NUWEIBA
750 MWe COMBINED CYCLE POWER PLANT PROJECT

Environmental Impact Assessment

Power Generation Engineering and Services Company (PGESCo)

March 2009
NUWEIBA POWER PLANT
750 MWe COMBINED CYCLE PROJECT

Environmental and Social Impact Assessment

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<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AADT</td>
<td>Annual Average Daily Traffic (based on full year counts)</td>
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<td>ADT</td>
<td>Average Daily Traffic (based on less than a year counts)</td>
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<td>AfDB</td>
<td>African Development Bank</td>
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<td>BOD</td>
<td>Biochemical Oxygen Demand</td>
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<td>BPPIP</td>
<td>Building Profile Input Program</td>
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<td>CAA</td>
<td>Competent Administrative Authority</td>
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<tr>
<td>CAPMAS</td>
<td>Central Agency for Public Mobilization and Statistics</td>
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<tr>
<td>CEDC</td>
<td>Canal Electricity Distribution Company</td>
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<tr>
<td>CTG</td>
<td>Combustion Turbine Generator</td>
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<td>COD</td>
<td>Chemical Oxygen Demand</td>
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<tr>
<td>CWDS</td>
<td>Circulating Water Discharge Structure</td>
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<td>DCS</td>
<td>Distributed Control System</td>
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<tr>
<td>DHV</td>
<td>Design Hourly Volume</td>
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<tr>
<td>DO</td>
<td>Dissolved Oxygen</td>
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<td>DS</td>
<td>Dissolved Solids</td>
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<tr>
<td>EAAQLs</td>
<td>Egyptian Ambient Air Quality Limits</td>
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<td>EAP</td>
<td>Environmental Action Plan</td>
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<td>EEA</td>
<td>Egyptian Electricity Authority</td>
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<td>Egyptian Environmental Affairs Agency</td>
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<td>EEHC</td>
<td>Egyptian Electricity Holding Company</td>
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<td>EETC</td>
<td>Egyptian Electricity Transmission Company</td>
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<td>EGAS</td>
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<td>EGPC</td>
<td>Egyptian General Petroleum Corporation</td>
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<td>EGSMA</td>
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EHS  Environmental Health and Safety
EIA  Environmental Impact Assessment
EIB  European Investment Bank
ENIT  Egyptian National Institute of Transport
ESIA  Environmental and Social Impact Assessment
ESMP  Environmental and Social Management Plant
EUPS  Egyptian Unified Power System
FHWA  Federal Highway Administration, (US)
GARBLT  General Authority for Roads, Bridges and Land Transport
GEP  Good Engineering Practice
GDP  Gross Domestic Product
GIS  Gas-Insulated Switchgear
HCM  Highway Capacity Manual
HGVs  Heavy Goods Vehicles
HRSG  Heat Recovery Steam Generator
ISC-Prime  Industrial Source Complex/Plume Rise Model Enhancements
LFO  Light Fuel Oil
LOS  Level of Service
MoEE  Ministry of Electricity & Energy
MSDSs  Material Safety Data Sheets
MWe  Mega-Watt electrical
NFRA  National Fire Protection Authority
NO₂  Nitrogen Dioxide
NOₓ  Nitrogen Oxides
NRIAG  National Research Institute of Astronomy and Geophysics
NPP  Nuweiba Power Plant
OSHA  Occupational Safety and Health Administration
PCBs  Polychlorinated Biphenyls
PCDP  Public Consultation and Disclosure Plan
pcph  passenger car per hour
PCPHPL  Passenger car per hour per lane
PHF  Peak Hour Factor
PM$_{10}$  (inhalable) Particulate Matter
RIGW  Research Institute for Ground Water
SO$_2$  Sulfur Dioxide
SS  Suspended Solids
STG  Steam Turbine Generator
TDS  Total Dissolved Solids
TIS  Traffic Impact Study
TOC  Total Organic Carbon
TSP  Total Suspended Particulates
TSS  Total Suspended Solids
TWA  Time-Weighted Average
V/C  Volume to Capacity Ratio
vph  vehicle per hour
EIB  World Bank
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NUWEIBA POWER PLANT
750 MWe COMBINED CYCLE PROJECT

Environmental and Social Impact Assessment

EXECUTIVE SUMMARY

1. INTRODUCTION

1.1 Background

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 technical documents and procedures required by the European Investment Bank (EIB) and the African Development Bank (AfDB) concerning the Environmental and Social Assessment of the Nuweiba Power Project.

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 A project under EIB & the AfDB rules and a Category C project under the Egyptian environmental regulations and therefore requires a full Environmental Impact Assessment. Financing from EIB & the AfDB is conditional upon obtaining the environmental clearance from all the Egyptian regulatory authorities, the EIB & the AfDB.

1.2 Project Overview

3. Egyptian Electricity Holding Company (EEHC) and its affiliate company: the East Delta Electricity Production Company (EDEPC) propose to construct and operate a combined cycle power plant at Nuweiba. The site is within an existing open area of uncultivated, uninhabited land in the South Sinai Governorate on the Gulf of Aqaba coast at Nuweiba, about 470 km southeast of Cairo, 170 km north of Sharm El-Sheikh and 70 km south of Taba. The overall proposed site area allocated for the plant is approximately 105,000 m2.

4. The proposed power plant will consist pf one electricity generating combined cycle module, with a rated capacity of 750 MWe composed of two combustion units and one steam unit, each with a nominal electricity generating capacity of 250 megawatts (MWe), which will be known as Nuweiba power plant. The overall generating capacity of the new power plant will be 750MWe. The power plant is intended to be fully operational by the year 2012/2013.
5. The power plant will utilize natural gas as its primary fuel, and also have the capability to operate using sollar (fuel oil # 2). The ability to "dual-fuel" the power plant (with natural gas or sollar) will provide security of electricity supply in the event that gas supplies are unavailable for any reason. In addition, 0.75 MW emergency generators, for the plant safe shut down, operating on sollar oil will also be provided on-site to drive key items of equipment within the power plant in the event of a power supply failure.

6. The power plant will incorporate a direct (once through) cooling system using water abstracted from the Gulf of Aqaba. The abstracted water will also be used following pre-treatment demineralization, to provide process water make-up in the HRSG systems. Potable water supplies will be drawn from the plant potable water system to support the plant and the colony potable water requirements.

7. The main demand for water is due to the direct cooling system. The use of a direct cooling system maximizes the electrical efficiency of the power plant and, after use, virtually all of the water will be returned to the Gulf of Aqaba at a slightly elevated temperature compared to the abstraction. No evaporative cooling towers are required; hence there is no opportunity for water drift or the formation of visible plumes of water vapor or ground fogging.

8. The proposed Nuweiba power plant site is located on the 25 Feddans (105,000 m²) within a wider open uncultivated uninhabited piece of land, which is located down-side to the east of the main arterial road of Sharm El Sheikh / Taba, approximately 65 km north of Dahab and about 270 km to the south from Mediterranean sea coastline. The site is surrounded by commercial, tourist and residential properties. Only two industrial facilities, wastewater / sewage treatment plant, which is located to the west and water desalination plant to the north east of the site boundary. Gulf of Aqaba is located to the east of the site area at an average 650 m distance from the site boundaries. The site of the proposed power plant is shown on Figure 1. Also, Figure 2 depicts this location within the context of the South Sinai Governorate. Figure 3 illustrates a general view of the proposed site land.
Figure 1 (A)

Location of the Proposed Nuweiba Power Plant
Figure 1 (B)

Location of the Proposed Nuweiba Power Plant
Figure 2

Location of the Proposed Site within the Context of the South Sinai Governorate
Figure 3 (A)

Landsat Image of the Hinterland of the Nuweiba Proposed Power Plant Site
Figure 3 (B)

Coordinates of the Proposed Site
Figure 3 (C)

Localized Map of the Proposed Site
2. THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

2.1 Contributors to the EIA Report

9. The Environmental and Social Impact Assessment (ESIA) report is prepared by PGESCo, a consulting firm (Egypt), based on many baseline studies undertaken by independent national and international consultants and on information provided by EEHC, EDEPC and their sub-contractors. Public consultation activities are undertaken by PGESCo and EEHC in conjunction with EDEPC. The ESIA report draws heavily on the environmental and social assessment documentation prepared by group of local and international multidisciplinary consultants and submitted to PGESCo, for preparing the ESIA report for local permitting purposes and financing requirements. All such documentations were reviewed by PGESCo and cleared for inclusion in this report. Most of the relevant local permits for the construction of the power plant have now been received (Further details of the relevant local permits are available in Section 2.3.1 of the main ESIA report).

2.2 Scope of the ESIA Report:
Legal and Administrative Framework

2.2.1 Government of Egypt Requirements

10. Beginning in the 1950s, the Government of Egypt has promulgated several laws and regulations concerning protection of the environment.

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

- Law No. 93 for 1962 regarding the drainage of liquid wastes, particularly sanitary drainage.

12. 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.
13. The EEHC / South Sinai Governorate will send the EIA to EEAA for review and provide its opinion within 60 days. Once EEAA has approved the project, a license to proceed can be issued. No additional environmental or social clearances are required other than the EIA approval to proceed with the project activities. The law requires that any new project should comply with all the relevant articles pertinent to environmental attributes, which could be impacted from project activities.

14. 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.

15. In addition to environmental impact assessment requirements, the Government of Egypt has established air pollution and water pollution limits applicable to the Power Plant project. These limits are discussed in Chapter 6, along with the actual air and water pollution levels expected from the Power Plant.

### 2.2.2 African Development Bank Guidelines

16. The African Development Bank follows a policy which stipulates that "at the identification phase, the screening exercise focuses on the environmental and social dimensions of a project to categorize it in one of four categories". "Category 1 projects are those that are likely to have the most severe environmental and social impacts and require a full ESIA", which includes thermal and hydro power plants. ANNEX 7 of the Environmental and Social Assessment Procedures (ESAP) for AfDB's Public Sector Operations, published in June 2001, states that "the projects assigned to Category 1 require a full Environmental and Social Impact Assessment (ESIA), including the preparation of an ESIA Report and Environmental and Social Management Plan (ESMP). These project may also be improved by carrying out complementary studies that are not specifically required under ESAP, such as detailed gender analyses or institutional analyses. The need for such complementary studies shall be determined on a project-by-project basis during the preparation phase".

17. 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:

- Environmental and Social Impact Assessment Procedures (ESAP) for AfDB’s Public Sector Operations (June 2001).
• Handbook on Stakeholder Participation (2201).
• Environmental Assessment Guideline on Renewable and Non-renewable Energy (March 1997).

2.2.3 European Investment Bank Guidelines

18. The European Investment Bank (EIB) supports EU environmental policy. Its approach is based on the environmental principles enshrined in the Treaty establishing the European Community and the standards and practices incorporated in European Union (EU) secondary legislation on the environment. Beyond the EU-27 and the Candidate and potential Candidate countries\(^{(1)}\), the environmental standards of the Bank are also subject to local conditions. EU environmental principles, practices and standards are described and explained in a large body of EU law and other official documents, notably the 6th Environmental Action Program (6EAP)\(^{(2)}\) and its Thematic Strategies\(^{(3)}\), as well as - for activities outside the EU - by the mandates of the Bank. The Board of Directors approved the latest Bank environmental policy in the “Environmental Statement 2004” (the Environmental Statement). The same principles, practices and standards are the foundation for the “European Principles for the Environment” (EPE)\(^{(4)}\).

19. The Environmental Impact Assessment (EIA) is the term used to describe a formalised process, including public consultation, in which all the relevant environmental consequences of a project are identified and assessed before authorisation is given. In the EU, if an EIA is required, the EIA is governed by EIA Directive 85/337/EEC, amended by Directives 97/11/EC and 2003/35/EC.

20. The Environmental Impact Study is the written report resulting from the EIA process. This is a document or documents containing the Environmental Information required under Article 5 of Directive 85/337/EEC as amended by Directives 97/11/EC and 2003/35/EC.

21. Also, The EIB applies a number of core environmental and social safeguard measures that reflect international good practice to all its lending activities. It requires that all its projects:

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\(^{(1)}\) Definitions as at June 2007: Candidate: Croatia, Turkey, Former Yugoslav Republic of Macedonia (FYROM); potential Candidate: other Western Balkan countries.


\(^{(3)}\) There are 7 approved Thematic Strategies, for air, waste, marine, soil, pesticides, resource use and the urban environment. Link [http://ec.europa.eu/environment/newprg/index.htm](http://ec.europa.eu/environment/newprg/index.htm).

\(^{(4)}\) Link to the “European Principles for the Environment”, [www.eib.org/epe](http://www.eib.org/epe).
• Apply the European Principles for the Environment, i.e. comply with EU environmental principles, standards and practices, subject to local conditions in some regions\(^{(5)}\).

• Comply with the EU environmental Acquits on environmental assessment.

• Apply "best available techniques", as appropriate.

• Apply good environmental management practices during project implementation and operation.

• Adhere to other specific international good environmental and social practices.

22. The EIB requires that all projects (irrespective of location) likely to have a significant effect on the environment be subject to an EIA, according to the definitions and requirements of Directive 85/337/EEC, amended by Directive 97/11/EC and 2003/35/EC. Annex I of the Directive lists the types of project for which an EIA is mandatory and Annex II the types of project for which the need to carry out an EIA is decided by the Competent Authorities. The EIA, which includes public consultation, is the responsibility of the Promoter and the Competent Authorities. It should be completed and its findings and recommendations should satisfy the requirements of the Bank prior to disbursement.

23. In all other regions, all projects should comply with national law; and benchmarked against the principles, standards and practices of EU environmental law\(^{14}\).

24. All projects should also comply with the obligations of relevant multilateral environmental agreements to which the host country - and the EU in the case of a Member State - is a party.

25. The Promoter is responsible for legal compliance whereas regulatory and enforcement tasks lie with the Competent Authorities.

26. The project Promoter is required to respect the requirements of the EU EIA Directive 85/337/EEC, amended by Directives 97/11/EC and 2003/35/E.

27. According to the sector, projects should comply with the relevant EU legal standards, for instance those of the Large Combustion Plant Directive\(^{(6)}\) in the power generation sector and the Integrated Prevention Pollution and Control Directive\(^{(7)}\) in the industry sector.

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\(^{(1)}\) The regional coverage of the European Principles for the Environment concerns at least the respective regions of operations of each signatory institution. For projects located in the Member States of the EU, the European Economic Area countries, the EU Candidate and potential Candidate countries, the EU approach, which is defined in the EC Treaty and the relevant secondary legislation, is the logical, uncontested and mandatory reference. The projects in this region should also comply with any obligation and standards upheld in relevant Multilateral Environmental Agreements, such as Convention on Biological Diversity, the Espoo Convention, United Nations Framework Convention on Climate Change, etc. In all other countries, projects financed by the signatories should comply with the appropriate EU environmental principles, practices and standards, subject to local conditions, such as affordability, local environmental conditions, international good practice etc.


28. All projects listed in Annex I of the EIA Directive 85/337/EEC, amended by Directives 97/11/EC and 2003/35/EC are Categorized (A) and require Full EIA.

29. **Category A Project is defined as** "a Project Completion Report will be required from the Promoter to the Bank. Monitoring for these projects is in general delegated to promoters and the Bank will rely on the Promoter's information for its own reporting on environmental matters".

30. **Annex I of the EU EIA Directive 85/337/EEC amended by 97/11/EC** stipulates that thermal power stations and other combustion installations with a heat output of 300 megawatts or more are of Category (A), which need Full EIA.

31. The EIB Bank aims in its Environmental Assessment of projects outside the EU to promote public consultation and participation, according to EU standards, through appropriate discussions with the Promoter and other parties. **Consultation** is defined as a tool for managing culturally appropriate two-way communications between project sponsors and the public. Its goal is to improve decisionmaking and build understanding, by actively involving individuals, groups, and organizations with a stake in the project. This involvement increases a project's long-term viability and enhances its benefits to locally affected people and other stakeholders.

