AFRICAN DEVELOPMENT BANK GROUP

PROJECT : BLAISE DIAGNE INTERNATIONAL AIRPORT
COUNTRY : SENEGAL

SUMMARY OF THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

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<th>Project team</th>
<th>Team Manager :</th>
<th>T. ANVARIPOUR</th>
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<td></td>
<td>Team members :</td>
<td>K. LONSWAY</td>
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<td>A. BABALOLA</td>
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<td>A. FOURATI</td>
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<td>R. ARON</td>
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<td>Sectoral Division Manager:</td>
<td>R. CLAUDET</td>
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<td>Sectoral Director :</td>
<td>T. TURNER</td>
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<td>Regional Director :</td>
<td>F. PERRAULT</td>
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<td>Chief Investment Officer</td>
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<td>Transport Engineer</td>
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<td>Senior Environment Officer</td>
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<td>Social Development Specialist</td>
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Environmental and social impact assessment (ESIA)
Summary

Project title : BLAISE DIAGNE INTERNATIONAL AIRPORT(AIBD)
Country : SENEGAL
Project reference : P-SN-DA0-001

1. INTRODUCTION
In accordance with the construction of the Blaise Diagne International Airport in Senegal, AIBD carried out an environmental and social assessment of the project including a Population Resettlement Plan (PRP). This executive summary provides the main conclusions of this environmental and social assessment and the main actions to undertake as per the Environmental and Social Management Plan of this project. The PRP summary will be elaborated and posted separately.

The environmental and social assessment was carried out according to the policies and procedures of the Bank and the operational policies of the World Bank.

2. PROJECT DESCRIPTION AND JUSTIFICATION

2.1. PROJECT DESCRIPTION
The future Blaise Diagne International Airport will be set up in the administrative region of Thiès, Diass village, 45 km from Dakar. The airport site occupies a surface area of 2 600 ha.

The airport will be developed in two consecutive development phases:
- The initial development phase with:
  - One 3 500 m runway;
  - Aircraft movement of 25 000 per year;
  - A capacity of 3 million passengers per year;
  - Freight capacity of 53 102 tonnes per year.

The structural and functional components of this initial phase are:
- One 3 500 m runway;
- A passenger terminal of approximately 21600 m² to the East of the runway. Its unidirectional capacity was established at 1170 passengers for the departure or arrival operations; the city terminal can be extended on either side by gangways which will increase its capacity to 10 million passengers/year in the final phase.
- A Presidential residence of approximately 4600 m² will be constructed in an isolated area to the North of the city terminal;
- A Hajj building of 2 350 m² having a capacity of approximately 500 persons to the North-East of the runway to control the flows during pilgrimage periods;
- An air traffic control tower and a technical block to the East of the passenger terminal;
- Navigation aids (NavAids);
- Rescue and fire safety section (SSIS) takes care of air emergencies and the fire fighting facilities to the South-West of the passenger terminals with an active 24/7 service;
- A Central Utility Complex (CUC) to the North-East of the runway is considered as the central section of the electromechanical departments;
- A freight building will be constructed to the South-West of the runway for the transportation of goods. This 12 800 m² area includes facilities such as freezers, storage areas for valuable, dangerous, fragile and special objects; offices and electromechanical departments will also be provided. A 9350 m² freight hangar to park a large capacity airplane and expansion areas will also be provided;
- An area for the warehouse and maintenance of engines and civil works is located to the East of the runway and to the South of the passenger terminals; and
- A parallel taxiway system and airport access routes, safety perimeter routes, external perimeter routes, service routes and freight access routes.

- The final development phase will be provided when the maximum capacity of the initial phase is attained. The final phase will include:
  - A second runway;
  - A passenger terminal and all the facilities resulting from it for a capacity of 10 Million passengers per year.

Two separate zones are defined in the airport to guarantee the safety and access control: the non-secure public areas and the secured areas. A 500 m buffer area is provided all around the airport to control the risks of anarchic occupations (Figure).
Figure 1: Covered area and buffer area of the airport
Figure 2: Block Plan of the Airport
The Diass airport is accessed from Dakar by National Highway 1 (RN 1) which opens up the South-East part of Senegal. The distance from the centre of Dakar largely depends on the time at which National Highway 1 is taken, subject to congestion during the peak morning and evening hours when the journey can take 2 hours, whereas during normal hours, the journey requires 50 to 55 minutes. The widening of National Highway 1 has been planned by the construction of a toll highway connecting the cities of Dakar-Diamniadio-Thiès. Other plans for the consolidation and modernization of the large roadway infrastructures are underway to facilitate access to the airport:

- Asphalting of the existing Noto-Gouye Diama-Mont Rolland-Thiès road;
- Construction Plan for a new Diass-Pout-Diandar link road;
- Construction Plan for a new access road between Diass and Thiès.

The main utility services related to the airport are given below:

- Electric energy will be provided to the airport and the special economic zone developed close to the airport. SENELEC confirmed the provision of energy before the commissioning of the airport;
- The water supply system will be combined for domestic needs and the fire fighting systems. It is accepted that water consumption for use at the airport is carried out from the Lac de Guiers underground pressure pipeline, a national project providing water to Dakar and its suburbs, Saint Louis, to the region of Richard Toll located further North and to several villages around the Lake. An additional pipe must be provided with the existing pipe towards Dakar and its suburbs, to supply the airport with the necessary requirement.
- The waste water collection system will be based on a separate system. A waste water processing station will be located to the North-East of the airport outside the airport area.
- The airport drainage will be carried out through runoff pipes towards the nearest thalwegs by using pits, canals and pipes, as required. The drainage of runoffs is designed in such a way that the natural water flows are preserved as far as possible.

