

**Arab Republic of Egypt
Ministry of Electricity and Energy
Egyptian Electricity Holding Company
East Delta Electricity Production Company**

**EL-AIN AL-SOKHNA
٢x٦٥٠ MWe GAS/OIL
THERMAL POWER PROJECT**

***Environmental and Social
Impact Assessment***

EXECUTIVE SUMMARY

**FINAL REPORT
Volume - II(A)**

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The full report is available at EEHC's premises.

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EL-AIN AL-SOKHNA ٢x٦٥٠ MWe GAS/OIL THERMAL POWER PROJECT

Environmental and Social Impact Assessment

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ABBREVIATIONS AND ACRONYMS

ASPP	Ain Sokhna Power Plant
BOD	Biochemical Oxygen Demand
BPIP	Building Profile Input Program
CAA	Competent Administrative Authority
CAPMAS	Central Agency for Public Mobilization and Statistics
EDEPC	Cairo Electricity Production Company
COD	Chemical Oxygen Demand
CWDS	Circulating Water Discharge Structure
DCS	Distributed Control System
DO	Dissolved Oxygen
DS	Dissolved Solids
EAAQLs	Egyptian Ambient Air Quality Limits
EDEPC	East Delta Electricity Production Company
EEA	Egyptian Electricity Authority
EEAA	Egyptian Environmental Affairs Agency
EEHC	Egyptian Electricity Holding Company
EGSMA	Egyptian Geological Survey and Mining Authority
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
ENIT	Egyptian National Institute of Transport
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
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 Production
GIS	Gas-Insulated Switchgear

HCM	Highway Capacity Manual
HFO	Heavy Fuel Oil
HGVs	Heavy Goods Vehicles
LFO	Light Fuel Oil
LOS	Level of Service
MWRI	Ministry of Water Resources & Irrigation
MSDSs	Material Safety Data Sheets
MWe	Mega-Watt electrical
NFRA	National Fire Protection Authority
NRIAG	National Research Institute for Astronomy and Geophysic
OSHA	Occupational Safety and Health Administration
PCBs	Polychlorinated Biphenyls
PCDA	Public Consultation and Disclosure Activities
pcph	passenger car per hour
RIGW	Research Institute for Ground Water
SGPP	Suez Gulf (BOOT) Power Plant
SS	Suspended Solids
STG	Steam Turbine Generator
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
TSS	Total Suspended Solids
TWA	Time-Weighted Average
vph	vehicle per hour

EL-AIN AL-SOKHNA ٢x١٥٠ MWe GAS/OIL THERMAL POWER PROJECT

Environmental and Social Impact Assessment

EXECUTIVE SUMMARY

١. INTRODUCTION

١.١ Background

١. Engineering Consultants Group (ECG), a private 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 World Bank Group (WB) and the African Development Bank (AfDB) concerning the Environmental and Social Assessment of the El-Ain Al-Sokhna Power Project.

٢. EEHC is seeking financial assistance from the WB & the AfDB for the construction and operation of this ٢x١٥٠ MWe, dual fuel power plant. The proposed plant is designated as a Category A project under WB & the AfDB rules and a Category C project under the Egyptian environmental regulations and therefore requires a full Environmental Impact Assessment. Financing from WB & the AfDB is conditional upon obtaining the environmental clearance from all the Egyptian regulatory authorities, the WB & the AfDB.

١.٢ Project Overview

٣. East Delta Electricity Production Company (EDEPC), a company incorporated in Egypt and affiliated to the Egyptian Electricity Holding Company (EEHC) proposes to construct and operate a new thermal power plant at El-Ain Al-Sokhna, which is along the Suez Gulf and about ٥٢ km south of the city of Suez on the western coast of the Suez Gulf. The site is within an existing piece of land allocated to previous Egyptian Electricity Authority (EEA) (today EEHC) by the Presidential Decree No. ٢٩٩ of the year ١٩٩٩. The overall proposed site area is approximately ٢٧٥,٠٠٠ m².

٤. The proposed power plant will consist of two supercritical thermal steam units, each with a nominal electricity generating capacity of ١٥٠ megawatts (MWe), which will be known as El-Ain Al-Sokhna Power Plant. The overall generating capacity of the power plant will be ٣٠٠ MWe. The power plant is intended to be operational by the end of the year ٢٠١٢/٢٠١٣. The power output from the proposed plant will be sold to the Egyptian Electricity Transmission Company (EETC).

٥. The power plant will utilize natural gas as its primary fuel, delivered to the site via an existing pipeline to be operated by "City Gas", and also have the capability to operate using mazout (heavy fuel oil). The ability to "dual-fuel" the power plant (with natural gas or mazout) will provide security of electricity supply in the event that gas supplies are unavailable for any reason. In addition, a small emergency generator, for the plant safe shut down, operating on solar oil (light fuel 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, and solar oil will also be able to be used, if required, to operate the auxiliary boiler during start-up.

٦. The power plant will incorporate a direct (once through) cooling system using water abstracted from the Suez Gulf. The abstracted water will also be used, following pre-treatment demineralization and desalination, to provide process water make-up in the boiler system. Potable water supplies will be drawn from the same existing supply system for the Suez Gulf BOOT power plant.

٧. 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 Suez 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.

