tr>
<tr>
<td>Official commercial</td>
<td>749</td>
<td>1</td>
</tr>
<tr>
<td>Service commercial</td>
<td>442</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>7421</strong></td>
<td><strong>7</strong></td>
</tr>
</tbody>
</table>


Table 4.9: Number of students and schools in Al Azhar education

<table>
<thead>
<tr>
<th>Educational Stage</th>
<th>Number of Students</th>
<th>Number of Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-school</td>
<td>165</td>
<td>-</td>
</tr>
<tr>
<td>Primary</td>
<td>731</td>
<td>1</td>
</tr>
<tr>
<td>Preparatory</td>
<td>661</td>
<td>1</td>
</tr>
<tr>
<td>Secondary</td>
<td>479</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2036</strong></td>
<td><strong>3</strong></td>
</tr>
</tbody>
</table>


4.3.4 Health Issues

In addition to the private clinics, a public hospital was established in 15th of May city, containing 150 beds. It is planned to establish one hospital and one local medical unit in addition to one medical rescue unit.

4.3.5 Infrastructure

Roads and Communication

A local 144 Km long road network has already been developed to cover most areas within the 15th May City. It is connected to the Greater Cairo cities mainly by the Autostrad highway which connects Masr El-Gedidah to Helwan.
Another major city connector that arrives at 15th May City is the underground Subway (metro).

A communication network grid has been developed to encompass all sections of the city. A telephone communication center has been established with an overall capacity of 30,000 members. This facility will be shortly expanded to accommodate 80,000 members.

**Potable Water**

In the absence of local water treatment plants, the city of 15th May relies on fresh treated water fed from North Helwan station. This station delivers water to the city through a main pipeline of diameter 1000 mm. According to the information obtained from the City Council, the current water amount fed to the city is 53,000 – 60,000 m³/day. Actually, this amount will not be adequate for future consumption which is expected to increase due to the expansion and development of 15th of May city at its current population growth rate. Furthermore, the actual water feed to the city does not satisfy the actual water needs, and therefore water shortage is considered a major problem in the city.

Another pipeline of diameter 1000 mm is being developed to deliver water from Al Tebin water treatment plant, to fulfill current and future water demands.

Generally, several factors influence the water consumption rates, including the size of the city, climate, standards of living, water pressure, water metering and cost and water collection system and sanitary discharge system. Water usage at 15th of May City is categorized into domestic, irrigation, commercial, services consumption and industrial consumption inside the new zone. Table 4.10 presents the water consumption percentage for each category.

<table>
<thead>
<tr>
<th>Consumption Category</th>
<th>Consumption (% of total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic</td>
<td>50</td>
</tr>
<tr>
<td>Public</td>
<td>20</td>
</tr>
<tr>
<td>Commercial</td>
<td>10</td>
</tr>
<tr>
<td>Industrial</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

As for the industrial zone, and according to the Egyptian Code for industries, the standard water consumption rate is 2-3 l/Acer/sec. The actual water consumption rate at 15th May industrial zone is 0.8 -1.35 l/Acer/sec. However, higher water consumption rates are expected in the future due to the population growth and continuous development. For 2% population growth, 0.2% increment is expected in the total water consumption of the city. Table 4.11 shows the total water consumption at present and in the future.
Table 4.11: Present and future water consumption at 15th of May City

<table>
<thead>
<tr>
<th>Year</th>
<th>Domestic Water Needs (m³/day)</th>
<th>Industrial Water Needs (m³/day)</th>
<th>Total Water Needs (m³/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>46,394</td>
<td>Included in the water needs</td>
<td>46,394</td>
</tr>
<tr>
<td>2003</td>
<td>81,937</td>
<td>9,072</td>
<td>91,009</td>
</tr>
<tr>
<td>On City completion</td>
<td>93,750</td>
<td>11,232</td>
<td>105,000</td>
</tr>
</tbody>
</table>

Electricity

The south Helwan power station provides all 15th May City power requirements. Through a power grid and a transformer station the city receives approximately 50 MW of power from this station.

A plan is under development for the expansion of the feed transformer station to provide an additional 25 MW of power. This amount will be directed to fulfill the requirements of the new expansions and industrial zone.

Sanitation

The city of 15th May is characterized by a natural declining slope from north to south (from 170 m to 126 m above sea level) and from east to west. The sanitation system was designed without the need for a main pumping station inside the city. The wastewater streams are collected under influence of gravity from their sources to the city wastewater treatment plant (30,000 m³/day), at which six pumping stations exist. The average effluent discharged from the WWTP ranges from 18,771 m³/day to 25,152 m³/day. The treated effluent is then discharged through a pipeline of a diameter 450-700 mm connected with Helwan discharging pipeline and both are discharged to an area of lower elevation. Local residents at these lands use the resulting effluent for crop irrigation posing a considerable hazard on health due to Helwan effluents which are mostly discharged untreated. It is worth mentioning that the original route of 15th May effluent is to Al Saff Canal. Table 4.12 shows the present and future wastewater discharges for the city.

Table 4.12: Wastewater discharge from 15th of May City

<table>
<thead>
<tr>
<th>Year</th>
<th>Industrial Discharges (m³/day)</th>
<th>Maximum Domestic Discharges (m³/day)</th>
<th>Total Discharges (m³/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population (person)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>Included in the domestic effluent</td>
<td>44,352</td>
<td>44,352</td>
</tr>
<tr>
<td>132,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>9,072</td>
<td>78,660</td>
<td>87,732</td>
</tr>
<tr>
<td>230,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On City completion</td>
<td>11,232</td>
<td>90,000</td>
<td>101,232</td>
</tr>
<tr>
<td>250,000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4.3.6 Economic Characteristics

Tables 4.13 and 4.14 show the available industrial activities at the industrial zones of the city.

**Table 4.13: Industrial establishments under construction (30/6/2001)**

<table>
<thead>
<tr>
<th>Implementation Phase</th>
<th>Number of Reserved Pieces</th>
<th>Operating Establishments</th>
<th>Establishments Under Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food processing</td>
<td>38</td>
<td>3</td>
<td>19</td>
</tr>
<tr>
<td>Wooden industries</td>
<td>22</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>Plastics industries</td>
<td>13</td>
<td>-</td>
<td>10</td>
</tr>
<tr>
<td>Paper industries</td>
<td>4</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Spinning industries</td>
<td>6</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Electrical industries</td>
<td>4</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Metallurgical industries</td>
<td>17</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Construction materials</td>
<td>4</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>Chemical industries</td>
<td>4</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Miscellaneous industries</td>
<td>39</td>
<td>5</td>
<td>22</td>
</tr>
<tr>
<td>Total</td>
<td>151</td>
<td>16</td>
<td>83</td>
</tr>
</tbody>
</table>

Total area (1000 m\(^2\)) 52 44
Annual production (EGP 1000) 15600 31000
Employment (person) 2140 1135


**Table 4.14: Industrial activities in the industrial zone at the city’s extension**

<table>
<thead>
<tr>
<th>Industrial Activity</th>
<th>Expected Labour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food processing</td>
<td>1800</td>
</tr>
<tr>
<td>Spinning and weaving</td>
<td>3000</td>
</tr>
<tr>
<td>Construction materials</td>
<td>650</td>
</tr>
<tr>
<td>Wooden industries</td>
<td>1000</td>
</tr>
<tr>
<td>Chemical industries</td>
<td>1700</td>
</tr>
<tr>
<td>Electrical industries</td>
<td>6400</td>
</tr>
<tr>
<td>New industries</td>
<td>1000</td>
</tr>
<tr>
<td>Stores</td>
<td>80</td>
</tr>
<tr>
<td>Services for spinning and weaving area</td>
<td>800</td>
</tr>
<tr>
<td>Food services</td>
<td>360</td>
</tr>
<tr>
<td>Chemical services</td>
<td>150</td>
</tr>
<tr>
<td>Electronically services</td>
<td>250</td>
</tr>
<tr>
<td>Central services</td>
<td>120</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>17310</strong></td>
</tr>
</tbody>
</table>

It was planned to construct two industrial zones at the city, as follows:

- The industrial zone at 15th of May city, for handicrafts and small industrial activities with an area 110,110 m². It was divided into 175 pieces which were sold to private investors.

- The industrial zone at the city’s extension, specified for providing new jobs for youth and promoting industrial investment. This zone is located south of the city on an area of 280 Feddans.

4.3.7 Landuse

Landuses at the city involve housing, services, traffic and transportation and green and open areas. It is worth mentioning that the area for each individual at the city ranges from 8 m² to 11.3 m² including the entertainment areas.

Landuse of 15th of May city involves the following:

- First Phase Area: includes 36 Megawra, divided into 3 Hay, with a total area of 6462 Feddans
- Second Phase Area: includes 12 Megawra of a total area 2095 Feddans.
- Third Phase Area: is an industrial zone at the south side of the city and of an area 280 Feddans.

Table 4.15: Landuse at 15th of May City (according to the General Layout, 1976)

<table>
<thead>
<tr>
<th>Landuse</th>
<th>Area (Feddans)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing</td>
<td>582.6</td>
<td>23.61</td>
</tr>
<tr>
<td>Services</td>
<td>393.1</td>
<td>15.91</td>
</tr>
<tr>
<td>Traffic and transportation</td>
<td>919.3</td>
<td>37.7</td>
</tr>
<tr>
<td>Open and green areas</td>
<td>568.6</td>
<td>23.1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2463.6</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>


Table 4.15 illustrates the landuses of 15th of May City, while Table 4.16 shows the landuses of the city including the northern extension area and the industrial zone south of the city.

Table 4.16: Landuse at 15th of May City (according to Year 2000 Situation)

<table>
<thead>
<tr>
<th>Landuse</th>
<th>Area (Feddans)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing</td>
<td>11950.5</td>
<td>40</td>
</tr>
<tr>
<td>Commercial</td>
<td>190.5</td>
<td>6.4</td>
</tr>
<tr>
<td>Services</td>
<td>1261.9</td>
<td>42.4</td>
</tr>
<tr>
<td>Industrial</td>
<td>333.3</td>
<td>11.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2976.2</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Source: Present Achievements and Future Creation, 2002
4.3.8 Public Consultation

Public consultation in the form of scoping meetings has been conducted on an individual basis with the different stakeholders. These meetings aimed at providing a better understanding for the study requirements, main constraints and concerns and identifying other important stakeholders for that type of development. A project-specific questionnaire was developed to better manage this activity. Details of this activity are provided in chapter 8.
5. Project Alternatives

5.1 No Development Alternative

The alternative to not develop the proposed plant was used in this EMP as the scenario with which to compare the environmental and social impacts of project operation. The “no development” alternative is not recommended because it would mean closing the facility, thus creating jobless conditions, and disposal of waste, including its organic content, without treatment in the landfill.