The consumption of resources during the construction and exploitation phases is summarized as below:

- Construction phase:
  - Consumption of approximately 47,000 m³ of water;
  - 4,640,776 m³ of excavation material produced of which 2,063,390 m³ will be reused as filling material;
  - 1,085 tonnes of fuel.

- Exploitation phase:
  - 1,158 m³ of water consumption/day;
  - Kerosene consumption of airplanes (jet fuel) estimated at 19,202 tonnes/year, fuel consumption of the road traffic and auxiliary units estimated at 20,181 tonnes/year. The fuel consumption of the motor vehicles is estimated at 979 tonnes/year.

A 33 months period was provided for the completion of the airport construction works. The construction phase must be completed in September 2011 and the exploitation of the airport is planned for 2012.
2.2. PROJECT JUSTIFICATION
The need to construct a new airport at Senegal is related to the high technical limitations and environmental anomalies induced by the current location of the Léopold Sédar Senghor International Airport (AILSS) located 9 km from the centre of the capital Dakar.

The Blaise Diagne International Airport will be constructed in the Thiès administrative region, Diass village, 45 km from Dakar. The airport will be considered as a regional hub and will favour the economic and touristic development of the country.

3. STATUTORY, LEGAL AND ADMINISTRATIVE FRAMEWORK

3.1 LEGISLATIVE FRAMEWORK
Environmental and social impact assessments in Senegal are regulated by the environmental code (Law No. 2001-01) and its application decree (decree No. 2001-282).

The national norms used in accordance with this study are:

- Norms NS 05 061 concerning waste water and runoffs;
- Norms NS 05 060 concerning atmospheric pollution;
- The environment code which stipulates the maximum noise levels in its article R 84.

3.2 INSTITUTIONAL FRAMEWORK
The Directorate of Environment and Classified Establishments (DEEC) related to the Ministry of Environment, Nature Conservation, Reservoirs and Artificial lakes is the direct body for the implementation of environmental policy in Senegal and for the validation and follow-up of the impact study reports with the technical committee’s support. Decentralized services exist even within different departments. The departments related to the study site fall under the Regional Division for Environment and Classified Establishments of Thiès.

Other institutions are also concerned by the construction of the airport:

- Local Authorities (Regional Council of Thiès, Rural Communities of Diass and Keur Moussa Sangalkam)
- Department of Urban Planning and Architecture
- National Planning and Development Department
- Department for the Supervision and Control of Land Use
- National Department of Hygiene
- Civil Protection Department
- Statutory companies of the networks
- The project execution agencies including the Municipal Development Agency, ADM.

The policies and procedures of the African Development Bank have been applied in the environmental and social appraisal of the project.
3.3 LIMITATIONS OF THE STATUTORY AND INSTITUTIONAL FRAMEWORK

The evaluation of the statutory and institutional context of the management of natural resources and environment protection, in relation to the airport sector, reveals certain lapses and limitations which are listed below:

- Absence of specific norms regulating sound emissions. The parameters of sound nuisance will be taken from the regulations of the Federal Aviation Agency (FAA).
- Absence of specific norms controlling the ambient air temperature. The parameters of ambient air quality will be taken from the World Health Organization.
- Absence of a strategic regional plan for the Thiès region controlling the development trends and measuring the environmental impacts of the different projects provided such as the construction of the Dakar-Diamniadio-Thiès highway, construction of the airport and planning of a special economic zone.

4. DESCRIPTION OF THE PROJECT ENVIRONMENT

4.1 CLIMATIC CHARACTERISTICS

Senegal belongs to the tropical zone, marked with relatively high temperature and irregular pluviometry. The pluviometric region is determined by atmospheric flows and includes two fundamental seasons: Rainy season from May to October dominated by monsoon floods and the dry season from November to April marked by the predominance of trade winds or the Harmattan and West South-West winds from May to October, controlled by the rain flow.

4.2 GEOLOGY AND TOPOGRAPHY

The airport is located in the horst plateau of Diass generally in the NNE-SSW direction with two main fault lines at Sébikhotane and Thiès, in the NNE-SSW and North-South direction respectively. The fault lines separating these different tectonic structures, particularly the Horst of Diass are not active and Senegal is considered as a 0 seismic zone according to the UBC 1997 code (Uniform Building Code).

The relief alternately has high points and low points, forming valleys where certain villages are located. The maximum point reaches 105 m. The site selected for the construction of the future Blaise Diagne International Airport is located in a zone where the altitudes are between 46 and 86 m. Even though certain earthworks are required for the construction of the different airport facilities, the general topography of the site does not have any limitations or special sensitivities with regard to the execution of the construction works.

4.3 SOILS

The main types of soils in the Horst of Diass are characterized by rocky soils and lithosol determined by the bioclimatic factors and by the geological substratum. The soils present at the site are in a highly deteriorated state and are subject to the climatic factors (high temperatures and short and intense rains), progressive stripping of the vegetation cover, and water and wind erosion.

