AFRICAN DEVELOPMENT BANK

ADB/BD/IF//
26 April 2009
Prepared by: OINF
Original: English
Translated by CLSU

Probable Date for Board Presentation:
Not Applicable

FOR INFORMATION

MEMORANDUM

TO: **THE BOARD OF DIRECTORS**

FROM: **Kordjé BEDOUMRA**
Secretary General

SUBJECT: **EGYPT: NUWEIBA COMBINED CYCLE POWER PLANT PROJECT**

SUMMARY ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

Please find hereto attached the above-mentioned document.

Attach.

Cc.: **The President**

***Questions on this document should be referred to:**			
Mr. G. MBESHERUBUSA	**Director**	**OINF**	**Ext. 2034**
Mr. A.T. DIALLO	**Division Manager**	**OINF.3**	**Ext. 2125**
Mr. Y. VYAS	**Lead Environmentalist**	**OIVP.0**	**Ext. 2178**
Mr. E. NZABANITA	**Principal Power Engineer**	**OINF.3**	**Ext. 3081**
Ms. E. MUTAMBATSERE	**Socio-Economist**	**OINF.3**	**Ext. 2640**

EXECUTIVE SUMMARY

Environmental and Social Impact Assessment

NUWEIBA POWER PLANT
750 MWe COMBINED CYCLE PROJECT

April 2009

TABLE OF CONTENTS

1. INTRODUCTION 1

2. PROJECT DESCRIPTION

2.1 Power Plant Design 1
2.2 Process Description. 1

3. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK 2

4. DESCRIPTION OF THE PROJECT ENVIRONMENT 3

5. PROJECT ALTERNATIVES 5

6. POTENTIAL IMPACTS AND MITIGATION / ENHANCEMENT MEASURES

Air Quality 6
Aquatic Environment 7
Noise Impacts 8
Flora and Fauna 8
Land Use, Landscape and Visual Impacts 8
Soils, Geology and Hydrology 9
Traffic 9
Socio-economic and Socio-cultural effects 9
Archaeology, Historic and Cultural Heritage 10
Natural Disaster Risks 10
Major Accident Hazards 11
Solid and Hazardous Waste Management 11
Occupational Health and Safety 11
Associated Infrastructure 11
Global Warming and Other Impacts 12

7. THE ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP) 12

8. PUBLIC CONSULTATION AND DISCLOSURE 14

9. RESPONSIBILITIES AND INSTITUTIONAL ARRANGEMENTS

9.1 Environmental Management Organization 14
9.2 Environmental Training 15
9.3 Occupational Health and Safety 15
9.4 Emergency Procedure and Accident Response 15

10. IMPLEMENTATION SCHEDULE AND REPORTING 16

11. CONCLUSIONS 16

References 16

List of Figures iv

List of Tables iv

List of Acronyms... iv

****

LIST OF FIGURES

Figure 1 Location of the proposed Nuweiba Power Plant ……..…..….. 17
Figure 2 Proposed Layout for the Nuweiba Combined Cycle Power Plant-Site General Arrangement …….……..... 18

LIST OF TABLES

Table 1 Environmental, Health and Safety Issues Relating to Construction and Operation of Nuweiba Power Project…….…….….. 19
Table 2 Environmental Impacts and Environmental Guidelines……..…….. 20
Table 3 Monitoring Program for Ambient Air Quality, Noise and Vibration……..... 21
Table 4 Monitoring of the Aquatic Environment during Operation……...…….. 22
Table 5 Key Issues Raised During ESIA Scoping & Public Consultation Meetings. 23

LIST OF ACRONYMS

AFD	Agence Française de Développement
AfDB	African Development Bank
CAA	Competent Administrative Authority
CTF	Clean Technology Fund
CWDS	Circulating Water Discharge Structure
EDEPC	East Delta Electricity production Company
EEAA	Egyptian Environmental Affairs Agency
EEHC	Egyptian Electricity Holding Company
EETC	Egyptian Electricity Transmission Company
EIB	European Investment Bank
EMS	Environmental Management Staff
ESAP	Environmental and Social Impact Assessment Procedures
ESIA	Environmental and Social Impacts Assessment
ESMP	Environmental and Social Management Plant
GAFRD	General Authority for Fish Resources Development
HGV	Heavy Goods Vehicle
KfW	KfW Bankengruppe
MWRI	Ministry of Water Resources and Irrigation
NPP	Nuweiba Power Plant
PCDA	Public Consultation and Disclosure Activities
PGESCo	Power Generation Engineering Services Company
PMU	Project Management Unit

1. INTRODUCTION

1.1 Power Generation Engineering Services Company (PGESCo), a consulting firm (Egypt) was commissioned by the Egyptian Electricity Holding Company (EEHC)/East Delta Electricity production Company (EDEPC) to prepare the Environmental and Social Impacts Assessment (ESIA) of the Nuweiba Power Project as required by the African Development Bank (AfDB) the European Investment Bank (EIB).

1.2 EEHC is seeking financial assistance from the EIB & the AfDB for the construction and operation of this 750 MWe, dual fuel combined cycle power plant. The proposed plant is designated as a Category 1 project under the AfDB rules and a Category C project under the Egyptian environmental regulations and therefore requires a full Environmental Impact Assessment.

1.3 The ESIA report presents the full assessment of the environmental, social, health and is safety impacts of the Nuweiba power plant http://www.egelec.com/mysite1/projects.htm). This Executive Summary presents a short resume of the findings of the ESIA report. For further details, reference should be made to the full ESIA report.

2. PROJECT DESCRIPTION

Power Plant Design

2.1 There are a wide variety of potential designs for the proposed power plant. On the basis of the key design features selected for the power plant, together with the adoption of general good practices within its overall design and layout, fuel and chemical storage facilities and pollution monitoring equipment, the power plant minimizes its potential impacts on the environment whilst ensuring safe, secure and efficient operation. Key aspects of the design, which have been compared with alternatives, are as follows:

2.2 The stack has been designed to maximize buoyancy and dispersion of emissions and its height (82 m) exceeds good engineering practice; the Gas Turbines will be equipped with low NOx combustors, minimizing emissions of NOx which is the key pollutant associated with combustion of natural gas; direct cooling water will be used to maximize generating efficiency, minimizing visual impact, noise emissions and the potential for visible vapor plumes or ground fogging. Alternatives such as cooling towers and air cooled condensers (open, whilst using less water, result in lower generating efficiencies and also result in impacts such as vapor plumes, visual and noise impacts). The availability of water is not considered an issue for this project given the use of water from the Aqaba Gulf; cooling water will be supplied from a sustainable water supply, namely the Aqaba Gulf, and the intake and outfall structures can be constructed and operated without significant impacts

Process Description

2.3 The key steps of the generating process of the proposed combined cycle power plant are as follows:

The main inputs to the generating process consist of natural gas or sollar oil, which will be transported to the station via pipeline (gas) or by trucks (sollar oil). Natural gas (or sollar oil

as a backup) will be mixed with air at the gas turbine unit compressor outlet and combusted to produce hot high-pressure flue gas, which drives the gas turbine electrical generator. Gas turbine exhaust will be used to generate steam from demineralized water to drive one steam turbine generator. The steam is cycled from the Heat Recovery Steam Generators through the turbine to a condenser. A direct, once through cooling system, extracting water from, and discharging to the Gulf of Aqaba, cool the condenser. The condensate is then returned for recirculation within the Heat Recovery Steam Generators.

3. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

Government of Egypt Requirements

3.1 The Egyptian standards have been drawn from the range of provisions in the following documents:

- Law 4/1994 and the Prime Minister's Decree No. 338 of 1995, which promulgates the Executive Regulations of Law 4.
- Amendment to the Law 4/1994 promulgated by the Prime Minister's Decree No. 1741 of 2005 for modifying some executive regulations of the Decree No. 338 of 1995.
- Law No. 93 for 1962 regarding the drainage of liquid wastes, particularly sanitary drainage.
- Law of Labor No. 12/2003.
- Law No. 38/1967 amended by Law No. 31/1976 on public cleanliness and collection and disposal of solid waste.