32. EIB policy towards EIA is summarised in its Environmental Statement 2004. The Bank applies the principles and practices of the EU EIA Directive (85/337, amended by 97/11 and by 2003/35/EC to incorporate the provisions of the Aarhus Convention, and since its introduction in July 2004, the SEA Directive (2001/42) - to all its regions of operation. The EIA Directive includes screening criteria, for purposes of determining the need for an EIA.

33. According to the EU EIA Directive, it is the responsibility of the host country and its Competent Authorities to ensure that the "public concerned" are informed and consulted on the proposed project (Articles 6 and 9). Bank staff as part of their environmental assessment check that these requirements have been fulfilled. Their findings are contained in the PJ Appraisal Report (Environmental Assessment D1) submitted to the CD.

### 2.2.4 International / World Bank Guidelines

34. The World Bank includes environmental impact assessment as an integral part of the evaluations it performs before financing a proposed project. The World Bank’s Operational Policy 4.01 (October 3, 1991 and its updates, 1999) provides guidance on the types of assessments that should be performed for different types of projects, and on the scope and content of
those assessments. According to Operational Directive 4.01, thermal power plant projects require a full Environmental Assessment (EA).

35. Annex B to Operational Directive 4.01 provides an outline of the information that should be included in a full EA. This Environmental and Social Impact Assessment follows the scope of Annex B.

36. In addition to environmental impact assessment guidelines, the World Bank has established guidelines concerning air pollution and water pollution form thermal power plants (Pollution Prevention and Abatement Handbook-Part III (July 1998)). The guidelines were officially published in 1988; since then, several sets of revisions have been proposed, most recently on March 22, 1996. The 1988 and proposed 1996 guidelines are discussed in Chapter 6, along with the actual air and water pollution levels expected from the Power Plant. Also, the most recent update of the World Bank Guidelines, issued in 2007 has been considered.


38. Public Consultation Process has been designed in accordance with World Bank Guidance for the Preparation of a Public Consultation and Disclosure Plan (January 1996);

39. The ESIA has assessed the impacts of the construction and operation of the New 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. Permits will be required from the relevant Competent Administrative Authorities.

40. The ESIA report presents the full assessment of the environmental, social, health and safety impacts of the Nuweiba power plant. 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.
3. GENERAL SETTING OF THE SITE:
DESCRIPTION OF THE ENVIRONMENT

41. The proposed Nuweiba power project site is located on an area of a rectangular-shaped piece of land of 25 Feddans (105,000 m²) 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.

42. The proposed site is located at latitude 29° 01' 39" N and longitude 34° 39' 33" E, sandwitched between the Sinai Mountains and the Gulf of Aqaba. On the north side (length 410 m) (true north) of the site is a residential spot and to the northeast is a water desalination treatment plant followed, to further north, by residential, commercial and administrative buildings. These buildings are bordered, to the north, by a paved road branching from the main western arterial road and running to the southeast along the coast line. Behind the road, to further north, is the Nuweiba city. On the south side (length 410 m) (true south) of the site is an empty land owned by the Government, followed directly by the northern branch of the flood plain, which flashes from the mountains, to the west, and runs in two divergent branches to the Aqaba Gulf. On the east side (length 256 m) (true east) of the site is an empty bare land owned by the Government, followed to the east by a compacted graveled road, branching from the main arterial road and running to the south-east until it ends at a cultivable rectangle-shaped piece of land, about 3 km to the south. This road is followed, to further east, by a strip of land on the coastal line of the Gulf of Aqaba. On the west side (length 256 m) (true west) of the site is an empty bare sandy land extending to the mountains area, just to the immediate vicinity of the main arterial road. Actually, the road runs on the mountains, but slopes down, at that location, to the site land and Nuweiba city. A main substation of 220/132/66 kV is located to the northwest of the site, adjacent to the main road.

43. Also, sewage treatment plant is located to the southwest of the power project site. The mountains series to the west of the project site are at a distance of about 1.25 km from the western border of the proposed site.

44. Nuweiba el-Mazena and Nuweiba el-Tarabin are both adjacent to Nuweiba city, partly Bedouin and within municipal boundaries. The nearest towns of importance are Dahab, about 65 km along Sharm El-Sheikh / Taba road in the south direction and Taba, about 70 km in the northern direction, in addition to areas of Abu Gallum, about 32 km in the south direction. Towns of importance in the wider vicinity of the power plant site are Sharm El-Sheikh, Saint Katherine, Nabq, Ras Mohamed and El-Tur. The general site location is shown in Figures 1, 2 & 3.
45. The site consists of approximately flat land, which is owned by East Delta Electricity Production Company (EDEPC), approximately 105,000 m². Localized map of the proposed site is shown in Figure 3(C). Localized map of the Nuweiba Area is shown also in Figure 3(B). Landsat image of the hinterland of the Nuweiba proposed power plant site is given in Figure 3(A).

46. The site is situated about 175 km north east of Sharm El-Sheikh city and north of Nuweiba port on the coast. The proposed site area is delimited by the following four point corners:

47. The land is identified by boundary lines determined by the coordinates of the proposed site, given in Figure 5-4, which indicates the following corner points:

<table>
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<th>Point</th>
<th>E</th>
<th>N</th>
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<tr>
<td>1.</td>
<td>34:39:54.44</td>
<td>29:01:17.95</td>
</tr>
<tr>
<td>2.</td>
<td>34:39:52.18</td>
<td>29:01:26.66</td>
</tr>
<tr>
<td>3.</td>
<td>34:40:06.96</td>
<td>29:01:29.61</td>
</tr>
<tr>
<td>4.</td>
<td>34:40:09.21</td>
<td>29:01:20.90</td>
</tr>
</tbody>
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48. The elevation of the site is about 1-4 m above sea level. The Gulf of Aqaba water is located about 650 m from the power project area.

49. Topographically, the area has a very gentle slope toward the Gulf of Aqaba (eastern side). The elevation ranges between 1 and 4 m above the sea level.

50. Nuweiba bay is a curvature inlet of the Gulf of Aqaba, laying between tourist es-Sayyadin village in the northeast and the dwellings of Arab Al-Mazina in the south.

51. Maximum air temperature reaches its highest levels (32-36 °C) between June and September each year, while the minimum temperature reaches its lowest values (15-17°C) in January and February.

52. 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.

53. 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.

54. 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.

55. 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.

56. The Nuweiba Power Plant proposed site is located along the coastal strip of the western coast of Gulf of Aqaba. It is bounded by the Nuweiba port from the north and by a small-size resort to the south. Parallel to the sea shoreline from the western side of the power plant, the mountain strip of East Sinai.

57. From the faunal diversity stand point, the site is relatively poor in the number of species present. However, it is preliminary characterized by a low density of certain insect species and bird species.

58. South Sinai covering an area of 28,438km2 is located in the peninsula of land between the Gulf of Aqaba on the west and the Gulf of Aqaba on the east.

59. The area is characterised 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.

60. The land area can be divided into four broad geographical regions: Gulf of Aqaba with little tourism, four significant towns, most of South Sinai agriculture, mineral and petroleum production industry and more commercial, workshops and small manufacturing than elsewhere; Gulf of Aqaba which is the prime tourism locale with 90% of all capacity, and practically no agriculture; the Central Mountains which are very dry and have no towns except St Katherine, the population is almost exclusively Bedouin and there is a small amount of agriculture at Wadi Feiran, there are few tourism activities, the exceptions being the cultural attractions of St Katherine and desert camping and safaris; and the Northern desert which has almost no settlements, agriculture, tourism or other attractions, and is entirely flat desert unrelieved by prominent features.

61. The 610 kilometres 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.

62. The area is defined by the demands of tourists, Bedouin, National Protectorates and the desire of central Government to increase the population of the area by migration from other areas of Egypt.
63. Tourism provides the economic platform for the area and it is essential that development of this sector is sustainable and maintains the image of the area as a top draw destination. Bedouin tribes form a declining share of the population of the area; any plans for the future of the Governorate must include the needs of this indigenous population and steps must be taken to ensure their cultural heritage is respected.

64. South Sinai Governorate is dominated by the Tih-Igman plateau, a mainly Cretaceous-Eocene sequence of limestone and dolomites, with local outcrops of Carboniferous-Jurassic formations. This gently sloping upland occupies 40% of the entire Sinai peninsula.

65. The southern mountain province is a massive complex of Afro-Arabian basement rocks, including granites, gneisses, and schist's, and represents the structural core of the peninsula. Over 80% of the Sinai massif is composed of 600 million year old granite, of a characteristic red colour. Overlaying this in many areas is a dark volcanic rock. Volcanic activity around 10 million years ago also created many of the peaks in the region. Approximately 25% of the region is over 1000 m in altitude, containing the highest mountains in Egypt, notably Mount St. Katherine (2,639 metres).

66. On the western coast, the Suez Rift Province extends inland to the southern mountains and Tih-Igman plateau. Terrain in this region is highly variable, extending from high relief inland to gentle slopes and low relief along the coast.

67. The Red Sea has been separating Africa from Arabia for approximately 70 million years. Current rates of rifting average 2 cm per year and accounts for mild earthquakes occasionally experienced in the region. The Gulf of Aqaba, a continuation of the Red Sea rift separating the Sinai from Arabia, is approximately 150 km long and averages 16 km in width. The main trough varies from 1,100 m deep in the north to 1,420 m in the south, reaching a maximum depth of 1,829 m. The Gulf joins the Red Sea at the Straits of Tiran, just 6 km wide and 300 m deep, restricting water exchange between the two bodies of water. The Gulf of Aqaba is 280 km long and 20 to 40 km wide, with a flat, sediment bottom between 55 and 73 m deep, deepening from north to south. It appears to be spreading and exhibits normal faulting. It has no sill connection with the Red Sea, but opens into deeper waters at the Strait of Jubal, north of Ras Mohamed.

68. Metallic and non-metallic deposits are found in the middle western portion of South Sinai. These deposits are scattered in evaporates and chemical organic sediments. In and around the city of Sharm el Sheikh there are Karst deposits, rich in manganese pellets. Other known deposits include: carbonaceous shale, copper, fluorite, pyrite, and soda feldspar (Albite). Small quantities of gold and uranium are known, and turquoise was mined in the area around Sarabeit el Khadem during the Pharaonic period.

69. Numerous deposits of building materials and ornamental stones are found in the western part of South Sinai. Very scattered deposits are found on the eastern side. Such deposits include alabaster, Egyptian alabaster, basalt, bentonite, clay, diorite, dolomite, granite, gypsum, kaolin, limestone, and white
sand (glass sand). Significant reserves of granite and marbles form the basis of the local ornamental stone industry.

70. The Sinai lies in the arid North African belt, with general conditions including high summer temperatures, mild winters, low humidity, and long rainless periods. There are two climatic regions in South Sinai Governorate, the Gulf of Aqaba is an extension of Mediterranean coastal conditions; arid, with annual rainfall between 20 and 100mm. The inland highlands and Gulf of Aqaba are classified as hyper arid with a cool winter (mean temperature of coldest month 0-100°C) and hot summer.

71. 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 280°C. The Gulf of Aqaba joins the Red Sea at the Straits of Tiran, which restrict exchange between the two bodies of water. With high average temperatures, low humidity and no inflows of fresh water, the Gulf tends towards high levels of salinity of 42 ppt on average, reaching 44 ppt in the north, with water temperatures ranging between 20 and 260°C.

72. In the Gulf of Aqaba wind-driven water circulation is driven by the prevailing north-easterly winds, with south-bound currents along both the Sinai and Saudi coastlines and a northerly current running up the centre of the Gulf. Consequent eddies may produce northward currents along the Sinai coast south of Nuweiba and south of Taba.

73. The Gulf of Aqaba is more subject to wave action than might be expected from its enclosure. Unprotected north-east shorelines and reefs can be exposed to moderately severe waves (up to 2m or more) for relatively long periods. The most severe wave action is generated by strong storms which blow occasionally from the south, affecting stretches of coast normally protected from the prevailing wind.

74. In the Gulf of Aqaba, there is no significant phase difference between tides in the southern and northern extremes. The tidal current is strongest, up to 1.5 m s⁻¹ at spring tides, at the Straits of Tiran, whilst it almost disappears (below 5cm s⁻¹) a few kilometres to the north. Tidal currents flow north with rising tides, and flow south with falling tides. The enclosed nature of the Gulf of Aqaba results in a reduced, lake-type circulation, primarily driven by evaporation with replacement waters entering via the Straits of Tiran.

75. 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.

76. There are also a number of local sources serving Bedouin communities. These include wells in Wadi Sheira and Sheikh Attia near Nuweiba, Gharandal (Ras Sudr Markaz), Garf and Babaa, Saal, El Barima (St.
Katherine Markaz) and El Roweka (Abu Zeneima Markaz). There are also occasional springs, including the Wadi Kid spring, which traditionally served villages near Sharm El-Sheikh. Most of these sources are slightly brackish and have a low yield, typically 20 m$^3$/day or less.

77. The increased water demand from tourism and an expanding population has created the need for new water sources. This need has been met by desalination and by pumping water from the Nile. In theory, the amount of water that can be produced by desalination is limited only by the need to find suitable sites for desalination plants close to the sea, where saline groundwater can be tapped and brine can be returned downstream of the point at which water is extracted.

78. 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.

79. The different physical oceanographic qualities of the Gulfs of Suez and Aqaba result in clear differences in the structure and ecology of the coral reefs found in each Gulf.

80. 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.

81. 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.

82. Landings in the Gulf of Aqaba are nominal, due to fishing controls and the prohibition of fishing within 500m of the reef in Ras Mohamed, Sharm el Sheikh and the Gulf of Aqaba. Traditional subsistence fishing by Bedouin is permitted.

83. 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.

84. 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.

85. Although South Sinai Governorate has relatively low faunal biodiversity the region supports several nationally or internationally endangered species. 42 reptile species (43% of Egyptian reptile fauna) are known from the area, 54 common resident breeding bird species (10% of Egyptian avifauna), and 39 mammal species in South Sinai (25% of Egyptian mammal fauna), with no amphibian species yet recorded. Insects have not been well studied in the region, with the exception of the Lepidoptera. 44 species of butterfly are known from the peninsula, 34 being confirmed residents.

86. Three broad but clearly distinguishable regions of South Sinai can be identified; Central Sinai, the Southern Mountain region, and the coastal plains of the Gulfs of Suez and Aqaba. Specific community types vary a great deal according to a range of environmental factors including height above sea level, differences in degree of slope, exposure and texture of surface material etc.

87. In the Gulf of Aqaba, the eastern foothills of southern Sinai descend sharply towards the shore, with the shoreline littoral and coastal plain generally very much reduced. In the southern part around Ras Mohammed, raised coral reefs and low limestone plateau are common features. This warm strip, protected against cold northerlies by the Sinai massif, forms a tropical corridor with several plant species of Sudanian elements, and patches of Avicennia marina mangrove present in Ras Mohammed and Nabq. Also present in the Nabq protectorate are three distinct dune communities, one of which is dominated by Arak (Salvadora persica), the most significant stand of this community in the Middle East.

88. 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.

89. 30 species of birds are known to commonly breed in the coastal plains. Characteristic species include Ardeola striata, Egeretta 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.

90. The importance of the marine and terrestrial ecosystems of the area has been recognised by the establishment of National Parks and Protectorates.

91. The five South Sinai Protectorates – Ras Mohamed National Park, Nabq Managed Resource Protected Area, Abu Galum Managed Resource...
Protected Area, Taba Protectorate and St. Katherine’s Protectorate - cover a total area of 9,836 km². This represents some 33% of the governorates surface area, and includes 52% of the terrestrial side and entire littoral and sublittoral extent of the Egyptian coastline of the Gulf of Aqaba. These areas, managed by the Nature Conservation Sector of the Egyptian Environmental Affairs Agency (NCS/EEAA), contain highly significant natural resources and provide major services to nature conservation and tourism in South Sinai.