4.4 HYDROLOGY

The drainage network of Horst of Diass does not have a permanent flow. The water flow is temporary, particularly during the rainy season. The state of reference of the project site is located on seven calibrated watersheds in the massifs of the horst having four directions of preferential flow:

- Flow to the North;
- Flow to the East;
• Flow to the South-East;
• Flow to the South-West.

In this intertropical zone, the alteration of the rock is particularly intense due to high temperatures and high humidity levels. A site visit along the existing watercourse enabled the identification of several points sensitive to erosion by photo identification. The points vulnerable to identified inundations are the villages located downstream, particularly to the North in the Soune Sérère village and to the South in the Diass village.

### 4.5 HYDROGEOLOGY

The underground water constitutes a main source of water supply for the local population. The drillings carried out up to a depth of 100 m or more in the deep units of the Maastrichtien sandstones serve in general several villages through local high storage reservoirs and hand dug wells with a depth of 25 to 50 m which exploit the upper perched aquifers in the Quaternaire depositions and the alternate layers, often clayey, that are subjacent.

The upper water level is mainly located at the upper levels of the Maastrichtien and partly in the recent capping. The nappes are supplied by the runoffs (rain water) which infiltrate through the upper formations of the lateritic crust, particularly in the fracture zones.

A sampling of the water quality of the superficial wells in Diass, Kirène, and Packy, in addition to those of Tchichy and Kessoukhat have shown that the water quality of all the wells has considerably exceeded the acceptable levels of Escherichia coli and total coliforms. Only the Soune Sérère wells have an acceptable level of E Coli, but exceeding the acceptable level of total coliforms.

### 4.6 ECOLOGY

The airport site is located in the classified forest of Diass which was declassified by decree. There are two types of protected areas around the airport site:

• The classified forests of Sébikhotane, Pout, Bandia, Thiès and Popenguine;
• The natural reserves of Bandia and Popenguine which are located within the classified forests of the same name.

The ecosystems dominating the Horst of Diass and the project site are terrestrial; the river and lake ecosystems are non-existent due to the intermittent nature of water flow. The flora present in the classified forest of Diass was essentially composed of shrubs and the fauna is progressively becoming rare over the years due to the destruction of the natural habitat and illegal hunting practiced by the local populations. Several species of birds have been identified within the project site area. Of the 23 species listed, the African vulture (Gyps Africanus) is considered to be on the verge of extinction in the red list categories of the International Union for Nature Conservation (UICN). Their population is reducing due to the loss of habitat, hunting and persecution and existence of the silvopastoral systems.

### 4.7 AIR QUALITY AND NOISE

The parameters of Sulphur Dioxide (SO2), Nitrogen Dioxide (NO2), Ozone (O3), Carbon Monoxide (CO), Suspended Particulate Matter (PM10) and Non-Methane Volatile Organic Compounds (NMVOC) were measured at the study site. The levels show that the status of the places in question is typical of rural sites and does not indicate levels of atmospheric pollution. The measures taken to determine the noise level show that the average values measured are between 40 and 50 dBAhréq [Translator: illegible]. These values are largely comparable to national norms, although the values for evening and night appear relatively high.
4.8 CULTURAL RESOURCES
The presence of traditional resources in the project zone is limited to the cemeteries of the current villages to be displaced that are present in the site area. The rare elements that could be considered to be cultural relics are the ancient sites of palaver trees that are often located in the centres of villages and which have been used since the Islamisation of the zone for social purposes rather than as objects of worship.

4.9 SOCIO-ECONOMIC CONTEXT

4.9.1 National and Regional Economic Context
Around 1.3 million people live in the impact zone of the airport in the Thiès Region. Taking into account the economic potential and the importance attached to the region in the National Plan, it transpires that Thiès is considered to be a centre of attraction for the future population, and 1.7 million inhabitants could pass through by 2015.

According to an overview of the current situation, it turns out that the region is coming up against several socio-economic constraints, including a high level of urbanisation and a mainly working-age population, very limited opportunities for job creation, a high level of poverty in the rural sector, limited resources for exploitation in rural areas, significant constraints in major sectors in connection with geographical factors (inaccessibility of the villages, deficit of resources and loss of agricultural lands, etc.), lack of access to credit, insufficient supply of electricity, drinking water and sanitation, and the poor quality the transport network.

However, the region comes up trumps in terms of its location, a seasoned workforce, social infrastructures and transport networks that are already in place. The economic recovery of the region depends upon its large-scale projects (AIBD, DISEZ and Tourist Zones, motorways and access roads, etc.), and at the same time projects included in the PTIP (Three-year Public Investment Program, 2008-2011), the PTIR (Three-year Regional Investment Program) and the PRDI (Integrated Regional Development Plan).