3.2 Law 4/1994 requires that, for establishments requiring licenses, an environmental impact assessment must be prepared and submitted to the Egyptian Environmental Affairs Agency (EEAA) for review. The environmental impact assessment must be submitted to the EEAA by "the Competent Administrative Authority (CAA) or the licensing authority" for the project in question. For the Power Plant Project, the Competent Administrative Authority is the EEHC or South Sinai Governorate.

3.3 Egyptian EEAA regulations specify the technical scope or contents of an environmental impact assessment. As a matter of practice, environmental impact assessments for power plant projects typically have a scope and organization similar to World Bank environmental assessments which are consistent with the AfDB procedures.

African Development Bank Guidelines

3.4 The African Development Bank sets out its procedures and policies with regard to conducting environmental assessment in a series of Policy and Guidelines documentation, out of them most importantly, the following documents:

- African Development Bank Group's Policy on the Environment (February 2004).
- Integrated Environmental and Social Impact Assessment Guidelines (October 2003).
- Environmental and Social Impact Assessment Procedures (ESAP) for AfDB's Public Sector Operations (June 2001).

- Handbook on Stakeholder Participation (2001).
- Disclosure of Information Policy (2004).
- Policy on Involuntary Resettlement (2003).

3.5 World Bank's *Pollution Prevention and Abatement Handbook-Part III* (July 1998) also, provides with principles of industrial pollution management, monitoring and air emission & effluent discharge requirements presented in the industry Guidelines including Guidelines for New Thermal Power Plants.

4. DESCRIPTION OF THE PROJECT ENVIRONMENT

4.1 The proposed Nuweiba power project site is located on an area of a rectangular-shaped piece of land of 25 Feddans (105,000 m^2) within a wider uncultivated land, which is laying between the mountain far behind and the coastal line of the Aqaba Gulf in front, approximately 170 km northeast of Sharm El-Sheikh and about 70 km south of Taba. The site is surrounded by mountain and desert lands. Only some few industrial facilities and tourist and residential spots are discreted around the site boundary. The Mediterranean sea is located about 260 km to the north of the site and the Aqaba Gulf about 500 m to the east of the site area at the immediate vicinity of the site boundaries. The site of the proposed power plant is shown on *Figure 1*.

4.2 Nuweiba el-Mazena and Nuweiba el-Tarabin are both adjacent to Nuweiba city, parlty Bedouin and within municipal boundaries.
Towns of importance in the wider vicinity of the power plant site are Sharm El-Sheikh, Saint Katherine, Nabq, Ras Mohamed and El-Tur.

4.3 Maximum air temperature reaches its highest levels (32-36^oC) between June and September each year, while the minimum temperature reaches its lowest values (15-17^oC) in January and February. Relative humidity seems to be more or less similar regardless of the season and ranges between 55 and 65%. Highest rainfall occurs in December and January and reaches a maximum of 50 mm. Prevailing winds usually blow from the North West and north directions. South westerly winds blow during January and February. Northern winds prevail between July and October each year.

4.5 Nuweiba power plant site is located on the most eastern part of the main habitat known as the Sinai Peninsula. This habitat is now recognized as a totally natural desert and mountain land system. The very scarce floral and faunal diversity now present in this habitat includes the species that can tolerate this natural land-type and weather system. The project area is located within the western coastline of Aqaba Gulf main ecosystem which is characterized by a sandy extended strip of coastline, with very little and discreted patches of human settlements as well as a very simple system of roads and corridors of roads. The project site lies uniquely within a junction area between the mountain and the Aqaba Gulf. This location is suited for the nature of the proposed activity which relies on water for cooling and discharge. The site with its current land use appears in harmony with its neighboring land uses and no ecological impacts were observed. The area is characterized by its:

- Natural and reasonably pristine environment with five protected areas, covering 40% of the land area of South Sinai, having been declared since 1983;
- Tourism potential with over 1.7 million international tourists visiting the area in 2003;

- Petroleum resources along the Gulf of Aqaba which account for much of the oil production in Egypt;
- Mineral resources, being a significant producer of non-metallic and ornamental stone.

4.6 The 610 kilometers of coastline contain some of the most significant tourist destinations of the country whilst inland there are also attractions; tourism is the single most significant economic activity of the area.

4.7 Surface waters at Ras Mohamed have a fairly constant salinity of 40.5 parts per thousand (global average 33ppt), and a summer temperature between 26 and 280C.

4.8 Groundwater abstracted from shallow wells sunk into quaternary deposits has been utilised as a resource. Water is also available in fissured carbonate rocks in Central Sinai and in the Nubian Sandstone in Watir and Feiran. The Ministry of Water Resources and Irrigation (MWRI) estimates that total abstraction may be as much as 37,000m3/day but much of this production is brackish. The MWRI estimates that around 80% of this abstraction is from quaternary deposits, with a further 10% each from fissured carbonates and the Nubian Sandstone.

4.9 A total of 209 hard and 16 soft coral species have been reported for the Egyptian Red Sea, with diversity generally increasing towards the north. 800 fish species are known from the Red Sea, 17% of them endemic. A Gulf of Aqaba study identified 180 fish species from 106 genera, 55 families and 15 orders. The Gulf of Aqaba is also reported to have high levels of endemism for molluscs (12%), echinoderms (12%) and amphipods (15%), with seven endemic species of finfish (0.7%). 23 species of fish common elsewhere in the Indo-Pacific region are not found anywhere in the Red Sea, except the Gulf of Aqaba. Similar data is not available for the Gulf of Aqaba. In the Gulf of Aqaba, there are narrow fringing reefs along the steep cliffs; at the mouths of wadis (river valleys) and across bays, the fringing reefs extend outward up to 1 km from shore.

4.10 Red Sea fisheries contribute approximately 16% of total annual Egyptian marine fisheries production. Of these, 56% of fish landings are pelagic. The General Authority for Fish Resources Development (GAFRD) aims to increase catches to 70 thousand tonnes by 2017. Total landings from the Gulf of Aqaba in South Sinai increased from 130 tons in 1985 to 5,948 tons in 2003.

4.11 Seagrasses are fairly widespread along Sinai's coasts, concentrated in shallow water areas such as lagoons, sharms and mesas. In the Gulf of Aqaba, high concentrations of seagrasses are found in just a few sites in Ras Mohamed, Nabq, and Abu Galum. Although the majority of seagrasses occur in depths of less than 10m, communities in the Aqaba Gulf are found as deep as 30m, and due to the more favourable conditions, they are more abundant.

4.12 Recent work suggests that South Sinai supports 800 plant species, with 62% considered rare or very rare. 33 are endemic, 4 are endemic to Sinai and other mainland regions of Egypt, and a further 135 of these do not occur anywhere else in Egypt. 420 species occur in the high mountain region around St. Katherine's, with 319 in the protectorate itself. Of these 19 are endemic, 10 are extremely endangered, and 53 are endangered.

4.13 Only 10 species of reptiles have been recorded from the gulf coasts, although this may reflect a lack of adequate surveys. Common species include Ptyodactylus hasselquistii, Uromastyx aegyptius, Acanthodactylus boskianus, Mesalina brevirostris and Cerastes cerastes. Mesalina brevirostris has been recorded from the Gulf of Aqaba, but nowhere else in Egypt.

4.14 Species of birds are known to commonly breed in the coastal plains. Characteristic species include Ardeola striata, Egretta gularis, Pandion haliaetus, Falco concolor, Streptopelia decaocto, Nectarinia osea and Corvus splendens. Up to 200 species pass through the area in great numbers during autumn and spring migrations, including populations of the White Stork Ciconia ciconia. 24 mammal species have been recorded, including Lepus capensis, Gerbillus pyramidum, Acomys cahirinus, Hyaena hyaena and Gazella dorcas.
The importance of the marine and terrestrial ecosystems of the area has been recognised by the establishment of National Parks and Protectorates.