Considering that the impacts of the project will be managed to levels where the environmental impact will not be detectable, the “no development” alternative has not been given further consideration.

5.2 Alternative Process Technologies

There are various available composting technologies from traditional windrows to state of the art in-vessel systems.

5.2.1 In-vessel Composting

In-vessel composting is an industrial form of composting biodegradable waste in closed reactors. This system can process large amounts of waste without taking up as much space as the windrow method. In addition, it can accommodate virtually any type of organic waste (e.g., meat, animal manure, bio-solids, food scraps).

The in-vessel system is generally composed of metal tanks through which air flow and temperature can be controlled. In-vessel composting can be used year-round in virtually any climate because the environment is carefully controlled, often by electronic means. This method produces very little odor and minimal leachate. Offensive odors are caused by excess nitrogen or moisture. This may be controlled with a higher carbon to nitrogen ratio or increased aeration (ventilation), mixing, or by using a coarser grade of carbon material. Insects may be controlled by keeping the bin closed with minimum size vents necessary for adequate air exchange.

In-vessel composters are expensive and require technical assistance to operate properly, but this method uses much less land and manual labor than windrow composting. Conversion of organic material to compost can take as little as a few weeks. However, upon removing the compost from the vessel, it still requires a few more weeks or months for the microbial activity to stabilize and the pile to cool.

5.2.2 Windrow Composting

Windrow composting is the production of compost by piling organic matter or biodegradable waste, like animal manure and crop residues, in long rows.
(windrows). Typically, windrows are between 1 meter (for dense materials like manures) and 3.5 meters (for light materials like leaves) in height. Width can vary from 1.5 to 6 meters and the equipment used to form the windrows can determine the actual shape.

The piles are generally turned to improve porosity and oxygen content, to mix in or remove moisture, and to redistribute cooler and hotter portions of the pile. Process control parameters include; the initial ratios of carbon and nitrogen rich materials; the amount of bulking agents added to assure air porosity; the pile size; moisture content; and, the turning frequency. In a warm arid climate, windrows are sometimes covered or placed under a shelter to prevent water from evaporating. In rainy seasons, the shape of the pile can be adjusted so that water runs off the top of the pile rather than being absorbed into the pile. Windrow composting often requires large tracts of land, sturdy equipment, a continual supply of labor to maintain and operate the facility, and patience to experiment with various material mixtures and turning frequencies.

Leachate released during the composting process can contaminate local ground-water and surface-water supplies and therefore should be collected and treated.

Windrow composting is a large scale operation and might be subject to regulatory enforcement. Samples of the compost should be tested in a laboratory for bacterial and heavy metal content. Odors also need to be controlled. The public should be informed of the operation and have a method to address any complaints about vectors or odors.

5.2.3 Aerated Static Pile Composting or Tunnel Composting

Aerated Static Pile (ASP) composting, or tunnel composting systems include both passive and active methods. These systems are most commonly used by larger, professionally-managed composting facilities. There are also considered hybrid windrow and in-vessel systems incorporating features of ASP. Aerated static piles do not need as much space as a windrow operation, but offer rapid biodegradation and process control similar to in-vessel composting, and work well for facilities processing wet materials or a wide variety of feed stocks. This method, however, does not work well for composting animal byproducts or grease from food processing industries. ASP facilities can be outdoor operations, under roof, or totally enclosed.

As the name implies, static piles are not turned, rotated, or otherwise manipulated during primary composting. Instead, the blended admixture is placed on perforated piping, improving air circulation. A passive ASP system relies on natural air currents. An active system uses fans to pull or push air through the composting mass. Rigid or flexible perforated piping, connected to fans, delivers the air. The pipes can be installed in channels, on top of a floor, or along the ground. Since there is no physical turning, this method requires careful monitoring to ensure that the outside of the pile heats up as much as the core. One way to alleviate bad odors is to apply a thick layer of finished compost over the pile, which can help maintain high temperatures throughout
the pile. Another way to deal with odor, provided that the air blower draws air out of the pile, is to filter this air through a bio-filter made from finished compost.

Like windrow composting, in a warm, arid climate, aerated static piles are sometimes covered or placed under a shelter to prevent water from evaporating. In cold climate, the core of the pile will retain its warm temperature, but aeration might be more difficult because this method involves passive air flowing rather than active turning. Some aerated static piles are placed indoors with proper ventilation.

This method typically requires equipment such as blowers, pipes, sensors, and fans, which might involve significant costs and technical requirements. Having a controlled supply of air enables construction of large piles, which require less land than the windrow method. This method produces compost relatively quickly (within 3 to 6 months).

5.3 Alternative Project Locations

The facility is already operational and its location is adjacent to the landfill and far from urban populations and from surface water resources. It is well connected by the existing road network to the South Cairo Zone, which provides the main input (organic material) to the facility. Accordingly, alternative locations for the proposed project location were not considered.

5.4 Selected Technology

Windrow composting technology was selected by ECARU according to various aspects:
- Availability of large areas of land which is ideally suitable for composting of large volumes;
- Simplicity of the windrow composting technology, which does not require sophisticated equipment;
- Provision of work opportunities as this method is much dependent on manual labor assistance;
- Climate conditions are suitable for aerobic composting technologies.
Environmental Impacts and Mitigation Measures

This chapter describes both positive and negative impacts associated with the proposed projects and illustrates feasible measures for the mitigation of negative impacts.

Approach

Potential impacts anticipated from the operation of the composting facility in hand were identified based on the analysis of the project’s components and activities, baseline data and literature review. This collaboration of data was conducted to satisfy the following objectives:

- Identify all potential impacts of the project;
- Evaluate the identified impacts (irrelevant (no impact), insignificant, significant); and,
- Devise appropriate mitigation measures for the significant impacts.

A “scoping” exercise, bringing together all generic impacts related to the project and its interactions with the receiving environment were conducted to satisfy the requirements of the first two objectives. Potential impacts were identified and irrelevant impacts were excluded via analyses of the project’s components and activities and their interactions with the environmental characteristics. Once project specific impacts were highlighted a significance level was assigned to every anticipated impact, such that the EIA focuses on the most significant ones.

The second phase of the scoping exercise, based on common EIA practice, involved the consideration of impact characteristics for the application of an impact evaluation criterion (Wathern, 1990; Bisset, 1990; Erickson, 1994). Upon identification and evaluation of impacts, mitigation measures were devised to eliminate or reduce impact magnitude to comply with or surpass allowable standards and guidelines.

This approach ensures, on one hand, that all potential impacts are considered and enumerated. The exclusion of impacts ensures, on the other hand, that only those impacts relevant to the specifics of the project site are focused on and considered in greater detail. This will also provide the decision makers and management team with a clear and concise idea about significant negative environmental impacts, and the types of mitigation measures that can be adopted to alleviate them.

Identification of Potential Impacts

The project was initiated by the CCBA to present an environmentally sustainable solution to the South Cairo region solid waste problem. As such, this project is anticipated to reflect a number of positive impacts, especially, with regards to public health, quality of life for area residents and surrounding municipalities.
On the other hand, as is the case with any similar project, potentially negative impacts may result from the different activities of the construction, operation and/or post-closure phases, unless properly managed. The aim of the following sections is to identify those potential impacts.

Positive Impacts

a. Income and Employment

The composting plant provides employment opportunities to the local community. It utilizes skilled, semi-skilled and unskilled labor. Some of the unskilled labor are sourced from neighboring towns and/or villages.

b. Waste valorization

Waste sorting and composting, as part of the integrated waste management system, is an important means of generating revenue from a source that, otherwise, would be lost.

c. Reduction of greenhouse gas emissions

The emission of methane to the atmosphere is reported as the principal greenhouse impact of concern for composting and related organics-processing facilities, because methane has about 21 times the greenhouse warming potential of carbon dioxide. In open windrow systems, when an aerobic environment is maintained with proper moisture content to encourage aerobic decomposition of the organics, the composting process does not generate significant quantities of methane (USEPA, 2002).

Landfills are usually oxygen poor, so methane is generally produced from the decomposition of organics in landfills. The capture of methane from the 15th of May landfill, was included during the design phase; but this is never 100% efficient, so the landfilling of organics will always release methane, a powerful greenhouse gas, into the environment. On the other hand, a well managed composting of organics will produce minimal amounts of methane, so this activity can contribute to a reduction of global warming by keeping organics out of landfill.

d. Public Health

The project forms an integrated waste management system with the landfill. Waste management improves overall public health by:

- Reducing waste disposal in the streets that presently act as a breeding ground for flies and rodents.
- Reducing unplanned waste burning which results in the emission of toxic and hazardous gases.
Reduce risks of fire break outs as a result of open air waste burning.

The aforementioned factors will reflect positive impacts on the public health through reduction of diseases which are spread by vectors inhabiting randomly disposed of waste. Another positive factor is the reduction of respiratory ailments which usually accompany air pollutants (e.g. carbon monoxide, nitrogen oxides, particulate matter, and dioxin) that are commonly associated with open burning of solid wastes.

\textbf{Potentially Negative Impacts}

The potentially negative generic impacts of a composting plants are usually guided on the basis of international experience with similar projects. As guided by previous studies as well as assessment of ongoing activities, a description of the impacts associated with the operational phase of the facility is presented in Table 6.1.

\begin{table}[h]
\centering
\begin{tabular}{|l|l|l|}
\hline
\textbf{Environmental Attribute} & \textbf{Source of Impact} & \textbf{Types of Impacts} \\
\hline
Geology and Hydrogeology & Leachate which may be formed from the composting process & Impact on soil quality and groundwater \\
& Litter & Waste dispersion \\
Surface Waters & Leachate & Impacts on water quality \\
& Delivery of feedstock material (may have been stored for some time prior to delivery) & Odors and emissions, including greenhouse gas emissions \\
Air Quality & Preparation of composting; screening, turning or shredding & Dust, air emissions \\
& Anaerobic conditions in windrows & Odors and emissions, including greenhouse gas emissions \\
& Leachate which may be formed in the delivery vehicle or from the composting process itself & Odors and emissions \\
Noise & Vehicles and operating machinery & Impacts on facility workforce; disturbance to neighboring communities \\
\hline
\end{tabular}
\caption{Summary of Typical Potential Negative Environmental Impacts}
\end{table}
Table 6.1 presents a summary of main impacts associated with the composting facility. The following sections aims at excluding irrelevant impacts, determining project specific potential impacts and highlighting the significance of these potential impacts.

### Irrelevant Impacts

Analysis of the generic environmental impacts listed in Table 5.1 in relation to the specifics of the project in hand (chapter 2) and the details of its receiving environment (chapter 3) indicated that some of the generic impacts do not apply. These impacts are thus considered irrelevant and will not be subject to further investigations.

