
U.S. TRADE AND DEVELOPMENT AGENCY



EXECUTIVE SUMMARY

Feasibility Study for the Construction and Operation of the Controlled Solid Waste Landfill of the City of Abidjan

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1. INTRODUCTION

The City of Abidjan wants to improve its solid waste management practices, particularly the treatment of solid wastes. The City of Abidjan's concern in solving this important environmental issue has resulted in the signature of a Grant Agreement concluded between the United States Trade and Development Agency (TDA) and the City of Abidjan.

The City of Abidjan has selected the Consortium Sadat International Inc. (SII), Edgeboro International, Inc. (EII) and the Bureau National des Etudes et Travaux de Développement (BNETD) to conduct such a feasibility study with an emphasis on the technical, financial, environmental and other aspects for the planned project. Next, the evaluation requires a diagnostic and a thorough analysis of the means and methods currently in place. The results of the analyses and field investigations will provide valuable information to propose remedial actions and solutions.

The present report is divided into 6 chapters. The first chapter being an introduction.

The feasibility study, consists first of a general evaluation of the existing situation in term of solid waste management with an emphasis on waste

Chapter 2 covers general data of the study area with specific information dealing with:

- Demographic and economic development aspects of the City of Abidjan
- Main infrastructures of the study area.

Chapter 3 describes the existing waste management system from an institutional, administrative, and organizational point of view. Current methods of collection, recycling, valorization and treatment are described.

Field investigations were conducted by BNETD to determine waste generation rates and waste compositions in the City of Abidjan. Field investigation results are covered in chapter 4. Pertinent collected data are then used to predict waste generation evolution with time,

Chapter 5, covers the present costs aspects associated with the solid waste management practices.

General data needed for the landfill site selection process are presented in Chapter 6 (geographical locations, geology, hydrogeology, and meteorological data)

2. STUDY AREA - BACKGROUND INFORMATION

2.1 THE CITY OF ABIDJAN

The Ivory Coast is located in Western Africa, on the Gulf of Guinea. It is bounded to the north by Mali and Burkina Faso, to the east by Ghana, to the south by the Gulf of Guinea, to the southwest by Liberia, and to the northwest by Guinea. The country area of 322,462 km² is occupied by a population of 15,446,231 (1998 census). A former French colony, Ivory Coast gained independence in August 7, 1960. The de facto capital is Abidjan; the administrative capital designate is Yamoussoukrou. Inherited from the colonization period are the official language, French, as well as the administrative, judiciary and educational systems.

Abidjan, a small fishermen village in 1900, has evolved into one of the largest port of Africa.

2.2 ECONOMIC DEVELOPMENT DATA

The urban economy of Abidjan is characterized by the juxtaposition of modern and traditional economies. The economic importance of Abidjan emerged after the completion in 1903 of the railroad connecting it with Bobo-Dioulasso (Burkina Faso). The tertiary sector is still important.

2.2.1 Tourism

Among others, the advantages of the Abidjan region are:

Breathtaking vast beaches of white sand
Historic colonial towns of Bingerville and Grand-Bassam
Representations and headquarters of international institutions
Economic pole of the

The hotel bed capacity of Ivory Coast is unequally distributed over the country and does not reflect the real tourism opportunities offered.

For example the Abidjan region alone, with its 6,323 hotel beds accounts for more than 60% of the Ivory Coast hotel capacity. Most of Abidjan's hotels are for business clients.

Since 1975, the tourism industry has evolved through three distinct phases:

The growth period (1975-1980)

This period has been characterized by a high hotel occupancy rate estimated at 80 to 90% from 1975 to 1979.

The stagnation period
(1980 - 1990)

This period has been characterized by the economic crisis. The average foreign tourist's growth rate fell from 16.4% to less than 1% during the years 1980-1985; and reached about 4% in the period of 1987-1990.

The recovery period (1994-present)

For this period the average occupancy rate is about 63%.

Table 1: Abidjan Hotel bed capacity per hotel category for year 1997

(Source OITH)

| Category | Number | Bed capacity |
|----------|--------|--------------|
| 5 stars | 2 | 994 |
| 4 stars | 3 | 686 |
| 3 stars | 5 | 321 |
| 2 stars | 15 | 553 |
| 1 star | 24 | 598 |
| Total | 49 | 3152 |

2.3 MAIN INFRASTRUCTURES

2.3.1 Roads

Abidjan has an important road network including paved boulevards and large streets but also roads of poor quality.

In 1960, the Abidjan road network was about 40 km with only one bridge connecting the Plateau and the Petit-Bassarn Island (Koumassi and Port-Bouet). From 1965, the population growth rate and the

From 1960 to 1964, the paved road network increased from 60 km to 1,070 km, which translate to about 70 km of new paved roads constructed per year (annual growth rate of 17%).

In 1992, the DCGTX agency reported that the Abidjan road network is composed of a total 2,042 km, including 1,212 km of paved road.

However, as of 1992, only 30.64% of the residential and domestic housing were serviced with paved roads.

The new site (Ahoupd-Anyama) is located 6 km east of the Akoup6-Anyama Village and 2 km from Abidjan's downtown. The site is reachable via a 4-km dirt road accessible from the paved road Abidjan-Anyama. While the Abidjan-Anyama paved road is suitable for all types of solid waste collection vehicles, the existing dirt road accessing the future site needs to be paved.