4.15 Abu Galum Managed Resource Protected Area covers 458 km^2 of land and sea area, including unique coastal and mountain ecosystems such as narrow wadis, fresh water springs, coastal sand dunes, gravel alluvial fans, raised fossil coral reefs and saline sabkha. Sandy beaches and rich coral reefs attract tourists travelling from Dahab by camel. As many as 165 species of flowering plants have been recorded, 47 of which, have not been found in the other coastal protectorates. There is an active Bedouin artisan fishery at Abu Galum relying on the reefs. A visitor centre at the northern boundary of the area will provide information and environmental educational programs.

4.16 The Taba Protected Area covers 2800 km^2 and contains many tourist attractions accessible to desert safaris, such as the Colored Canyon. The aim of the Taba protected area has been to preserve the beauty and ecology of the area, as well as the value of the investments along the coast.

5. PROJECT ALTERNATIVES

5.1 Project alternatives studied included the “no action” option, alternative technologies and fuels and alternative sites.

- The **no action alternative** will result in the demand for electricity exceeding supply, with an increasing deficit as demand increases in future years. A lack of secure and reliable electricity generation and supply system has significant social, economic and environmental implications, since it will constrain existing and future economic development and investment; restrict socio-economic development; and inhibit provision of public health and social services .As a result, the "no action" option is not a viable or acceptable alternative to the proposed project.

- **Combined cycle technology** is more efficient than other traditional modes of generation capacities in terms of fuel consumption and flexibility of operation. Hence, the technology chosen by the EEHC for the project is a combined cycle system.

- The consideration of **alternative sites** by the EEHC and PGESCo indicated that only site 7 satisfied most of the evaluation criteria on the basis of allocating an area of approximately 25 Feddans for one 750 MWe combined cycle module without the plant housing colony. Accordingly, the Nuweiba selected site has no significant

disadvantages and has several beneficial aspects and desirable site development characteristics. Therefore, Nuweiba site 7 was selected as the preferred site for the power plant.

- **Power Plant Design :**. Key aspects of the design, which have been compared with alternatives, are as follows:
  The stack has been designed to maximize buoyancy and dispersion of emissions and its height (82 m) exceeds good engineering practice; the Gas Turbines will be equipped with low NOx combustors, minimizing emissions of NOx which is the key pollutant associated with combustion of natural gas; direct cooling water will be used to maximize generating efficiency, minimizing visual impact, noise emissions and the potential for visible vapor plumes or ground fogging. Alternatives such as cooling towers and air cooled condensers (open, whilst using less water, result in lower generating efficiencies and also result in impacts such as vapor plumes, visual and noise impacts). The availability of water is not considered an issue for this project given the use of water from the Aqaba Gulf; cooling water will be supplied from a sustainable water supply, namely the Aqaba Gulf, and the intake and outfall structures can be constructed and operated without significant impacts.

6. POTENTIAL IMPACTS AND MITIGATION / ENHANCEMENT MEASURES

6.1 The ESIA has assessed the impacts of the construction and operation of the Nuweiba Power Plant and has also considered the cumulative air quality impacts of the plant and other existing sources in the project area. Consideration has also been given to the operation of the transmission line and other outside facilities.

6.2 A thorough assessment of the impacts of the proposed plant has been carried out based on information provided by EEHC, EDEPC and their sub-consultants. A combination of quantitative and qualitative assessment techniques, ranging from computer and/or physical modeling for air, water, noise and traffic impacts to ecological and aquatic surveys and visual evaluation, have been undertaken. The results of the assessment work have been compared with the environmental standards set by the Government of the Arab Republic of Egypt, EIB, AfDB and the World Bank, whichever is the more stringent.

6.3 The following items are examined in the corresponding sub-sections of the ESIA Study Report:

Air Quality

Construction Dust

6.3.1 Construction activities will result in locally high levels of dust. This may affect nearest receptors or sensitive environments which lie in the immediate boundaries of the power plant. Existing concentrations of airborne dust are already low in this area. Potential impacts from dust emissions on site will be significantly reduced by careful management and the implementation of mitigation measures to reduce dust generation.

Stack Emissions and Background Air Quality

6.3.2 The power plant will burn natural gas as its primary fuel. As a result, the principle pollutant during normal operation will be NOx. During emergency operation (and for not more than 2% of operating time), the burning of light fuel oil will result in emissions of particulate matter and SO_2 along with trace amounts of other pollutants. Emissions from the plant will meet Egyptian, EIB, AfDB and World Bank Guidelines.

6.3.3 In order to analyze the potential impacts of the plant's emissions during normal operation (firing gas) on ambient air quality in the project area, dispersion modeling has been undertaken.

6.3.4 An air quality monitoring system composed of 2 or 3 monitoring stations will be utilized. The monitoring station equipped with meteorological monitoring system will be located near to, or within, the power plant site, the other one or two stations will be located one down wind within the designated area of maximum predicted pollutant concentration and the other (if any) upwind.

Aquatic Environment

6.3.5 Cooling water and process water for power plant operation will be drawn from the Aqaba Gulf via an intake structure and will be returned back to the Aqaba Gulf at about 13.6 m^3/sec. Process water abstracted from the Aqaba Gulf is about 0.07% of this quantity. Potable water will be supplied to the power plant via plant potable water treatment system. Cooling water will be returned to the Aqaba Gulf via a discharge structure whilst waste process water will be disposed of after treatment via discharge system, which includes two pathways: plantation irrigation network and Circulating Water Discharge Structure (CWDS). Sanitary waste water will be disposed of -after treatment- via plantation irrigation network or city sewer system. No ground water or other surface water will be used during power plant construction and operation. The Contractors will be responsible for relevant water/toilet facilities during construction and the need to provide appropriate services will be specified in their contracts. Power plant operation will result in a heated plume of cooling water being discharged into the Aqaba Gulf. Process water will be disposed of to the discharge system (identified above). All discharges of process water will be treated prior to discharge to ensure that the Egyptian and World Bank waste water quality guidelines are met. Treatment includes neutralization, oil separation, flocculation and filtration.

6.3.6 The returned cooling water will be released at a temperature of no more than 9^oC at the point of discharge. Thermal modeling of the discharge plume shows that, at full load operation, the point at which the plume has decreased in temperature to $<3^oC$ above ambient, lies at approximately 70 m from the point of discharge. The mixing zone has been defined to be 100 m from the point of discharge.

6.3.7 The temperature of the returned cooling water at the point of discharge conforms to the Egyptian Standard, and the discharge as modeled satisfies the World Bank standard of a maximum increase of 3^oC above ambient at the edge of the mixing zone (100 m from the point of discharge). In addition, the area affected by the highest temperature increases and therefore where aquatic ecology is likely to be most affected, is localized and the aquatic habitats in this area have been found to already be relatively impoverished. Outside this area,

more marginal increases in the Aqaba Gulf water temperature are likely to create new or improved habitats for flora and fauna.

6.3.8 Physical aquagraphy, Nuweiba segment of the Aqaba Gulf Shoreline access, fishing and navigation are not predicted to be significantly affected by the presence of the intake and discharge structures.

Noise Impacts

6.3.9 The construction of the Nuweiba power plant is expected to generate a maximum noise level of 58 dB(A) during the day at the fence of the power plant and 55 dB(A) at night. These worst-case construction noise levels are both within Egyptian and World Bank[)] guidelines, and for most of the construction periods, the noise levels will be lower than these values. There are no residential receptors within 150 m of the plant fence.