92. Abu Galum Managed Resource Protected Area covers 458 km² 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.

93. The Taba Protected Area covers 2800 km² and contains many tourist attractions accessible to desert safaris, such as the Coloured 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.

94. There are a number of national agencies with particularly important development roles in South Sinai:
- South Sinai Development Authority (SDA)
- Tourist Development Authority (TDA)
- EEAA and the Nature Conservation Sector
- General Organisation for Physical Planning (GOPP)

95. Sinai is seen as “a model of national pioneer development” in the “building of new societies... in a bid to solve key problems atop of which are overpopulation in the Nile Valley and unemployment”. Plans for developing South Sinai and other desert regions is a fundamental policy of the Egyptian Government to extend settlement out of the crowded Nile valley. A national development map (1997) called for the settlement and habitation of 20% of Egypt’s surface area by 2017, up from the current 4%.

96. Reinforcing this general desert development policy is the Egyptian Government’s strategic concern to defend the Sinai Peninsula. Having already been occupied twice, it is seen as a national imperative to develop and populate the Peninsula so that Egyptian sovereignty can never again be challenged.

97. The proposed site lies within the administrative boundary of the South Sinai Governorate. In 1992, the Ministry of Housing, Utilities and Urban Communities (MHUUC); General Organization for Physical Planning (GOPP) produced the “National Plan for Sinai Development (NPSD) 1992-2017”, which laid down an ambitious plan for developing land-use management and populating the Sinai Peninsula.
98. The 1992-2017 NPSD sets out the Investment Map of South Sinai Governorate to control development in the South Sinai region, and the proposed land uses set out in the NPSD for Nuweiba area are shown in Figure 4. The proposed land uses around the proposed site, developed in 2007 by the GOPP, regional office in Ismailia, within the Master and Structure Plans for most of the towns of South Sinai, are also shown in Figure 4.
Figure 4

*Proposed Land-use Planning for the Nuweiba City, including the Proposed Power Project as per 2007*
4. PROJECT DESCRIPTION

4.1 Overview of the Power Plant

99. The power plant site will occupy an area of approximately 105,000m², rectangle-shaped piece of land and will include the following main elements:

- Two indoor combustion turbine generator (CTG) units.
- Two outdoor heat recovery steam generators (HRSGs) without supplementary firing.
- One indoor condensing steam turbine generator (STG) unit.
- The project is rated for 750 MWe (nominal) net power generation at ISO conditions of 15 °C ambient air temperature, and 60 percent relative humidity.
- Each CTG will feed exhaust gases to its respective HRSG. The steam produced from the two HRSGs will feed the STG.
- The primary fuel for the combustion turbines will be natural gas supplied by Owner at 26.0 barg guaranteed at the interface. The secondary fuel for the combustion turbines will be sollar oil (Fuel oil No. 2).
- Power will be generated at the manufacturer’s standard voltage and stepped up through main transformers to be connected to a 220 kV gas insulated switchgear (GIS).
- The power plant is designed to operate as a base load unit with the STG operating in sliding pressure mode.
- Cooling water supply will be provided by an extraction from, and discharge to, the Gulf of Aqaba.

100. The power plant will include the following main components:

- Gas Turbine 1A.
- Gas Turbine 1B.
- HRSG Unit 2 A.
- HRSG Unit 2 B.
- Steam Turbine Unit 1 A.
- Elec. Bldg. Unit 1 A.
- Elec. Control Bldg. Unit 1 B.
- Main Transformers Unit 1 A.
- Main Transformers Unit 1 B.
- Aux. Transformers Unit 1 A.
- Aux. Transformers Unit 1 B.
- Switchyard Area.
- Diesel Generator.
- Switchgear Control Room.
- Stacks Module 1.
• Fuel Gas Receiving/Reducing Station.
• Sollar Oil Unloading Pumps.
• Sollar Oil Storage Tanks.
• Water Treatment Area.
• Circulating Water fire Water Pump House.
• Circulating Water Electrical Equipment Bldg.
• Chlorine Tank/Pump.
• Condensate Water Tank.
• Condensate Water Discharge Structure.
• Condensate Water Seal Well.
• Demineralized Water Storage Tank.
• Waste Water Treatment Plant.
• Administration Building.
• Warehouse/Work Shops.
• Security office.
• Fire Station.
• Hydrogen Generation Building.
• Bottled Gas Storage/Gen. Area.
• Foam Equipment.
• Black Start Facility.

101. The layout and main components for the power plant is presented in Figure 5.

4.2 Process Description

102. 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.
The final exhaust gases will be discharged to the atmosphere in accordance with emission standards set by the EEAA. The main by-products from combustion of natural gas are carbon dioxide (CO₂), water vapour (H₂O), carbon monoxide (CO) and nitrogen oxides (NOₓ). Sulfur dioxide (SO₂) and particulates, which are typically associated with coal and oil combustion, will not be produced other than in trace quantities during natural gas firing. When solar oil is used instead of natural gas, SO₂ and particulates will also be key emissions from the power plant.
Figure 5

Proposed Layout for the Nuweiba Combined Cycle Power Plant-
Site General Arrangement
4.3 Operational Releases from the Power Plant

103. During operation, the key releases into the environment from the power plant will comprise the following:

- Exhaust gases, will be emitted into the atmosphere, normally from the Boilers’ stack as a result of fuel combustion. Emissions from the combustion of natural gas are carbon dioxide (CO₂), water vapor, carbon monoxide (CO) and nitrogen oxides (NOₓ). Sulfur dioxide (SO₂) and particulates, which are typically associated with coal and oil combustion, will only be produced in trace quantities during natural gas firing. In emergencies when light fuel oil (sollar) is used instead of gas, SO₂ and particulates will however be key emissions from the power plant.

- Heated cooling water will be discharged into the Gulf of Aqaba via the cooling water discharge structure at a temperature of no more than 9 °C at the point of discharge. Process waste water will be treated and discharged into the discharge system, which includes two pathways: one to the circulating water discharge system (CWDS) and the other to the plantation irrigation network. Any oil and residual solids will be removed before discharge and the pH of discharged water maintained at between 6 and 9.

- Chlorine will be added to the cooling water system to control bacterial and algal growth on various surfaces and in the cooling water intake. The cooling water discharge will contain residual quantities of chlorine at concentrations below the World Bank standard for free chlorine of 0.2 mg/l.

- Small volumes of solid wastes will be segregated, collected and disposed of by licensed waste disposal contractors.

104. The power plant incorporates a rang of measures to eliminate or reduce operational releases within its design and layout, such as low NOₓ combustors in the gas turbines, oil interceptors fitted to the site drainage system and effluent treatment facilities to treat wastewater prior to discharge. As a result, the power plant is designed to meet high environmental standards and comply with the emission limits of the Arab Republic of Egypt and the international / World Bank.

5. ANALYSIS OF ALTERNATIVES

5.1 Current Situation ("No Action" Option)

105. 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;
• inhibit provision of public health and social services.

106. As a result, the "no action" option is not a viable or acceptable alternative to the proposed project.

5.2 Alternative Technologies and Fuels

107. The EEHC has an objective to provide a secure, reliable electricity generation and distribution system for Egypt. A key element in meeting this objective is the establishment of a diversity of technologies to avoid over-reliance on any particular fuel or technology, which may adversely affect the ability to provide electricity or meet the fluctuations in demand which occur day-to-day or seasonally.

108. The EEHC generation expansion plan includes provision of the following:

• gas/oil-fired steam units;
• gas/oil-fired combined cycle units;
• gas/oil-fired simple cycle combustion turbine units;
• wind farms;
• hybrid solar-thermal generation; and
• nuclear power.

109. Consistent with the plan, the EEHC has specified that the Nuweiba power project should be gas/oil-fired combined cycle units of 750 MW nominal generating capacity. The reasons for the selection of this technology are as follows:

• Existing and planned generating capacity using gas/oil-fired steam units is already considered sufficient by the EEHC and further reliance on this particular technology is not preferred for reasons of security of supply, response to demand and economics.

• An existing labor force is available which is competent in the construction, operation and maintenance of combined cycle units, whilst experience in other technologies are more limited. Hence, the selection of combined cycle units allows greater local employment benefits to be obtained and should be economically advantageous.

• Combined cycle technology is more efficient than other traditional modes of generation capacities in terms of fuel consumption and flexibility of operation.

110. Hence, the technology chosen by the EEHC for the project is a combined cycle system.

5.3 Power Plant Design
111. 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:

- 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.

5.4 Alternative Sites

112. EEHC generating plan for 2007 to 2012 includes a Combined Cycle power Plant to be located at the Sinai Peninsula. First identification of the site was to select an area about 40km south of El-Tur city to the north of Sharm El Sheikh. This site was found acceptable, except that the supply of the natural gas would require significant additional capital investment to extend the Taba/Sharm El-Sheikh gas line by approximately 60km to reach the proposed site.

113. The gas company suggested to EEHC to locate the proposed power plant closer to the under construction Gas line (Taba/Sharm El Sheikh).

114. EEHC contacted the Sinai local authorities to solicit support in identifying potential available sites for the new power project. The following group of three site areas were suggested:

- **Sharm El Sheikh Area:**
  a. Site 1- Area to the west of the existing Sharm El-Sheikh airport.
  b. Site 2- Area to the north-west of the existing Sharm El-Sheikh airport.
  c. Site 3- Area within Naqab wild life refuge (Site #3).
• Dahab Area:
  a. Site 4- Area at the west of Dahab lagoon close to the existing resorts.
  b. Site 5- Area at the south-west of Dahab lagoon nearby existing resorts.
  c. Site 6- Area at the south of Dahab lagoon (Site # 6).

• Nuweiba Area:
  a. Area to the north of Nuweiba city (Site # 7).
  b. Area to the south of Nuweiba city (Site # 8).

**Site Evaluation Criteria**

115. The key criteria used in evaluating alternative sites by the EEHC and their Consultant PGESCo were as follows:

1. Topographic nature of land.
2. Site required area:
   a. Power block and associated facilities (170'000 m² for 2x750 MWe combined cycle plant).
   b. Construction lay down area (20'000 m²).
   c. Power Plant Housing Colony (20'000 m²).
3. Proximity to main roads, gas supply line, and source of cooling and raw water.
5. Potential environmental impacts.
6. Site development.

Other economic factors were considered:
7. Capital costs.
8. Operation and maintenance costs.

116. The key findings of the consideration of alternative sites are summarized in Table 1. 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.

**Table 1**

<table>
<thead>
<tr>
<th>Proposed Area</th>
<th>Site</th>
<th>Key Findings</th>
</tr>
</thead>
</table>

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Power Generation Engineering and Services Company (PGESCo)
<table>
<thead>
<tr>
<th>Site</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sharm El-Sheikh Area</strong></td>
<td></td>
</tr>
<tr>
<td>Site 1</td>
<td>Suggested area is located to the west of the existing airport and already dedicated to the airport extension. Accordingly, this eliminates Site 1 as a potential site.</td>
</tr>
<tr>
<td>Site 2</td>
<td>Suggested area is located to the north-west of the existing airport and already dedicated to tourism development authority. Section of the site is already sold to investors. Accordingly, this eliminates Site 2 as a potential site.</td>
</tr>
<tr>
<td>Site 3</td>
<td>Suggested area is located at the most north of Sharm El-Sheikh City. This area is designated as a wild life refuge. Accordingly, this eliminates Site 3 as a potential site.</td>
</tr>
<tr>
<td><strong>Dahab Area</strong></td>
<td></td>
</tr>
</tbody>
</table>
| Site 4 | 1. The suggested area is located at the west beach of Dahab lagoon area, very close to the tourism resorts.  
2. The area is located on a plateau which has a level difference of average 25-30 meters to the sea level.  
3. There are a resort area between the suggested area and the sea water which might impact the circulating water piping rout.  
4. The existing gas supply line is approximately 30 km from the site. This will necessitate capital investment to extend the line.  
5. Power evacuation will require construction of power lines of at least 25 Km of 220 kV power lines.  
Based on the site evaluation criteria, the suggested area was found not suitable. |
| Site 5 | The suggested area is located within Dahab city and just 5 km to the north of Site 4. This site has same restriction applied to Site # 4. Accordingly, the suggested area was found not suitable. |
| Site 6 | 1. The suggested site is located 3 Km to the south of site # 5.  
2. The suggested area is basically flat  
3. The existing gas supply line is approximately 40 km from the site. This will necessitate capital investment to extend the line.  
4. Power evacuation will require construction of power lines of approximately 25 Km of 220 kV transmission lines.  
5. The access to area needs additional roads to facilitate the transportation of equipments and goods to the site  
6. Area looks like natural extension for the tourist resorts in Dahab area.  
Based on the evaluation criteria, the suggested area was found not suitable. |
Table 1 (Contd.)

Key Findings of the Consideration of Alternative Sites

<table>
<thead>
<tr>
<th>Proposed Area</th>
<th>Site</th>
<th>Key Findings</th>
</tr>
</thead>
</table>
| Nuweiba Area  | Site 7 | 1. Suggested area is flat and level at approximately 10 meters above sea level.  
2. Suggested area is located to the north of Nuweiba port, just next to the existing 220/66 kV substation.  
3. The suggested area is adequate to accommodate the facilities required, namely 2x750MW CC plant as follows: ✓ Power facilities (170’000 m²)  
✓ Construction lay down area (20’000 m²)  
✓ Colony (20’000 m²)  
4. The suggested site is close to the shore line (1000-1500 meters)  
5. The suggested site is very close to the gas line (500-1000 meters)  
6. The existing 220/66 kV substation and associated high voltage lines could be used for power evacuation.  
7. The suggested site is very close to Nuweiba port and good asphalt roads. |
|               |        | Based on the evaluation criteria, the suggested area was found suitable. |
| Nuweiba Area  | Site 8 | 1. The suggested site is located to the most south point of Nuweiba area, where the mountain becomes very close to the shore line.  
2. The suggested area is adequate for sitting the power plant |
|               |        | Based on the evaluation criteria, the suggested area was found not suitable |

6. KEY FINDINGS OF THE ENVIRONMENTAL IMPACT ASSESSMENT

6.1 Introduction

117. 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.

118. The following items are examined in the corresponding sub-sections of the ESIA Study Report:  
− Air Quality;  
− Aquatic Environment;  
− Noise and Vibration;
- Terrestrial Ecology;
- Land use, Landscape and Visual Impacts;
- Soils, Geology and Hydrology;
- Traffic;
- Socio-economics and Socio-cultural Effects;
- Archaeology, Historical and Cultural Heritage;
- Natural Disaster Risks;
- Major Accident Hazards;
- Solid Waste Management;
- Public Health Effects;
- Occupational Health and Safety; and
- Associated Infrastructure.

119. Table 2 presents environmental, health and safety issues relating to construction and operation of Nuweiba power project.

120. For each of these items, a concise description and evaluation of the significance of potential impacts of the project is presented in the ESIA study report. Where modeling has been undertaken, a description of the model as well as corresponding maps summarizing the results of the assessment are provided.

121. Where potentially significant adverse impacts are identified, possible mitigation measures are suggested wherever possible, to ameliorate the impact to an acceptable level. Where identified, beneficial or positive impacts/effects of the project are also highlighted.