The composting site and its neighboring area does not attain the following components:

**a. Groundwater Resources**

Site specific geotechnical and hydrogeological studies indicate that no groundwater aquifers exist in the vicinity of the site. Furthermore, these studies suggests that the area is free of any fractures or faults and that the closest groundwater table may be encountered at an approximate depth of 800 m below grade level (BGL).

**b. Surface Water Resources**

No surface water bodies exist in the area. The River Nile falls approximately 6 Km west of the proposed site. Site specific studies indicate that the site does not fall in the Nile's watershed and that no
hydrological connections or pathways exist between the site and the river.

c. **Cultural and archaeological significance**

The area is not recorded as an area of cultural and archaeological significance nor was it found to attain any components of such significance.

d. **Protected areas and biodiversity importance**

No protected areas exist in the vicinity of the site and no sensitive, commercially important, endangered and/or protected species are recorded within the area hinterland.

Given the above, impacts that may be reflected on these components of the environment are considered irrelevant and will not be subject to further investigations.

\(3,4\) **Negative Environmental Impacts**

Beyond the exclusion of the irrelevant impacts, an identified set of negative impacts has been analyzed and evaluated to assign significance levels to these impacts.

Environmental impacts were analyzed and evaluated based on baseline data as well as impact evaluation criteria which included the following:

- **Magnitude**

  The magnitude of the impact is an important criterion for impact evaluation. Activities that have large magnitude of impact will be included in the analysis, even if they affect a limited receptor or have small spatial and/or temporal extent.

- **Spatial/Temporal Extent**

  Some of the activities might have a limited spatial extent, while others might have a larger extent thus be more important. Meanwhile, some impacts might express themselves immediately and for a short period of time. Other may appear at later time intervals of the project life and last for varying periods of time. Therefore, the temporal extent of the impacts should be carefully considered.

- **Receptor Importance and Size**

  Impacted receptor (s) vary greatly in its size and importance. As the receptor importance or size increases, the impact tends to be crucial.
Insignificant Impacts

- **Impacts on Terrestrial Habitats, Flora and Fauna**

  The area is almost devoid of vegetation and attains a very low level of biodiversity. Moreover, recorded species are very common and widespread in Egyptian desert environments; therefore impacts on biodiversity are expected to be insignificant.

- **Impacts on Soil Quality**

  The main pollution source is the leachate that may created by the anaerobic digestion. However, leachate is collected and transferred to a lined evaporation pool. Moreover, the plant is located in an arid area where rainfall is very limited and the evaporation rate is very high. Accordingly, no impacts on soil quality are expected from migration of leachate to surrounding areas.

- **Impacts on Local Communities**

  The 15th of May residential area is located more than 3 km north of the composting facility and there are no other settlements in the proximity of the plant. The dominant wind direction was found to attain a northern component. Thus, odors, dust and gaseous emissions due to project activities would be blown to the south away from any sensitive receptors, especially the 15th of May residential community.

Significant Impacts and their Mitigation Measures

In this section, the identified significant negative impacts on the environment attributes are given, along with appropriate mitigation measures.

- **Visual Impacts**

  The facility is located in a desert area. therefore, together with the adjacent landfill, it constitutes a long-term visual impact on the aesthetics. However, the location is classified as an industrial area and does not include important or sensitive habitats.

  **Mitigation Measures**

  - The facilities steel structures are blue, the distinguishing color of the composting and recycling facilities. It is well integrated with the yellowish color of the surrounding environment;
  - The site is surrounded by a green belt of trees which provides a pleasant view.
• **Air Quality**

Minor air quality problems may occur as a result of dusts and gaseous emissions and, in general, air pollution is not a major concern at composting facilities and no significant impacts on air quality are anticipated to occur from the project activities. However, air quality at the study area is currently significantly impacted in terms of particulate matter concentrations as a result of ongoing cement activities. The landfilling activities are also expected to have increased dust emissions. Accordingly, impacts due to dust and gaseous emissions are herein considered as significant impacts to avoid cumulative impacts due to current conditions.

• **Dust**

Dust has the potential to be emitted in considerable quantities particularly when dry composted organic material is being screened, turned or shredded. Dust can also be generated through vehicle and machinery movements on site.

**Mitigation Measures**

To mitigate dust-related, the following mitigation measures could be applied:

- All transporting vehicles must be cleaned in the washing station regularly to avoid any pollution in the leading roads to the site;
- Using the water tank truck to avoid dust during operation processes;
- Wetting the stored bulk compost in fermentation area when it is necessary to decrease the amount of flying dust;
- Maintain internal roads clean and clear of dust accumulations;
- Restrict vehicle transport to assigned roads;
- The compost curing process usually generates heavy amounts of dust if the compost is dry. Therefore, the moisture content should be maintained at not less than 25%.

• **Gaseous emissions**

These include gaseous emissions resulting from vehicles and machinery, as well as potential release of ammonia and methane resulting from fermentation and anaerobic conditions in windrows.

**Mitigation Measures**

To mitigate gaseous emissions due to combustion, the following mitigation measures could be applied:

- Restrict drivers and equipment operators from unnecessary early start up of engines;
- Apply daily soil cover to prevent/minimize odor emissions and airborne waste;
- Turning over the fermented rows several times according to composting best practices to formation of methane due to anaerobic conditions in the rows;
- Staff should be provided with appropriate Personal Protective Equipment (PPE) in accordance with health and safety regulations;
- Proper management and provision of adequate training for workers to properly manage the waste.

• **Odors**

Odors are emitted during the delivery of fresh material and the formation and turning of the material in windrows. Usually, the release of odors from composting sites is a major cause of concern and may lead to complaints from the public. However, as previously mentioned, there are no local communities and settlements in the vicinity of the project site. The only people that may influenced by odors are those working at Koumia Cement Company, located south of the composting plant and the facility workforce.

**Mitigation measures**

The best defense against odor complaint is not to generate odors. The following points should minimize the production of odors:

- Rigorous control of delivered feedstock, contaminated or odorous wastes (stored too long) should be rejected.
- Use a good mix of raw materials, which do not have excessive moisture content.
- Adding a high carbon source can combat any pungent ammonia odors. Ensuring the carbon to nitrogen ratio is between 20:1 and 40:1 will reduce odors as will avoiding materials with an excessive nitrogen content.
- Use good practice procedures to prevent anaerobic conditions occurring. Avoid delaying the piling of newly delivered and rapidly decomposable feedstock materials.
- Incorporate a drainage layer at the base of windrow to encourage the movement of leachate. The shape and structure of the composting mass and the orientation of the windrows can also help in the control of odors.
- Static piles can be covered with matured compost to act as a biofilter.
- Regular cleaning of operational areas such as roads and drainage channels will discourage odor generation from old degrading materials. This can be easily achieved through good housekeeping.
- Odor disruption systems are available but should be used as a last resort. Good management of site operations is a better strategy for odor control.
• **Litter**

Municipal solid wastes can have a high content of plastic, paper and fines, which may cause litter problems offsite if not managed correctly. Currently, non-recyclables removed from compost during the refining phase are transferred directly to the designated landfill cells. However, litter can be generated from open loads, plastic and paper blowing from windrows, and rejects blowing away during screening.

**Mitigation Measures**

Litter can be controlled by:

- Requiring loads of incoming material to be covered;
- Fencing the whole site perimeter to facilitate collection of litter;
- Collecting litter as soon as possible before it becomes scattered offsite;
- Removing plastic bags before windrowing or collecting in paper bags, in plastic bins, or in bulk (for leaves and woody material).

• **Noise**

The equipment used at the site, such as the loaders, tractors, compost turners, and trucks, are noise generators. However, this noise is localized within the site in addition to the fact that the remoteness of the site allows for the dissipation of the noise associated with the composting operations. Thus, noise would only affect the workforce. Noise measurements carried out at the facility eastern boundary during operational hours resulted in a noise intensity of 64.5 dB(A), which is below the limits set in the executive regulations 338/1995 of Law 4/1994 for day time noise levels in industrial areas.

**Mitigation Measures**

To further minimize noise intensity levels, the following control measures can be considered:

- Maintain machinery, equipment and vehicles in good working conditions to minimize noise generated;
- Perform proper maintenance on all noise producing equipment to prevent excessive rattling and vibration of metal surface;
- Supply ear protective equipment to workers to minimize possible impacts from high noise intensity and assure that workers use equipment.

• **Airborne micro-organisms and bioaerosols**

Elevated numbers of micro-organisms are released into the air when any agitation of organic material occurs, be it turning, screening or shredding. Leachate may also release micro-organisms and due to their microscopic size, once released to the air, they can remain airborne for...
long periods of time forming what is known as “bioaerosol” – an aerosol of biological particles.

**Mitigation Measures**

- Turning, screening and shredding should be undertaken when wind speeds will not cause micro-organisms to become airborne or conducted within enclosures so that any emission can be controlled.
- The workforce should try to limit their exposure by being upwind of any screening, shredding or turning and staying within vehicle cabs or other protected environments.
- Staff should use the appropriate Personal Protective Equipment (PPE) in accordance with health and safety measures.

**Pests**

Pests such as insects, rodents and stray dogs and cats can cause nuisance problems but are dependent on the waste types being composted. Putrescible wastes can attract pests as they can provide a food source for certain vermin and insects. Pests can also provide vectors for disease.

Improper leachate management may enhance the growth of marginal vegetation and the establishment of fly and mosquito. These species are a major source of nuisance and public health threat. However, as previously mentioned, leachate is collected in a lined pool.

**Mitigation Measures**

The following control measures should be considered to minimize/eliminate anticipated impacts:

- Construct an adequate fence around the site to limit undesired faunal access;
- Avoid delaying the piling of newly delivered and rapidly decomposable wastes;
- Cover piles with matured compost to act as a barrier against pests;
- High temperatures within windrows will minimize the problem of pests;
- If necessary, use environmentally safe biocides to control mosquitoes and flies; and,
- Inspect site for growth of marginal vegetation and regularly remove it, should it develop.

**Health and Safety**

Slips, falls, equipment and tools -caused injuries are considered safety hazards to workers.
Worker health and safety may also be impacted as a result of impacts on air and noise quality. VOCs, contained in solvents, paints and cleaners, are also a potential source of risk to workers. In addition, resuspension of particulate matters and bioaerosols can cause health problems to the facility workforce. The presence of potentially airborne cement dust may also significantly affect the respiratory system and cause lung damage for workers at the site. Increased levels of noise intensity may result in temporary or permanent hearing loss.

Composting materials might also pose health and safety hazards if improperly stored.