6.3.10 The potential noise emissions from the Nuweiba plant during operation have been modeled to provide noise contours in the area around the site. The predicted operational noise levels at the site boundary and at all receptors are below the Egyptian and World Bank guidelines during daytime and nigh-time.

Flora and Fauna

6.3.11 No areas protected for their conservation value are located on, or in the vicinity of, the project area. The proposed site itself and the surrounding land is poorly vegetated with much of the area having been dominated by sands and stones. Given that the potential impacts of construction and operation on power plant area likely to be localized and good site management practices will be implemented, no significant effects are predicted.

Land Use, Landscape and Visual Impacts

6.3.12 The land use at the project site is industrial land. There is no loss of this land to the power plant development, as this land is dedicated for a power generation activity in the regional physical planning of Nuweiba area, therefore there is not significant land use impacts due to the Nuweiba power project.

6.3.13 The surrounding land use is generally industrial, commercial, tourist and residential. As the land is highly tourist typed with almost no vegetation, all existing views will be significantly influenced by the power plant, but given the surrounding industrial facilities, particularly the existing water desalination and wastewater treatment plants and industrial facilities of Nuweiba port, the visual intrusion of the power plant will be minimal.

6.3.14 Visual impacts of the power plant from the residential (tourist) areas to the east and southeast are also expected to be significant given the near distance of their locations from the site and orientation of the facilities. The potential landscaping of the project is therefore expected to mitigate the impacts to the extent that it would be minor and not significant.

Soils, Geology and Hydrology

6.3.15 Due to the characteristics of the soils and geology of the site, in particular the lack of any sensitive features, and the mitigation measures proposed as part of the construction and operation of the power plant, no significant impacts are predicted to occur. In addition, preliminary land surface investigations confirmed the site as being uncontaminated.

Traffic

6.3.16 The greatest potential for traffic impacts to occur arises during a short period at peak construction.. Mitigation measures will be put in place to reduce the potential for impacts to arise. During operation, a small number of workers and HGVs are associated with operating the power plant and no impacts are predicted to occur.

Socio-economics and Socio-cultural effects

Employment:

6.3.17 It is anticipated that the power plant will provide a net positive socio-economic impact through the provision of employment opportunities and attraction of economic investment into the area. In addition, the use of local labor (95% during construction), will maximize these positive impacts through the development of the local skill base and will also generate increased demand for local services, materials and products.

Relocation and compensation:

6.3.18 Therefore no displacement, resettlement or compensation of local populations, or disruption of economic activities, is anticipated. Nevertheless, EEHC has drawn up a Resettlement Policy Framework in line with EIB policies and guidelines on resettlement and compensation, in case resettlement is required.

Pressure on social infrastructure:

6.3.20 Because Nuweiba is at present a small town with a relatively small population, part of the 'local' work force is expected to come from the greater South Sinai area. Experiences from elsewhere have shown that when large numbers of workers move into an area, as is bound to happen during construction of the power plant, problems associated with increased pressure on public services may arise. These problems are anticipated, and some measures have been put in place to address them, specifically the development of a colony – a self contained settlement for plant workers including housing, water and sanitary facilities, school, health center, playground and mosque – in the project area prior to project inception. A total of US$ 5.39 million has been allocated in the project costing to cover associated costs. Additionally, a policy in place in South Sinai to guarantee companies working in the area land needed to build housing for their employees.

Socio-cultural disruptions, health and disease:

6.3.21 Other than the desert nomadic communities known as the Bedouins, who dwell in diverse locales and account for about 17% of the total South Sinai governorate, no distinct historical or cultural features are known to exist in the project area. Therefore cultural

conflicts resulting from migration into the project area is unlikely. The risk of spread of communicable diseases is also considered low, given very low national prevalence rates (e.g. less than 1% for HIV) and past experience in power plant construction sites in Egypt. Given EEHC and EDEPC's experience in power plant construction and operation the possibility of major accidents on site was determined to be minimal, and the mitigation measures proposed in the ESMP will reduce the risk to the lowest practicable limit.

Potential loss of livelihoods:

6.3.22 Land developments in the Nuweiba area are limited, a small low-height-hut style resort is located near the project site, two industrial facilities are located west and north east of the site, and about 4 km from the site lies the Port of Nuweiba. The rest of the land is either open, uncultivated land, or residential properties. With the exception of minor negative visual effects expected during plant construction and during operation, none of these facilities will be adversely affected by project in any significant way. Measures have been proposed to minimize visual intrusion of the power plant.

6.3.23 The effects on the fisheries of warmer water returned to the Aqaba Gulf from similar power plants along the sea coasts are well known. Experience from about 10 other power plants located on the shorelines of both of the Mediterranean and Red seas that have operated in Egypt for a number of years indicates that the overall impacts on fisheries of slightly warmer water actually are positive, and consultations with the fishermen indicate that the catches in these areas have increased rather than decreased. Since this is part-time, small-scale fisheries no statistics are available, but after many years the warmer water around the various points of discharge, is clearly perceived by the fishermen to have positive effects. In line with this recognition, discussions have already been initiated between the EEHC and the General Authority for Fishery Development with a view to jointly take advantage of this, e.g. establishing a fry collection station near the edge of the mixing zone.

Archaeology, Historic and Cultural Heritage

6.3.24 No available information was found which identified any archaeological, historic or cultural remains on the site or in the surrounding area. Consequently, no impact is predicted to occur on any known archaeological, historic or cultural resources.

6.3.25 EDEPC have incorporated mitigation measures into the construction program to ensure that any potential finds of significance are recorded and are accorded the required protection in consultation with Supreme Council for Antiquities.

Natural Disaster Risks

6.3.26 An assessment of the risks to the power plant from seismic activity has concluded that given the engineering measures incorporated into the design of the power plant, the potential environmental impacts of a seismic event during power plant operation are not anticipated to be significant. Furthermore the power plant will be designed to conform to the International Building Code Zone D seismic criteria, according to US regulations for earthquake. These design criteria are therefore considered sufficient to withstand the level of seismic activity experienced in the area.

6.3.27 The risks of flooding during power plant construction and operation were also examined. However, site protection measures against any anticipated flash flooding will be put in place. Also, site drainage will be constructed to minimize any risks of contaminated water reaching the surroundings and to properly drain the site, no significant flood risk impacts are anticipated.

Major Accident Hazards

6.3.28 Given the wider land surrounding the Nuweiba power plant and the measures incorporated into the design of the plant to minimize the risk from fire and explosion, the plant is not anticipated to pose a potential risk of any significance to any third party facilities.

Solid and Hazardous Waste Management

6.3.29 The management of wastes during construction and operation of the power plant will include mitigation measures to collect and store waste on-site, record all consignments of solid or contaminated waste for disposal and periodically audit waste contractors and disposal sites to ensure that disposal is undertaken in a safe and environmentally acceptable manner according to the rules set by Law 4/1994 and the Governorate of South Sinai.

Occupational Health and Safety

6.3.30 With the provision of a high standard of health and safety management on site, construction and operation of the power plant in accordance with good industry practice, the occupational health and safety risks associated with construction and operation of the power plant will be minimized and are not significant.

Associated Infrastructure

6.3.31 EEHC / EDEPC has already submitted a request to the Gas Company for their needs for the new plant which will necessitate a connection pipeline to be extended for a length of around 1 km only from the already existing gas pipeline passing through west to the site from Taba in the north to Sharm El-Sheikh in the south.

6.3.32 The electricity generated by the proposed power plant will be exported via the 220 kV electricity transmission system. The power plant will be connected to the 220 kV switchyard via step-up transformers.

6.3.33 The electricity generated by the proposed Nuweiba power plant will be exported by the EETC electricity network, via the transmission system, double circuit 220 kV lines passing adjacent west to the power plant site. Due to relatively short distance (0.6 km) to the substation, no environmental and social impacts due to the transmission lines are expected. Also, land take or resettlement will not be associated to the power interconnecting lines (because the area in question is largely uninhabited public desert land and only one proposed alternative routing has already been identified).