It should be noted that the Anyama road

2.3.2 Sanitary network

The sanitary and drainage network for the city of Abidjan is relatively important. It is composed of-

- Sewer collection network

- 710 km of conduit

- 150 km of Storm water drainage

- 555 km of buried piping

- 490 km of concrete open flow channels

The sanitary network is equipped with 33 waste water treatment stations composed of 8 primary mechanical stations with an individual treatment capacity of 300 m³/day and 23 biological secondary treatment stations.

To preserve the aquatic environment, the City of Abidjan has installed an ocean outfall as part of an environmental protection project. This ocean outfall is intended to convey and discharge in the Atlantic Ocean, far from the shore, Abidjan's domestic and industrial wastewater effluents. The outfall is made of a 1200-mm steel pipe diameter coated with 16 cm of reinforced concrete. The total length is 1270 m and the end diffuser is at 20 meter below the free ocean surface water.

This environmental project includes a primary treatment train and a pumping station located at the East of the Koussami dike. The pretreatment train consists of the following unit operations: Screening, Grit removal and Oil and grease removal. Since the wastewaters (domestic and industrial) are subjected only to a physical pretreatment, their discharge to the marine environment is a source of chemical, biological and microbial pollution.

The area proposed for the CET is not equipped with a sanitary liquid network. Most of the population in the region surrounding the proposed area use septic tanks and abandoned wells. The Operation building for the CET will be equipped with septic tanks.

2.3.3 Electrical Network

The electric network for the Abidjan extends to about 3,117 km. This represents about 16% of the national electric length (20,276 km).

Table 2 Type of lightning per household and per municipality

| Municipalities | Type of domestic lightning | | | | Public lightning | | |
|----------------|----------------------------|-------|------------------|--------|------------------|---------|-------|
| | Electrical | Lamps | Electrical+ lamp | others | Good | Partial | None |
| Abobo | 56,16 | 36,76 | 5,39 | 24,12 | 1,06 | 24,12 | 59,09 |
| Adjamé | 80,2 | 16,28 | 2,15 | 1,36 | 55,86 | 31,72 | 12,41 |
| Cocody | 52,2 | 41,00 | 3,58 | 2,72 | 19,42 | 24,86 | 53,69 |
| Attécoubé | 59,36 | 35,55 | 1,29 | 3,27 | 50,11 | 16,10 | 30,97 |
| Kournassi | 65,61 | 30,57 | 2,91 | 0,90 | 17,67 | 15,86 | 66,43 |
| Marcory | 76,76 | 18,27 | 3,96 | 1,01 | 40,16 | 17,89 | 41,95 |
| Plateau | 96,83 | 0,51 | 1,50 | 1,16 | 100 | | |
| Port-Bouet | 31,39 | 19,35 | 1,41 | 3,23 | | | 58,9 |
| Treichville | 83,70 | 12,64 | 1,24 | 2,41 | 79,95 | 20,05 | |
| Yopougon | 72,48 | 24,12 | 1,83 | 1,57 | 38,10 | 1,44 | 60,30 |
| Total Abidjan | 63,49 | 27,35 | 2,93 | 1,75 | 33,46 | 15,78 | 46,80 |

Electrical power nearby the future site, high and medium electric tension lines (90 kV and 30 kV), will be used for electrical supply.

2.3.4 Hospital, schools and universities infrastructures

2.3.4.1 Public health

Abidjan is confronted to the same severe health problems as faced by the rest of the country. The health situation is alarming. Health service facilities are insufficient and are not adapted to the population needs. The public health sector includes: primary facilities (health centers), secondary facilities (hospitals) and tertiary facilities (University hospitals).

The puzzling situation of Abidjan is an oversized tertiary health sector with 3 university hospitals, a poor secondary health sector (only 2 general hospitals) and relatively small sized tertiary health sector comprised of 30 health centers which corresponds to 1 health center per 108,000 inhabitants.

The two general hospitals Port-Bouet and Abobo have a capacity of 70 and 120 beds, respectively.

The population uses frequently the private medical sector. In 1992, the private medical sector in Abidjan consisted of 150 medical centers.

2.3.4.2 Schools

In comparison with the rest of the country, Abidjan has the largest school infrastructure with 47% of the nation elementary and secondary schools and 51% of the nation's teachers. The nation's private school system is mainly concentrated in Abidjan. Abidjan is also characterized by the highest children's enrollment in the country, with 63% of Abidjan's children enrolled in the school system. Overall, the classroom occupancy rate is too high. The nation's occupancy rate is 42 students per classroom, compared to 50-55 students per classroom in Abidjan. The schools infrastructure increased only from 496,000 seats in 1192 to 550,000 seats in 1997.

2.4 DEMOGRAPHY AND URBAN SITUATIONS

2.4.1 Demographic development

The booming demography of Abidjan experienced in the 60's and 70's have been characterized by a large flux of migration and average annual population growth rates about 10%. Abidjan's growth rate has declined with the economic crisis in the 80's. For the past 15 years, the annual population growth rate is about 4.3%; with 0.8% due to population migration and 3.5% due to natural growth.

Abidjan's population was 1.938 millions as per the 1988 census. Based on an annual growth rate of 4.3%, the 1998 Abidjan's population is estimated at 2.945 millions. Abidjan's population prediction up to year 2020 is presented in Table 3.

Based on an annual population growth rate of 4.3%, and the 1990 - 1996 demographic data supplied by BNETD, the following predictive equation was developed:

$$Y = - 96,923 X - 190,838,722$$

Where

Y = population

X = year

This equation predicts a population of 4,945,738 inhabitants for Abidjan in year 2020.