122. The conclusions of the assessment are that (with suitable mitigation measures described in Tables 4, 5, 6 and 7) the project is in compliance with the environmental requirements of both the Government of Egypt, EIB, AfDB and the World Bank with respect to stack emissions of the new power plant, ambient air quality, discharge quality and noise. Table 3 provides with a summary of anticipated impacts in relation to the Egyptian and World Bank environmental guidelines for stack emissions, ambient air quality, liquid effluent and noise. The following discussion highlights some of the key considerations and results of the assessment.
Table 2

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

<table>
<thead>
<tr>
<th>Subject Area</th>
<th>Potential Impacts During Construction</th>
<th>Potential Impacts During Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Air Quality</strong></td>
<td>Dust from construction activities. Traffic-related air quality impacts.</td>
<td>Impacts of emissions from stacks on ambient air quality. Traffic-related air quality impacts. Global warming potential.</td>
</tr>
<tr>
<td><strong>Noise and Vibration</strong></td>
<td>Noise from construction activities.</td>
<td>Noise from power plant operations on surrounding land uses.</td>
</tr>
<tr>
<td><strong>Soils, Geology and Hydrogeology</strong></td>
<td>Effects on soils and geological features. Soil contamination. Effects on groundwater.</td>
<td>Soil contamination. Effect on groundwater.</td>
</tr>
<tr>
<td><strong>Flora and Fauna</strong></td>
<td>Loss of habitat or species due to landtake. Disturbance or damage to adjacent habitat of species.</td>
<td>Disturbance or damage to adjacent habitat. Effects of structures on bird migration routes.</td>
</tr>
<tr>
<td><strong>Major Accident Hazards</strong></td>
<td>Risk to third-party hazardous industry.</td>
<td>Risk to third-party hazardous industry. Risk to power plant of third-party hazardous industry.</td>
</tr>
<tr>
<td><strong>Natural Disaster Risk</strong></td>
<td>Seismic risk. Flood risk.</td>
<td>Seismic risk. Flood risk.</td>
</tr>
<tr>
<td><strong>Solid Waste Management</strong></td>
<td>Contamination of soils and water. Hazards to workers health. Accident risks.</td>
<td>Contamination of soils and water. Hazards to workers health. Accident risks.</td>
</tr>
</tbody>
</table>
6.2 Air Quality

Construction Dust

123. 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

124. 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 \( \text{SO}_2 \) along with trace amounts of other pollutants. Emissions from the plant will meet Egyptian, EIB, AfDB and World Bank Guidelines.

125. 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.

126. The assessment indicates that the 1-hour maximum impact areas from the new proposed Units 1 & 2 of the Nuweiba power project occurred to the Northwest of the plant at the edge of the polar grid at 2,088 m from the origin of the modeling grid network. The results further indicated that the maximum impact area from Units 1 & 2 for each of the three years considered all occurred between 1.9 km and 2 km within 42 degrees from the Northwest. The majority of the 24-hour maximum impact areas from Units 1 & 2 occurred to the Southeast of the plant at distances between 133 m and 135 m. The 24-hour maximum impact area from Units 1 & 2 occurred to the Southeast of the plant at a distance of 315 m from the origin of the modeling grid network (see Figure 6).

127. Monitoring stations should be located in areas of maximum impact levels. In addition, the maximum impact areas for the 1-hour average for Units 1 & 2 occur at distances of at least 2 km away to the northwest beyond the main Road of Sharm El-Sheikh / Taba. This would cause difficulties and hardships in terms of facility, security, program management, and power supply. More ideally, the 1-hour maximum levels for the second alternative of operation, which is close to the first alternative in terms of concentrations value occur much closer at around 321 m. Due to the close proximity and highest concentration values, the areas with 1-hour and 24-hour maximum impact levels are ideal for monitoring stations. Therefore it is recommended that a monitoring station be located within the contours for the 1-hour maximum impact level of alternative (2) and the 24-hour maximum impact level of alternative (1).

It is recommended that 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.

Figure 6
Nuweiba Air Quality Monitoring Locations
### Table 3

#### Environmental Impacts and Environmental Guidelines

<table>
<thead>
<tr>
<th>Impact Area</th>
<th>Predicted Max. Concentration from Nuweiba Power Plant</th>
<th>Existing Ambient Air Quality (Effect of All Surrounding Industries) (2)</th>
<th>Cumulative Air Quality Impact of both the Nuweiba &amp; Aqaba Gulf Power Plants and Surrounding Industries</th>
<th>Egyptian Standard</th>
<th>World Bank Guideline</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stack emissions (70% load) (when firing Natural Gas)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NOx – 1 hour</td>
<td>&lt; 40.6 mg m⁻³</td>
<td>&lt; 300 mg m⁻³</td>
<td>300 mg m⁻³</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SO₂ – General (all sizes)</td>
<td>&lt; 0.4 mg m⁻³</td>
<td>&lt; 2,000 mg m⁻³</td>
<td>2,000 mg m⁻³</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TSP – General (all sizes)</td>
<td>&lt; 2.7 mg m⁻³</td>
<td>&lt; 200 mg m⁻³</td>
<td>200 mg m⁻³</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Stack emissions (70% load) when firing Light fuel oil (&lt;2% of total annual operating time)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NOx – oil firing</td>
<td>&lt; 667.3 mg m⁻³</td>
<td>300 mg m⁻³</td>
<td>460 mg m⁻³</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SO₂ – oil firing</td>
<td>&lt; 15 mg m⁻³</td>
<td>2,500 mg m⁻³</td>
<td>2,000 mg m⁻³</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TSP – General (all sizes)</td>
<td>&lt; 4.6 mg m⁻³</td>
<td>200 mg m⁻³</td>
<td>50 mg m⁻³</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ground Level Concentration (when firing National Gas)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NOx – 1 hour</td>
<td>291.13 µg m⁻³</td>
<td>34.2 µg m⁻³</td>
<td>325.33 µg m⁻³</td>
<td>400 µg m⁻³</td>
<td></td>
</tr>
<tr>
<td>NOx – 24 hours</td>
<td>134.4 µg m⁻³</td>
<td>13.88 µg m⁻³</td>
<td>148.06 µg m⁻³</td>
<td>150 µg m⁻³</td>
<td></td>
</tr>
<tr>
<td>NOx – 1 year</td>
<td>21.03 µg m⁻³</td>
<td>2.74 µg m⁻³</td>
<td>33.77 µg m⁻³</td>
<td>100 µg m⁻³</td>
<td></td>
</tr>
<tr>
<td>SO₂ – 1 hour</td>
<td>Trace</td>
<td>10.0 µg m⁻³</td>
<td>12.4 µg m⁻³</td>
<td>150 µg m⁻³</td>
<td></td>
</tr>
<tr>
<td>SO₂ – 24 hours</td>
<td>Trace</td>
<td>4.0 µg m⁻³</td>
<td>4.0 µg m⁻³</td>
<td>150 µg m⁻³</td>
<td></td>
</tr>
<tr>
<td>SO₂ – 1 year</td>
<td>Trace</td>
<td>0.8 µg m⁻³</td>
<td>0.8 µg m⁻³</td>
<td>80 µg m⁻³</td>
<td></td>
</tr>
<tr>
<td>PM₁₀ – 24 hours (3)</td>
<td>Trace</td>
<td>1.15 µg m⁻³</td>
<td>1.15 µg m⁻³</td>
<td>150 µg m⁻³</td>
<td></td>
</tr>
<tr>
<td>PM₁₀ – 1 year (3)</td>
<td>Trace</td>
<td>2.83 µg m⁻³</td>
<td>2.83 µg m⁻³</td>
<td>70 µg m⁻³</td>
<td></td>
</tr>
<tr>
<td><strong>Liquid Effluent</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>6-9</td>
<td>6-9</td>
<td>6-9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BOD</td>
<td>&lt; 30 mg/l</td>
<td>&lt; 60 mg/l</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chromium</td>
<td>&lt; 0.5 mg/l</td>
<td>1 mg/l</td>
<td>0.5 mg/l</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copper</td>
<td>&lt; 1 mg/l</td>
<td>1.5 mg/l</td>
<td>0.5 mg/l</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iron</td>
<td>&lt; 0.5 mg/l</td>
<td>1 mg/l</td>
<td>1.0 mg/l</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zinc</td>
<td>&lt; 1 mg/l</td>
<td>5 mg/l</td>
<td>1.0 mg/l</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil and Grease</td>
<td>&lt; 5 mg/l</td>
<td>10 mg/l</td>
<td>10 mg/l</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Suspended Solids (TSS)</td>
<td>&lt; 30 mg/l</td>
<td>60 mg/l</td>
<td>50 mg/l</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual Chlorine (total)</td>
<td>&lt; 0.2 mg/l</td>
<td>0.2 mg/l</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature Increase (°C)</td>
<td>≤ 0°C at the point of discharge and ≤ 3°C within 100 m.</td>
<td>(max. absolute temp 10°C at the point of discharge above ambient Mixing zone up to 3°C)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Notes:
1. Egyptian standards for NOx are expressed in terms of NO₂.
2. Ambient air quality monitoring results measured by the NRC air quality monitoring equipment in Nuweiba area during August 2008.
3. The PM₁₀ 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 mg/l 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 5°C 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.

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6.3 Aquatic Environment

128. Cooling water and process water for power plant operation will be drawn from the Aqaba Gulf via an intake structure. The quantity of the cooling water that will be returned back to the Aqaba Gulf is about 13.6 m³/sec. Process water that will be 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 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. The key potential impacts of the power plant on the aquatic environment will therefore be impacts to the aquatic flora and fauna during power plant construction and operation.

129. The aquatic environment just before the project site and surroundings is characterized by generally fair water quality. The aquatic flora is characterized by poor biodiversity and no sensitive ecosystems. No coral reefs. No commercial fishing occurs in the vicinity of the project.

130. During construction of the power plant, dredging and construction of the intake and discharge structures could lead to potential impacts on physical aquagraphy, water quality and removal of, or disturbance to, aquatic habitats, flora and fauna. Given that the area of impact is very localised, losses are in many cases temporary and field survey data available do not indicate significant or sensitive habitats, the impacts of power plant construction on the aquatic environment are not considered to be significant. In addition, good site management and engineering practices during construction will ensure that any residual impacts are reduced to a minimum.

131. 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.

132. The returned cooling water will be released at a temperature of no more than 9 °C 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 °C above ambient, lies at approximately 70 m
from the point of discharge. The mixing zone has been defined by the HRI/MWRI to be 150 m from the point of discharge.

133. 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°C 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.

74. 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.

6.4 Noise Impacts

134. 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\(^{(1)}\) 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.

135. Construction traffic on local roads will also generate additional noise, however noise levels on local roads predicted for peak construction activity (during 2010-2012) is expected to be only 0.3dB(A) above ambient levels. This magnitude of increase is generally not perceptible to the human ear, consequently no construction traffic impacts are predicted.

136. 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 night-time.

\(^{(1)}\) There are no World Bank Guidelines for demolition and construction noise, therefore Operational noise guidelines are applied here.
6.5 Flora and Fauna

137. 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.

6.6 Land Use, Landscape and Visual Impacts

138. 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.

139. 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.

140. 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.

6.7 Soils, Geology and Hydrology

141. 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.

6.8 Traffic

142. The assessment of traffic and transport covers the changes in traffic conditions in terms of delay and congestion during construction and operation.

143. The greatest potential for traffic impacts to occur arises during a short period at peak construction. There is some potential for increased congestion on the main roads to the power plant, however the impacts will only occur during the peak construction phase and during peak hours. The overall impact is therefore predicted to be insignificant. Mitigation measures will be put in place to reduce the potential for impacts to arise.
144. During operation, a small number of workers and HGVs are associated with operating the power plant and no impacts are predicted to occur.

6.9 Socio-economics and Social-cultural effects

145. 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.

146. In addition to the area specifically designated for the plant, there are large empty spaces next to the power plant site. All activities related to the construction of the new plant will therefore take place during construction only within the area next to the power plant site, i.e. there will be no off-site activities or associated land acquisition.

147. As indicated in the main document, scientific research has shown that certain species of the fish grow considerably faster in warmer water.

148. 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 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.

149. 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.

6.10 Archaeology, Historic and Cultural Heritage

150. 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.

151. 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.
6.11 Natural Disaster Risks

152. 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.

153. 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.

154. 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.

6.12 Major Accident Hazards

155. 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.

6.13 Solid and Hazardous Waste Management

156. 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.

157. Private sector contractor will be assigned via general bidding process and the contract will include detailed environmental procedures, according to Law 4/1994 and Governorate of South Sinai regulations, for disposing debris materials. The contract covers all fees required.

158. During construction and operation, all wastes including debris waste, general waste, packaging waste, commercial wastes, raw-water pre-treatment sludge, tank sludge and interceptor sludge will be disposed of by licensed waste contractors according to the rules set by Law 4/1994 and the Governorate of South Sinai.

159. Solid and hazardous waste management is not predicted to cause any significant impacts.
6.14 **Occupational Health and Safety**

160. 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.

6.15 **Associated Infrastructure**

161. Connections to existing gas and electrical facilities will be the responsibility of the gas Company operating at South Sinai, EETC and the EDEPC respectively. In regard to the gas connection with the gas reducing station of the site and light fuel oil transport from nearest refinery to the site, no environmental or social impacts are anticipated.

162. 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.

163. 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.

164. 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.

165. The potential environmental and social impacts of the transmission lines have been considered, as this component would not have been required without the power plant itself. Mitigation measures are given in Table 7 of this Executive Summary.

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).

166. EETC and EDEPC will submit Screening Form B to the EEAA concerning this interconnection. No significant impacts are anticipated.

6.16 **Global Impacts**
167. 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 (CO₂), moderate emission levels of nitrogen oxides (NOₓ) and the lowest emission levels (almost traces) of sulfur dioxide (SO₂) and particulates.

168. The greenhouse effect is caused by the build-up of carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O) and chlorofluorocarbons (CFCs) in the atmosphere. Water vapor and ozone (O₃) can also act as greenhouse gases. For power generation processes, CO₂ is the key emission of concern, as methane and CFCs are not emitted by power plants and none of the other greenhouse gases are emitted in sufficient quantities from power generation to be considered important in terms of the greenhouse effect.

169. The efficiency of the proposed combined cycle power plant is about 52-54% with natural gas, with associated CO₂ emissions of about 0.42 kg/kWh. This compares with the efficiency of a typical efficient steam power plant of 42-45% and associated CO₂ emissions of around 0.55 kg/kWh.

170. Emissions of carbon dioxide are estimated to be up to 1,260 kilotonnes per year (expressed as CO₂). 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 CO₂ from fuel burning in Egypt amounted to around 169,000 kilotonnes in 2006/2007 (Ref: EEA: Second National Communication, not published yet). Fuel combustion will account for most of Egypt’s CO₂ emissions from all sources. Hence, the power plant as proposed will emit up to around 0.74% of the total Egyptian CO₂ 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.

171. Natural gas, which is the main fuel to be used in the Nuweiba plant, contains very low concentrations of sulfur or particulate matter, therefore the potential for emissions of SO₂ and particulates from the electricity generating process is also very low. Fuel oil however, leads to greater emissions of SO₂ and particulates, due to the relatively high sulfur content of these fuels and the generation of ash during their combustion.

172. Natural gas fuel also has the significant benefit of being able to be delivered by an existing pipeline.

7. **ENVIRONMENTAL MITIGATION AND MONITORING:**

THE ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

7.1 Enhancement and Mitigation Plan

173. 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).

174. The mitigation measures represent a synthesis of those measures which are part of the basic power plant design and those that have been recommended in Section 6 of the ESIA report for both the construction and operational phases of the power plant. The mitigation measures discussed in this section are summarized in the following three Tables, together with respective environmental monitoring and management arrangements. It should be noted that many of the mitigation measures presented below for the construction phase, will be carried forward into plant Operation.

175. All the mitigation, monitoring and management measures proposed below and in Section 8 of 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. 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.

176. 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, as described in Sections 4 and 6 of the ESIA report, 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.