4.9.2 Socio-Economic Characterisation of the Villages
The two rural communities (Diass and Keur Moussa) affected by the airport project have around 38,000 inhabitants. The populations affected by the project are:

- displaced persons (the localities of Kessoukhate-Centre, Mbadate and Kathialite in the village of Kessoukhate) which shelter 343 households or 2,661 persons
- the populations of the host villages (Lene, Landou, Touly and Soune)
- the populations of the villages of Kirene and Diass (which lost agricultural parcels)

The female population in the villages that have taken censuses represents 48.7% of the total. The results of the socio-economic survey clearly indicate the existence of a young population, which will exert immense pressure on community resources, principally in terms of water, agricultural land and employment. Men are predominantly the heads of household. We also note a phenomenon of daily rural exodus towards large urban centres in search of employment in the agricultural sector, and the secondary and tertiary sectors. In the past five years, the population of the Rural Community of Keur Moussa has increased at a rate of 3.7%.

According to the hierarchy of the human centres, Diass is the village most affected by the project. Its development is tied principally to the economic activities of the urban centres, notably Thiès. Despite its importance, we note a lack of services supplied to populations in the health sectors, water services
and educational infrastructures. The AIBD supports local populations in terms of access to water, education and health services.

The local population works predominantly in the agricultural sector, which accounts for more than 20% of employed persons. Agriculture consists of food crops produced in the small fields close to the villages. The zone has seen a notable diminishing of agricultural land exploited locally, due mainly to the airport project. Extensive livestock farming is also threatened by the project, which has generated a lack of pastureland and an absence of rough grazing for livestock, causing conflict between breeders and farmers. The activities of the construction sector (the sale of concrete blocks and bricks, and work on construction sites) are concentrated around the quarries and cement works.

The commercial activities are characterised by a large presence of travelling markets in the big cities and urban centres. In the rural community, commerce involves mainly women around the national roads area.

The activities of the community, social and personal services are equally notable in the villages. The economy of the villages affected is neither diversified nor sufficiently developed to secure the livelihood of the rural populations. Due to the uncertainty of work, which is mainly part-time, the local populations are extremely vulnerable in terms of their means of subsistence and are very likely to be affected by large projects in the region.

5. ALTERNATIVE SOLUTIONS

5.1 JUSTIFICATION OF THE CHOICE OF SITE

Three sites were the subject of a comparative study to arrive at the final choice: Sendou, Diass and Bambilor – Lac Rose. The selection criteria used to compare these three sites is based on operational, social, environmental and economic considerations and infrastructure. The site of Diass was agreed on the basis of a detailed technical evaluation involving various comparison methods. The site has the following advantages:

- Least high cost of construction;
- Possibility of extension and very favourable aeronautical procedures and clearance;
- Strong potential for developing economic activities (industrial free zones and proximity of tourist sites);
- Ease of airport service from ground access;
- Existence of infrastructure around the site;
- Relative proximity of Dakar;

5.2 ‘NO PROJECT’ OPTION

If the project were not realised, the conservation of a protected forest resource would be guaranteed, although the forest was in a state of degradation before construction work began. The ‘no project’ option will still cancel out any potential risk to the natural resources of the site such as the risk of air pollution, the contamination of surface water and groundwater, and the contamination of the soil.

Finally, the non-realisation of the airport will result in conserving the present way of life of the inhabitants of the villages of Kessorhate, Katialite and Mbadat, who might perceive their forced displacement as negative.

However, consideration of the zero option will not improve the existing situation of Léopold Sédar Senghor International Airport (LSSIA) in Dakar which poses environmental and social problems to the neighbouring highly-urbanised zone, notably the vibrations and noise impact from air traffic and the
pollution of the air resulting from aircraft emissions. Moreover, the current airport presents technical
disadvantages in terms of the degradation of the existing airport infrastructures and a limited capacity
to function at peak periods.

6. POTENTIAL IMPACTS AND MITIGATION MEASURES

6.1 Pollution and Soil Erosion
This impact is of average intensity but does not pose any significant health problems or extreme
nuisances for the neighbouring population or construction site workers. The risk of soil pollution is
likewise presented off-site by the transport of raw materials during construction work and the
replenishment of jet fuel and other substances used for the airport functioning. The contamination of
soil may occur as a result of accidental or deliberate leakages from transport activities.

6.2 Erosion
With intense and short precipitation events, the elimination of the sward diminishes the capacity of soil
infiltration in the short term and increases the intensity and the speed of run-off water leaching. This
risk of erosion is temporary and small considering the short duration of precipitation events. This risk
of erosion is more significant during the operational phase with modification of the special features of
drainage and the drainage basins. This risk is evaluated as average, affecting localised zones at the site
and its immediate surroundings. Field visits have shown that the development of water erosion is
limited to small gullies of several metres in length and from 10 to 20 cm in width without showing
large-scale erosion problems within the community of Diass.

6.3 Risks of Flooding
The risk of flooding posed in the construction phase is connected to the reduction of the soil infiltration
capacity owing to the bareness of the ground vegetation, the increase in water run-off and drainage
speeds. The site contains several subdivided drainage basins in sub-drainage basins draining in two
main directions, towards the north in the direction of the village of Soune Sérère and towards the south
in the direction of the village of Diass. The run-off waters coming from the airport in the operational
phase therefore double the volume of water received by the village of Diass, posing a risk of flooding
the inhabitants and their activities. The risk is average since it can be avoided by the application of
good practices by the design of an appropriate drainage network capable of receiving maximum rates
of flow.