Global Warming and other Impacts

6.3.34 Natural gas has been selected as the main fuel for the power plant. Compared to other fossil fuel generating technologies, gas fired combustion turbines have a relatively low emissions of carbon dioxide (CO_2), moderate emission levels of nitrogen oxides (NOx) and the lowest emission levels (almost traces) of sulfur dioxide (SO_2) and particulates.

6.3.35 The efficiency of the proposed combined cycle power plant is about 52-54% with natural gas, with associated CO_2 emissions of about 0.42kg/kWh. This compares with the efficiency of a typical efficient steam power plant of 42-45% and associated CO_2 emissions of around 0.55 kg/kWh. Emissions of carbon dioxide are estimated to be up to 1,260 kilotonnes per year (expressed as CO_2). This assumes that the plant operates for the whole year and consumes around 3 million cubic meters tonnes of gas per day. The emissions of CO_2 from fuel burning in Egypt amounted to around 169,000 kilotonnes in 2006/2007 (Ref: EEAA: Second National Communication, not published yet). Fuel combustion will account for most of Egypt's CO_2 emissions from all sources. Hence, the power plant as proposed will emit up to around 0.74% of the total Egyptian CO_2 energy sector's emissions in 2006/2007. This is an upper estimate as the plant will not operate 100% of the year or at full load 100% of the time.

6.3.36 Egypt has qualified to benefit from the Clean Technology Fund (CTF) managed by the World bank and Regional Development Bank to promote large scale renewable energy such as wind and clean transport. There are also bilateral programs through KfW and ADF to promote exploitation of wind power, recovery of methane gas from landfills, etc

7. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

7.1 The Environmental and Social Management Plant (ESMP) includes mitigation measures, design of monitoring programs where appropriate, and specification of management measures (including institutional responsibility and training requirements).

7.2 All the mitigation, monitoring and management measures proposed in the ESIA report (the Environmental and Social Management Plan (ESMP)), will be adopted by the Project Company and imposed as conditions of contract on the contractor and any sub-contractors employed to build or operate any part of the power plant.

7.3 Mitigation measures introduced into the design and construction phase of the power plant will be carried forward into the operational phase by the EDEPC Company. Many of the mitigation measures have already been integrated into the design of the power plant in order to minimize any operational impacts on the environment. Mitigation measures such as low NOx combustors, noise silencers and water discharge controls are for example integral to the design of the power plant.

7.4 Since many of the mitigation measures presented are considered an essential, integrated component of the construction and operation works, it is not possible to separate the specific costs of their implementation from the overall construction costs. However, the total implementation cost of the Environmental and Social Management Plan is about US$ 1.76 million, which amounts to about 0.23% of the total project cost. Annual cost of 90,000 US$ is estimated for operation phase.

Monitoring Program

Stack Emissions

7.5 Stack emissions will be monitored continuously during plant operation at a representative point in the stack. Operational monitoring of stack emissions shall comprise monitoring the levels of: Oxides of Nitrogen; Sulfur Dioxide; Carbon Monoxide; and Total Suspended Particles and PM_{10}. The automatic monitoring system used will be linked in the controlling room to an alarm system to warn when emission limits for each pollutant are being approached.

7.6 Concentrations will be recorded as hourly rolling averages and reports on stack emissions monitoring will compare recorded emissions against predicted levels and Egyptian, EIB, AfDB and International/WB guidelines. Reports will be submitted to the EEAA, the EIB, AfDB and any other concerned authority on an annual basis (or as required).

Ambient Air Quality - Validation of Modeling Predictions Using Continuous NOx, SO_2 and TSP Analyzer

7.7 The use of a continuous NOx, SO_2, CO and TSP analyzer allows for baseline air quality monitoring on a continuous basis. The provision of continuous monitors (two or three: one at the site, one upwind and the third downwind) will provide the basis for "validating" the predictions made in the ESIA. The monitors will also include a weather station providing data on air temperature, wind speed, wind direction and mixing heights on a continuous basis. These monitors shall, also, be connected electronically, if possible, to the EEAA ambient monitoring system.

7.8 The construction and operational monitoring of air quality around the Nuweiba power project will include the parameters summarized in *Table 3.*

Aquatic Environment

7.9 Monitoring of impacts of the power plant on the aquatic environment will include monitoring of the quality of the discharge water, Aqaba Gulf shoreline and benthic sediments, ambient water quality and the impact on aquatic flora and fauna. The survey techniques and areas will be comparable to the survey undertaken by both of the Hydraulics Research Institute and the National Research Center during August-November 2008. The survey will include the area affected by the thermal plume (i.e. 100-150 m from the discharge point).

7.10 The operational monitoring of cooling water and effluent discharge will include the parameters summarized in *Table 4*.

7.11 Monitoring data will be analyzed and reviewed at regular intervals and compared with Egyptian and World Bank guidelines. Records of monitoring results will be kept in a suitable format and will be reported (in summary format with any exceptions identified) to the responsible government authorities, the EIB and AfDB or any other concerned authority as required. As a result, the project company, in discussion with the EEAA, EEHC, the EIB and the AfDB or any other concerned authority, will review the need to implement any additional mitigation features, such as provision of further water treatment facilities on site and also on the need to continue monitoring.

Waste Monitoring

7.12 Wastes generated on site and collected for disposal by skilled firms will be referenced, weighed and recorded. Environmental audits will be undertaken which will assess the quality and suitability of on- and off-site waste management procedures.

8. PUBLIC CONSULTATION AND DISCLOSURE

8.1 The adopted methodology for the public consultation, which conforms to the EIB, World Bank & AfDB requirements, comprised four elements, namely:

Phase I

- discussions with local stakeholders and interested parties during preparation of the environmental documents for local permitting requirements;
- discussions with local stakeholders during a series of scoping mini-meetings, held in collaboration with different stakeholders, and preparation of this ESIA-Report;

Phase II

- the organization of a Public Meeting in the South Sinai Governorate, and
- on-going consultation through an "open-door" policy during construction and operation of the power plant.

8.2 As far as public disclosure is concerned, major initiatives to inform the public and interested parties about the Nuweiba Power project included the following:

- press advertisement describing the project and inviting interested parties to attend the public meeting and review the Draft Final ESIA Reports (published in Al-Ahram Newspaper -in Arabic- on Wednesday 8th April 2009, (See Volume-III);
- distribution of an invitation and Arabic copy of the Non Technical Summary describing the context of the power plant, the technology employed, the impact on the environment, the mitigation measures and the ESMP; and
- disclosure of the Draft Final ESIA Report locally and the Executive Summary, including ESMP via the Infoshop.

8.3 The full methodology for consultation and disclosure is presented in the project's Public Consultation and Disclosure Activities (PCDA), given in Annex B of the full report.

Ongoing Consultation and Disclosure

8.4 Nuweiba Power Plant's (NPP's) Assistant Plant Manager, who is responsible for the Environment, Safety and Quality Assurance program for the plant, will have full responsibility for implementing and supervising the ESMP. This role includes ongoing communication with local industrial and commercial interests, local authorities and other interested parties. An "open door" policy will be adopted to allow stakeholders to voice ongoing concerns.

9. RESPONSIBILITIES AND INSTITUTIONAL ARRANGEMENTS

Environmental Management Organization

During Design and Construction

9.1 Suitably qualified and experienced contractors will be responsible for the detailed design and construction of the power plant. Construction workers will be required to demonstrate appropriate skills, qualifications and/or experience prior to employment.

9.2 During construction, Project Management Unit / Environmental Management Staff (PMU/EMS) and the Assistant Plant Manager in collaboration with PGESCo Site Manager will ensure that all contracts with Contractors and sub-contractors stipulate all construction management measures (as given in this ESMP), operational design criteria and environment, health and safety standards which must be implemented at the project site.