**Mitigation Measures**

The following measures should be considered for enhancing work health and safety conditions:

- Provide workers with suitable personal protective equipment (PPE), including, goggles and air masks to guard against irritations and health problems caused by cement dust, bioaerosols and VOCs, whenever needed;
- Provide adequate ventilation in the working environment to avoid workers’ exposure to VOCs;
- Provide first aid kits and train personnel on CPR procedures;
- Limit vehicle speed onsite to reduce possibility of accidents;
- Enforce access control measures to the site, by using visible site boundary markers (e.g. visible tape) to prevent unauthorized access to the site;
- Inspect all equipment prior to the start of the job to ensure safety of the workers.
- Store flammable materials (if any) in an isolated, shaded, and well instantiated area. Fire extinguishers should be installed in designated locations at the site;
- Prepare a fire fighting plan for the facility;
- Use safe and legally allowed insecticides and rodenticides.

**Impacts of the Environment on the Project**

Analysis of the environmental setting at the proposed area suggests that natural environmental components may reflect impacts on the well-being of the project. As previously discussed, natural air-borne dusts (due to the desertic nature of the area) as well as dusts generated from cement companies represent the main sources of impact on the project.

**Impacts Due to Flash Flooding**

The site falls 250 – 300 m south of a run-on channel, as such is not at a highly susceptible to flashflood risks. Nevertheless, a collecting basin has been established by the composting facilities to divert storm water to its natural surface drainage network, should an incident occur.
V. Management and Monitoring Plans

This section presents a description of the environmental management procedures required to alleviate potentially negative impacts associated with project. It also sets a preliminary environmental monitoring plan to enable early detection of any negative impact.

V. General

The previous chapter addressed potential negative environmental impacts of the operation of the 15th May City composting plant. A description of adequate-feasible mitigation measures to alleviate the anticipated significant impacts was also provided.

To ensure the sound environmental performance and sustainability of the project, this chapter is devised to summarize and highlight some of the important management issues that should complement the mitigation measures of project specific impacts. Additionally, to provide indicators of environmental performance and early warning in the unlikely case of any deviation from the norms, a section of this chapter has been devoted to propose monitoring plans to be implemented during the different project phases.

This chapter encompasses the following:

- Summary of potential impacts and proposed mitigation measures, including estimated implementation costs;
- Management procedures required to complement mitigations; and,
- Proposed environmental monitoring program to be implemented and updated during the various phases of the proposed project. This includes estimated monitoring costs, frequency as well as the parties who will incur the costs and implement these measures.

V. Summary of Potential Impacts and Mitigation Measures

A summary of impacts is presented in Table 7.1.

<table>
<thead>
<tr>
<th>Irrelevant Impacts</th>
<th>Insignificant Impacts</th>
<th>Significant Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groundwater resources</td>
<td>Impacts on terrestrial habitats, flora and fauna</td>
<td>Visual impacts</td>
</tr>
<tr>
<td>Surface water resources</td>
<td>Impacts on soil quality</td>
<td>Cumulative impacts on air quality (dust and gaseous emissions)</td>
</tr>
<tr>
<td>Cultural and archaeological significance</td>
<td>Impacts on local communities</td>
<td>Odor impacts</td>
</tr>
<tr>
<td>Protected areas and biodiversity importance</td>
<td></td>
<td>Litter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Noise</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Airborne micro-organisms and bioaerosols</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pests</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Impacts on workforce health and safety</td>
</tr>
</tbody>
</table>
Table 7.2 includes mitigation measures for significant impacts and estimated costs for implementation of such measures.

Table 7.2: Main mitigation measures, implementation costs and responsibilities

<table>
<thead>
<tr>
<th>Mitigation Measures</th>
<th>Estimated Cost of Implementation (LE)</th>
<th>Source of Financing</th>
<th>Responsible for Implementation</th>
<th>Responsible for Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance of green belt</td>
<td>61905</td>
<td>Self finance</td>
<td>Belts technician</td>
<td>Quality control manager</td>
</tr>
<tr>
<td>Cleaning and washing of vehicles</td>
<td>58440,37</td>
<td>Self finance</td>
<td>Cleaning &amp; washing technician</td>
<td>Quality control manager</td>
</tr>
<tr>
<td>Maintenance of vehicles</td>
<td>3267.5</td>
<td>Self finance</td>
<td>Maintenance engineer</td>
<td>Quality control manager</td>
</tr>
<tr>
<td>Cleaning of roads and operational areas</td>
<td>37923,87</td>
<td>Self finance</td>
<td>Cleaning</td>
<td>Quality control manager</td>
</tr>
<tr>
<td>Restrict vehicle transport to assigned roads</td>
<td>11447</td>
<td>Self finance</td>
<td>Operational formal</td>
<td>Quality control manager</td>
</tr>
<tr>
<td>Restrict unnecessary early start up of engines</td>
<td>38847,85</td>
<td>Self finance</td>
<td>Operational engineering</td>
<td>Quality control manager</td>
</tr>
<tr>
<td>Cover loads of incoming material</td>
<td>169499,55</td>
<td>Self finance</td>
<td>Pre treatment engineering</td>
<td>Quality control manager</td>
</tr>
<tr>
<td>Control of delivered feedstock</td>
<td>47392</td>
<td>Self finance</td>
<td>Weight bridge</td>
<td>Quality control manager</td>
</tr>
<tr>
<td>Watering and wetting of compost</td>
<td>124791,45</td>
<td>Self finance</td>
<td>BiologicalT.M engineering</td>
<td>Quality control manager</td>
</tr>
<tr>
<td>Good practice procedures to prevent anaerobic conditions</td>
<td>59913,4</td>
<td>Self finance</td>
<td>Lab engineering</td>
<td>Quality control manager</td>
</tr>
<tr>
<td>Inspection and maintenance of machinery</td>
<td>691810,33</td>
<td>Self finance</td>
<td>Maintenance engineer</td>
<td>Quality control manager</td>
</tr>
<tr>
<td>Incorporate a drainage layer at the base of windrow</td>
<td>0</td>
<td>Self finance</td>
<td>Lab engineering</td>
<td>Quality control manager</td>
</tr>
<tr>
<td>Fencing the whole site</td>
<td>0</td>
<td>Self finance</td>
<td>Civil engineering</td>
<td>Quality control manager</td>
</tr>
<tr>
<td>Collecting scattered litter</td>
<td>12777,05</td>
<td>Self finance</td>
<td>cleaning</td>
<td>Quality control manager</td>
</tr>
<tr>
<td>Supply of protective equipment to workers</td>
<td>158867,21</td>
<td>Self finance</td>
<td>Safety engineering</td>
<td>Quality control manager</td>
</tr>
<tr>
<td>Availability of environmentally safe biocides</td>
<td>Not available</td>
<td>Self finance</td>
<td></td>
<td>Quality control manager</td>
</tr>
<tr>
<td>Mitigation Measures</td>
<td>Estimated Cost of Implementation (LE)</td>
<td>Source of Financing</td>
<td>Responsible for Implementation</td>
<td>Responsible for Monitoring</td>
</tr>
<tr>
<td>----------------------------------------------------------</td>
<td>--------------------------------------</td>
<td>---------------------</td>
<td>-----------------------------------------</td>
<td>---------------------------------------</td>
</tr>
<tr>
<td>Adequate ventilation in the working environment</td>
<td>120000</td>
<td>Self finance</td>
<td>Safety engineering Operational engineering</td>
<td>Quality control manager</td>
</tr>
<tr>
<td>First aid kits</td>
<td>9309.6</td>
<td>Self finance</td>
<td>Safety engineering</td>
<td>Quality control manager</td>
</tr>
<tr>
<td>Provide suitable storage to flammable and dangerous materials</td>
<td>0</td>
<td>Self finance</td>
<td>Administration clerk</td>
<td>Quality control manager</td>
</tr>
<tr>
<td>Prepare a fire fighting plan</td>
<td>315029.16</td>
<td>Self finance</td>
<td>Project fire man</td>
<td>Quality control manager</td>
</tr>
</tbody>
</table>
Management Requirements

The following presents an outline of the required management procedures of the composting facility. It is the responsibility of the company to assure that operation activities are conducted in a manner which would minimize the potential impacts on the environment and public health of the workers.

Health, Safety and Environmental Department

The facility includes a Health, Safety and Environmental Department. The department is concerned with the staff preventive health, environmental protection, ensuring staff safety against injuries and accidents, and the site against fire and disasters. The department is composed of three divisions, namely the Health, Safety and Environmental Divisions. The role and plans of each division is presented hereunder.

- **Health Division**

  The plan aims at preventing diseases, providing first aid treatment for onsite injuries and providing healthcare services to the workforce.

  - Running periodical or surprise examinations on the staff;
  - Staff vaccination against occupational and environmental diseases according to a specific program;
  - Establishment of an equipped clinic supervised by a doctor and a nurse to provide first aid in case of simple injuries. The clinic would be provided with its basic needs of medicines and first aid kit in continuous coordination with the preventive medicine department at the Ministry of Health;
  - Establishment of medical aid centers at all the work sites at the composting factory and landfill where the first aid would be provided by trained staff under the central clinic supervision;
  - Taking all the necessary measures to direct the staff to the Health Insurance Authority and specialized hospitals that deal with the company to provide healthcare;
  - Preparation of daily and monthly reports on the on-site injuries with an examination of their causes and methods of prevention based on the company’s experience in operating treatment and diversion utilities.

- **Environmental Division**

  The plan aims at protecting the environment against pollution as well as site maintenance and rehabilitation to provide suitable working and living conditions for the staff in coordination with the concerned departments at the Egyptian Environmental Affairs Agency (EEAA) and other related bodies.
- Creation of green areas in the factory and around the administrative buildings to improve the working conditions and provide suitable working environment for the staff;
- Preparation of monthly reports on the division’s performance including plan achievements and improvement of its performance;
- Carrying out the tasks related to quality control and the preparation of the registers required for inspection and follow-up.

**Industrial Safety Division**

The plan aims at preventing and providing protection to the staff against work injuries. It is mainly concerned with preventing or, at least, limiting accidents and providing protection measures in coordination with the related departments of the Ministry of Labor.