6.4 Water Pollution
The run-off waters in the rainy season risk altering the quality of the surface water by the propagation
of polluting substances. Chronic or accidental pollution may be generated during construction and
operational work. The overall risk of contamination of the layers is considerable. However, this risk is
attenuated after the construction and disaggregation works, which will compact the surface layer and
reduce permeability. In the exploitation phase the zones where the risk of contamination is highest are
the parking spaces, the oxidation pond, the fuel tank, the central utility complex and the runway. Since
the replenishment of the superficial aquifers is made possible by the restitution of the airport drainage
towards natural watercourses, the risk of pollution of the subsurface waters is present but remains
nonetheless controllable.

6.5 Impact of drainage and consumption of resources
The consumption of water during construction works is estimated at 47,000 m³ per three borehole
wells created at the project site. The impact on the replenishment of the superficial aquifer resulting
from the construction works is estimated as average. The populations that will be affected by the
reduction of this replenishment are the villages of Diass, Kirène, Packy, Soune Sérère, Lène and
Landou which have hand-dug wells using superficial aquifers. Although this groundwater is scarcely reliable it is a very important resource for the local populations as a means of domestic water supply. In the operational phase, the realisation of a drainage network concentrates the intake of water at a given point, which can disrupt the replenishment of the downwatercourse groundwater. This impact is on the other hand temporary since the discharge of the run-off from the drainage network into natural watercourses restores the natural infiltration of the downwatercourse groundwater although at a certain distance from the initial basin.

The water supply for all the operations of the airport estimated at 870 m3/j will be provided by a national resource development project for the surface water of Lac de Guiers, which will integrate the requirements of the airport. The project will not therefore pose any risk regarding the exhaustion and excessive consumption of groundwater resources. Water consumption will become problematic at regional level if the airport’s water supply comes via groundwater resources, external intake in tanks or the present construction wells. This will deprive the local populations now facing water stress and water access stress.

6.6 Impact on biodiversity
The main impact of the project on the environment is posed by the destruction of a part of the protected forest of Diass during the preparation of the site for construction work. Although the forest had poor ecological value, it contained certain habitats of plant and animal species specific to national and international conservation of which 5 plant species are partially protected by the Senegalese Government, 3 species of birds are fully protected by Senegalese legislation, 3 species are partially protected by Senegalese legislation and 1 species is almost endangered on the IUCN Red List. The habitat of certain avian species can be easily replaced around the rest of the protected forest or around the protected forests nearby (Thiès, Pout, Sébikhotane, Bandia and Popenguine). The loss of floral habitat, initially present on site but not in abundance, does not cause critical deterioration of the regional biodiversity or a significant loss of ecological heritage.

During the construction phase, the remainder of the forest of Diass not yet cleared risks being affected by the cropping of local plants and wood products and by the risk of construction site workers causing forest fires. The operation of the airport will not have additional impact on the environment and local biodiversity not counting the changes to habitats and flight paths of avian species.

Measures to protect fauna and flora are planned Periodic inventory tracking and other measures of protection will also enhance environmental management project.

6.7 Energy consumption
The airport will be supplied with electricity from the SENELEC network. A fuel distribution network was set up at the site and the refuelling station will be set up by a partner and connected to the distribution network.

At regional level the airport will not consume the energy resources of the local population but could on the other hand reinforce local consumption by introducing electricity in certain villages currently [managing] without.

6.8 Solid waste
The excavation materials evaluated at 2,577,386 m3 will be largely reused at the construction site. The other types of waste (packaging waste, general construction waste and other non-hazardous waste) shall be discharged.
A private operator is currently contracted for the collection and transport of construction waste around the Mbeubeuss waste dump, which is still operating. This waste dump is full and will presently be closed. A new waste dump is planned at Sindia and is expected to start functioning before the airport is put into operation.

The activities of the Blaise Diagne International Airport will produce various types of waste for the duration of the operational phase. The amount of waste produced during the operation of the airport is around 14 tonnes/per day. A detailed plan of solid waste management at the airport was drawn up including all the minimisation and management measures.

6.9 Wastewater
The sewage from the camps and associated buildings will be produced in sanitary installations managed and collected on site. These wastewaters will be treated in a special oxidation station situated to the west of the development of Phase 1 and within the borders of the airport. The treatment station will be designed to guarantee zero spillage of septic matter (partially treated or untreated) in the surrounding zones or in the watercourse, to create a high-quality tertiary treatment supply containing chlorine for reuse in irrigation, to guarantee conformity to national norms (NS 05-061) and to have low maintenance requirements.

6.10 AIR
The main potential negative impacts on the air quality caused by the construction of AIBD would be dust emissions. The distance of sensitive receptors from the main construction work is sufficient to efficiently eliminate the majority of dust pollution. Kirène and the bottling factory are the most sensitive external receptors but they will only be affected in the case of a moderately strong wind from the North-West Face, which is not frequent in the course of the year. The effects of dust particles in the short term are potentially considerable for the labourers carrying out digging work and, to a lesser extent, in the excavation sites.

Gaseous emissions are possible both on and off site: the emission of escape gas issued from the construction traffic, factory and equipment, storage installation ventilation emissions (principally hydrocarbons), emissions issued from production, in this case, the coating factory as well as the laying of tarmac roads. The majority of sources is mobile and will generate emissions in the short term and temporarily. The atmospheric emissions for the construction phase for 2009 were evaluated at 111 tonnes of NO2, 13 t of COV, 106 t of CO and 31 t of SO2.