٨. The site is bordered to the south by the ٢ x ٣٤١,٢٥ MWe Suez Gulf BOOT power plant on the rest of the land area that was allocated to the Egyptian Electricity Authority (EEA) (today EEHC) by the Government of the Arab Republic of Egypt. EEA have granted exclusive rights of use of that adjacent land to the BOOT project company. The site of the proposed power plant is shown on *Figure ١*. Also, *Figure ٢* depicts this location within the context of the Suez Governorate. *Figure ٣* illustrates a general view of the proposed site land.

Figure ١

Location of Proposed El-Ain Al-Sokhna Power Plant

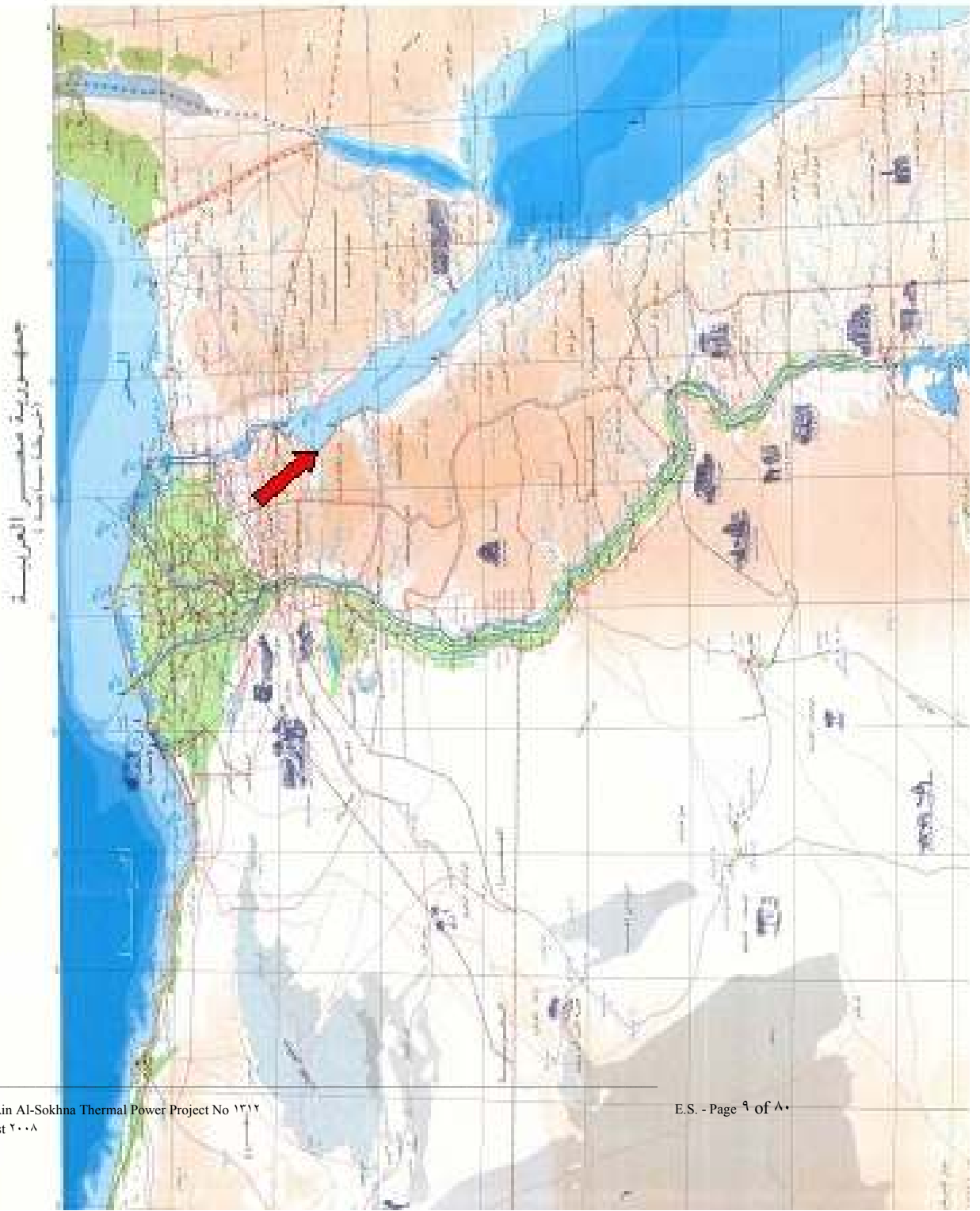


Figure ٢

Location of the Proposed Site within the Context of the Suez Governorate



Figure ٣

General View for the Proposed Site Land



٢. THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

٢.١ Contributors to the EIA Report

٩. The Environmental and Social Impact Assessment (ESIA) report is prepared by ECG, a private 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 ECG 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 ECG, for preparing the ESIA report for local permitting purposes and financing requirements. All such documentations were reviewed by ECG and cleared for inclusion in this report. Most of the relevant local permits for the construction of the power plant have now been received.

٢.٢ Scope of the ESIA Report: Legal and Administrative Framework

٢.٢.١ *Government of Egypt Requirements*

١٠. Beginning in the ١٩٥٠s, the Government of Egypt has promulgated several laws and regulations concerning protection of the environment.