177. The key features of the ESMP relate to air quality, aquatic discharge and implementation of good site management practice. The ESMP is summarized in Tables 4, 5, 6 and 7 which relate to construction and operational phases respectively. Table 8 summarizes the cost of ESMP which will require to be included in the project financial plan.
### Table 4

#### Institutional Arrangements for Nuweiba Power Project

<table>
<thead>
<tr>
<th>Issue/Impact</th>
<th>Mitigation Measures</th>
<th>Implementation Schedule</th>
<th>Type and Frequency of Reporting / Monitoring</th>
<th>Responsibility</th>
<th>Implementation Supervision</th>
<th>Monitoring Indicators</th>
<th>Budget in US$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Construction Phase</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Institutional capacity to address environmental and social issues</td>
<td>Establishment of the Project Management Unit (PMU), including the Environmental Management Staff (EMS) (will include 2-3 staff members, B.Sc. and/or 5 years high technical education), construction phase. Basic training of persons employed to operate the monitoring activities. Basic induction training for all employees on good construction and site management practice.</td>
<td>Prior to starting construction. Ongoing training</td>
<td>Quarterly to EEHC/EDEPC Environmental Management (EEM) and EEHC/EDEPC Chairman</td>
<td>PMU / EMS</td>
<td>EDEPC Project Manager in collaboration with PGESCo Site Manager</td>
<td>Training programs Compliance with ESMP</td>
<td>Environmental Quality quarterly monitoring will start with the commencement of construction phase. Basic Training Basic Induction Training Air quality continuous monitoring will start 6 months ahead of commissioning. Training since that time is included in air quality monitoring package Training time and cost (included in construction cost) (around US$ 155 k) EDEPC responsibility</td>
</tr>
<tr>
<td><strong>Operation Phase</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Institutional capacity to address environmental and social issues</td>
<td>Establishment of the Project Management, including the Environmental Management Staff (EMS) (will include 2-3 staff members, B.Sc. and/or 5 years high technical education), operation phase. Basic training of persons employed to operate the monitoring activities. Induction, specific and refresher training for all employees on good operation management practice. Training methods, facilities &amp; manuals</td>
<td>Prior to starting operation. Ongoing training</td>
<td>Quarterly to EEHC/EDEPC Environmental Management (EEM)</td>
<td>PM / EMS</td>
<td>EDEPC Project Manager in collaboration with PGESCo Consulting Firm</td>
<td>Training programs Compliance with ESMP</td>
<td>Included in air quality monitoring package Training time and cost (included in operation cost) (around US$ 20 k) EDEPC responsibility</td>
</tr>
</tbody>
</table>

**Notes:**

(*) EDEPC responsibility: means that training and capacity building activities are included in the company organizational structure and budget.
### Table 5  
**Construction Impact Mitigation, Monitoring and Management Measures**(*)

<table>
<thead>
<tr>
<th>Issue/Impact</th>
<th>Mitigation Measures</th>
<th>Implementation Schedule</th>
<th>Monitoring</th>
<th>Responsibility</th>
<th>Type and Frequency of Reporting/monitoring</th>
<th>Management and Training</th>
<th>Indicative Cost Estimate (US$)</th>
</tr>
</thead>
</table>
| **Air Quality** Dust emissions caused by construction activities, construction vehicle movements, and transport of friable construction materials. | Implementation of good site practices including:  
• appropriate siting and maintenance of stockpiles of friable materials so as to minimize dust blow;  
• minimizing drop heights for material transfer activities such as unloading of friable materials;  
• construction phase to begin with construction of access roads;  
• roads will be kept damp via a water bowser;  
• roads will be compacted and graveled if necessary;  
• regulation of site access;  
• sheeting of lorries transporting friable construction materials and spoil;  
• enforcement of vehicle speed limits on unmetalled roads to <35 km/h. | Before construction and during construction | Before Construction and during Construction until 6 months ahead of Commissioning | EDEPC Project Manager in collaboration with PGESCo Site Manager | Quarterly reporting of summary results (or more if requested) and submitted to the EEHC and any other concerned authority, (e.g., EEAA, EIB, AfDB, etc.). | EDEPC/PMU responsible for management of the air quality monitoring system. Submission of annual summary reports to EEHC and any other concerned authority. | Dust levels (TSP, PM10), NO2, SO2, CO levels. | Baseline Air Quality Monitoring: First construction period: third party monitoring (e.g., National Research Center), four times a year until using continuous monitoring: US$70K Second construction period: 6 months ahead of commissioning: Permanent Continuous Monitoring System-approx. US$1000-1500K plus management time & reporting. |  
|  |  |  |  |  |  |  |  |

(*) Environmental regulations are to be included in all construction contracts.
### Table 5 (Contd.)

**Construction Impact Mitigation, Monitoring and Management Measures(\*)**

<table>
<thead>
<tr>
<th>Issue/Impact</th>
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<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aquatic Environment</td>
<td>Dredging and construction of the intake structure and water discharge structure.</td>
<td>During construction of intake and discharge structures</td>
<td>Off-shoreline survey undertaken September 2008 along 5 profiles fronting the site. Report to be maintained for later monitoring and evaluation during operation. Continuous visual inspection.</td>
<td>EDEPC Project Manager in collaboration with PGESCo Site Manager.</td>
</tr>
<tr>
<td></td>
<td>Increased suspended sediment and pollutant loads, permanent loss and disturbance to aquatic flora and fauna.</td>
<td>During construction of intake and discharge structures</td>
<td>Implementation of Good Site Management practices shall be the responsibility of all contractors on site under supervision of the PMU / EMS and the Assistant Plant Manager.</td>
<td>Actual parameters to be measured.</td>
</tr>
<tr>
<td></td>
<td>The following measures will be taken:</td>
<td></td>
<td>EDEPC Project Manager in collaboration with PGESCo Site Manager.</td>
<td>Quarterly reporting of summary results (or more if requested) and submitted to the EEHC and any other concerned authority, (e.g. EEAA, EIB, AfDB, etc.).</td>
</tr>
<tr>
<td></td>
<td>• Construction Method Statement to be produced by the Contractor;</td>
<td></td>
<td>EDEPC Project Manager in collaboration with PGESCo Site Manager.</td>
<td>EDEPC/PMU to ensure all contractors and subcontractors working on site are aware of ESMP and all employees are given basic induction training on good construction and site management practice.</td>
</tr>
<tr>
<td></td>
<td>• dredged areas limited to minimum area required;</td>
<td></td>
<td>EDEPC Project Manager in collaboration with PGESCo Site Manager.</td>
<td>These mitigation measures must be a condition of any construction contracts commissioned.</td>
</tr>
<tr>
<td></td>
<td>• disposal of dredged sediments to an agreed site;</td>
<td></td>
<td>EDEPC Project Manager in collaboration with PGESCo Site Manager.</td>
<td>EDEPC/PMU to ensure all contractors and subcontractors working on site are aware of ESMP and all employees are given basic induction training on good construction and site management practice.</td>
</tr>
<tr>
<td></td>
<td>• all works will be made clearly visible using flags, beacons and/or signals;</td>
<td></td>
<td>EDEPC Project Manager in collaboration with PGESCo Site Manager.</td>
<td>These mitigation measures must be a condition of any construction contracts commissioned.</td>
</tr>
<tr>
<td></td>
<td>• shore area will be reinstated following construction.</td>
<td></td>
<td>EDEPC Project Manager in collaboration with PGESCo Site Manager.</td>
<td>EDEPC/PMU to ensure all contractors and subcontractors working on site are aware of ESMP and all employees are given basic induction training on good construction and site management practice.</td>
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<tr>
<td></td>
<td>During construction of intake and discharge structures</td>
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<td>EDEPC Project Manager in collaboration with PGESCo Site Manager.</td>
<td>EDEPC/PMU to ensure all contractors and subcontractors working on site are aware of ESMP and all employees are given basic induction training on good construction and site management practice.</td>
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<td>The following measures will be taken:</td>
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<td>• Construction Method Statement to be produced by the Contractor;</td>
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<td>EDEPC Project Manager in collaboration with PGESCo Site Manager.</td>
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<td>• all works will be made clearly visible using flags, beacons and/or signals;</td>
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<td>EDEPC/PMU to ensure all contractors and subcontractors working on site are aware of ESMP and all employees are given basic induction training on good construction and site management practice.</td>
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<td></td>
<td>• shore area will be reinstated following construction.</td>
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<td>EDEPC Project Manager in collaboration with PGESCo Site Manager.</td>
<td>EDEPC/PMU to ensure all contractors and subcontractors working on site are aware of ESMP and all employees are given basic induction training on good construction and site management practice.</td>
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(\*) Environmental regulations are to be included in all construction contracts.
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<th>Type and Frequency of Reporting / monitoring</th>
<th>Management and Training</th>
<th>Indicative Cost Estimate (US$)</th>
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</thead>
<tbody>
<tr>
<td>Contamination of the aquatic environment as a result of construction activities on land e.g. spillages, disposal of liquid wastes, surface run-off, exposure of contaminated soils (see also under &quot;Soils and Hydrology&quot;).</td>
<td>Mitigation activities will include the following: • no discharge of effluents into the Aqaba Gulf - all effluents shall be collected and removed off site for treatment by approved firms; • development of a site drainage plan which reduces flow velocity and sediment load; • protection of temporary stockpiles of soil from erosion by using a reduced slope angle where practical, sheeting and by incorporating sediment traps in drainage ditches; • maintenance of well kept construction site.</td>
<td>During construction</td>
<td>Continuous visual inspection will be conducted.</td>
<td>Implementation of Good Site Management practices shall be the responsibility of all contractors on site under supervision of the PMU/EMS and the Assistant Plant Manager.</td>
<td>EDEPC Project Manager in collaboration with PGESCo Site Manager.</td>
<td>Quarterly reporting of summary results (or more if requested) and submitted to the EEHC and any other concerned authority (e.g. EEAA, IIB, ADB, etc.), if required.</td>
<td>EDEPC/PMU to ensure all contractors and subcontractors working on site are aware of ESMP and all employees are given basic induction training on good construction and site management practices.</td>
<td>Management time and costs (included in construction cost).</td>
</tr>
</tbody>
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### Table 5 (Contd.)

#### Construction Impact Mitigation, Monitoring and Management Measures(*)

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<tr>
<td>Noise</td>
<td>Increased noise in the project area as a result of the use of noisy machinery and increased vehicle movements.</td>
<td>Implementation of good site practices including:</td>
<td>During construction</td>
<td>Monthly monitoring and supervision by PMU/EMS is required to ensure the implementation of good site management practices by all contractors during construction.</td>
<td>Implementation of Good Site Management practices shall be the responsibility of all contractors on site under supervision of the PMU/EMS and the Assistant Plant Manager.</td>
<td>EDEPC Project Manager in collaboration with PGESCo Site Manager.</td>
<td>EDEPC/PMU to ensure all contractors and subcontractors working on site are aware of ESMP and all employees are given basic induction training on good construction and site management practices.</td>
</tr>
<tr>
<td>Flora and Fauna Site Clearance- Vegetation removal and habitat disturbance.</td>
<td>Good site management practices will be observed to ensure that disturbance of habitats off-site are minimized. Specific mitigation measures include restricting personnel and vehicles to within construction site boundaries, lay down areas and access roads.</td>
<td>During construction</td>
<td>Periodic inspection and supervision by PMU/EMS is required to ensure the implementation of good site management practices by all contractors during construction.</td>
<td>Implementation of Good Site Management practices shall be the responsibility of all contractors on site under supervision of the PMU/EMS and the Assistant Plant Manager.</td>
<td>Good conservation of floral wealth.</td>
<td>EDEPC Project Manager in collaboration with PGESCo Site Manager.</td>
<td>EDEPC/PMU to ensure all contractors and subcontractors working on site are aware of ESMP and all employees are given basic induction training on good construction and site management practices.</td>
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</tr>
</thead>
<tbody>
<tr>
<td>Soils and Hydrology</td>
<td>Site clearance, excavation and disposal of material, exposure of potentially contaminated soils, spillage or leakage of substances on land, movement of equipment and vehicles on site.</td>
<td>The potential for impacts are largely dependent on management of the construction site and activities. The following mitigation measures will be implemented: • development of effective site drainage systems; • restriction of access only to construction site areas; • monitoring and control of spoil; • disposal of waste materials unsuitable for reuse on-site, (e.g. for landscaping) at appropriately licensed sites; • provision of oil and suspended solids interceptors; • management of excavations during construction to avoid the generation of drainage pathways to underlying aquifers; • provision of impermeable bases in operational areas to prevent absorption of spillages.</td>
<td>During construction.</td>
<td>Implementation of Good Site Management practices shall be the responsibility of all contractors on site under supervision of the PMU/EMS and the Assistant Plant Manager.</td>
<td>• site drainage. • access only to construction site areas. • spills. • waste materials. • oily waters. • drainage pathways. • potential spillage in operational areas.</td>
<td>Quarterly reporting of summary results (or more if requested) and submitted to the EEHC and any other concerned authority (e.g. EEAA, EIB, AfDB etc.), if required.</td>
<td>Costs for mitigation measures and management time included in construction costs. Any additional features (e.g. bunding, interceptors etc.) may incur additional costs of between US$ 30-50K dependent on the measure.</td>
</tr>
</tbody>
</table>

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### Table 5 (Contd.)

**Construction Impact Mitigation, Monitoring and Management Measures(*)**

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<th>Indicative Cost Estimate (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic and Transport Disruption, noise and increased air pollution due to increased traffic, heavy loads and abnormal loads.</td>
<td>Standard good practice measures will be implemented as follows: • adherence of abnormal load movements to prescribed routes, outside peak hours and advance publication of movements if required; • construction shifts will be staggered; • scheduling of traffic to avoid peak hours on local roads; • transportation of construction workers by contract bus.</td>
<td>During construction. Monitoring traffic entering the site during morning &amp; evening peaks to ensure the implementation of good site management practices by all contractors during construction.</td>
<td>Implementation of Good Site Management practices shall be the responsibility of all contractors on site under supervision of the PMU / EMS and the Assistant Plant Manager.</td>
<td>EDEPC Project Manager in collaboration with PGESCo Site Manager.</td>
<td>Increased congestion Travel time (compared to reasonable daily commute)</td>
<td>Three times per month Quarterly reporting of summary results (or more if requested) and submitted to the EEHC and any other concerned authority (e.g. EEAA, EIB, AfDB etc.), if required.</td>
<td>EDEPC/PMU to ensure all contractors and subcontractors working on site are aware of ESMP and all employees are given basic induction training on good construction and site management practices.</td>
<td>Management time</td>
</tr>
</tbody>
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**Construction Impact Mitigation, Monitoring and Management Measures(*)**

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</thead>
<tbody>
<tr>
<td>Socio-Economic Environment</td>
<td>Positive impacts identified. All activities related to the construction of the new plant will take place within the area belonging to EDEPC, i.e. there will be no off-site activities or associated land acquisition during construction. The entire labor force will be daily commuters, thus no worker housing or associated facilities will be erected on site during construction. The contractors will be responsible for relevant temporary water / toilet facilities during construction and the need to provide appropriate services will be specified in their contracts. Public and Industry Relations will be maximized through open dialogue between EDEPC (through the Assistant Plant Manager who has direct responsibility for EHS Liaison) and local authority, public and industry representatives.</td>
<td>PMU/EMS and the Assistant Plant Manager in collaboration with PGESCo Site Manager.</td>
<td>Workers satisfaction as measured by staff interviews and complaints submitted.</td>
<td>Editing a special report</td>
<td>Responsibility of EDEPC/PMU.</td>
<td>Responsibility of EDEPC.</td>
</tr>
</tbody>
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**Construction Impact Mitigation, Monitoring and Management Measures(*)**

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<th>Management and Training</th>
<th>Indicative Cost Estimate (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Archaeology</td>
<td>Potential chance finds of archaeological remains during construction.</td>
<td>During construction.</td>
<td>Supervision of construction activities.</td>
<td>Construction contractors</td>
<td>EDEPC Project Manager in collaboration with PGESCo Site Manager.</td>
<td>Chance finds (see annex II)</td>
<td>Daily inspection</td>
<td>EDEPC/PMU to ensure that all workers on site are aware of the importance of archaeological remains and must report any potential finds immediately. Immediate liaison with Competent Administrative Authority should a potential find be uncovered.</td>
</tr>
</tbody>
</table>

The project site does not lie on, or in the immediate vicinity of any known archaeological areas of interest. If remains are found EDEPC is committed to:
- ceasing activities and consult Antiquities authority;
- protection in situ if possible;
- excavation of areas where protection not feasible;

During construction.