In the operational phase and as with all airports the emissions come from aircraft, ground services equipment, ground access vehicles, stationary sources and private vehicles. At ZIBD, the planes must constitute the main source although the equipment and vehicles will also be considerable contributors in the overall balance of total emissions. Almost 90% of SO2 emissions would be associated with runway activities. The emissions of the airport in operation are estimated annually at 235 tonnes of NO2, 27 t of COV, 248 t of CO and 20 t of SO2.

6.11 Noise pollution
In the construction phase, the noise emissions from small temporary installations and road traffic on the main access road (RN1) is not considered sufficient in terms of quantity or type to considerably increase the existing noise level, in particular at night, a critical period. The traffic on other construction roads is considered to be fairly limited, creating occasional one-off [instances of noise] pollution. Other smaller installations are supposed to be temporary and only produce intermittent noises and at relatively weak levels. However, in order to guarantee that the effects of noises emitted from such
sources be effectively eliminated, such sites must be located at a minimum distance of 500m from all receptors sensitive to noise.

The estimated noise levels suggest that the construction works will not cause noise pollution during the day even without the application of typically available attenuation measures such as the establishment of good construction practice. The noises from internal equipment will be treated as health and safety matters.

### Noise pollution and implications of development

The noise emitted by the activity of aircraft may be a major source of pollution and in several cases a factor limiting development around the airport.

Despite the fact that AIBD is located in a site that is relatively far from the current main developments it is probable that it is the centre of a process of major development. As a consequence the aircraft noise forecast constitutes an important planning consideration.

NEF (Noise Exposure Forecasts) for the scheduled aircraft are given for each scenario.

The principle conclusions of this analysis are:

1. The exclusion zones stretch beyond the site borders.
2. It is possible that the expansion of the factory at Kirène close to the airport site along the Kirène road be restricted, even within the perimeters of its current site.
3. The zones with noise constraints are very limited. Nonetheless, the cumulative effect of Phase 1 and Phase 2 developments is far more marked than the zone of Phase 1 alone.
4. The economically significant development zone of the Petit Cote and SEZ are hardly affected by the limitations of the airport.
5. The constraints in the north are considerable for current small installations but have little implication for the development of the Route de Pout corridor. Similar constraints are applied to the corridor of the Kirène road.
6. The development along the corridor of Route RN1 in the east will be severely affected at the north of the road. This could also affect the development of Diass.
7. The height restriction of 45 m should not create a major constraint to development.
6.12 Land acquisition and resettlement
A Resettlement Action Plan detailing the resettlement of the populations affected by the services of the new Blaise Diagne International Airport was drawn up in 2005 and recently updated. According to this plan, the inhabitants of the localities of Kessoukhate-Centre, Kathialite and Mbadat (localities of the village of Kessoukhate), which contain some 343 households or 2,661 persons, will be displaced and resettled elsewhere and will be directly affected by the loss of houses and farms. The loss of agricultural parcels in the villages of Diass and Kirene is also taken into account in the Revised Resettlement Action Plan. On the other hand, the inhabitants of the villages of Soune Sérère, Lène, Landou and Toully will be subjected to losses of fields.

Taking into account the fact that the displaced inhabitants depend upon the agricultural lands, pasturelands and water resources, they are extremely vulnerable to external changes. The chosen host site is situated to the north of the airport in a triangle between the villages of Toully, Lène and Landou and extends over an area of around 150 ha.

6.13 Employment creation and population movement
The project has the potential to attract an influx of sizeable populations towards the sub-region, be it of a temporary (construction phase) or permanent (operational phase) nature. The total number of workers hired by the Contractor during the airport construction phase varies between 1000 and 2500 per month and the current figure is 896, of whom 793 are Senegalese, of whom 45% come from neighbouring villages and the remainder from other regions of the country. The total [number of] direct, indirect and secondary jobs created in the neighbouring villages during the construction period would be in the order of 450 persons.

In the operational phase it is likely that 55 short-term positions and 120 long-term positions could be filled locally, notably at an unqualified level. The rest of the jobs will be taken by immigrants drawn from the existing LSSIA and the zone immediately outside the airport. Supposing that some of the immigrants will live in the region with their families we can expect a population influx directly connected to the workforce at the airport of 1,750 persons in the short term and 5,000 persons in total in the long term.

6.14 Impacts on the economic activities and risks of social conflicts
The agricultural lands are in general of poor quality with some evidence of deterioration in recent years with less reliable rainy seasons and less precipitation. With the water supply difficulties and the lack of financing/credit for purchasing fertilisers and pesticides, etc., this is proving to lead to a change in the cropping systems and potentially a decrease in overall crop areas. The region of Thiès is not considered to be a natural livestock zone and the herds are in general controlled by the nomads rather than in a sedentary way. For the nomads the key resources include the crop waste and the pastureland of the protected forests. The AIBD project has the potential to generate tensions among the communities directly affected and the immigrants, both temporary and permanent, who arrive at the project zone in search of employment opportunities. Several sources may be at the origin of such tensions, which may affect different sub-groups of the population. An economic diversification study and a social action plan are being drawn up by the AIBD in order to bring these social aspects under control before the airport enters into service.