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

- Law ٤/١٩٩٤ and the Prime Minister's Decree No. ٣٣٨ of ١٩٩٥, which promulgates the Executive Regulations of Law ٤.
- Amendment to the Law ٤/١٩٩٤ promulgated by the Prime Minister's Decree No. ١٧٤١ of ٢٠٠٥ for modifying some executive regulations of the Decree No. ٣٣٨ of ١٩٩٥.
- Law No. ٩٣ for ١٩٦٢ regarding the drainage of liquid wastes, particularly sanitary drainage.
- Law of Labor No. ١٢/٢٠٠٣.
- Law No. ٣٨/١٩٦٧ amended by Law No. ٣١/١٩٧٦ on public cleanliness and collection and disposal of solid waste.

١٢. Law ٤/١٩٩٤ 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 Suez Governorate.

١٣. The Suez Governorate will send the EIA to EEAA for review and provide its opinion within ٦٠ 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.

١٤. 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.

١٥. 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 ٦, along with the actual air and water pollution levels expected from the Power Plant.

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World Bank Guidelines and Safeguard Policies

١٦. 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 ٤,٠١ (October ٣, ١٩٩١) and its updates, ١٩٩٩) 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 ٤,٠١, thermal power plant projects require a full Environmental Assessment (EA).

١٧. World Bank Environmental Safeguard Policies provide ١٠ potential issues that may need to be considered in an EA, depending on the specific characteristics of each project. *Table ١* summarizes the expected applicability of the potential Safeguard Policies to the Al-Sokhna Power Plant Project. The Safeguard Policies identified as "applicable" are those which may be triggered and thus considered "Requiring Management". When the detailed design of the Al-Sokhna Power Plant has been determined, the EDEPC should prepare project-specific plans to manage these potential impacts.

١٨. No safeguard policies were triggered except for the Environmental Impact Assessment and the Involuntary Resettlement. *Table ١* shows potential World Bank environmental Safeguard Policies and El-Ain Al-Sokhna project applicability. The table justifies the applicability or lack thereof for WB Safeguard Policies.

١٩. Annex B to Operational Directive ٤,٠١ 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.

Table 1

**Potential World Bank Environmental Safeguard Policies
and El-Ain Al-Sokhna Power Project Applicability**

No. Safeguard Policy	Applicability to El-Ain Al-Sokhna Project	Policy Triggered?	Justification
1. Environmental Assessment	Yes	Yes	<ul style="list-style-type: none"> This policy applies to all projects requiring a Category A Environmental Assessment Under OP 4.01.
2. Forest	No	No	<ul style="list-style-type: none"> All environmental and social aspects included in El-Ain Al-Sokhna project are adequately examined. El-Ain Al-Sokhna project is not likely to have significant potential (reverse) environmental risks & impacts in its area of influence (impacts on the natural environment: air, water & land; human health & safety; physical cultural resources; and transboundary and global environment concerns). No forest areas exist.
3. Involuntary Resettlement	Yes	Yes	<ul style="list-style-type: none"> This policy applies to all projects triggering OP 4.12. There may be relocation or loss of shelters along the routing of interconnecting transmission lines. There may be loss of assets or access to assets. There may be loss of income sources or means of livelihood. All activities related to the construction of the new plant will take place within on EPC land either on the site or on land directly adjacent to the site. i.e. no land acquisition. Not even temporary will result from the construction.
4. Indigenous Peoples	Yes	No	<ul style="list-style-type: none"> Experience from a number of similar power plants along the Mediterranean or Suez Gulf shore line has shown that the impacts on fisheries of the discharge of warm water into the sea waters have been positive. Consultations with the fishermen support this assertion. Impacts will be positive rather than negative, i.e. no loss of livelihood. Transmission lines which will evacuate power generated by the El-Ain Al-Sokhna power plant will extend to the west direction with a length of approximately 90 km on high voltage 220 kV to connect the power plant with existing 220 kV "South Tobin/Abu Zaabal" transmission line and to the north direction with a length of about 40 km or high voltage 220 kV via opening the existing "Kattamyah/El-Masryyah Cement" double circuit transmission line and extending it for about 40 km. Land take or resettlement may be associated to the power interconnecting lines.
5. Safety of Dams	No	No	<ul style="list-style-type: none"> The project does not affect the indigenous peoples in the project area. The project does not involve construction of a large dam. The project is not dependent upon an existing dam.
6. Pest management	No	No	<ul style="list-style-type: none"> Procurement of pesticides or pesticide application equipment is not envisaged. The project will not affect pest management in any way.

Table \ (Contd.)