During Power Plant Operation

9.3 During operation, direct responsibility for environmental compliance and the implementation of the mitigation, management and monitoring measures will continue to be with the Plant Environmental Staff under direct supervision of the Assistant Plant Manager. This position, will report directly to the Chairman/General Manager of EDEPC/NPP.

Environmental Training

9.4 The Project Company will ensure that the power plant is manned 24 hours a day, 7 days per week. All staff employed at the plant will be trained in the following :general operation of the power plant; specific job roles and procedures; occupational health and safety; and contingency plans and emergency procedures .In addition to this environmental training for all staff employed at the plant, special environmental training will be given to the staff employed for the EMU.

Occupational Health and Safety

9.5 EDEPC/NPP will establish and integrate policies and procedures on occupational health and safety into the operation of the power plant which meet the requirements of Egyptian, EIB, AfDB and International / World Bank guidelines as given in Section 2 of the report.

Emergency Procedures and Accident Response

9.6 Instructions on emergency measures necessary to safeguard employees and the wider environment will be prepared as part of the Operations Manual for the power plant .
Contingency plans and emergency procedures are being developed to cover events due to operational failures, natural causes and acts of third parties. The plans and procedures will cover, as a minimum, the following fire; explosion; bomb alerts; leaks and spills of hazardous materials; structure or equipment failures; injuries and illnesses; risk from natural disasters (wind, sandstorm, earthquake); and third-party risks (potential impacts of an accident occurring at another industrial facility which may impact upon the power plant).

Oil Spill Contingency Plan

9.7 As Good practice and part of the ESMP, EDEPC/PMU/EMS will prepare an Oil Spill Contingency Plan to be ready for implementation by the start of construction activities.

10. IMPLEMENTATION SCHEDULE AND REPORTING

Environmental and social management and monitoring activities will be implemented (according to the ESMP), following the same project schedule, as all activities are mainstreamed in the project design. Achievements/problems will be reported in the project quarterly progress reports and should be timely addressed by the project management and the Banks.

11. CONCLUSIONS

11.1 The Project Company proposes to develop a new combined cycle power plant of total capacity 750 MWe at the area reserved for the Nuweiba Power Plant on land allocated to the EDEPC Company. The site is an Industrial Setting and does not contain significant residual environmental sensitivity of importance.

11.2 The key environmental issues associated with the power plant are as follows: Emission of oxides of nitrogen to the air; Generation and disposal of liquid effluents including cooling water; and Emission of noise.

11.3 The Environmental and Social Impact Assessment has evaluated the potential environmental impacts during construction and operation of the proposed power plant. In particular, the potential impacts of the flue gas emissions to the air, generation and disposal of liquid effluents including cooling water; and the emissions of noise have been assessed using sophisticated modeling techniques, which include consideration of the ambient background environment and the characteristics of the releases or emissions, and predicts the potential impacts which may occur. The assessment indicates that no significant environmental impacts will occur as a result of the construction or operation of the power plant and, when taken together, the overall environmental and social impacts will not be significant.

References: *Environmental and Social Impact Assessment;* NUWEIBA POWER PLANT 750 MWe COMBINED CYCLE PROJECT; EEHC; May 2009

Contacts

EEHC: Managing Director for Environmental Management and Studies; EEHC: **Eng. Maher Aziz Bedrous;** Egyptian Electricity Holding Company (EEHC), email: maher_aziz49@yahoo.com

AfdB: Yogesh Vyas; Lead Environmentalist; y.vyas@afdb.org

Figure 1 : *Location of the Proposed Nuweiba Power Plant*

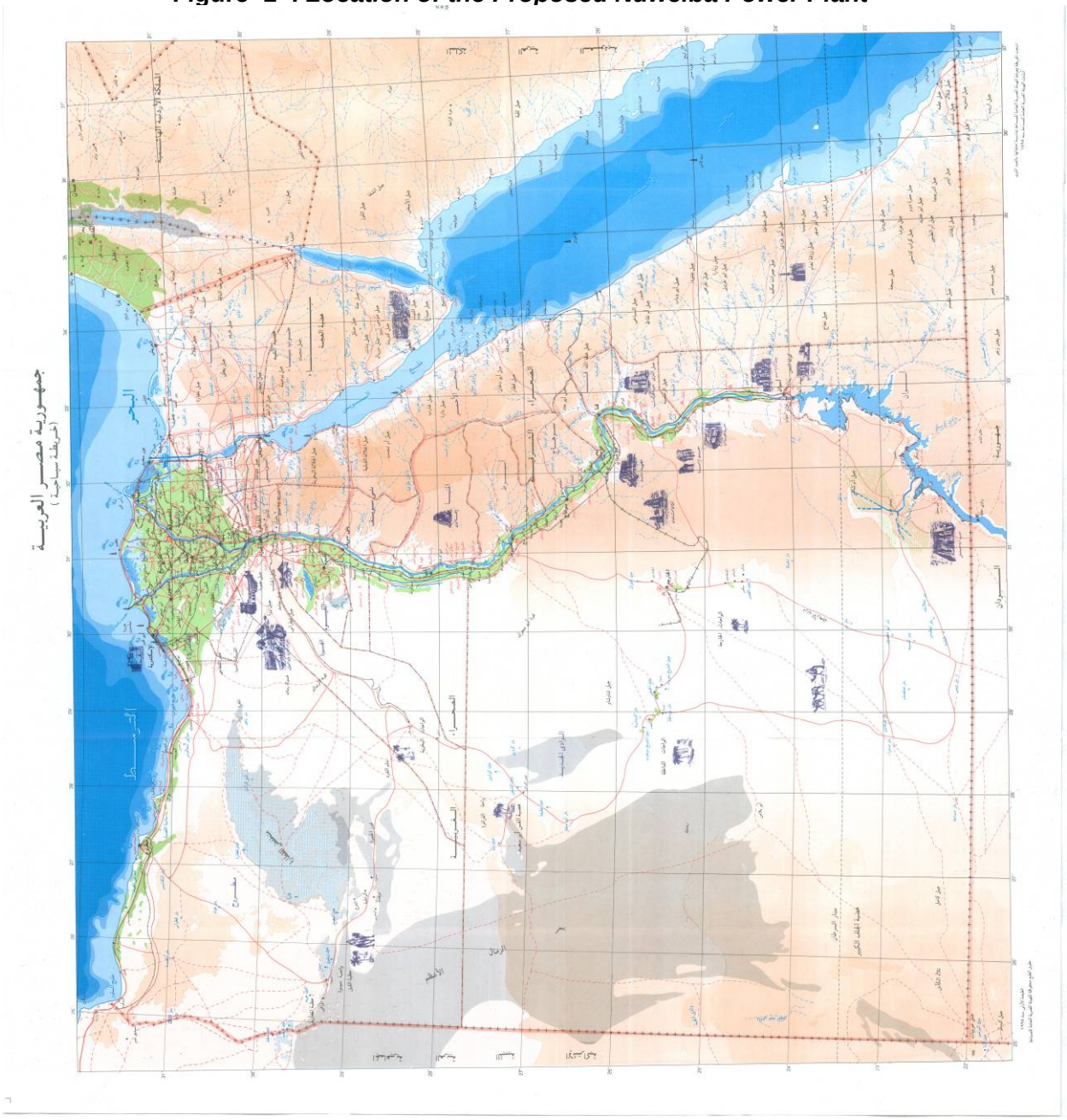

Figure 2: Proposed Layout for the Nuweiba Combined Cycle Power Plant-Site General Arrangement