6.15 Change of regional economic climate
The economic potential of the Theis Region will have been subjected to revival through the major projects planned in infrastructure and social sectors in the framework of the PRDI (Integrated Regional Development Plans) as well as the PTIR (Three-year Regional Investment Program). The AIBD and
the ZES are the two largest projects that risk generating the most major potential impact. The other projects are designed to improve regional access and provide the means of exploiting these resources.

On the grand scale of economic development in Senegal, the closure of LSSIA could lead to a decline in employment and prospects of development in the Dakar region where the airport is currently situated, above all in the short term. In the medium and long term, we predict that these will be counterbalanced by the new developments proposed for the site to be released (Free Zone and industrial property, etc.).

6.16 Cumulative impact

Although the social and economic impacts of the construction and operation of the AIBD are considered to be potentially significant, no fundamental or negative change to the economic and social systems of the affected communities is perceived as inevitable. In effect, in certain cases it is possible to envisage economically stronger communities applying modified and more intensive agricultural production systems in the medium term. However, the changes introduced by the application of the planned regional developments in the Diass zone, in particular the Special Integrated Economic Zone of Diass (ZESID) could have more significant impacts.

Perceptions of injustice could be extremely high in particular in the case where other persons/communities benefit directly from the project or where other persons/communities participate in the increase of problems incurred by the local communities by monetizing the economy and by introducing inflationary pressure for goods and services leaving members incapable of affording basic goods and services in their own communities.

7. ENVIRONMENTAL RISK MANAGEMENT

During construction, risks linked to public safety and staff stem from on-site accidents (conflict due to equipment, access to hazardous areas, and accidents in active dangerous sites) and accidents off-site (direct conflict with construction equipment and road traffic accidents).

There is also a potential risk presented by the transportation of hydrocarbons from the Léopold Sédar Senghor International Airport (AILSS) to the new Blaise Diagne International Airport (AIBD).

The main dangers identified are:

- **Aircraft accidents:** Accidents can take place over the runway, during landing or take-off. The probability of an accident is considered to be rare and the seriousness is considered to be catastrophic.
- **Fire or explosion in the fuel tank, aircraft, road tanker or piping systems:** Large quantities of fuel are stored, pumped and used in the airport and present an increased risk of explosion in hangars, on roads and taxiways, in piping systems and the fuel tank. Fuel tanks are designed to be in compliance with API 650 criteria (American Petroleum Institute), which indicate that the tank must contain Jet A1 aviation fuel, which does not produce inflammable vapour in ambient conditions, because they are stored below the fuel’s flash point.
- **Fuel or chemicals leaks:** The environmental risk of a fuel leak could occur following a leak in the fuel tank or pipe system, a road tanker accident, a leak in a chemical storage unit (oils, lubricants etc.), a fuel leak or leaking of other chemicals following a plane crash or draining of contaminated products (foam etc.) during an emergency. The probability is considered to be occasional. The gravity of the event is connected to any deterioration in quality of the underground
aquifers and the risk is considered as between great to critical depending on the degree of contamination. These risks should be attenuated using appropriate measures during the design and management of airport operations such as the design of safety zones and restricted development zones. The fuel tank should be placed in a location away from the sensitive areas of the airport. The risk of a fuel or chemical leak may be avoided by positioning high-risk leak areas far away from watercourses; using confinement areas for storing material and intensive monitoring. A risk analysis has been conducted by the contractor.

7.1 Bird strike
With reference to the FAA advisory circular 150/5200-33, the minimal distance recommended in order to eliminate the risk of bird strike over runways is 8km. The new discharge outlined by the local authorities to replace the Mbeubeuss discharge is located in the city of Sindia, which is more than 8km from the airport’s runway. The risk of bird strike presented by this new controlled discharge is therefore inexistent.

8. MONITORING PROGRAMME

The Monitoring Plan of the Environmental and Social Management Plan includes three internal elements:

**Monitoring of the Site Environmental and Social Management Plan (SESMP):**
Monitoring will be carried out in order to verify and document that the building and tender activities associated with the construction of the airport and corresponding facilities (temporary or permanent) are carried out in compliance with the requirements of the SESMP. It will also ensure that the feedback required to update and revise the SESMP is available.

**Monitoring of impacts during the operation phase (EMS):** The EMS will be subject to continuous monitoring in accordance with a specific calendar. The revision process and establishment of ESMP reports will be done using inspection reports carried out monthly (internal inspection programme, environmental performance as well as zones and degrees of non-compliance); quarterly (source of primary information concerning the project activities as well as environmental compliance) and yearly (revision of environmental policy, revision of environmental indicators, summary of environmental monitoring programmes, discussion of any major environmental incidents and future changes to national environmental legislation and/or regulation).

The provisional SESMP budget is estimated at 2,657,910 USD. The provisional budget for the management plans in the operation phase is estimated at 1,097,400 USD.

In the construction phase, the institutional framework proposed for the application of the Construction Environmental Management Plan includes the AIBD SA (*French public limited company*) whose objective is to implement policies, environmental objectives and targets as well as to supervise and enforce the plan through its Environmental and Social Department (ESD) which will have the overall responsibility of applying the SESMP, and the Contractor who will be responsible for preparing and enforcing the SESMP; ensuring the plan can be applied and implementing the required monitoring networks.