**Natural Disasters**

<table>
<thead>
<tr>
<th>Issue/Impact</th>
<th>Mitigation Measures</th>
<th>Implementation Schedule</th>
<th>Monitoring</th>
<th>Responsibility</th>
<th>Monitoring Indicators</th>
<th>Type and Frequency of Reporting/monitoring</th>
<th>Management and Training</th>
<th>Indicative Cost Estimate (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flash flooding.</td>
<td>Good engineering design will incorporate the following mitigation measures:</td>
<td>During construction.</td>
<td>No monitoring measures are envisaged.</td>
<td>PMU/EMS and the Assistant Plant Manager</td>
<td>EDEPC Project Manager in collaboration with PGESCo Site Manager.</td>
<td>Quarterly reporting of summary results (or more if requested) and submitted to the EEHC and any other concerned authority (e.g. EEAA, EIB, AfDB etc.), if required.</td>
<td>EDEPC/PMU to ensure that all workers on site receive training in emergency preparedness and response procedures.</td>
<td>Relevant costs are included within the construction costs</td>
</tr>
</tbody>
</table>

- drainage system designed to direct flood water from main plant areas into the sea and direct potentially contaminated waters through the oil interceptor;
- Protection measures from severe flash floodings.

During construction.

No monitoring measures are envisaged.

PMU/EMS and the Assistant Plant Manager

EDEPC Project Manager in collaboration with PGESCo Site Manager.

Quarterly reporting of summary results (or more if requested) and submitted to the EEHC and any other concerned authority (e.g. EEAA, EIB, AfDB etc.), if required.

EDEPC/PMU to ensure that all workers on site receive training in emergency preparedness and response procedures.

Relevant costs are included within the construction costs.

(*) Environmental regulations are to be included in all construction contracts.
### Table 5 (Contd.)

**Construction Impact Mitigation, Monitoring and Management Measures**

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</tr>
</thead>
<tbody>
<tr>
<td><strong>Solid Waste Management</strong></td>
<td>Good practice measures such as the following: • all waste taken off-site will be undertaken by a licensed contractor and EDEPC will audit disposal procedure; • collection and segregation of wastes and safe storage; • recording of consignments for disposal; • prior agreement of standards for storage, management and disposal with relevant authorities. It is of highest importance that final disposal of wastes shall be strictly adhered to environment friendly disposal Contract.</td>
<td>During construction. Periodic inspection is required to ensure the implementation of good management practices during construction.</td>
<td>Implementation of Good Site Management practices shall be the responsibility of all contractors on site under supervision of the PMU/EMS and the Assistant Plant Manager.</td>
<td>EDEPC Project Manager in collaboration with PGESCo Site Manager.</td>
<td>EDEPC Project Manager in place Functional transfer station.</td>
<td>Quarterly reports from management contractor to EDEPC and then to EEHC. These reports are to be submitted to any other concerned authority (e.g., EEAA, EIB, AfDB, etc.), if required.</td>
<td>EDEPC/PMU to ensure all contractors and subcontractors working on site are aware of ESMP and all employees are given basic induction training on good construction and site management practices.</td>
<td>Management time plus costs (&lt; US$ 25K)</td>
<td></td>
</tr>
</tbody>
</table>

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</tr>
</thead>
</table>
| Occupational Health & Safety      | Good local and international construction practice in Environment, Health and Safety (EHS) will be applied at all times and account will be taken of local customs, practices and attitudes. Measures include:  
  • Implementation of EHS procedures as a condition of contract all contractors and sub-contractors;  
  • Clear definition of the EHS roles and responsibilities of all construction companies and staff;  
  • Management, supervision, monitoring and record-keeping as set out in plant’s operational manual;  
  • Pre-construction and operation assessment of the EHS risks and hazards;  
  • Completion and implementation of Fire Safety Plan prior to commissioning any part of the plant;  
  • Provision of appropriate training on EHS issues for all workers;  
  • Provision of health and safety information;  
  • Regular inspection, review and recording of EHS performance; and  
  • Maintenance of a high standard of housekeeping at all times. | During construction. Daily inspection is required to ensure the implementation of EHS Policies, plans and practices during construction. | EDEPC Project Manager in collaboration with PGESCo Site Manager. | Management procedures in place. Workers health and safety as measured by no. of incidents. | Daily inspection  
Quarterly reporting of summary results (or more if requested) and submitted to the EEHC and any other concerned authority (e.g. EEAA, EIB, AfDB, etc.), if required. | EDEPC/PMU to ensure all contractors and sub-contractors for workers on site include reference to the requirements of the ESMP and are aware of the EHS policies and plants. All employees will be given basic induction training on EHS policies and practices. | Contractors are responsible for ensuring that a Fire Safety Plan, which conforms to NFPA 850, is prepared and implemented prior to commissioning of any part of the plant under supervision of PMU/EMS and the Assistant Plant Manager. | Mitigation measures will require management time plus costs of up to US$ 50K for implementation of EHS Plans. |

(*) Environmental regulations are to be included in all construction contracts.
### Table 6
**Operational Impact Mitigation, Monitoring and Management**

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Air Quality</td>
<td>Emissions from stack are not expected to exceed standards.</td>
<td>Air quality affected by emissions from the power plant.</td>
<td>Automatic monitoring of stack emissions for NOx, SO2, particulate matter and carbon monoxide (CO) via test ports installed in the main stacks.</td>
<td>The analyzer stations will be owned and operated by EDEPC/NPP/EMS. Assistant Plant Manager</td>
<td>Automatic stack monitors: included in the project cost.</td>
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<td></td>
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<td>During first three years of operation.</td>
<td>Install two continuous NOx, SO2, CO, PM10 &amp; TSP monitoring stations to monitor short-term concentrations in the area predicted to have the highest impacts on humans (if there are no other 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). The analyzer stations will be electronically connected to the EEAA ambient monitoring system.</td>
<td></td>
<td>Management time for compilation of reports and performance monitoring: included in operation cost.</td>
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<td></td>
<td>EEHC Environmental Management &amp; Studies Sector. Report introduced to EEAA as requested. Third party inspection.</td>
<td>Purchase of Continuous Monitors (see construction management table).</td>
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<td>Annual servicing, calibration &amp; running costs: included in operation cost.</td>
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<td></td>
<td>Stack emissions (at least PM10, NOx, SOx and CO).</td>
<td>Continuous Hourly data acquisition. Quarterly reporting to EEHC.</td>
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<td>Records must be kept and summary data (including any deviations from Egyptian and World Bank standards) will be submitted to the Government, ADB and EIB on annual basis (or more frequently if required). Annual reporting by EDEPC/NPP/EMS to Government, ADB and EIB etc. (or more frequently if required) highlighting key features and comparing results with air quality standards and prediction in ESIA report.</td>
</tr>
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</table>
## Table 6 (Contd.)  
Operational Impact Mitigation, Monitoring and Management

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| Aquatic Environment Discharge of process and cooling water. | The design of the intake and cooling water structures have already incorporated measures to reduce impacts. In addition, good site management practices including the following will be implemented:  
• neutralization, oil separation, flocculation and filtration of any contaminated water before discharge to either plantation irrigation network or Ettaqa sewer network (in the near future);  
• no disposal of solid wastes or waste water into the discharge structure;  
• regular maintenance of site drainage system to ensure efficient operation;  
• all discharges will comply with local Egyptian and World Bank guidelines.  
In addition, EDEPC/NPP/EMS will demonstrate the validity of the conclusions drawn in the ESIA report. If pollutant concentrations in the discharge or impacts to the surrounding aquatic environment are found to be above local and World Bank standards or unacceptable, options for further mitigation will be discussed. | Lifetime of the plant | Prepare regular water quality monitoring program including:  
• quality of all water prior to discharge (continuous monitoring) of all discharged water for temperature and pH, daily monitoring of process water for COD, TSS, oil & grease and residual chlorine and monthly monitoring of heavy metals and other pollutants  
• ambient water quality in the area affected by the discharge plume (3-monthly monitoring of temperature, pH, COD, BOD, TOC, DO, TSS, oil & grease, residual chlorine, heavy metals and other pollutants).  
Annual monitoring of benthic environment within a 2 km radius of the discharge point (over a 3 year period)  
Weekly monitoring of fish catches on intake screens including species, numbers and size (over a 1 year period). | EDEPC/NPP/EMS, EEHC Environmental Management & Studies Sector | Basic parameters as per the Law 4/1994 and Law 93/1962  
Continuous monitoring of water quality etc.  
Monthly monitoring of heavy metals and other pollutants  
3-monthly monitoring of the plume.  
Annual monitoring of benthic environment (over a 3 year period).  
Weekly monitoring of fish catches on intake screens (over a 1 year period).  
Reports are to be available to any of the concerning authorities (EEAA, EIB, AfDB, etc.). | Monthly reports from EDEPC/NPP/EMS to EEHC | Records will be kept and compared on regular basis against Egyptian, AfDB and World Bank standards and impacts predicted in ESIA. Summary reports (with any exceptions identified) will be submitted to the Government, AfDB and EIB etc. on annual review basis (or more frequently if required). | Management time for implementation of site management practices. Included in operation cost. | All costs are included in operation cost. |
Table 6 (Contd.)

Operational Impact Mitigation, Monitoring and Management

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<tr>
<td>Noise</td>
<td>Specific design mitigation measures to minimize noise impacts include: • steam turbine generators; air compressors, pumps and emergency diesel engines are enclosed in buildings; • air compressors are equipped with silencers; • noisy outdoor equipment are designed to a noise limit of 60 dB (A) at 1 m. In addition, plant workers will be provided with protective wear in plant areas with high noise levels. The plant will operate in accordance with internationally accepted health and safety measures.</td>
<td>During first year of operation.</td>
<td>When the plant is fully operational, noise audit measurements are to be carried out at noise sources and at the fence of the power plant as well as at noise receptors around the plant.</td>
<td>EDEPC/NPP/EMS Third party audit supervised by Assistant Plant Manager</td>
<td>EEHC Environmental Management &amp; Studies Sector.</td>
<td>Quarterly to EDEPC and EEHC. Monthly reporting of summary results (or more if requested) and submitted to the EEHC and any other concerned authority (e.g. EEAA, EIB, etc.), if required.</td>
<td>Should any complaints be received regarding noise, these will be logged and the Assistant Plant Manager will investigate problem. EDEPC/NPP/EMS to ensure that all employees are given basic induction training on the requirements of the ESMP, good site management practices and H&amp;S procedures. The Assistant Plant Manager will ensure implementation of procedures.</td>
<td>Minimal costs (up to US$ 10K per annum) required for provision of protective wear (included in operation cost). No further mitigation or monitoring costs envisaged with the exception of management time. Noise audit US$ 10-20K (included in operation cost).</td>
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## Table 6 (Contd.)

### Operational Impact Mitigation, Monitoring and Management

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| Flora and Fauna Disturbance to habitats as a result of noise, vehicle and personnel movements. | The following mitigation measures will be implemented:  
- restrict personnel and vehicle movements to access roads and within boundaries of site only; and  
- control of noise during operation. | Lifetime of the plant. | No monitoring is envisaged. | EDEPC/NPP/EMS Assistant Plant Manager | EEHC Environmental Management & Studies Sector. | Good plantation | Yearly | EDEPC/NPP/EMS to ensure that all employees are given basic induction training on the requirements of the EMS, good site management practices and H&S procedures. The Assistant Plant Manager will ensure implementation of procedures. | Management time |
| Visual Impact Visual image of power plant from surrounding areas. | The visual effect of the power plant will be improved through:  
- creation of landscaped boundary along the fence of the power plant.  
- Ficus elastica var decora and Ficus nitida will be propagated and the resulting plants will be used for decorating and landscaping the site when completing the new power plant. One may obtain 200-300 individual plants from a single tree. | Lifetime of the plant. | No monitoring is envisaged. | EDEPC/NPP/EMS Assistant Plant Manager | EEHC Environmental Management & Studies Sector. | Improved visual image | | Considered management of landscaped areas to maximize visual image and habitat creation.  
EDEPC/NPP/EMS to contract a suitable firm to manage landscaped areas. | Approx. US$ 20-35K for landscaping measures (included in operation cost) |
### Table 6 (Contd.)

**Operational Impact Mitigation, Monitoring and Management**

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<tr>
<td><strong>Soil and Hydrology</strong></td>
<td>Spillage of oils, chemicals or fuels on site.</td>
<td>Good site management measures as described under Aquatic Environment will minimize any potential risks. As part of this, regular checks of bunds and drainage systems will be undertaken to ensure containment and efficient operation.</td>
<td>Lifetime of the plant</td>
<td>Implementation: EDEPC/NPP/EMS Assistant Plant Manager</td>
<td>EDEPC/NPP/EMS Environmental Management &amp; Studies Sector.</td>
<td>Quality of bunds and drainage systems. Efficiency of operation.</td>
<td>6-monthly reports from management to EEHC. Annual reporting of summary results (or more if requested) and submitted to the EEHC and any other concerned authority (e.g. EEAA, EIB, AfDB etc.), if required.</td>
<td>EDEPC/NPP/EMS, through the Assistant Plant Manager, will implement a Spills Response Plan and all employees will receive corresponding training.</td>
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<tr>
<td><strong>Solid Waste</strong></td>
<td>Good practice measures undertaken during the construction phase will be continued into the operation phase (see Table 6). It is of highest importance that final disposal of wastes shall be strictly adhered to environment friendly disposal Contract.</td>
<td>Continuous monitoring is required to ensure the implementation of good management practices during operation.</td>
<td>Lifetime of the plant</td>
<td>Implementation: EDEPC/NPP/EMS Implementation of Good Site Management practices shall be conducted under supervision of the Assistant Plant Manager.</td>
<td>EEHC Environmental Management &amp; Studies Sector.</td>
<td>Management contract in place. Functional transfer station.</td>
<td>3-monthly reports from management to EEHC. Annual reporting of summary results (or more if requested) and submitted to the EEHC and any other concerned authority (e.g. EEAA, EIB, AfDB etc.), if required.</td>
<td>EDEPC/NPP/EMS to ensure all employees are given basic induction training on good operation and site management practices.</td>
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<tr>
<td>Occupational Health and Safety, Risks and Hazards</td>
<td>Standard international practice on EHS issues shall be employed on site. The mitigation measures summarized in construction management Table apply. In addition, the following measures will be undertaken:  - Provision of training in use of protection equipment and chemical handling.  - Use of protective equipment.  - Clear marking of work site hazards and training in recognition of hazard symbols.  - Installation of vapour detection equipment and control systems.  - Development of site emergency response plans.</td>
<td>Lifetime of the plant</td>
<td>Regular on-site training. Regular staff checks, system checks and field tests of emergency procedures by on-site management.</td>
<td>EDEPC/NPP/EMS Assistant Plant Manager</td>
<td>Management procedures in place. Workers health and safety measured by incidents, injuries and illnesses.</td>
<td>Monthly reports from management to EEHC. Annual reporting of summary results (or more if requested) and submitted to the EEHC and any other concerned authority (e.g. EEAA, EIB, ADB, etc.), if required.</td>
<td>EDEPC/NPP/EMS to ensure that all employees are given basic induction training on H&amp;S policies and procedures. Emergency Preparedness and Response Plan and a Site Response Plan. The Assistant Plant Manager is to ensure implementation of procedures. EDEPC/NPP/EMS is responsible for ensuring that the site emergency response plan is complete and implemented prior to commissioning. Management time and costs (&lt; US$ 15K per annum) (included in operation cost).</td>
</tr>
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</table>

EDEPC/NPP/EMS to ensure that all employees are given basic induction training on H&S policies and procedures. Emergency Preparedness and Response Plan and a Site Response Plan. The Assistant Plant Manager is to ensure implementation of procedures. EDEPC/NPP/EMS is responsible for ensuring that the site emergency response plan is complete and implemented prior to commissioning any part of the power plant. |
### Table 7
Transmission System Impact Mitigation, Monitoring and Management