- Selecting and providing the protective equipment to personnel in adequate quantities and specifications. Equipment include working boots, hard hats, gloves, dust masks, goggle and ear protection that suits the work environment;
- Ensuring that the personnel is using the adequate industrial safety products;
- Determining accurately the risk of machinery, secure them by providing the proper protection measures and ensure the personnel obligation to follow these measures;
- Placing warning signs in suitable work and maintenance/repair areas, using suitable colors (yellow for warning, red for danger) and standard symbols;
- Placing descriptive illustrations for both the personnel and the visitors in alleys and work sites;
- Ensuring that the machinery and equipment are correctly operated by the personnel by holding training programs on the operation and implementation of safety and protection measures during operation;
- Following the implementation of planned and preventive maintenance programs ensuring the machinery efficiency and reducing the risk of work injuries;
- Supervising the personnel training programs on firefighting and first aid;
- Regulating smoking on the site to prevent fires and restricting it to designated areas;
- Collaborating with the emergency and firefighting department to developing a plan to secure the site against fire, especially the landfill, the waste receptions area and the compost warehouses;
- Providing appropriate types of fire extinguishers in sufficient quantities and locations as follows:
  - Frothy extinguishers;
  - Powder extinguishers;
- Carbon dioxide extinguishers.
- The extinguishers are provided in suitable size and quantities for the following work places:
  - Sorting lines and fixed equipment;
  - Compactors and workshops;
  - Mobile equipment;
  - Electric boards and units;
  - Waste reception and storage areas;
  - Compost and sorted materials warehouses.
- Controlling the fire and smoke detection network periodically and conducting periodic fire drills;
- Preparing the requested reports to the Civil Defense Department about the status of the facility;
- Preparing periodical management reports and holding meeting with the persons in charge to discuss professional risks and risk areas and methods of securing them;
- Organizing training courses for the personnel on industrial safety precautions that should be taken into account in each department and division, to include:
  - Sorting and material classification staff;
  - Fixed equipment operators;
  - Mobile equipment operators;
  - Composting personnel;
  - Purification and storage personnel.

Environmental Management Techniques

The following section reviews the main management techniques required to minimize major impacts, prevent accidents and ensure a good operation of the facility.

- **Minimizing Amenity Impacts**
  - Keep stockpiles of raw organics and finished products as small as practicable to avoid potential negative environmental impacts.
  - To minimize generation of PM$_{10}$ and total suspended particulate (TSP) matter, spray water to suppress matter that has been deposited on unsealed areas. Regularly turn composting windrows and ensure that they have a suitable moisture content.
  - The storage times of organic feedstock should be controlled to avoid emissions of offensive odors.
  - To minimize the emission of airborne pathogens, do not allow organics that are being processed, or composts, to lose too much moisture.
  - It has been found to be very useful to cover the windrows with a 15-centimetre-thick layer of freshly made compost. The micro-organisms
that are present in the fresh compost are able to reduce odor emissions by converting the odorous substances to less volatile substances.

- Contaminated products or organics and process residues should not be stockpiled and immediately disposed of because they can have negative impacts on the environment at or near the facility and contaminate organics in the process and/or the finished product.

• **Minimizing Noise**

Onsite noise attenuation measures include treating equipment acoustically and limiting hours of operation. Other items such as speed humps and vibration grids could be taken into account to prevent noise generation.

• **Pest Management**

Wastes have the potential to attract pests at the composting facility. Good housekeeping and process control will deter pests. The reception of waste feedstocks should be managed efficiently. This includes limiting the amounts of waste stored, regular cleaning of waste reception areas and the use of buildings to enclose wastes and deter pests.

• **Fire Management**

The facility have sufficient fire-fighting capacity by developing a site-specific fire management strategy to minimize the incidence and impact of fires. A preliminary fire fighting plan has been developed by the facility and presented in the following section (Emergency Plans).

To prevent fires from occurring at the facility, it is important that adequate fire prevention measures are in place, fire-fighting equipment is accessible, and staff are trained and able to manage fire outbreaks at any part of the facility. The following points should generally be covered:

- Clear signs should tell the public that flammable liquids are not permitted on the site. This should be reinforced by advice to customers at the gatehouse and inspection of loads at the organic reception area.
- Approved quantities of combustible contaminants that have been separated from the organics received for processing and are destined for recycling (such as tyres and plastic bottles) should be stockpiled in small piles or in windrows.
- All fuels or flammable solvents for operational use should be stored in an appropriately ventilated and secure store. This store should be located away from reception, storage and processing areas.

\(\text{\textit{Emergency Response Plan}}\)

Solid waste management projects need to incorporate safeguards against hazards, which could expose workforce to danger, interrupt the facility operations, or create abnormal pollution problems.
Potential hazards include:

- Fire starting in wastes before handling, during treatment, or burying or in refused materials;
- Potential gas emissions and odor due to chemical reactions;
- Potential explosion of flammable or volatile materials or objects;
- Heavy rains and flash floods;
- Strikes;
- Breaking into the site for theft or scavenging.

• **Fire Fighting**

Areas that are most susceptible to fires in the site are the reception, sorting and treatment areas; in addition to the fuel station, transformers house, and electricity outlets, which are usually the starting point of fires.

A preliminary fire fighting plan has been developed for the facility. The plan will be refined and the facility will acquire all the required equipment. The Fire fighting plan include the following:

- The site has been divided up into four major areas depending on their significance, i.e. facility No. 1, facility No. 2 and administration area.
- A sketch of the layout of each area has been drawn, including more hazardous areas, fire fighting points and their components according to expected type of fire, etc.
- Fire crews and company staff have been periodically trained on the fire plan together with hands-on demonstrations.
- Suitable places for the fire crew have been designated in order to be close to fire fighting point and to make sure that they are available as soon as needed.
- Making sure that prevention instructions, especially smoking prohibitions are enforced.
- Provision of sufficient numbers of fire extinguishers to cover the whole area of the facility
- Training of equipment operators on fire fighting
- Placing fire hydrants and foam materials in maintenance areas and fuel station.

• **Gas emissions and odors due to chemical reactions**

Prevention and control procedures include:

- Provide gas masks;
- Identify the emitted gas for suitable fighting approach.
• **Explosion of unidentified materials**

Solid waste may contain some unidentified materials or objects that may explode if subject to pressure, hammering or for any other reason. Generally, such objects are small and have limited effect. However, they may lead to dangerous injuries. Hence, the following procedures should be taken:

- First aid;
- Prompt notification of the ambulance service and police about the incident;
- Prompt transfer of the injured person to the nearest medical point.

• **Heavy rains and flash floods**

Rains or flash floods may fall in Cairo during October, November and December, which may cause important damages. Flash flood may result in the following:

- Equipment (in part or whole) may be flooded or damaged;
- Reception, sorting and burying areas may be flooded, with wastes moving to other places and strewn around;
- Electric panels and power sources may be damaged;
- Fires may start due to electric sparks or shortages.

Prevention and control procedures include:

- Equipment should be kept away from the path of flash floods and put on asphalted ground with their hand brakes raised to prevent their slippage.
- Workers should be trained to handle all kinds of emergencies;
- The emergency transport plan is part of the comprehensive plan for the site;
- Parties that should be notified in case of heavy rains or flash floods include:
  - Fire fighting department and civil defense
  - Ambulance service

• **Breaking into the site for theft or collecting waste and/or recyclables**

This is one of the major risks faced by the company from some people working in similar activities (e.g. garbage collectors, “Zabalin”), robbers, or collectors of sorted out materials. To address this issue, the following should be considered:

- Secure the administrative facilities and all equipment and vehicles;
- Presence of security guards at watch points;
- Presence of security guards inside the facility during the night;
- Call the police, as soon as the presence of robbers is detected.

**V, V, 4  Emergency Instructions and Procedures**

These are applicable to:

- All ECARU employees at the 15th of May facility;
- All contractors present at the company;
- All visitors present at the company.

**Reporting**

In case of emergency, people on site and the safety/emergency control center can be warned through:
- Internal telephone
- Direct telephone at 15th of May facility
- Witness to the incident or someone to be assigned for this
- Activating the alarm system

**Activating the alarm system**

When sounding the alarm system, the person must inform supervisors of the facilities about the type incident. In addition, the persons who witnessed the incident should immediately inform the emergency center. Information to be reported include:
- Name of person reporting
- Location of incident
- Nature of incident
- In case of fire the following information should be reported:
  - Type of wastes on location (i.e. sorted out materials or solid wastes)
  - Type of combustion (self-combustion or flames)

**Emergency alarm**

The fire alarm (bugle or siren) can be operated through:
- Breaking the glass of the alarm button in any section on site;
- Pressing the test button in the local alarm panel in the emergency coordination room or the shift supervisor office;
- Turning on the alarm switch in the safety section.

**Types of Alarm**

Alarms can be distinguished as follows:
- Fire: sounding the siren for 45 seconds
- Termination of emergency: sounding the siren for three 35-second intervals

**Testing the Emergency Alarm**

The emergency siren will be tested on the first Saturday of each month at 10:30 a.m. The safety officer will call the different departments in the company and administration building 30 minutes before the test to prevent any interruption in the work process.

**Procedures**

Upon the occurrence of an emergency, coordinators should:
- Wear their yellow jacket to be easily distinguished;
- Contact persons on site by megaphone, if necessary;
- Call the emergency control room for further instructions;
- Assist persons in need and provide them with safety equipment;
- Assist visitors and contractors in getting to the proper gathering point;
- Request the shift supervisor at the incident area to follow emergency instructions and demand information on situation;
- Call the safety personnel to be available at the emergency control room for coordinating rescue operations and control.

**Emergency Actions**

In case of emergency the following actions must be taken, as follows:
- Facility management should be available at the emergency control room;
- Upon the sound of the alarm, all non-staff persons at the facilities and maintenance should:
  - Head for places away from smoke and flames;
  - Follow instructions of the emergency coordinator once they reach the gathering point away from the incident area.

**Emergency Coordinators**

The following table describes the main responsibilities of the emergency coordinators.

**Table 7.3: Responsibilities of Emergency Coordinators**

<table>
<thead>
<tr>
<th>Coordinator</th>
<th>Responsibilities</th>
</tr>
</thead>
</table>
| First aid officer       | - Communicate directly with the clinic;  
                           - Coordinate first aid activities, assist first aid men, and evacuate the injured to the clinic or hospital, if required;  
                           - Call the ambulance, if necessary.                                                                                                                                                                           |
| Safety officer          | - Head to the incident area and review with the manager of the facility to assess situation;  
                           - Contact the emergency control room and report the incident;  
                           - Make necessary arrangements for evacuating the site, if necessary.                                                                                                                                       |
| Security officer        | - Ensure the security of the site;  
                           - Instruct security guards to prevent entry or exit from the site without instructions from the emergency control room or the safety officer;  
                           - Take the necessary procedures to ensure safe and smooth exit of staff, contractors, and visitors through safe passages to the gates of the company, upon receiving instructions from the emergency control room for evacuation. |
<p>| Administrative Affairs  | - Perform public relations services; provide information and data to concerned parties in line with the company emergency plans and procedures.                                                                 |</p>
<table>
<thead>
<tr>
<th>Coordinator</th>
<th>Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guards</td>
<td>- Should be available in the area beside the main gate of the composting facilities for any instructions or information coming from the emergency control room;</td>
</tr>
<tr>
<td></td>
<td>- Should also prevent any vehicles or persons from entering the site, except for the persons needed for handling the emergency and providing assistance, or as per instructions of the emergency control room.</td>
</tr>
<tr>
<td>Telephone operator</td>
<td>- Report to the emergency control room and implement the emergency communications plan.</td>
</tr>
<tr>
<td>Emergency chief</td>
<td>- Coordinate all rescue operations and other necessary procedures to ensure the safety of the staff, the site and surrounding areas.</td>
</tr>
</tbody>
</table>

- **Emergency Case Form**

The following form should be filled and kept as a record after the emergency has been dealt with and corrective actions have been taken.