**Potential World Bank Environmental Safeguard Policies
and El-Ain Al-Sokhna Power Project Applicability**

No. Safeguard Policy	Applicability to El-Ain Al-Sokhna Project	Policy Triggered?	Justification
٧. Physical Cultural Resources	Yes	No	<ul style="list-style-type: none"> Physical cultural resources are adequately examined. The El-Ain Al-Sokhna project is not likely to have any significant impact on physical cultural resources.
٨. Natural Habitats	Yes	No	<ul style="list-style-type: none"> Natural Habitats are adequately addressed and examined. The El-Ain Al-Sokhna project is not likely to have any significant impacts on natural habitats.
٩. Projects in Disputed Areas	No	No	<ul style="list-style-type: none"> The EDEPC/EEHC is not involved in any disputes over an area with any of its neighbors. The project is not situated in a disputed area.
١٠. Projects on International Waterways	No	No	<ul style="list-style-type: none"> Any component likely to be financed as part of the project is not situated in a disputed area. Cooling water abstracted from the Suez Gulf (٤٠٠٠ m³/sec.) is returned totally back to it. Actual water consumption is less than ٠.٠٧% of the abstracted water. No disturbance to the Suez Gulf waters is expected either upstream or downstream. Hydrological/hydraulic study is carried out and the study revealed that no impact is expected and the mixing zone is limited to ٧٠٠ m distance with ٠.٥ C above ambient, which diluted to ٣ C at a distance between ١٠٠ and ١٥٠ m with full compliance with Egyptian Law ٤/١٩٩٤ and WB regulations.
٢٠.			<ul style="list-style-type: none"> MWRI is in full agreement with EEHC regarding its plan for water abstraction. <p>In addition to environmental impact assessment guidelines, the World Bank has established guidelines concerning air pollution and water pollution from thermal power plants (<i>Pollution Prevention and Abatement Handbook-Part III</i> (July ١٩٩٨)). The guidelines were officially published in ١٩٨٨; since then, several sets of revisions have been proposed, most recently on March ٢٢, ١٩٩٦. The ١٩٨٨ and proposed ١٩٩٦ guidelines are discussed in Chapter ٦, 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 ٢٠٠٧ has been considered.</p>
٢١.			<p>World Bank's <i>Pollution Prevention and Abatement Handbook-Part III</i> (July ١٩٩٨) also, provides with principles of industrial pollution management, monitoring and air emission & effluent discharge requirements presented in the industry Guidelines including Guidelines for New Thermal Power Plants.</p>
٢٢.			<p>Public Consultation Process has been designed in accordance with World Bank Guidance for the Preparation of a Public Consultation and Disclosure Plan (January ١٩٩٦);</p>
٢٣.			<p>The ESIA has assessed the impacts of the construction and operation of the New El-Ain Al-Sokhna Power Plant and has also considered the</p>

cumulative air quality impacts of the plant and other existing industry in the project area, including the Suez Gulf BOOT power plant. 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.

٢٤. The ESIA report presents the full assessment of the environmental, social, health and safety impacts of the El-Ain Al-Sokhna 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.

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African Development Bank Guidelines

٢٥. 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 ١ 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 ٧ of the Environmental and Social Assessment Procedures (ESAP) for AfDB's Public Sector Operations, published in June ٢٠٠١, states that "the projects assigned to Category ١ 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".

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

- African Development Bank Group's Policy on the Environment (February ٢٠٠٤).
- Integrated Environmental and Social Impact Assessment Guidelines (October ٢٠٠٣).
- Environmental and Social Impact Assessment Procedures (ESAP) for AfDB's Public Sector Operations (June ٢٠٠١).
- Assessment Guidelines - Energy (March ١٩٩٧).
- Handbook on Stakeholder Participation (٢٢٠١).
- Disclosure of Information Policy (January ١٩٩٨).
- Environmental Assessment Guidelines (May ١٩٩٢).
- Environmental Assessment Guideline on Renewable and Non-renewable Energy (March ١٩٩٧).
- Guidelines on Involuntary Displacement and Resettlement in Development Projects (May ١٩٩٥).

٢.

GENERAL SETTING OF THE SITE: DESCRIPTION OF THE ENVIRONMENT

٢٧. The Al-Sokhna power plant site is located on the western coast of the Gulf of Suez, part of the Red Sea, approximately ٥٢ km south of Suez City, and ١,٦ km east of the Suez/Red Sea Highway, which runs parallel to the Gulf of Suez. The site is within the administrative boundary of the Suez governorate and its Ettaqa District. The site, also, is within the Suez industrial complex, an area being developed for industrial use. The area surrounding the site is locally known as the El-Ain Al-Sokhna area. The general site location is given in Figure ٥,١ (A, B & C-Landsat image of the Suez Region).

٢٨. The site is located in a developing industrial zone (Suez Gulf Development Corporation and El-Ain Al-Sokhna) and lies ١ km south of the Al-Sokhna Port which is currently under operation. The port is being developed to be a major commercial harbour facility. Areas directly to the west and south of the proposed site are being developed with a variety of heavy and light industrial activities.

٢٩. Land cover on the site consists primarily of bare sand, with scattered low-growing vegetation. No residences, agricultural activities or other significant land uses are located on the site or in its immediate vicinity and the arid nature of the area provides little opportunity for agricultural production.

٣٠. The site is located some ٥٢ km south of Suez City and is delimited by the two coordinates: Latitudes ٢٩ ٣٠' and ٣٠ ٠٠' North and Longitudes ٣٢ ٠٠' and ٣٢ ٣٠' East.

٣١. The annual average surface water temperature in the Suez Gulf site area is ٢٣,٦ C°, with a range of ١٥,٧ C (recorded in February) to ٣٠,٤ C (recorded in August). The highest monthly average surface water temperatures are ٢٧,١ C in July and ٢٨,٠ C in August.

٣٢. The project area lies within the hyperarid climatic province of Egypt characterized by a mild winter and hot summer. During ٢٠٠٦, the monthly average low temperature ranged between ١١,٥ C and ٢٦,٢ C, and the monthly average high temperature ranged between ١٨,٦ C and ٣٨,٣ C. The high temperature exceeded ٤٢ C in some summer days. During ٢٠٠٦, the average yearly temperature was around ٢٣,٩ C, and the average yearly humidity was around ٥٢,٢٥%. The air pressure is generally high all through the year; its minimum level occurs in August.