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| **Direct**                                                                   | • Utilize appropriate clearing techniques, (e.g., hand clearing versus mechanized clearing).  
  • Maintain native ground cover beneath lines.  
  • Replant disturbed sites.  
  • Manage ROWs to minimize wildlife benefits.                                                                 | During Construction and Operation | Visual inspections of the materials being used, the construction practices and mitigation measures.  
  Short-term monitoring to assure that negative land use and/or ecological impacts are avoided and proper mitigation measures are employed.  
  Monitoring of ROW maintenance activities to assure proper control methods.                                            | Egyptian Electricity Transmission Company (EETC)  
  EDEPC / PMU / EMS | EEHC management  
  EDEPC Project Manager in collaboration with PGESCo Site Manager. | Effects on environmenta l and human resources involved (negative land uses, ecological damage)  
  Degree to which they are affected.                                                                                       | Weekly (during construction).  
  Maintenance time (during operation)                                                                                            | Environmental training and management will be warranted for ROW maintenance techniques, including the proper use of chemical and mechanical clearing methods.  
  Training will be conducted by EETC and EDEPC/PMU with assistance from environmental consultant.  
  Staff workers should have an understanding of the rational for the recommended mitigation and monitoring that they may be implementing. | Included in construction and operation cost. |
| **Habitat fragmentation or disturbance.**                                     | • Select ROW to avoid important natural areas such as sensitive habitats.  
  • Maintain habitat (i.e., native vegetation) beneath lines.  
  • Make provisions to avoid interfering with natural fire regimes.                                                                 |                         |            |                                      |                       |                                         |                        |                                  |
|                                                                              | • Select ROW to avoid sensitive lands.  
  • Develop protection and management plans for these areas.  
  • Use discontinuous maintenance roads.                                                                                     |                         |            |                                      |                       |                                         |                        |                                  |
| **Increased access to sensitive lands.**                                      |                                                                                       |                         |            |                                      |                       |                                         |                        |                                  |

**Egyptian Electricity Transmission Company (EETC)**  
**EDEPC / PMU / EMS**  
**EEHC management**  
**EDEPC Project Manager in collaboration with PGESCo Site Manager.**  
**Effects on environmenta l and human resources involved (negative land uses, ecological damage)**  
**Degree to which they are affected.**  
**Weekly (during construction).  
Maintenance time (during operation)**  
**Environmental training and management will be warranted for ROW maintenance techniques, including the proper use of chemical and mechanical clearing methods.  
Training will be conducted by EETC and EDEPC/PMU with assistance from environmental consultant.  
Staff workers should have an understanding of the rational for the recommended mitigation and monitoring that they may be implementing.**  
**Included in construction and operation cost.**
### Table 7 (Contd.)

**Transmission System Impact Mitigation, Monitoring and Management**

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| Runoff and sedimentation from grading for access roads, tower pads, and substation facilities, and alteration of hydrological patterns due to maintenance roads. | • Select ROW to avoid impacts to water bodies, floodplains, and wetlands.  
• Install sediment traps or screens to control runoff and sedimentation.  
• Minimize use of fill dirt.  
• Use ample culverts.  
• Design drainage ditches to avoid affecting nearby lands.  
• Select ROW to avoid important social, agricultural, and cultural resources.  
• Utilize alternative tower designs to reduce ROW width requirements and minimize land use impacts.  
• Adjust the length of the span to avoid site-specific tower pad impacts.  
• Manage resettlement in accordance with World Bank & ADB procedures.  
• Utilize mechanical clearing techniques, grazing and/or selective chemical applications.  
• Select herbicides with minimal undesired effects.  
• Do not apply herbicides with broadcast aerial spraying.  
• Maintain naturally low-growing vegetation along ROW. | During Construction and Operation | Visual inspections of the materials being used, the construction practices and mitigation measures.  
Short-term monitoring to assure that negative land use and/or ecological impacts are avoided and proper mitigation measures are employed.  
Occurs along the line as it is constructed.  
Monitoring of ROW maintenance activities to assure proper control methods. | Egyptian Electricity Transmission Company (EETC)  
EDEPC / PMU / EMS | Effects on environmenta l and human resources involved (negative land uses, ecological damage)  
Degree to which they are affected. | Weekly (during construction).  
Maintenance time (during operation) | Environmental training and management will be warranted for ROW maintenance techniques, including the proper use of chemical and mechanical clearing methods.  
Training will be conducted by EETC and EDEPC/PMU with assistance from environmental consultant.  
Staff workers should have an understanding of the rational for the recommended mitigation and monitoring that they may be implementing. | Included in construction and operation cost. |
| Loss of land use and population relocation due to placement of towers and substations. | | | | | | | | |
| Chemical contamination from chemical maintenance techniques. | | | | | | | | |

Note: This table continues on the next page.
Table 7 (Contd.)

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<tr>
<td>Avian hazards from transmission lines and towers.</td>
<td>• Select ROW to avoid important bird habitats and flight routes.</td>
<td>During Construction and Operation</td>
<td>Visual inspections of the materials being used, the construction practices and mitigation measures.</td>
<td>Egyptian Electricity Transmission Company (EETC) EDEPC / PMU / EMS</td>
<td>Effects on environment and human resources involved (negative land use, ecological damage) Degree to which they are affected.</td>
<td>Weekly (during construction). Maintenance time (during operation)</td>
<td>Environmental training and management will be warranted for ROW maintenance techniques, including the proper use of chemical and mechanical cleaning methods. Training will be conducted by EETC and EDEPC/PMU with assistance from environmental consultant. Staff workers should have an understanding of the rational for the recommended mitigation and monitoring that they may be implementing.</td>
<td>Included in construction and operation cost.</td>
</tr>
<tr>
<td>Aircraft hazards from transmission lines and towers.</td>
<td>• Install towers and lines to minimize risk for avian hazards.</td>
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<td>EDEPC Project Manager in collaboration with PGESCo Site Manager.</td>
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<tr>
<td>Induced effects from electromagnetic fields.</td>
<td>• Install deflectors on lines in areas with potential for bird collisions.</td>
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<td>Impaired cultural or aesthetic resources because of visual impacts.</td>
<td>• Select ROW to avoid airport flight paths.</td>
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<td>• Install markers to minimize risk of low-flying aircraft.</td>
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<td>• Select ROW to avoid areas of human activity.</td>
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<td>• Select ROW to avoid sensitive areas, including tourist sites and vistas.</td>
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<td>• Construct visual buffers.</td>
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<td>• Select appropriate support structure design, materials, and finishes.</td>
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<td>• Use lower voltage, DC system, or underground cable to reduce or eliminate visual impacts of lines, structures, and ROWs.</td>
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During Construction and Operation

Visual inspections of the materials being used, the construction practices and mitigation measures.
Short-term monitoring to assure that negative land use and/or ecological impacts are avoided and proper mitigation measures are employed. Occurs along the line as it is constructed. Monitoring of ROW maintenance activities to assure proper control methods.

Egyptian Electricity Transmission Company (EETC) EDEPC Project Manager in collaboration with PGESCo Site Manager.

Effects on environment and human resources involved (negative land use, ecological damage) Degree to which they are affected.
Weekly (during construction). Maintenance time (during operation)
Environmental training and management will be warranted for ROW maintenance techniques, including the proper use of chemical and mechanical cleaning methods. Training will be conducted by EETC and EDEPC/PMU with assistance from environmental consultant. Staff workers should have an understanding of the rational for the recommended mitigation and monitoring that they may be implementing.

Included in construction and operation cost.
## Table 7 (Contd.)

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<td></td>
<td>Induced secondary</td>
<td>Provide comprehensive</td>
<td>During</td>
<td>Egyptian</td>
<td>Effects on</td>
<td>Weekly (during construction).</td>
<td>Environmental training and management will be warranted for ROW maintenance techniques, including the proper use of chemical and mechanical cleaning methods. Staff workers should have an understanding of the rational for the recommended mitigation and monitoring that they may be implementing.</td>
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<td>development during</td>
<td>plans for handling induced</td>
<td>Construction</td>
<td>Electricity</td>
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<td>construction in the</td>
<td>development.</td>
<td>and Operation</td>
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<td>Induced secondary</td>
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<td>Effects on</td>
<td>Weekly (during construction).</td>
<td>Environmental training and management will be warranted for ROW maintenance techniques, including the proper use of chemical and mechanical cleaning methods. Staff workers should have an understanding of the rational for the recommended mitigation and monitoring that they may be implementing.</td>
<td>Included in construction and operation cost.</td>
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Egyptian Electricity Transmission Company (EETC)  EDEPC / PMU / EMS  
EEHC management  
EDEPC Project Manager in collaboration with PGESCO Site Manager.
Table 8

**Summary of Implementation Cost of the ESMP**

<table>
<thead>
<tr>
<th>No.</th>
<th>Phase of Implementation</th>
<th>Cost in US$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Construction Phase</td>
<td>1755 K (upper limit)</td>
</tr>
<tr>
<td>2</td>
<td>Operation Phase</td>
<td>90 K annually (included in operation cost)</td>
</tr>
</tbody>
</table>

Total (Construction Phase) 1755 K

178. Table 8 shows that 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.

7.2 MONITORING PROGRAM

**Stack Emissions**

179. 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 PM10.

180. The automatic monitoring system used will be linked in the controlling room to an alarm system to warn when emission limits (as stated in Section 2) for each pollutant are being approached.

181. 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 (as given in Section 2). 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, SO₂ and TSP Analyzer**

182. The use of a continuous NOx, SO₂, CO and TSP analyzer allows for baseline air quality monitoring on a continuous basis. The provision of two continuous monitors (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.

183. The construction and operational monitoring of air quality around the Nuweiba power project will include the parameters summarized in Table 9.
Aquatic Environment

184. 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).
### Table 9

**Monitoring Program for Ambient Air Quality, Noise and Vibration**

<table>
<thead>
<tr>
<th>Item</th>
<th>Monitoring Parameters</th>
<th>Sampling Frequency</th>
<th>Monitoring Locations</th>
<th>Indicative Cost Estimate (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Construction Phase</strong></td>
<td></td>
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</tr>
<tr>
<td><strong>Air Quality</strong></td>
<td>Dust emissions caused by construction activities, construction vehicle movements, and transport of friable construction materials.</td>
<td>Quarterly during most of the construction period.</td>
<td>On site of the project and its surroundings.Continuous monitoring during 6 months ahead of commissioning.</td>
<td>Measurement cost: US$70K Approx. US$ 1000-1500K</td>
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<td></td>
<td>NO\textsubscript{2}, SO\textsubscript{2}, CO, TSP and PM\textsubscript{10}.</td>
<td></td>
<td>2 locations minimum: at maximum predicted pollution concentration and downwind. Third location, if any, will be 1 km upwind.</td>
<td></td>
</tr>
<tr>
<td><strong>Noise</strong></td>
<td>Decibels (dB) A</td>
<td>Quarterly</td>
<td>6 locations minimum: at nearest residences</td>
<td>Third party noise measurement costs (~US$ 23k)</td>
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<tr>
<td><strong>Operation Phase</strong></td>
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<tr>
<td><strong>Air Quality</strong></td>
<td>Emissions from stack are not expected to exceed standards.</td>
<td>Continuous and/or 24 hour average.</td>
<td>2 locations minimum: at maximum predicted pollution concentration and downwind. Third location, if any, will be 1 km upwind.</td>
<td>Included in the plant operation</td>
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<td>Automatic monitoring of stack emissions for NO\textsubscript{x}, SO\textsubscript{2}, particulate matter and carbon monoxide (CO) via test ports installed in the main stack. In addition, conduct surrogate performance monitoring.</td>
<td>Continuous and/or passive samples every 2/4 weeks</td>
<td>The analyzer stations will be electronically connected to the plant controlling room and EDEPC Chairman’s office.</td>
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<td>Install (at least) two continuous NO\textsubscript{x}, SO\textsubscript{2}, CO, PM\textsubscript{10} &amp; 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).</td>
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<tr>
<td><strong>Noise</strong></td>
<td>Bi-annually to annually</td>
<td>6-10 sites at nearest receptors and fence around the plant</td>
<td>Noise audit US$ 10-20K (included in operation cost) Third party (e.g. NRC) Measuring instruments and equipment.</td>
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</table>
185. The operational monitoring of cooling water and effluent discharge will include the parameters summarized in Table 10 below.

Table 10

Monitoring of the Aquatic Environment During Operation

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

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

186. Monitoring data will be analyzed and reviewed at regular intervals and compared with Egyptian and World Bank guidelines (as given in Section 2). 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

187. 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

188. In order to ensure that the views and interests of all project stakeholders are taken into accounts, public consultation will be carried out according to the EEAA guidelines which require coordination with other government agencies involved in the EIA, obtaining views of local people and affected groups. This consultation will be undertaken as part of the Environmental Impact Assessment process.

189. The objectives of consultation and disclosure are to ensure that all stakeholders and interested parties, are fully informed of the proposed project, have the opportunity to voice their concerns and that any issues resulting from this process are addressed in the EIA and incorporated into the design and implementation of the project.

190. The adopted methodology for the public consultation, which conforms with the EIB, WB & AfDB requirements, comprises 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.

191. As far as public disclosure is concerned, major initiatives to inform the public and interested parties about the Nuweiba Power project include 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.

192. The full methodology for consultation and disclosure is presented in the project’s Public Consultation and Disclosure Activities (PCDA), given in Annex B. The purpose of the activities is to establish the process by which EDEPC/NPP will consult and involve stakeholders in the planning, development, construction and operation of the power plant.
193. During the preparation of an ESIA-Report for local permitting requirements, PGESCo, EEHC and EDEPC undertook consultations with a variety of organizations to assist them in the identification of environmental and social concerns and the overall development of the project. These stakeholders included the Egyptian Electricity Holding Company (EEHC), East Delta Electricity Production Company (EDEPC), Egyptian Environmental Affairs Agency (EEAA), the South Sinai Governorate and the Administrative City Council of Nuweiba Zone, Egyptian General Authority for Shore Protection, Hydraulics Research Institute and local population leaders.

194. The purpose of these consultations was primarily to provide information regarding the project, identify published and non-published sources of relevant data and information relating to the site and surrounding area, obtain views on the scope of the project, and open channels for ongoing discussions.

195. A series of scoping mini-meetings for this ESIA undertaken by PGESCo in collaboration with the EEHC and EDEPC, took place, during which a wide selection of personnel from different orientations contributed actively to their activities.

139. The key objectives of this consultation were to identify primary and secondary stakeholders, ensure that they had received sufficient information about the project during earlier PGESCo/EEHC/EDEPC consultation activities and to identify their immediate concerns.

196. In addition to the scoping mini-meetings, several other meetings were held with some particular affected stakeholders for taking their viewpoints into consideration.

197. The key environmental issues raised during this consultation process are summarized in Table 11 and these issues were subsequently taken into account in the preparation of ESIA documentation both for local permitting requirements and ESIA report.

198. The main results of phase 1 consultation was to successfully raise the level of local awareness about the plant, to identify the immediate local concerns and to seek stakeholder involvement in the implementation of the project.
### Key Issues Raised During ESIA Scoping and Public Consultation Meetings

<table>
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<tr>
<th>Key issue discussed</th>
<th>Comments</th>
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<td>Overall Project</td>
<td>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.</td>
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<td>Social and Economic Impact</td>
<td>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 &amp; its surroundings because many of project's employment in the Nuweiba Region &amp; entire South Sinai have been drawn from the outside of the area.</td>
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<td>Land Acquisition/ Compensation</td>
<td>There was a clear and common appreciation when fair compensation rules were explained.</td>
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<td>Waste water discharge and the aquatic environment</td>
<td>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.</td>
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<td>Cooling Water</td>
<td>Representative of the National Institute for Oceanographic Studies &amp; 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.</td>
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| 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. |
199. Phase II of the public consultation and disclosure process included the disclosure of information about the project (advertisement, invitation including a copy of the Non-Technical Summary, in Arabic, and public access to the Draft Final ESIA Report) and organization of a public meeting.