<table>
<thead>
<tr>
<th>Serial No.</th>
<th>Date</th>
<th>Time</th>
<th>Incident Reporter</th>
<th>Location</th>
<th>Emergency Type</th>
<th>Procedures Taken</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[\text{V, 4} \quad \text{Monitoring Plan}\]

The monitoring program is an essential element of the environmental management scheme of the project. It provides information for periodic review and adjustment of the environmental management plan, as necessary, to ensure that environmental protection is achieved through early detection of negative impacts.

It is important to note here that environmental monitoring is a dynamic process. Locations, parameters and frequencies are subject to variations, based on early monitoring findings.

According to law 4/1994, establishments should maintain an environmental register to track all the environmental aspects of their activities. The environmental register will contain all self-monitoring results.

Four main environmental components have been identified, in Chapter 5, to be at jeopardy of undergoing relatively significant impacts as a result of the operational activities. These are air quality, noise quality, terrestrial life and worker health and safety. To assure that devised mitigation measures serve their purpose, these components will be monitored as follows:

\[ a. \quad \text{Air Quality}\]

Air quality would be monitored for PM$_{10}$ and TSP levels through the duration of the operation phase. Monitoring would be conducted on a semi-annual basis to account for the impacts of seasonal variations (increased wind speed during winter season). The locations would be
selected such that one location would indicate for upwind air quality while the other would indicate for down wind air quality.

b. **Noise Intensity**

Increased noise intensity is anticipated to mainly impact on site workers. As such, spot measurement of noise during the construction of each of the landfill cells should be conducted. Noise levels recorded should be compared to levels set within the guidelines. The limit stipulated in Law No. 4, 1994 for work places with 8 hour shift is 90 decibel (A).

Moreover, measurements beyond the site should be conducted to delineate noise emissions in the northern direction, where the residential receptor is located. Limits detected should be compared to the limit stipulated in Law No. 4, 1994 for Industrial areas, daytime noise (07:00 to 18:00) is 60 - 70 decibel (A).

It is suggested to acquire a noise level meter, e.g. Testo 816 (Figure 7.1) in order to perform in-house noise measurements on a weekly bases for the work environment and on a monthly bases for ambient air. This would reduce noise monitoring costs on the long run.

c. **Terrestrial Life**

Continuous visual inspection will be sufficient to indicate whether changes have been brought about to the biodiversity of the area.

d. **Worker Health and Safety**

Regular visual inspection and medical checkups should be sufficient for worker health and safety monitoring. Any reoccurring incidents such as irritations, rashes, respiratory problems, etc, should be recorded and appropriate mitigation measures updated and enhanced.

Management should monitor workers to assure that all health and safety and protective gear are being used for their assigned purpose.

Table 7.4 presents the proposed monitoring measures, its estimated cost and the party responsible for implementation. All costs will incurred by the company.
Table 7.4: Monitoring measures, costs and responsibilities

<table>
<thead>
<tr>
<th>Monitoring Measures</th>
<th>Criteria/Indicators to be Monitored</th>
<th>Frequency of Monitoring</th>
<th>Estimated Cost (LE)</th>
<th>Responsible for Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air quality</td>
<td>PM$_{10}$ and TSP</td>
<td>24 hour monitoring, twice a year</td>
<td>3500</td>
<td>Third party (e.g. Research Centers or Universities)</td>
</tr>
<tr>
<td>Noise</td>
<td>Noise intensity db(A)</td>
<td>Monthly (Ambient air)</td>
<td>4500 to be paid once (price of noise level meter)</td>
<td>Health, Safety and Environment Department, Environmental and Industrial Safety Divisions</td>
</tr>
<tr>
<td></td>
<td>Changes in species composition of the area</td>
<td>Annual</td>
<td>5000</td>
<td>Third party (e.g. Research Centers, Universities, or consulting firms)</td>
</tr>
<tr>
<td>Terrestrial life</td>
<td>Type and number of pests</td>
<td>Every three months</td>
<td></td>
<td>Health, Safety and Environment Department, Health and Environmental Divisions</td>
</tr>
<tr>
<td>Workers’ health and safety</td>
<td>Medical visual inspection</td>
<td>Monthly</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Medical check-up</td>
<td>Twice a year</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Expiry date of medicines</td>
<td>Each time a medicine is prescribed; Monthly (all stock)</td>
<td></td>
<td>Health, Safety and Environment Department, Health Division</td>
</tr>
<tr>
<td></td>
<td>Expiry date of food</td>
<td>Daily</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Efficiency of safety equipment</td>
<td>Monthly</td>
<td></td>
<td>Health, Safety and Environment Department, Industrial Safety Division</td>
</tr>
</tbody>
</table>

Monitoring data can be also complemented with relevant data concerning the monitoring activities for the adjacent landfill.

A department for Monitoring Performance and Quality is established at the facility. It is actually responsible of the following activities:

- Coordinating with inspecting agencies the inspection works and accompanying them during inspections, report-writing and follow up;
- Following up the work plan implementation during work preparation and making sure that time schedule is followed, as well as following up shortage causes when they occur;
- Inspection and preliminary supervision of supplies, services in the site and workshops;
- Inspection of scales, monitor their accuracy, follow up the maintenance processes, verification of weights and calibrating them regularly;
- Performing a monthly security examination on the site;
- Checking that the necessary safety equipment are available (according to working conditions);
- Assuring that industrial safety equipment and fire extinguishers are properly working;
- Check the expiry date of food offered to employees and workers;
- Assuring that medicine, medical instruments and first aid kits are available and not expired;
- Checking all records, situation and administration works
- Following the inspection process of the site equipment and examining all units before and after working hours in collaboration with specialized committees;
- Following the treatment process of all waste delivered to the composting facility.

\section{Staffing and Training}

The level and nature of staffing and training should be adequate for environmentally responsible and safe management of the composting and related organics processing facility. Staffing levels should be high enough to ensure that the facility can comply at all times with all provisions of the environmental protection approval issued by the EEAA. Training of staffing is also important to ensure proper implementation and monitoring of mitigation measures. Accordingly, the training plans should be developed in accordance with the management and monitoring programs of the present study.

In general, staff training should be effective enough to ensure that:
- All equipment operators are skilled at undertaking all the tasks required of them;
- All lab and quality control personnel are familiar with the required testing and sample retention protocols;
- All personnel who inspect incoming organics are skilled at identifying organics that are unacceptable and can record data accurately.
- Staff training activities should include first aid training, quality control and environmental management and monitoring training as well as industrial safety precautions. Each division would be responsible for determining the training requirements of its staff.

Staffing requirements should vary as a function of the size of the facility, the type of organics, and the diversity and complexity of present and future site operations.

\section{Management Plan Review}

The Project Manager is authorized to change and re-issue the EMP. The Site Supervisor should be informed of any changes made by the Project Manager and is authorized to change and re-issue procedures for environmental control. Moreover, each procedure would be regularly reviewed by the Site Supervisor. He is also responsible for ensuring that the workforce is complying with procedures, informing the staff of any changes and ensuring that the staff is aware of changes before starting any works.
8. Public Consultation and Disclosure

The consultation process is important for the development of a project and its planning. The consultation process involves different phases, including:

- Stakeholder identification
- Initial stakeholder meetings and scoping
- Public consultation during EIA development
- Ongoing consultation during project development

The project is already operational and an EIA has been previously presented to the EEAA. Therefore, this section includes a public consultation in the form of individual meetings with relevant stakeholders to assist the present EMP. Being a Category “B” project, a public disclosure meeting was not requested by the World Bank, unless contentious issues arise. However disclosure should be done in an appropriate way in order to allow public view and comments on the project.

8.1 Stakeholder Identification

The initial identification of project stakeholders is usually based on an analysis of the institutional, legal and administrative framework of the project. A preliminary meeting with the EIA department of the EEAA, in addition to a site survey and visit, assisted in the identification of concerned governmental entities, communities affected by the project and local nongovernmental organizations (NGOs) with environmental interests in the project. A preliminary list of potential stakeholders was prepared and presented in Table 8.1.

<table>
<thead>
<tr>
<th>Stakeholders</th>
<th>Role/potential interests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egyptian Environmental Affairs Agency</td>
<td>Overall coordinating body of monitoring, enforcement and regulating developments through setting the EIA system, managing the protection and preservation of natural environment in coordination with concerned and responsible authorities.</td>
</tr>
<tr>
<td>- EIA Central Department</td>
<td></td>
</tr>
<tr>
<td>- Solid Waste Management Department</td>
<td></td>
</tr>
<tr>
<td>- Climate Change Central Department</td>
<td></td>
</tr>
<tr>
<td>- Cairo Regional Branch office</td>
<td></td>
</tr>
<tr>
<td>Cairo Governorate:</td>
<td>Governorate official bodies responsible for licensing, implementation and follow up of regulations.</td>
</tr>
<tr>
<td>- Cleaning and Beautification Authority</td>
<td></td>
</tr>
<tr>
<td>- Environmental Management Unit (EMU)</td>
<td></td>
</tr>
<tr>
<td>15th of May City Council</td>
<td>Local coordination and follow up</td>
</tr>
<tr>
<td>Local community</td>
<td>To act as representatives of the public</td>
</tr>
<tr>
<td>NGOs</td>
<td>Safeguard the environment and influence decision-making, representatives of the public</td>
</tr>
<tr>
<td>Scientific community</td>
<td>Research in related topics and influence decision-making through public channels</td>
</tr>
</tbody>
</table>

The stakeholder identification process generally occurs early during the scoping phase of the project. However, stakeholder identification is a continual process that is carried on during the subsequent phases of
consultation and project development. Scoping meetings provide further information for the stakeholder identification process. Understanding the potential interests of these groups also assists in identifying the main issues that should be covered during the consultation meetings to be held.

8.2 Scoping Meetings and Consultation

Meetings with stakeholders aim at:

- Providing basic information about the project and the intention to prepare an EIA;
- Seek their views regarding the potentially affected/interested parties;
- Identify issues;
- Discuss any special types of analysis required, data sources and management procedures, responsibilities and schedules.
- Identify other stakeholders to be included in the study.