٣٣. The annual average wind speed for ٢٠٠٦ was ٤,٢٧m/sec. Wind speeds rarely exceeded ١٠ meters/second. The prevailing wind direction was generally from the North and/or North Northwest for over ٦٠% of the year.

٣٤. The land around the Gulf of Suez is generally composed of littoral salt marsh, coastal desert plain and adjoining hills; the project area lies in the coastal desert plains, These plains extend between the littoral salt marsh belt on the seaward side and the coastal range of hills and mountains on the inland side. The coastal plain is characterized by active soil transporting

agencies (water and wind). Except for the main drainage channels or deltas of wadis, the coastal plain is mostly devoid of plant and animal life.

٣٥. The only vegetation found on the project site is scattered low-growing bushes. Most of the site is bare sand. This type of habitat is not expected to provide adequate food or cover for large animals. The site probably is used by a limited number of invertebrates, reptiles, and birds.

٣٦. Bird migration generally occurs during the autumn season. During this season, large numbers of raptors migrate and pass through the northern sector of this coastal plain, including the project site. Other migratory species utilize vegetated areas of the coastal plains.

٣٧. The main transport infrastructure linking the Suez South area to the country main ports facilities is principally based on road network. The site is accessible through, at least, three main highways. The Suez/Red Sea highway runs parallel to the Gulf of Suez. The Maadi/El-Ain Al-Sokhna highway crosses the southern part of the area from northwest to southeast. The Wadi Hagul highway runs from Cairo/Suez highway southwards to connect with Maadi/El-Ain Al-Sokhna highway west of Suez Cement Factory.

٣٨. The water resources in the project area are mainly: (١) the hallow and deep aquifers in the area; (٢) Nile River, at Maadi-Helwan reach; (٣) fresh Suez Canal irrigation branch, fed from Manayyef and Ismailia Canal; and desalination of Red Sea water. Rain is generally the main source of groundwater, either for surface sedimentary aquifers (Wadi Bedaaa and Wadi Gheweiba) or for structural aquifers deeply seated. It is believed that during the alluvial time, huge quantities of fresh water were kept in the porous beds and in wadi alluvium. Aquifers along the main valleys are recharged every now and then with rainwater. Percolation occurs when rainwater runs along the slopes to the Red Sea. Wadi Bedaaa and Wadi Gheweiba have the largest watershed area and rainwater flows.

٣٩. The proposed site lies within the administrative boundary of the Suez Governorate. The Governorate of Suez has prepared an Urgent Development Plan (UDP) for land use management and planning (١٩٩٣) and its update (٢٠٠٧), in which it sets out its policy to control development in the Suez region up to ٢٠٠٠.

٤. PROJECT DESCRIPTION

٤.١ Overview of the Power Plant

٤.٠. The power plant site will occupy an area of approximately ١٢٥,٠٠٠ m², within a total allocated area of ٢٧٥,٠٠٠ m² rectangle-shaped piece of land and will include the following main elements:

- Supercritical steam power plant, comprising two generating units primarily fired by natural gas, at approximately ١٠-١١ bar gauge at the interface, but also designed to run on mazout (heavy fuel oil) in emergency situations as a secondary fuel. Each unit will consist of one outdoor supercritical

steam generator for steam generation and one supercritical steam turbine generator (STG) providing 600 MWe (nominal) electrical generation capacity per unit at the 100% of the STG output case. Each STG will be fed by steam from the respective steam generator (boiler);

- Circulating water system, with the main pumps and associated piping, the intake and discharge structures, the screening system, the chlorination system and the cathodic protection system;
- Heavy fuel oil and light fuel oil storage tanks;
- Intermediate water storage, the demineralization plant and the make up water system; and
- Power will be generated at the manufacturer's standard voltage and stepped up through main transformers to be connected to the new 200 kV GIS switchgear.

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

- Boiler Unit \ A.
- Boiler Unit \ B.
- Auxiliary Boiler.
- Steam Turbines Unit \ A.
- Elec. Bldg. Unit \ A.
- Elec. Control Bldg. Unit \ B.
- Main Transformers Unit \ A.
- Main Transformers Unit \ B.
- Aux. Transformers Unit \ A.
- Aux. Transformers Unit \ B.
- Switchyard Area.
- Diesel Generator.
- Switchgear Control Room.
- Stacks Module \.
- Fuel Gas Receiving/Reducing Station.
- Mazout Fuel Oil Unloading Pumps.
- Sollar Oil Unloading Pumps.
- Mazout Fuel Storage Tank \.
- Mazout Fuel Storage Tank \.
- Sollar Oil Unloading Pumps.
- Mazout Oil Heaters/Transfer Pumps.
- Sollar oil Storage Tank.
- 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.

٤٢. The power plant is designed to operate as a base load unit with the STG operating in sliding pressure mode up to approximately ٦٠% load and at fixed pressure for higher loads.