In the operation phase, the management plan requires the implementation of an Environmental Management System (EMS). Responsibilities will be divided between the AIBD SA board
representing the higher management levels of AIBD SA) and the airport operator who will be responsible for designing and implementing the EMS. Stakeholder groups, the Ministry of Environment and other parties will also be involved in the institutional framework.

9. PUBLIC CONSULTATION AND THE PUBLICATION OF INFORMATION

Public consultation is an integral part of the entire impact study process. Consultants consulted with the different groups affected by the project and took their point of view into consideration. These groups were met with several times:

- During the previous environmental assessment and before the finalisation of the terms of reference in May 2008;
- Public information session held on 23 September 2008 at the Thiès Regional Council which announced the launch of on-site investigations (socio-economic, ecological and cultural);
- The Environmental and Social Impact Assessment was disclosed at local level and a public hearing took place in December 2009 following the pre-validation of the DEEC report.

During these sessions the main results and recommendations of the project were presented to the rural communities of Keur Moussa and Diass, the opinions and observations of the populations were also noted.

The main issues addressed by the population concerned the risk of flooding, loss of forest reserves aspects related to resettlement, impacts of construction and employment of local people. The majority of these concerns were already being addressed by the project.

An environmental compliance certificate has been issued by the DEEC in April 2010.

10. FURTHER INITIATIVES

Further initiatives aimed at the economic and socio-cultural development of the affected communities exist for the project. These initiatives include the AIBD’s Social Action Plan, which includes the construction of basic social facilities (health centres, schools, etc.); the elaboration of a economic diversification study; the consideration of an urbanism blueprint for land planning and management in the resettlement area; and a partnership between the AIBD SA and ANREVA (the Senegalese Office for the Return to Farming) which will supervise willing PAP producers in agriculture and particularly in export crops.

11. CONCLUSIONS

An Environmental and Social Impact Assessment (final version edited in February 2010) has been carried out for both phases of the project. This study analysed the problems associated with the airport’s construction and operation phases: air emissions and noise pollution, waste management, erosion and flood risk, resettlement of populations, socio-economic impacts, safety of communities and workers, etc...

The Site Environmental Management and Monitoring Plan constitute the framework for the planning and execution of activities during its construction and operation phases. It is compliant with the Senegalese legal and regulatory requirements of the AfDB as well as the international civil aviation standards.
This plan also constitutes a method of ensuring monitoring and defines the roles and responsibilities of the different stakeholders in the design and execution of the project.

Further action plans and procedures will be drafted. Some are currently been reviewed:
  - Economic diversification study
  - Social actions plan
  - Economic diversification plan
  - Land management plan
  - HIV/AIDS plan
  - Environmental and social clauses to which the operator will be bound
  - An Environmental Management System (EMS) in accordance with the ISO 14001 standard.

12. REFERENCES AND CONTACTS

The documents reviewed by the African Development Bank include the environmental and social impact assessment for the Blaise Diagne International Airport and its annexes (Environmental and Social Management Plan, Environmental and Social Management Plan for the construction phase, the emergency response plan for the construction phase, the solid waste management plan, etc.), drafted by DAR EL HANDASAH Consultants in February 2010.

A revised population resettlement plan was drafted by AECOM-Tecsult in October 2010 the summary of which is posted on the AfDB website along with the summary of the ESIA.

CONTACTS:

BLAISE DIAGNE INTERNATIONAL AIRPORT-SA
El Hadji Ibrahima MANE, General Coordinator, Blaise Diagne International Airport-SA (AIBD SA)
Rue du Dr THEZE, Immeuble la Rotonde
Telephone: +221 338896501 Fax: +221 338237085 Email: imane@aibd.sn

Aissatou THIOUBOU, Head of the Environmental and Social Department, Blaise Diagne International Airport-SA (AIBD SA), Rue du Dr THEZE, Immeuble la Rotonde
Telephone: +221 33889 6500 Fax: +221 33823 7085 Email: athioubou@aibd.sn

AFRICAN DEVELOPMENT BANK
Tas ANVARIPOUR, Chief Investment Officer, Private Sector Department, African Development Bank, BP 323 - 1002 Tunis Belvedere, Tunisia
Tel: (216) 71 10 2228, Email: n.anvaripour@afdb.org

Kurt LONSWAY, Head of the Environment and Climate Change Division (ONEC.3), Department of Energy, Environment and Climate Change (ONEC), African Development Bank, BP 323 - 1002 Tunis Belvedere, Tunisia
Tel: (216) 71 10 3313, Email: k.lonsway@afdb.org
Awatef SIALA FOURATI, Senior Expert for the Environment, Environment and Climate Change Division (ONEC.3), Department of Energy, Environment and Climate Change (ONEC), African Development Bank, BP 323 - 1002 Tunis Belvedere, Tunisia
Tel: (216) 71 103854, Email: s.fourati@afdb.org

Rachel ARON, Senior Expert in Social Development, Environment and Climate Change Division (ONEC.3), Department of Energy, Environment and Climate Change (ONEC), African Development Bank, BP 323 - 1002 Tunis Belvedere, Tunisia
Tel: (216) 71 10 2792, Email: r.aron@afdb.org