An Arabic questionnaire was prepared to facilitate the consultation process. It contains general queries that could be asked to all stakeholders as well as specific queries specific to the role of each stakeholder. The questionnaire includes the following questions:

2. Do you have previous experience with similar projects?
3. What are the main problems and issues that have arisen from these projects?
4. What were the actions undertaken?
5. Were the mitigation measures for these projects satisfactory?
6. Were there unsolved issues? What are your suggestions?
7. Have you previously carried out monitoring/follow up activities related to similar projects?
8. Were there any complaints related to similar projects?
9. Was the public involved in previous projects?
10. What are the required permits and administrative procedures for this kind of project?
11. Has the project area particular sensitivities?
12. Has this type of project particular impacts?
13. Do you think that the project could affect the hinterland?
14. Are there any planned projects/establishments in the project area that could interfere with the seismic survey?
15. How, do you suggest, can the local communities be involved in the project phases? And what is the best way to get the local communities involved?
16. What are the other entities that should be consulted in relation to this project?
17. Do you have any other comments regarding this project?
18. Do you have any other suggestions aiming at improving the EIA?
A summary of these meetings and the resulting output is included below.

8.2.1 Meeting Results

**Date: 16/4/2007**  
**EEAA : EIA Central Department**  
**Geologist Mahmoud Allam: Director at the EIA Central Department**

Mr. Mohammad Allam confirmed that he has previous experiences with similar projects. He said that the main issues were the location, the environmental management inside the factory, the unavailability of statistics concerning the amount of wastes in the areas in which the factory is located, the lack of information regarding the type of wastes, and the position of the factory within the overall management plan for solid wastes. These issues were dealt with as follows:

- A committee was formed with stakeholders to define the best suitable locations for establishing the recycling facilities and landfills;
- Governorates provide technical cooperation together with the EEAA to carry out studies concerning the amount of wastes for each governorate;
- The development of guidelines for integrated solid waste management is currently being performed;
- An integrated environmental assessment study is presented in the case of an integrated project of solid waste administration but in the case of a recycling facility only a limited study is carried out (Form B).

The mitigation measures taken were generally unsatisfactory but currently there is coordination with the governorate in concerning solid waste monitoring and to find suitable solutions for waste, in addition to the rehabilitation of some of the uncontrolled dump sites. Also, separation at source and proper management within the facility are important to reduce waste reject and to increase the quality of the final product.

There were some problems with previous projects, that have not been solved yet, such as the absence of a desert area and the lack of an area which meets the requirements for recycling locations (e.g. in Gharbeya Governorate).

The company needs to abide with the environmental regulations, apply proper environmental management and abide with the environmental law, so as not to impact the area. In case there is a problem, the Competent Administrative Authority (CAA) should be responsible to deal with it and if the problem persists and is a cause of major negative impacts on the environment, the EEAA should be informed.
The civil society has been informed in a previous project, which involved the establishment of a landfill beside the recycling facility. The best way to include the public is to use the methods used by the civil society such as public hearings, scoping sessions and media.

Other bodies that should be informed include universities and research centers because of their important technological knowledge and their ability to suggest new technologies. Other bodies include the Ministry of Investment, companies of the business sector (since they lack environmental awareness and so need to learn about waste management for their companies) and the Investment Authority (for its ability and experience in attracting investors).

Date: 16/4/2007
EEAA: Solid Waste Management Department
Mr. Mohamed Hussein Ahmed: Environmental Researcher at the Solid Waste Management Department

The most important issue with previous projects was the location. A study of the location should be implemented to assess whether it fits with the environmental requirements or not. Some of the mitigation measures of previous projects were satisfactory and some were not and this depends mainly on the facility management. There were some problems faced by other facilities, such as in Beheira Governorate, where the facility did not have the capacity to accept all the agricultural waste and, therefore, exceeding waste was collected and burned. Moreover, the facility was located beside agricultural and residential areas.

The main role of the solid Waste Management department is to assess whether the location meets the environmental requirements and to give a primary approval for the location. Then, an EIA is carried out and it is revised by the EIA Central Department. This project is located in an almost empty area with no important sensitivities and, accordingly, no major impacts would occur.

The facility should work at its maximum capacity to accept all the waste so that no excess waste is disposed without treatment. There should also be good environmental management in the facility so that no problems arise during the recycling process.

The best way to involve the public is to make a meeting with the community leaders such as the local council member, the local unit members, the civil society, the different political parties, etc. There are many NGOs that work in the field of solid waste management. The Cleaning and Beautification Authority should be consulted because it is responsible for monitoring the project.

Date: 16/4/2007
EEAA: Central Department for Environmental Inspection
Dr. Ahlam Farouk: Head of Inspection Department
The most important issues raised with similar projects included the safe disposal of sorted waste which did not enter a composting facility. The best way should be chosen for the composting operation, and preferably it should be by using windrows system instead of piles system because it allows for more ventilation. Mesh waste using mesh size sieves to reduce rejects. All resulting wastes should be safely disposed of. Workers should be provided with Personal Protection Equipment (PPE). There should be an environmental register for the facility with documentation of water sources and washing wastewater disposal methods. Windrows should be placed over cement-lined grounds. Lined septic tanks and be also in place. In case of violations, a judicial record is prepared by the inspecting team. The mitigation measures of previous projects were to a large extent satisfactory. There were some unsolved problems, for example in some locations the residential area extended to reach the facility neighborhood.

The main official bodies concerned with such a project are the Cleaning and Beautification Authority (Cairo Governorate) and the Solid Waste Management Department of the EEAA. There will be no problems if all regulations are abided with. One particular problem can be odor emissions, especially during summer. The environmental regulation and the management plan should be followed so that such problems do not occur. In case there is a problem, the EEAA and, particularly, the Inspection Department should be consulted on how to deal with it. There should also be biological, chemical and physical laboratories at the facility to guarantee quality control, in addition to self-monitoring.

There is no knowledge of any other projects that might conflict with this project but the environmental administration should be asked for reassurance. The civil society has not been consulted in previous projects because the residential area was far away from any of the projects. The best way to involve the public is to involve the executive bodies responsible for the area as well as the press. Other parties that should be consulted include NGOs, the civil society and the Central Department for Climate Change of the EEAA.

**Date: 16/4/2007**
**EEAA: Central Department for Climate Change**
**Eng. Samir Tantawy**
**Climate Change Specialist**
**Member of the Egyptian Bureau for CDM**

This is the first recycling project that enters into the realm of CDM. The Egyptian council for CDM has released an approval letter for the project (which is a committee made up of 15 members from different ministries). The CDM has previous experiences with projects concerned with safe landfills. There is a similar project (ONYX) in Alexandria which is funded by the World Bank. The most important thing for CDM is the lowering of methane gas emission rates. In fact, lowering the waste amount consequently leads to the decrease of methane gas emissions. These projects are currently under implementation and the results have not been assessed yet.
For a project to be approved by CDM, a specialist prepares a Project Idea Note (PIN) which is presented to CDM office for approval. The study is then presented to a Validator to assess the Project Design Document (PDD) and issue the final approval and to register the project internationally. It is important to make sure that all CDM projects contribute to economic, environmental and social development. Two types of approvals are needed; the Letter of No Objection (LON), and the Letter of Approval and Authorization (LOA), after a Validator has approved the project. The social aspect must be taken into consideration; the project should create job opportunities and should have a budget to make social development projects in the area. We try and support such projects because they have multiple functions; they make use of waste by recycling it and it is profitable for the owner. The owner of the project is required to organize an awareness workshop explaining the aims of the project, inviting owner of similar projects, the civil society, the Designated National Authority (DNA), the press and the community leaders, before issuing the LOA. Therefore, the best way to involve the public is through organizing workshops.

Date: 19/4/2007

ECARU Company
Mr. Mosaad Mohamed Sherif (plumber/worker at the facility and lives on location)

Mr. Mosaad Mohammad Sherif explained that he has worked in similar projects with ECARU in Qatamy and Al Obour. He has learnt the skill for this job through the company. He also explained that the project was useful for the area. Before the project was established, garbage was collected, garbage collectors (Zabbalin) took what they needed from it and the rest was burnt. Moreover, the location of this facility was full of cement dust, either from stacks or simply disposed the area, which has been removed by the project, and buried in another area. The location has been planted with grass, instead.

Some plastic bags are blown away from the facility to the workers residence area but they are removed daily by cleaners. The residence is being disinfested daily to avoid the presence of any insects. Water is bought in tanks and is filtered for drinking. There are cars, that the company either rented or owned, which transport the workers as far as Helwan. Furthermore, the workers on location get three meals a day from the company. There are stacks from other companies which have a polluting influence on the area and consequently on the workers living on location.

Date: 19/4/2007

Ms. Amal Mohamed Abdel Latif
Worker on the separation line

She said that she is from Al Arab, which is 15 minutes away by car. Most workers in the company are from Al Arab village but there are also workers from Maadi and Ramses as well as from other areas. She has been working in the company for four months. It was practical for her to take this job because it is nearby, unlike other jobs that are usually away from the village, and it does
not need skilled labor. She has to financially support her household and also take care of it. Therefore, it is most practical for her to work somewhere near her residence area. The company also trains workers. When she was hired, she had never worked on waste sorting and separation. She first started with emptying the waste bags and then was trained in working in every section of the sorting line until she finally chose the section she preferred.

Date: 19/4/2007
Engineer Hiam
Environment Office Director at the Environment Office of 15th of May City Council

Engineer Hiam explained that she was not aware about the project. She also added that the project does not fall under the 15th of May City jurisdiction. The influence of the project on the city and local residents is unknown to her.

Date: 22/2/2007
Dr. Shadia El Shishini
Professor of Chemical and Environmental Engineering
Faculty of Engineering
Cairo University

Dr. Shadia has had experience with similar projects. The main concerns of these projects were the VOC and ammonia emissions resulting from waste decomposition and the particulate matter generated from the grinding and shredding operations. These problems were dealt with by minimizing the occurrence of anaerobic conditions that cause VOCs, methane and NH3 emissions by the use of technologies, including:
- Enclosures;
- Forced aeration; and
- In-vessel composting.

The use of such mitigation measures was successful. It reduced the emissions by about 50-70%. A problem that could not be solved was related to odors, but it can be minimized through proper site selection. The presence of nearby cement factories is an advantage as they can burn the tires in the rotary kilns. Residential areas located downwind, if any, may/will suffer from odor emissions.

Date: 22/4/2007
EMU Cairo Governorate
Mr. Gamal Ahmad Salah
Head of EMU Office for Cairo governorate

For similar previous projects the Cleaning and Beautification Authority (CAA) was consulted. Such a project needs the approval of the Competent Administrative Authority (CAA). An approval license should be granted by the district to prove its agreement and that there is coordination with the
Cleaning and Beautification Authority. To learn more about the sensitivities related to the project, the EIA should be reviewed. The public should be included by carrying out a survey covering the local community and the local council. In addition, the importance of the project should be explained to the public. Other bodies that may be consulted are the Cleaning and Beautification Authority, the district in which the project fall under its jurisdiction, the local council and the local community.