200. A public meeting will be held in the Sharm El-Sheikh / South Sinai Governorate on Wednesday, 15th April 2009. The aim of the meeting is to present and explain the results of the Draft Final ESIA Report to local stakeholders, to provide them with the opportunity to raise any further or additional concerns and to ensure that all issues are taken into account in the Final ESIA Report and corresponding ESMP.

201. The key environmental issues that will be raised during this public consultation meeting will be added also to Table 11.

**Ongoing Consultation and Disclosure**

202. 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.

203. The process and results of the public consultation activities held to date are documented in the EISA, Chapter 9 and Annexes A and B.

204. All issues have been taken into account and addressed in the ESIA through assessment and the inclusion of mitigation, management and monitoring requirements which are detailed within the ESMP.

9. **RESPONSIBILITIES AND INSTITUTIONAL ARRANGEMENTS**

9.1 **Environmental Management Organization**

**During Design and Construction**

205. 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.

206. 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.

207. Implementation of these measures will be enforced by PMU/EMS and the Assistant Plant Manager and supervised by the Assistant Plant Manager,
supported by EDEPC Project Manager in collaboration with PGESCo Site Manager, who will have direct responsibility for the Environment, Safety and Quality Assurance program on site during construction and operation. The Assistant Plant Manager is responsible for ensuring that construction works comply with the requirements of the ESMP and all environmental permits. His key roles will be to:

- assume the interface with authorities for environmental authorizations and permits;
- act as the Assistant Plant Manager for local authorities, industrial and commercial interests and any other interested parties;
- ensure that mitigation measures to reduce impacts during the construction phases are implemented;
- ensure that monitoring to be undertaken during construction is implemented;
- ensure compliance with the environmental and social management plan; and
- ensure that health and safety requirements are respected.

During Power Plant Operation

208. During operation, direct responsibility for environmental compliance and the implementation of the mitigation, management and monitoring measures described in this Summary and in Section 7 of the Main Report, 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.

209. The Assistant Plant Manager will be based at the site and will be responsible for recruiting, training and managing his staff. He will be responsible for implementing the mitigation and management measures described above and for monitoring and record keeping of the following:

- stack emissions;
- air quality;
- noise emissions;
- quality of water discharge; and
- waste management.

210. In his role, the Assistant Plant Manager will also be responsible for maintaining any pollution control equipment and for developing and implementing procedures for safe handling and storage of any hazardous materials used on site.

211. Chemicals used during plant operation are process-related. Hazardous chemicals to be used include chlorine and sulfuric acid. Handling, storage and application of these chemicals will be used under strict regulations of handling hazardous materials stipulated by Law 4/1994.
212. The Assistant Plant Manager will also have lead responsibility for maintaining a written Environmental Register with respect to environmental impacts as required under Egyptian, EIB, AfDB and International / WB guidelines. The written records will identify the characteristics of discharges and emissions, details of periodic testing including results, procedures for follow-up environmental safety actions and the person in charge of this follow-up. Should any prescribed standards be breached, PMU/EMS, through the Assistant Plant Manager, will immediately inform the EEAA and disclose the procedures being taken to rectify non-conformity.

213. Results of environmental monitoring as described above, shall be recorded and submitted to the EEAA, EEHC and to any other party (i.e. EIB, AfDB etc.) as required. The EEAA, EIB and AfDB are entitled to audit the project company in order to ensure conformity with environmental standards and requirements.

214. In addition, the project company must keep a record of any significant environmental incidents occurring at the plant including accidents and occupational illnesses, spills, fires and other emergencies. The Assistant Plant Manager will be responsible for ensuring that these records are maintained up to date and are available on site.

215. The Assistant Plant Manager will supervise and lead the Environmental Department (ED) and the Environmental Management Staff (EMS) directed by the ED. Figure 7 illustrates the organization of the EMS.

9.2 Environmental Training

216. 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.

217. Training will include:
• induction training on appointment;
• specialist training (as required for their prescribed job role); and
• refresher training as required.
Figure 7
Environmental Management Staff (EMS) within the Project Management Unit (PMU)

Prior to Operation

- Nuweiba PROJECT MANAGER
- PMU
- Assistant Project Manager
- Engineering Consultant (PGESCo)
- Head of Environmental Management Staff (EMS) (2-3 staff members)
- Implementation of ESMP Measures
- Environmental Monitoring & Reporting
- Data Collection for Physical Environmental Condition to Support Engineering
- Environmental Data Collection & Analysis

During Operation

- EEHC’s Chairman
- EEHC Executive Board Member for Studies
- EEHC Head of Environmental Sector
- Assistant Plant Manager
- Head of Environmental Department (2-3 staff members)
  - Air Quality Monitoring
  - Noise Monitoring
  - Water Effluents Monitoring
  - Occupational Health & Safety
  - Environmental Management & Emergency Procedures

EEHC's Executive Board Member for Studies
EEHC's Head of Environmental Sector
EEHC's Executive Board Member for Studies
EEHC's Head of Environmental Sector
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EEHC's Executive Board Member for Studies
EEHC's Head of Environmental Sector
218. The training program will be designed to ensure that appropriate skilled staff are used to operate the power plant at all times. Aspects of occupational health and safety and emergency procedures are described below.

219. 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. They will receive training in the following:

- day-to-day monitoring activities;
- monitoring the stack emissions;
- collection and analysis of air quality data;
- monitoring the water effluents;
- collection and analysis of water quality information;
- use of monitoring equipment, operation and maintenance;
- industrial hygiene;
- occupational health and safety; and
- emergency and contingency procedures.

Table 12 illustrates the recommended training for the EMS.

9.3 Occupational Health and Safety

220. 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. The policies and procedures will also be designed to comply with all manufacturers safety data sheets for chemical storage and usage, so as to provide a safe and healthy working environment.

221. Occupational health and safety programs will be supported by staff training for the power plant and the appointment of the Assistant Plant Manager. The training will include, but will not be limited to, the following:

- general area safety;
- specific job safety;
- general electrical safety;
- handling of hazardous materials;
- entry into confined spaces;
- hearing conservation;
- repetitive stress disorders;
- Code of Safe Practices;
- use of personal protective equipment; and
- first-aid.
Table 12

Recommended Training Required for the PMU/EMS

<table>
<thead>
<tr>
<th>Training Course</th>
<th>Contents</th>
<th>Type of Training</th>
<th>Participants</th>
<th>Proposed Scheduling</th>
<th>Cost Estimate (L.E.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General EHS Training:</td>
<td>• General operation of the power plant.</td>
<td>Classroom and On-job training.</td>
<td>All power plant staff, including EMS.</td>
<td>Once before project implementation and during operation for refresher training.</td>
<td>Included in construction &amp; operation cost. (around US$ 145 k)</td>
</tr>
<tr>
<td>• Induction Training on Appointment</td>
<td>• Specific job roles and procedures.</td>
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<tr>
<td>• Specialist Training</td>
<td>• Occupational Health &amp; Safety:</td>
<td></td>
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<tr>
<td>• Refresher Training (as required)</td>
<td>• general area safety;</td>
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<td></td>
<td>• specific job safety;</td>
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<td>• general electrical safety;</td>
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<td>• handling of hazardous materials;</td>
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<td>• entry into confined spaces;</td>
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<td>• hearing conservation;</td>
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<td>• repetitive stress disorders;</td>
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<td>• Code of Safe Practices;</td>
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<td>• use of personal protective equipment;</td>
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<td>and</td>
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<td></td>
<td>• first-aid.</td>
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<tr>
<td></td>
<td>• Contingency Plans &amp; Emergency Procedures.</td>
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<tr>
<td>Special Environmental Training on Environmental Aspects of Power Generation and Monitoring.</td>
<td>• Allover Environmental Performance of the P.P.</td>
<td>Classroom and On-job training.</td>
<td>EMS. (2-3 staff members)</td>
<td>Once before project implementation and monitoring program.</td>
<td>Included in construction &amp; operation cost. (around US$ 10 k)</td>
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<tr>
<td></td>
<td>• Day-to-day monitoring activities.</td>
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<td></td>
<td>• Monitoring the stack emissions.</td>
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<td></td>
<td>• Collection &amp; analysis of air quality data.</td>
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<td>• Monitoring the water effluents.</td>
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<td>• Collection &amp; analysis of water quality information.</td>
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<td></td>
<td>• Use of monitoring equipment, operation and maintenance.</td>
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<td></td>
<td>• Industrial Hygiene.</td>
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<tr>
<td>Environmental Auditing and Inspection, including periodic safety audits</td>
<td>• Environmental Auditing Techniques.</td>
<td>Classroom and Field Exercises.</td>
<td>EMS.</td>
<td>Once after project implementation</td>
<td>Included in operation cost. (around US$ 10 k)</td>
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<td></td>
<td>• Auditing Checklists.</td>
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<td>• Environmental Auditing Reports.</td>
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<td></td>
<td>• Safety Audits:</td>
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<td></td>
<td>- Physical inspections;</td>
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<td>- Review of plant records;</td>
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<td>- Interviews with staff.</td>
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<tr>
<td>Social Communications</td>
<td>• Communications Skills.</td>
<td>Classroom and Field Exercises.</td>
<td>EMS.</td>
<td>Once before project implementation and monitoring program.</td>
<td>Included in construction &amp; operation cost. (around US$ 10 k)</td>
</tr>
<tr>
<td></td>
<td>• Mass Communications.</td>
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</tbody>
</table>
222. The training will include induction courses when staff are first employed at the power plant, with specialist and refresher training as required by the job role. Training will be updated annually and occupational health and safety procedures will be included within the Operations Manual for the power plant.

223. The safety record at the power plant will be reviewed each month at a formal meeting, led by the Assistant Plant Manager, where the agenda items, comments and attendance will be recorded and kept on file.

224. In addition, periodic safety audits will be conducted to verify compliance with safe working practices, which will comprise physical inspections, review of plant records and interviews with staff. The audits will assign responsibility for any corrective action necessary to mitigate a potential hazard and allow the tracking of the completion of the corrective measure.

9.4 Emergency Procedures and Accident Response

225. 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.

Accident Response

226. As part of the preparation of emergency procedures and the plans for accident response arrangements, the project company will carry out the following:

- Review industry-specific and Egyptian and International / World Bank standards and regulations;
- Establish general guidelines on potential safety and accident risks;
- Prepare job-specific operating instructions where appropriate;
- Establish safety and security notices for hazardous materials;
- Prepare specific emergency operating instructions;
- Provide protective equipment (including clothing, air and ear protection etc.) as required;
- Evaluate information and feedback from employees; and
- Record and investigate all accidents, injuries and incidents.

227. 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**

228. 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.

229. Light fuel oil will be delivered to the site by road and stored in:
• two 2,000 m³ tanks for the light fuel oil (oil no. 2 / sollar).

230. These tanks are surrounded contained within separate retention area which is designed to contain 110% of one tank.

175. The plan will cover the following activities.
• delivery;
• handling;
• spills; and
• cleanup.

231. The plan will detail procedures, responsibilities, chains of command, information flows, monitoring and documentation. **Table 4** presents institutional arrangements for the Nuweiba power project.

10. **IMPLEMENTATION SCHEDULE AND REPORTING**

232. 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**

233. 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.

234. 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.
235. 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.

236. 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 impact will not be significant.

12. REFERENCES AND CONTACTS

References and Documents Consulted


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47. MB Consultant (September 2008): *Noise Prediction for Nuweiba Combined Cycle Power Project,* Ain Shams University, Faculty of Engineering.


51. Prof. Dr. Osama A. Aly (September 2008): Assessment of Water Quality Along Selected Sites for the Construction of Electric Generation Station at Nuweiba, National Research Center.


Contacts

237. Key persons contacted for comments or further information include the following:

- Chairman of the EEHC: Dr. Mohamed Awad
- Executive Board Member for Planning, Research and Service Companies Affairs: Dr. Kamel Yassin
- Chairman of EDEPC: Eng. Tarek Youssef Ali
- Managing Director for Environmental Management and Studies; EEHC: Eng. Maher Aziz Bedrous
- Project Manager of PGESCo: Dr. Eng. Emad Akkoush
- Assistant Project Manager of PGESCo: Dr. Eng. Ahmed Younes
Annex I

CHANCE FIND PROCEDURES

Chance find procedures will be used as follows:

(a) Stop the construction activities in the area of the chance find;
(b) Delineate the discovered site or area;
(c) Secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be present until the responsible local authorities and the equivalent take over;
(d) Notify the supervisory Engineer who in turn will notify the responsible local authorities and the General Authority of Antiquities immediately (within 24 hours or less);
(e) Responsible local authorities and the General Authority of Antiquities would be in charge of protecting and preserving the site before deciding on subsequent appropriate procedures. This would require a preliminary evaluation of the findings to be performed by the archaelogists of the General Authority of Antiquities (within 72 hours). The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage; those include the aesthetic, historic, scientific or research, social and economic values;
(f) Decisions on how to handle the finding shall be taken by the responsible authorities and the General Authority of Antiquities. This could include changes in the layout (such as when finding an irremovable remain of cultural or archeological importance) conservation, preservation, restoration and salvage;
(g) Implementation for the authority decision concerning the management of the finding shall be communicated in writing by the General Authority of Antiquities; and
(h) Construction work could resume only after permission is given from the responsible local authorities and the General Authority of Antiquities concerning safeguard of the heritage.

These procedures must be referred to as standard provisions in construction contracts, when applicable. During project supervision, the Site Engineer shall monitor the above regulations relating to the treatment of any chance find encountered are observed.
## Annex II

### LIST OF EIA AND SOCIAL ASSESSMENT TEAM MEMBERS

<table>
<thead>
<tr>
<th>Position</th>
<th>Name</th>
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<tbody>
<tr>
<td><strong>PGESCo</strong></td>
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<tr>
<td>Project Manager</td>
<td>Dr. Eng. Emad Akkoush</td>
</tr>
<tr>
<td>Assistant Project Manager</td>
<td>Dr. Eng. Ahmed Younes</td>
</tr>
<tr>
<td><strong>Local Consultants</strong></td>
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</tr>
<tr>
<td>Atmospheric Dispersion Modeling</td>
<td>ECG Air Quality Dept.</td>
</tr>
<tr>
<td>Specialist</td>
<td>ECG Socio-economic Studies Dept.</td>
</tr>
<tr>
<td>Socio-economic Specialist</td>
<td>Dr. Mahmoud Hussein</td>
</tr>
<tr>
<td>Terrestrial &amp; Marine Ecology</td>
<td>National Research Center</td>
</tr>
<tr>
<td>Air Quality Measurements</td>
<td>Al-Azhar University, Faculty of Engineering</td>
</tr>
<tr>
<td>Water Quality Measurements</td>
<td>Dr. Mohamed Youssry and the team</td>
</tr>
<tr>
<td>Traffic &amp; Transport</td>
<td>MB. Consultant</td>
</tr>
<tr>
<td></td>
<td>Consulting team of the Firm</td>
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<tr>
<td>Noise &amp; Vibration</td>
<td></td>
</tr>
<tr>
<td>Geology, Geomorphology,</td>
<td>CSC Consulting Firm</td>
</tr>
<tr>
<td>Geohydrology &amp; Seismicity</td>
<td>Geological Special team</td>
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<tr>
<td>Risk Assessment</td>
<td>EcoConServe</td>
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<tr>
<td></td>
<td>Quantitative Risk Assessment team</td>
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<tr>
<td>Hydraulics Studies &amp; Modeling</td>
<td>Hydraulics Research Institute</td>
</tr>
<tr>
<td></td>
<td>Eng. Ibrahim El-Dessouki and the team</td>
</tr>
<tr>
<td><strong>EEHC Supervisor</strong></td>
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<tr>
<td>Head of Environment Management</td>
<td>Eng. Maher Aziz Bedrous</td>
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<td>and Studies Sector</td>
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