٤٣. The layout and main components for the power plant is presented in *Figure ٤*.

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Process Description

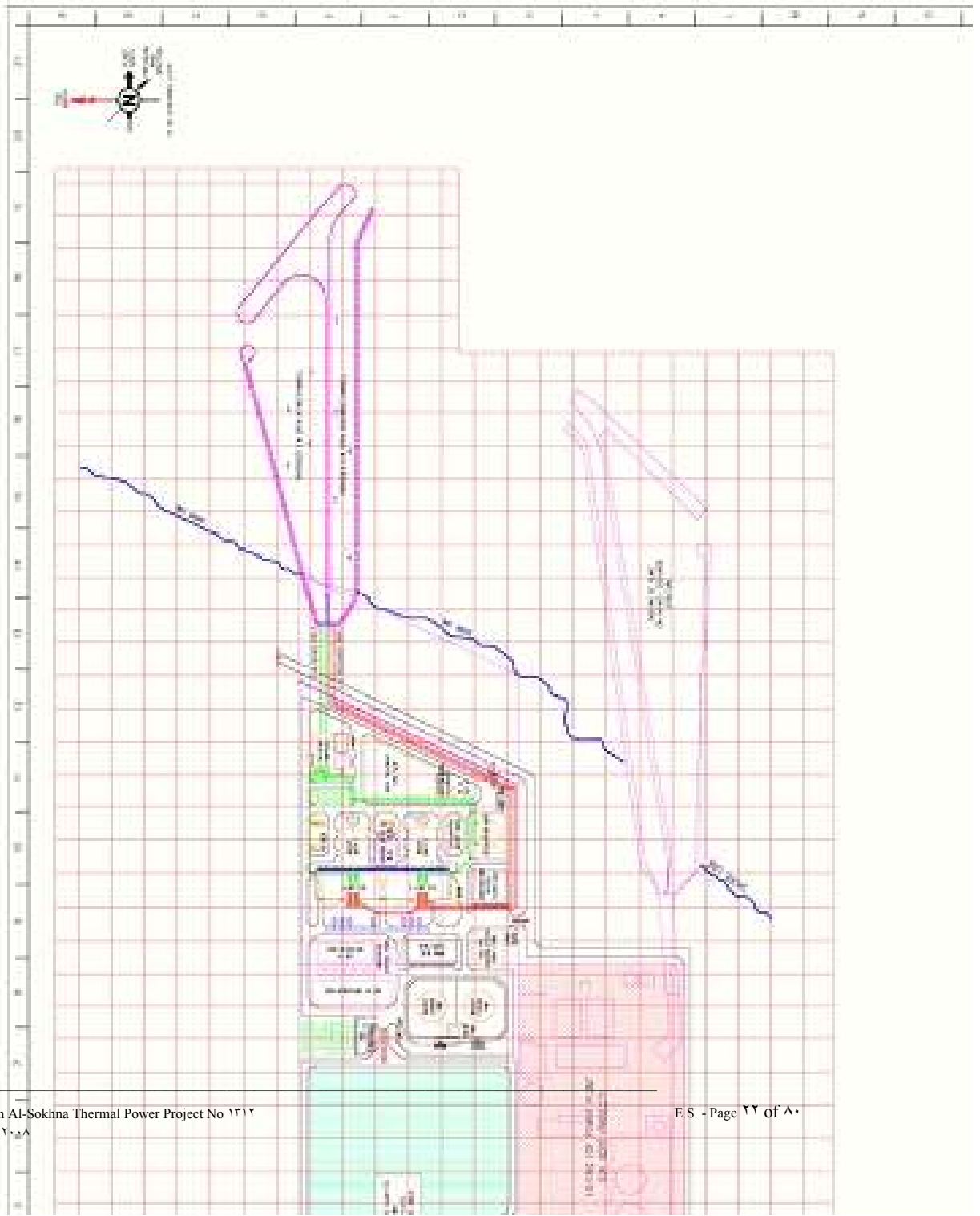
٤٤. The key steps of the generating process of the proposed power plant are as follows:

- The key inputs to the generating process are natural gas or mazout oil, which will be delivered to the site via underground pipelines (gas or mazout), together with air and water.
- Natural gas (or mazout oil when natural gas is unavailable) will be mixed with air and combusted to generate steam from demineralized water to drive two turbines serving electrical generators. The combustion of the fuel is supported by injection of air. The process results in the generation of electricity and also produces hot exhaust gases.
- The steam is cycled from the boilers through the turbines to condensers. The condensers are cooled by a direct cooling system, abstracting water from, and discharging the used effluent to, the Suez Gulf. The condensate is then returned for recirculation within the boilers.
- The final exhaust gases will be discharged to the atmosphere via a flue housed in a single stack of ١٥٠ m height for each unit in accordance with emission standards set by the EEAA. The main by-products from combustion of natural gas are carbon dioxide (CO₂), water vapour, carbon

monoxide (CO) and nitrogen oxides (NO_x). 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 mazout oil is used instead of natural gas (in emergency situations for only less than ۲% of the total operating hours), SO₂ and particulates will also be key emissions from the power plant.

Figure 4

Layout of the Proposed Power Plant



٤,٣

Operational Releases from the Power Plant

٤٥. 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 (NO_x). 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 heavy fuel oil (mazout) 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 Suez via the cooling water discharge structure at a temperature of no more than ١٦,٦ °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 ٦ and ٩.
- 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 ٠,٢ mg/l.
- Small volumes of solid wastes will be segregated, collected and disposed of by licensed waste disposal contractors.

٤٦. The power plant incorporates a range of measures to eliminate or reduce operational releases within its design and layout, such as low NO_x burners in the boilers, 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 World Bank.