Date: 22/4/2007
NGO: Nahdet El Mansoureya for Development
Engineer Inas Omar
Head of the Organization

The organization works on integrate waste management for rural villages. It collects wastes from neighboring areas while cooperating with the cleaning and beautification authorities. A previous project similar to this was the composting project of the Association for the Protection of the Environment (APE), in Manshaat Nasser and Tora. The most important issues in the previous project were:

- Workers having to sort waste by hand;
- Bad odors; and
- Increase in number of flies due to the presence waste.

It was suggested that a cooperation for garbage collectors (Zabbalin) should be established. It was also suggested that another location should be chosen for the project, which is further away from the residential area of the garbage collectors. Development of the sorting process was also considered.

The current project (ECARU’s) should take into consideration that the garbage might be blown away by wind and should designate a buffer zone with trees and plants to minimize wind-blown waste. The project should be advertised in order that the public would learn about it. Moreover, the waste recycling process should be explained through television channels. Another body that should be consulted is the transport and waste collection company.

8.2.2 Main Concerns

A number of concerns were raised by the different stakeholders during the individual meetings. These included:

- Many of the stakeholders expressed their worry that the project would cause bad odor and inquired whether it would affect the nearby residential areas.
- There were worries that there is a possibility that some of the wastes might be blown away by wind and might pollute the surrounding project area.
- Workers should be provided with Personal Protection Equipment (PPE).
- An environmental register should be available at the facility to include full documentation of mitigation and self-monitoring measures.
- Some experts emphasized that in previous projects there was a problem with the VOC and ammonia emissions resulting from waste decomposition and with the particulate matter generated from grinding and shredding operations, which might be concerns for this project as well.
- There were concerns whether workers would have to sort waste by hand.
- The project should be advertised and the waste recycling process should be explained to the public.

A list of the consulted stakeholders is presented in Table 8.2.

### Table 8.2: List of consulted stakeholders

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Contacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geol. Mahmoud Allam</td>
<td>Director at the Central EIA Department, EEAA</td>
<td>02/5256452 (EEAA Tel. Number)</td>
</tr>
<tr>
<td>Mr. Mohamed Hussein Ahmed</td>
<td>Environmental Researcher, Solid Waste Management Department, EEAA</td>
<td>02/5256452 (EEAA Tel. Number)</td>
</tr>
<tr>
<td>Dr. Ahlam Farouk</td>
<td>Director of the Inspection Department, EEAA</td>
<td>02/5256452 (EEAA Tel. Number)</td>
</tr>
<tr>
<td>Eng. Samir Tantawy</td>
<td>Climate Change Specialist &amp; Member of the Egyptian Bureau for CDM Central Department for Climate Change, EEAA</td>
<td>02/5256452 (EEAA Tel. Number)</td>
</tr>
<tr>
<td>Dr. Shadia El Shishini</td>
<td>Professor of Chemical and Environmental Engineering, Faculty of Engineering, Cairo University</td>
<td>02/5678625 02/5678613 (Tel. of the Chemical Engineering Department secretariat)</td>
</tr>
<tr>
<td>Mosaad Mohamed Sherif</td>
<td>Worker at the company and lives on-site</td>
<td>010/6240331 (Composting facility)</td>
</tr>
<tr>
<td>Amal Mohamed Abdel Latif</td>
<td>Worker at the company and lives in Al-Arab (close area)</td>
<td>010/6240331 (Composting facility)</td>
</tr>
<tr>
<td>Mr. Gamal Ahmad Salah</td>
<td>Head of EMU Office, Cairo governorate)</td>
<td>010/5226706</td>
</tr>
<tr>
<td>Engineer Hiam</td>
<td>Environment Office Director at the 15th of May City Council</td>
<td>NA</td>
</tr>
<tr>
<td>Engineer Inas Omar</td>
<td>Head of the NGO Nahdet El Mansoureya for Development</td>
<td>02/8903302 012/2158861</td>
</tr>
</tbody>
</table>

### 8.3 Community Services

The company actually provides employment for 220 persons. It also provides on-site accommodation and meals for 175 of them. Moreover, many of the offsite residents come from nearby districts such as Maadi, Al Arab, Tebbin and Helwan. The company is interested in sharing its expertise and transferring its know-how in sorting and composting to relevant NGOs and interested parties. It has already facilitated visits to its site to “Nahdet El Mansoureya for Development” NGO. The company aims towards further cooperation with NGOs interested in the field of Solid Waste Management.
Training and integration of garbage collectors (Zabbalin) in potential future developments is also a company objective.

8.4 Public Disclosure

To maintain the consultation process all through project development and involve the public in the disclosure phase, various methods could be used. The various disclosure methods that could be carried out are herein presented.

One way of including the public is to post a newspaper advertisement on the project, which includes a phone number, a postal address and/or an e-mail address. People interested in requesting information about the project and the EIA/EMP or those who have any question or complaint regarding them, could either call to request information or post any questions concerning the project or EIA process. This method of involving the public assures that the consultation process is continuous and keeps the public informed about the project at any time throughout its development.

Another method could be the use of a website to display information. In the website, an email address should be included for any questions regarding the project, the EIA/EMP study and potential complaints.

Also, local TV channels could be used as a medium to inform the public about the project and related studies, as well as NGOs that could be informed to take over the role of explaining the project and EIA.

A previously used method is to post an advertisement in the newspaper stating that the EIA/EMP is available at the company headquarter for whoever is interested. The company would assign a person responsible for meeting interested people and providing them with all the requested information.

At the present stage, the latter option seems to be the most appropriate, and hence it would be carried out. However, the company will investigate the other options and select the most performing one (or a combination of many) in coordination with the World Bank.
References


Annex A
EEAA Approval
السيد الأستاذ / محمد أحمد نبيل
رئيس مجلس إدارة الهيئة العامة للطاقة والجميل القاهرة

الإجراء: إلى كتاب ساهمك البارز س.8/4/2005 والمرفق بهنموذج التصنيف الإبدائي (18) بشأن مشروع
مصنع السلام الممتلكة للهيئة وموجودة خلاب بنivals 12، شرق طريق الأوليمبليك، والتي تصل بواسطة الممر.

الקוב والمطارات المطلوبة: إلى الإنترنت بأسماء مبادرة ممكنتين مبرمجة لتنافسية النبالة على المشروع
المذكور شرعة الإذن بإتمام الإجراءات التي جاءت بالمتوافق مع الإذن بإتمام الإجراءات التي تم عليها التنفيذ رغم
مدة 1994 سنة حالة فعالية تمتليئة بالإنترنت بالإضافة الأجل:

- الإذن بمرور نبالة 500 مكرون متر 1/3، وقافلة من 12 متر 1/3، مقاطعة 3 كم كما ورد بالتزامن على أن تتم

الحفاظ على هذه المبادرة في أي نقطة مبدئي.

- الإدارة تلتزم بالسنوات المبللة للسنة "18" بعد إعدادها من مبادر، توزع وتوزع توزع
من المبادر والغرامات الصناعية، وفقًا لتحملها أو غير فلدية إعداد النمو.

- أن يتم الدخول إلى النمو براتب 1.5 متر حول المسمى على أن يتم توطير المبادرة المبسطة.

- مراقبة وفقاً لحدود النمو والمواد المنجزة عن اشتراك مع عملية إعداد للاستفادة وقروض.

- التنسيق في النمو للأنهار الناحية من تنطلق عن طريق تجسيده في خزان مزرعة من البضائع.

- مراقبة صحة بيئة العمل وعوامل الأمان، بالإضافة إلى ضرورة توفير نشاط الطرق الرافدة والكشف تطبيقي الدور.

- تجنب استعمال المبادرات، أو السمات الصناعية أو المبادرات الأخرى.

- إعداد نماذج البيئة بعد مرور 18 سنة من التخطيط.

- هذه المبادرة من الناحية البيئية، فقط دون الإذن بإذن أن تؤدي أو تؤدي أو تؤدي آخر من منطقة هذا النشاط.

- fébr 2005

30 Misr Helwan El-Zyraei Rd., Maadi - Cairo Egypt. P. O. 11728. Tel: 5256452 - Fax: 5256490
السيد الأساتذة الدكتور / رئيس جهاز شؤون البيئة

تحية طيبة وبعد;

نتشرف بأن نرفق طليق نموذج التصنيف البياني (ب) و الخاص بمصانع السماد المملوكة للهيئة،

و الموجودة جنوب مدينة 15 مايو شرق طريق الإيوتستراد و التي تبلغ سعتها الاستهلاكية

600 طن/يوم و التي تعمل بواسطة الشركة المصرية لتدوير المخلفات الحفيلة.

و ذلك حتى يتسنى لسيداتكم مراجعتها و إجازتها.

وتفضلوا سيادتكم بقبول فائق الاحترام،

وكيل أول الوزارة
رئيس مجلس إدارة الهيئة

[توقيع]

تحرير في: 13 / 8 / 2005

[توقيع]

أم التقييم، المدير المس

14 أニュース 2005
نموذج التصنيف البيئي (ب)

Environmental Screening Form (B)
لا يمكنني قراءة النص المكتوب باللغة العربية بشكل طبيعي بسبب التراكم الكثيف والحرفية. إذا كنت بحاجة إلى مساعدة مع شيء معين من النص، يمكنني مساعدتك. يمكنني أيضًا مساعدتك في ترجمة النص إلى اللغة الإنجليزية إذا كنت ترغب في ذلك.
لا يوجد نموذج التصنيف البيئي (B) / (B)
لدوّرنا التصوّف البيوني (بيتا) / (B) / 4

هذه النسخة توزع بالمجان.
8.3 وصف لأية رسائل أخرى للخطاب الآثار المادية للمشروع، يتم ذكرها سابقاً;

8.3. الاحتياجات المذكورة بشأن صحة بيئة العمل وأمان المساكن، وшимوايات متكاملة الحرف:

أقر أنا المواقع أدناه بأن البيانات المدونة عالياً صحيحة، وذات طابع ملف المساكن المذودرة لدى، وأنه
في حالة أي تدخل، أعني شراء circuit مبنية البيئة في حينه،
و هذا إقرار مبني بذلك ...

المست: 

رقم البطاقة/رقم الفوضى/رقم السفر: 

التوقيع: 

تاريخ: 

بشكل متساوي، يعترف الهيئة الإدارية المذكورة، أو المانحة للتوقيع،

اعتماد الهيئة الإدارية:

الاسم: 

التوقيع: 

التوقيع: 

خاتم شعار الجمهورية
Annex B
Facility Layout