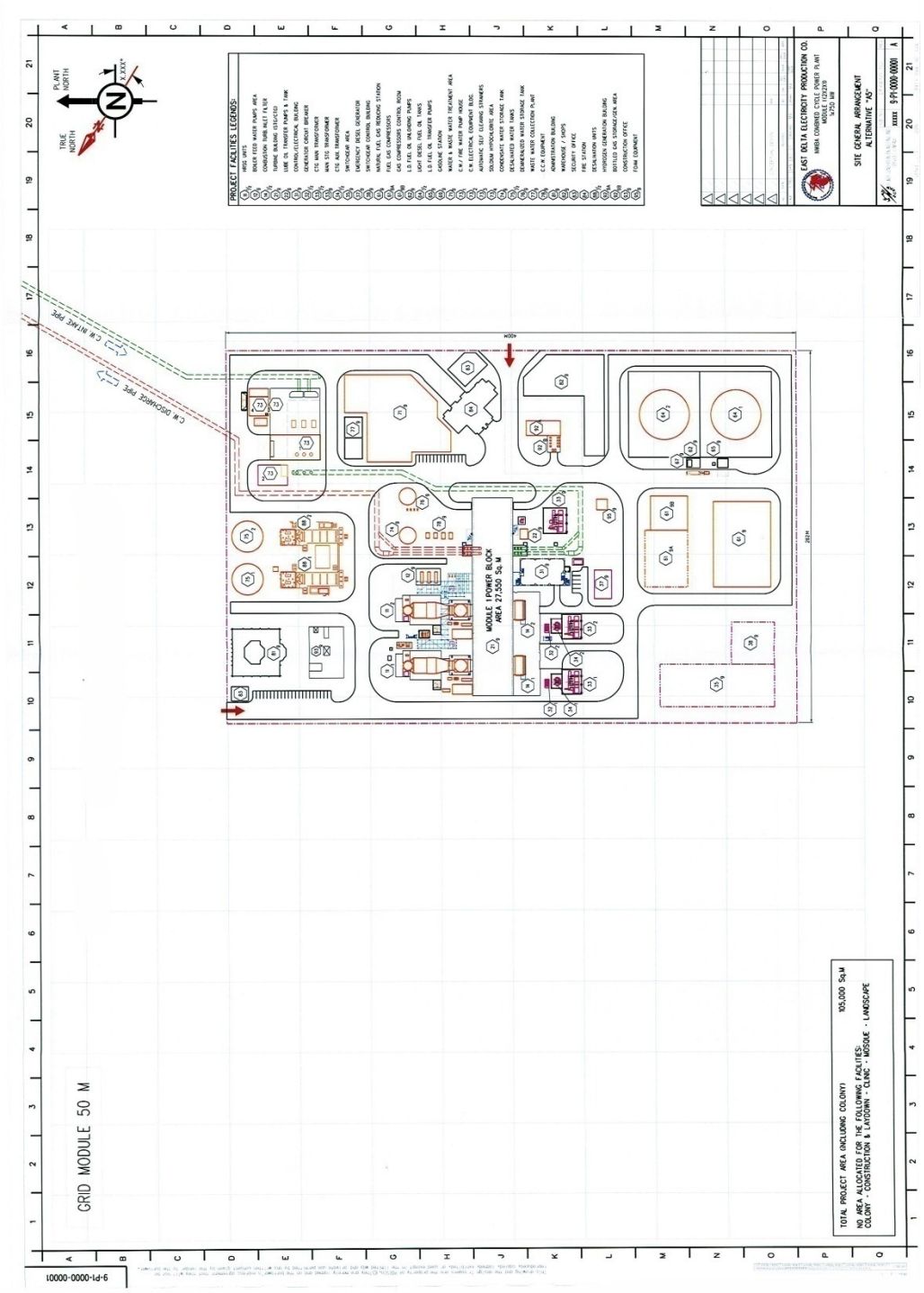

Table 1 :*Environmental, Health and Safety Issues Relating to Construction and Operation of Nuweiba Power Project*

Subject Area	Potential Impacts During Construction	Potential Impacts During Operation
Air Quality	Dust from construction activities. Traffic-related air quality impacts.	Impacts of emissions from stacks on ambient air quality. Traffic-related air quality impacts. Global warming potential.
Aquatic Environment	Control and management of site drainage. Wastewater discharge. Sewage disposal and foul drainage.	Thermal water discharge. Water requirements for power plant operation. Discharge of process and wastewater. Operation of drainage systems on site. Discharge of storm water, sewage and drainage.
Noise and Vibration	Noise from construction activities.	Noise from power plant operations on surrounding land uses.
Land Use, Landscape and Visual Issues	Land use on site. Land use in the surrounding area. Effects of construction activities on landscape character. Visual impact of construction activities.	Land use on site. Land use in the surrounding area. Effects on landscape character. Visual impact of the power plant and operation activities.
Soils, Geology and Hydrogeology	Effects on soils and geological features. Soil contamination. Effects on groundwater.	Soil contamination. Effect on groundwater.
Flora and Fauna	Loss of habitat or species due to landtake. Disturbance or damage to adjacent habitat of species.	Disturbance or damage to adjacent habitat. Effects of structures on bird migration routes.
Traffic	Traffic conditions/disruption to road users. Traffic-related air quality. Traffic-related noise.	Traffic conditions/disruption to road users. Traffic-related air quality impacts. Traffic-related noise impacts.
Major Accident Hazards	Risk to third-party hazardous industry.	Risk to third-party hazardous industry. Risk to power plant of third-party hazardous industry.
Natural Disaster Risk	Seismic risk. Flood risk.	Seismic risk. Flood risk.
Solid Waste Management	Contamination of soils and water. Hazards to workers health. Accident risks.	Contamination of soils and water. Hazards to workers health. Accident risks.
Occupational Health and Safety	Accidents. Effects on health of workforce. Safety at work.	Accidents. Effects on health of workforce. Safety at work.

Table 2
Environmental Impacts and Environmental Guidelines

Impact Area	Predicted Max. Concentration from Nuweiba Power Plant	Existing Ambient Air Quality (Effect of All Surrounding Industries)(2)	Cumulative Air Quality Impact of both the Nuweiba and Surrounding Industries	Egyptian Standard	World Bank Guideline
Stack emissions (70% load) (when firing Natural Gas)					
NO_x(1)	$\leq$ 40.6 mg m^{-3}			300 mg m^{-3} (1)	320 mg m^{-3}
SO_2	$\leq$ 0.4 mg m^{-3}			3,600 mg m^{-3}	2,000 mg m^{-3}
TSP – General (all sizes)	$\leq$ 2.7 mg m^{-3}			200 mg m^{-3}	50 mg m^{-3}
Stack emissions (70% load) when firing Light fuel oil (<2% of total annual operating time))					
NOx – oil firing	$\leq$ 69.7 mg m^{-3}			300 mg m^{-3}(1)	460 mg m^{-3}
SO_2 – oil firing	$\leq$ 667.3 mg m^{-3}			2,500 mg m^{-3}	2,000 mg m^{-3}
TSP – General (all sizes)	$\leq$ 4.6 mg m^{-3}			200 mg m^{-3}	50 mg m^{-3}
Ground Level Concentration (when firing National Gas)					
NOx – 1 hour	291.13 μgm^{-3}	34.2 μgm^{-3}	325.33 μgm^{-3}	400 μgm^{-3}	-
NOx – 24 hours	134.4 μgm^{-3}	13.68 μgm^{-3}	148.08 μgm^{-3}	150 μgm^{-3}	150 μgm^{-3}
NOx – 1 year	31.03 μgm^{-3}	2.74 μgm^{-3}	33.77 μgm^{-3}	-	100 μgm^{-3}
SO_2 – 1 hour	Trace	10.0 μgm^{-3}	12.42 μgm^{-3}	350 μgm^{-3}	-
SO_2 – 24 hours	Trace	4.0 μgm^{-3}	4.0 μgm^{-3}	150 μgm^{-3}	150 μgm^{-3}
SO_2 – 1 year	Trace	0.8 μgm^{-3}	0.8 μgm^{-3}	60 μgm^{-3}	80 μgm^{-3}
PM_{10} – 24 hours(3)	Trace	14.15 μgm^{-3}(3)	14.15 μgm^{-3}	150 μgm^{-3}	150 μgm^{-3}
PM_{10} – 1 year	Trace	2.83 μgm^{-3}	2.83 μgm^{-3}	70μgm^{-3}	50 μgm^{-3}
Liquid Effluent					
pH	6-9			6-9	6-9
BOD	<30 mg/l			< 60 mg/l	-
Chromium	-			1 mg/l	0.5 mg/l
Copper	<0.5 mg/l			1.5 mg/l	0.5 mg/l
Iron	<1 mg/l			1.5 mg/l	1.0 mg/l
Zinc	<1 mg/l			5 mg/l	1.0 mg/l
Oil and Grease	<5 mg/l			15 mg/l	10 mg/l
Total Suspended Solids (TSS)	<30 mg/l			60 mg/l	50 mg/l
Residual Chlorine (total)(4)	<0.2 mg/l			-	0.2 mg/l (4)
Temperature Increase (^oC)	$\leq$9^oC at the point of discharge and $\leq$3^oC within 100 m.			(max. absolute temp 10^oC at the point of discharge above ambient Mixing zone up to 3^oC.	$\leq$3^oC at edge of mixing zone (5)
Noise (6)					
Daytime (max.)	Max. <60 dB(A)			70 dB(A)	70 dB(A)
Night time (max.)	Max. <60 dB(A)			60 dB(A)	70 dB(A)