٥.

ANALYSIS OF ALTERNATIVES

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Current Situation ("No Action" Option)

٤٧. The no action alternative to the proposed El-Ain Al-Sokhna power plant would result in the demand for electricity exceeding supply, with an increasing deficit as demand increases in the future. Hence the lack of a secure and reliable electricity generation and supply system, would have significant social and economic implications including constraining existing and future economic development and restricting socio-economic development. As a result, the "no action" option is not considered to be a viable or acceptable alternative to the proposed project.

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Alternative Technologies and Fuels

٤٨. On the basis of security of supply, response to demand and economic advantages, the EEHC has specified that the Al-Sokhna project should be a two gas/oil-fired supercritical steam cycle units of ٦٥٠ MWe nominal generating capacity each. The EEHC's rationale for choosing this technology in preference to other electricity generating technologies as follows:

٤٩. 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;
- pumped storage;
- wind farms; and
- integrated solar-thermal generating units.

٥٠. Other possible options include "importing electricity", "rehabilitation of existing power plants", "transmission and distribution investment" and "IPPs".

٥١. **These technological alternatives constrained by the following:**

- **Importing electricity:** Egypt is interconnected to Libya and Jordan and is exporting electricity to both countries. Interconnection to Libya has a capacity of ٣٠٠ MWe, and that of Jordan has a capacity of ٣٥٠ MWe, which was increased to ٤٥٠ MWe in ٢٠٠٦. Libya and Jordan are currently paying ٤ US\$/kWh for the Egyptian power supply. As they are net importers, there is currently not much scope for electricity imports to Egypt from the interconnected networks. In addition, the cost of electricity in both countries is much higher than that of Egypt, making it an uncompetitive alternative. There is currently no south border connection to Sudan, although there is an ongoing activities in the context of the Nile Basin Initiative (NBI) whereby Egypt could potentially import hydroelectric power starting approximately in ٢٠١٢, if the price is competitive. However, considering the abundance of natural gas and thus the low cost electricity provision in Egypt, it will be difficult for imported electricity to be competitive.
- **Renewable energy:** Current world market cost of wind based electricity is ٥,٩-٧,٣٨ US\$/kWh, whilst is ٢,١ US\$/kWh with current grant financing for wind projects, which is higher than the cost from natural gas thermal plants. Therefore, renewable energy is not competitive unless further subsidies are provided.
- **Rehabilitation of existing power plants:** EEHC has concluded that the rehabilitation option is cost effective in seven of its existing power plants,

and these sites have already been or will be rehabilitated. However, these efforts are not enough to cope with the growing demand for electricity.

- **Transmission and distribution investments:** EEHC has developed a transmission and distribution (T&D) development plan and the T&D system is optimized for the current load requirements and generation capacity. To meet the demand growth for the fast track period and medium term expansion, a T&D investment plan has been developed. New electricity generation capacity is required in the network; therefore, strengthening of T&D capacity alone will not replace the need for the generation capacity. Furthermore, T&D losses are at a relatively low level, around 10% on average, and reducing the losses further would not free up the amount of electricity supply required.
- **BOOTS/PPs:** Three BOOT projects (100 MWe each) have been built in Egypt in late 1990's and early 2000's. The government is encouraging private sector participation in order to attract private investment. However, given the worldwide reduction in investor's interest in the power sector, private financing for power generation in the near term is still unlikely.

٥٢. **Consistent with the generation expansion plan, the EEHC has stipulated that the El-Ain Al-Sokhna should be gas/oil-fired supercritical steam units of a net 1x100 MWe generating capacity. The reasons for the selection of this technology are as follows:**

٥٢. The steam cycle (SC) technology, which fires natural gas as a main fuel and mazout as a back-up fuel, has been used for decades in Egypt. The plant efficiency is around 46% with 100 MWe size drumless type super-critical steam cycle, which exceeds the similar sub-critical unit efficiency with at least 4% ratio. The investment cost of Steam Cycle Super-critical plant, based on recent worldwide market experience, is around \$ 1200/kWe (EPC basis with multiple packages). The application of large scale (1000MWe) gas turbine combined cycle (CC) technology, which fires natural gas as a main fuel and diesel fuel as a back-up fuel, has been operational since 2004. Plant efficiency exceeds 60% and the investment cost, based on recent worldwide market experience, is around \$160/kWe (EPC basis with multiple packages). Given that CC plants show lower investment cost and higher plant efficiency, there should be a distinguished rationale to justify why the SC technology has been selected for the proposed project. The reasons are the following:

- **Operational flexibility:** The EEHC plans to operate large scale (i.e., 1000 MWe) CC plants at 100% full flat base-load with a possibility of reducing operations to 20% once a week. This is because the cycling capacity of large-scale CC plants is still to be confirmed (frequent start and stop, and partial load operation capacity). Consequently, SC plants are required to take the role of reducing the load, while CC plants keep 100% full load. EEHC therefore sets the maximum proportion of CC in the generation mix to be 30-35%. As a result, the Electric Generation Expansion Analysis System (EGEAS) model selected the proposed El-EI-Ain Al-Sokhna SC plant as the most viable option based on this generation mix criteria. If the CC technology were selected, it

would exceed the limit of CC in the generation mix, requiring CC plant cycling operation beyond what it is capable of.