(1) Egyptian standards for NOx are expressed in terms of NO_2.
(2) Ambient air quality monitoring results measured by the NRC air quality monitoring equipment in Nuweiba area during August 2008.
(3) The PM_{10} concentrations resulting from the power plant itself only is traces.
(4) "Chlorine shocking" may be preferable in certain circumstances, which involves using high chlorine levels for a few seconds rather than a continuous low level release. The maximum value is 2 mgl^{-1} for up to 2 hours, which must not be more frequent than once in 24 hours (and the 24 hour average should be 0.2 mg/l).
(5) The effluent should result in a temperature increase of no more than 3^oC at the edge of the zone where initial mixing and dilution take place. Where this zone is not defined, use 100 m from the point of discharge when there are no sensitive aquatic ecosystems within this distance.
(6) There are no sensitive receptors for noise within 150m of the power plant. The area has been categorised as "Industrial area" with respect to Egyptian ambient noise standards and "Industrial commercial" with respect to World Bank guidelines.

Table 3

Monitoring Program for Ambient Air Quality, Noise and Vibration

Item	Monitoring Parameters	Sampling Frequency	Monitoring Locations	Indicative Cost Estimate (US$)
Construction Phase				
Air Quality Dust emissions caused by construction activities, construction vehicle movements, and transport of friable construction materials.	NO_2 , SO_2 , CO, TSP and PM_{10}.	Quarterly during most of the construction period. Continuous monitoring during 6 months ahead of commissioning.	On site of the project and its surroundings. 2 locations minimum: at maximum predicted pollution concentration and downwind. Third location, if any, will be 1 km upwind.	Measurement cost: US$70K Approx. US$ 1000-1500K
Noise	Decibels (dB) A	Quarterly	6 locations minimum: at nearest residences	Third party noise measurement costs (~US$ 23k)
Operation Phase				
Air Quality Emissions from stack are not expected to exceed standards. Ambient air quality affected by emissions from the power plant.	**Automatic monitoring** of stack emissions for NOx, SO_2, particulate matter and carbon monoxide (CO) via test ports installed in the main stack. In addition, conduct surrogate **performance monitoring**. **Install (at least) two continuous** NOx, SO_2, CO, PM_{10} & TSP **monitoring stations** to monitor short-term concentrations in the area predicted to have the highest impacts on humans (as there are sensitive environments). The analyzer station near or within the site boundaries will include a **continuous monitor** of meteorological conditions (temperature, wind speed, wind direction and mixing heights).	Continuous and/or 24 hour average Continuous and/or passive samples every 2/4 weeks The analyzer stations will be electronically connected to the plant controlling room and EDEPC Chairman's office.	2 locations minimum: at maximum predicted pollution concentration and downwind. Third location, if any, will be 1 km upwind.	Included in the plant operation
Noise		Bi-annually to annually	6-10 sites at nearest receptors and fence around the plant	Noise audit US$ 10-20K (included in operation cost) Third party (e.g. NRC) Measuring instruments and equipment.

Table 4

Monitoring of the Aquatic Environment During Operation

Issue	Parameter	Method	Frequency of measurements
Water Quality	Temperature & pH of all discharged water	Continuous automatic monitor in discharge structure	Continuous
	COD, TSS, Oil & Grease, residual chlorine of effluent	Sample taken from water in discharge structure and submitted for lab. Analysis	Daily
	Heavy metals & other pollutants of effluent	As above	Monthly
Ambient Water Quality	Temperature, pH, COD, BOD, TOC, DO, TSS, oil & grease, residual chlorine, heavy metals & other pollutants	Grab sampling and analysis within the area predicted to be affected by the discharge plume	3-monthly
Flora & Fauna (1)	Benthic flora & fauna	Transect sampling (following same method as in baseline monitoring) within a 2 km radius of the discharge point	Annual
Entrainment (2)	Fish entrainment on screens	Removal and analysis of any debris caught in intake screens	Weekly

Notes:
(1) To be undertaken for the first 3 years of plant operation.
(2) To be undertaken for the first year of plant operation.

Abbreviations:
COD: Chemical Oxygen Demand
BOD: Biological Oxygen Demand
TOC: Total Organic Carbon
DO: Dissolved Oxygen
TSS: Total Suspended Solids

Table 5

Key Issues Raised During ESIA Scoping and Public Consultation Meetings

Key issue discussed	Comments
Overall Project	All parties consulted expressed their overall approval for the project. Local Stakeholders commented that the power plant will be central to securing power supply for the tourist, industrial and commercial activities in the area as well as wider South Sinai Governorate and will benefit the local economy through labor opportunities.
Social and Economic Impact	Local stakeholders and council leaders considered the social and economic impact of the plant to be wholly positive. There was an emphasize on the necessity of hiring most of the plant workers from the Nuweiba Region & its surroundings because many of project's employment in the Nuweiba Region & entire South Sinai have been drawn from the outside of the area.
Land Acquisition/ Compensation	There was a clear and common appreciation when fair compensation rules were explained.
Waste water discharge and the aquatic environment	All local stakeholders expressed concern about the quality and quantity of water in the Aqaba Gulf Nuweiba segment and the quality of water which will be discharged from the power plant. It was, however, acknowledged that there are no significant aquatic ecosystems close to the power plant. The suggestion was made that treated sanitary wastewater could be used for irrigation of landscaped areas and treated industrial wastewater would be directed to the circulating water discharge structure.
Cooling Water	Representative of the National Institute for Oceanographic Studies & Fisheries raised the issue of coral reefs in the Aqaba Gulf and the thermal plume diffusion within the coral batches. There was a clarification that during marine studies undertaken for the ESIA, study, marine divers have surveyed the area in front of the power plant site and found no coral reefs there.
Air Quality	There was big concern over the following issues: • compliance with air quality standards and the effect that non-compliance and subsequent plant closure could have on security of employment in the area; and • back-up light fuel oil utilization during emergencies.
Ecology of the Site	There was significant attention to keeping a landscape area inside the power plant fence.
Shoreline & Seabed Morphology	Some parties expressed their fears of causing damaging effects due to sedimentation and erosion processes associated with cooling water abstraction and discharge.
Environmental Compliance	An underlying concern expressed by all local stakeholders was compliance with environmental regulations. Assurances from EDEPC are sought to the effect that EDEPC will guarantee implementation of the environmental compliance measures which will be stated in the Environmental and Social Management Plan.