- Grid stability: SC turbine has bigger inertia and is therefore more stable to network disturbances. When the CC ratio is too high in the generation mix, CC may overreact to the disturbances and interfere with each other, which could cause load instability.
- Unforeseen risk of new technology: Applying a new technology to the Egyptian specific climate and environment may have unforeseen risks. For example, recently, dust and humidity caused a quick filter pressure drop in the Cairo North plant, commissioned in May ٢٠٠٤, which was not expected when the CC plant was designed.
- Fuel flexibility: SC plants use mazout as a back-up fuel, easily available domestically, while CC plants use imported diesel oil that is more expensive. Even though the back-up fuel is not expected to be used often, the SC plant has lower back-up fuel cost.
- Local manufacturing capacity: In Egypt only ٣٠% of CC plants are manufactured locally, in comparison to about ٤٠-٤٥% of SC plants manufactured locally. Therefore, the use of SC technology creates more local employment and requires less foreign exchange.

٥٤. Given this rationale, existing and planned generating capacity using gas/oil-fired combined cycle 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. As shown in Table ٣-١, almost ٢٧% of installed capacity in ٢٠٠٦/٢٠٠٧ was provided by combined cycle technology. The new combined cycle units at New Kureimat and El-Atf, Sidi Krir and New Talkha will add more ٣٠٠٠ MWe to the installed capacity within the next ٢ years. Also, declared combined cycle additions of Nuweiba on the Gulf of Aqaba will increase the combined cycle capacity by another ٧٥٠ MWe within the same period. The EEHC is implementing a process of meeting and generating increased demand through the provision of conventional steam generation plants in order to generate sufficient demand to install further CCGT capacity in the future. This will result in increased potential to incorporate more CCGT capacity.

٥٥. Hence, with the current policy to limit CC to ٣٠-٣٥% in the generation mix (as identified by EGEAS), and with urgent need of supply capacity with load following capability, SC technology has been identified as the most viable option for the El-Ain Al-Sokhna project. This will ensure operational flexibility, network stability, fuel flexibility, local job creation, and avoid unforeseen risks of applying new technologies too rapidly in Egypt.

٥٦. Natural gas has been selected as the main fuel for the power plant and compared to other fossil fuels generating technologies, steam turbine generators have a relatively low emissions of carbon dioxide (CO₂), moderate emission level of nitrogen oxides (NO_x), and lowest emissions, almost traces, of sulfur dioxide (SO₂) and particulates.

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Power Plant Design

٥٧. ٥٣. 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 (١٥٠ m) exceeds good engineering practice;
- the steam generators will be equipped with low NOx burners, 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 Suez Gulf;
- cooling water will be supplied from a sustainable water supply, namely the Suez Gulf, and the intake and outfall structures can be constructed and operated without significant impacts.

٥,٤

Alternative Sites

٥٨. The EEHC designated the proposed El-Ain Al-Sokhna site for power plant construction from a group of three alternative sites, namely: Safaga, Sharm esh-Sheikh and El-Ain Al-Sokhna. The site area was allocated to the Egyptian Electricity Authority (EEA) (today, EEHC) by the Government of Egypt (Presidential Decree no. ٢٩٩ of the year ١٩٩٩, issued on ٢١ September ١٩٩٩) and EEHC has given rights of use of the site to EDEPC. In selecting the required site, consideration was given to the following criteria:

Economic Factors:

- capital costs;
- operation and maintenance costs;
- requirement for natural gas;
- requirement for cooling water;
- demand loads for electricity; and
- requirements for electricity transmission lines and sub-stations.

Non-economic Factors:

- potential environmental impacts; and
- site development.

٥٩. Potential environmental impacts have been examined for all sites. Screening level assessment during feasibility study indicated that the level of environmental impact will be relatively constant for all three sites.

٦٠. Following negotiations with the concerned authorities, the planned location of El-Ain Al-Sokhna power plant was found to be the most cost effective site for the following reasons:

- minimal additional infrastructure would be required;
- desirable benefits for development of the site area; and
- no workers' colony is required as a local workforce is available.

٦١. In addition, the power plant will be constructed and operated on a land originally dedicated for power generation activity, thus it will not include any land take. Also, the power plant site will bring socio-economic benefits to the wider Suez Region, through employment opportunities, supply contracts and the effects of project expenditure within the local economy.

٦. KEY FINDINGS OF THE ENVIRONMENTAL IMPACT ASSESSMENT

٦.١ Introduction

٦٢. 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 and the World Bank, whichever is the more stringent.

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

- Air Quality;
- Aquatic Environment;
- Noise and Vibration;
- Flora and Fauna;
- 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.

٦٤. *Table ٣* presents environmental, health and safety issues relating to construction and operation of El-Ain Al-Sokhna power project.

٦٥. 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.

٦٦. 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.

٦٧. The conclusions of the assessment are that (with suitable mitigation measures described in *Tables ٤, ٥, ٦ and ٧*) the project is in compliance with the environmental requirements of both the Government of Egypt and the World Bank with respect to stack emissions of the new power plant, ambient air quality, discharge quality and noise. *Table ٣* 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 ٢

Environmental, Health and Safety Issues Relating to Construction and Operation of El-Ain Al-Sokhna Power Project

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

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Air Quality

Construction Dust

٦٨. 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 high in this industrial 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

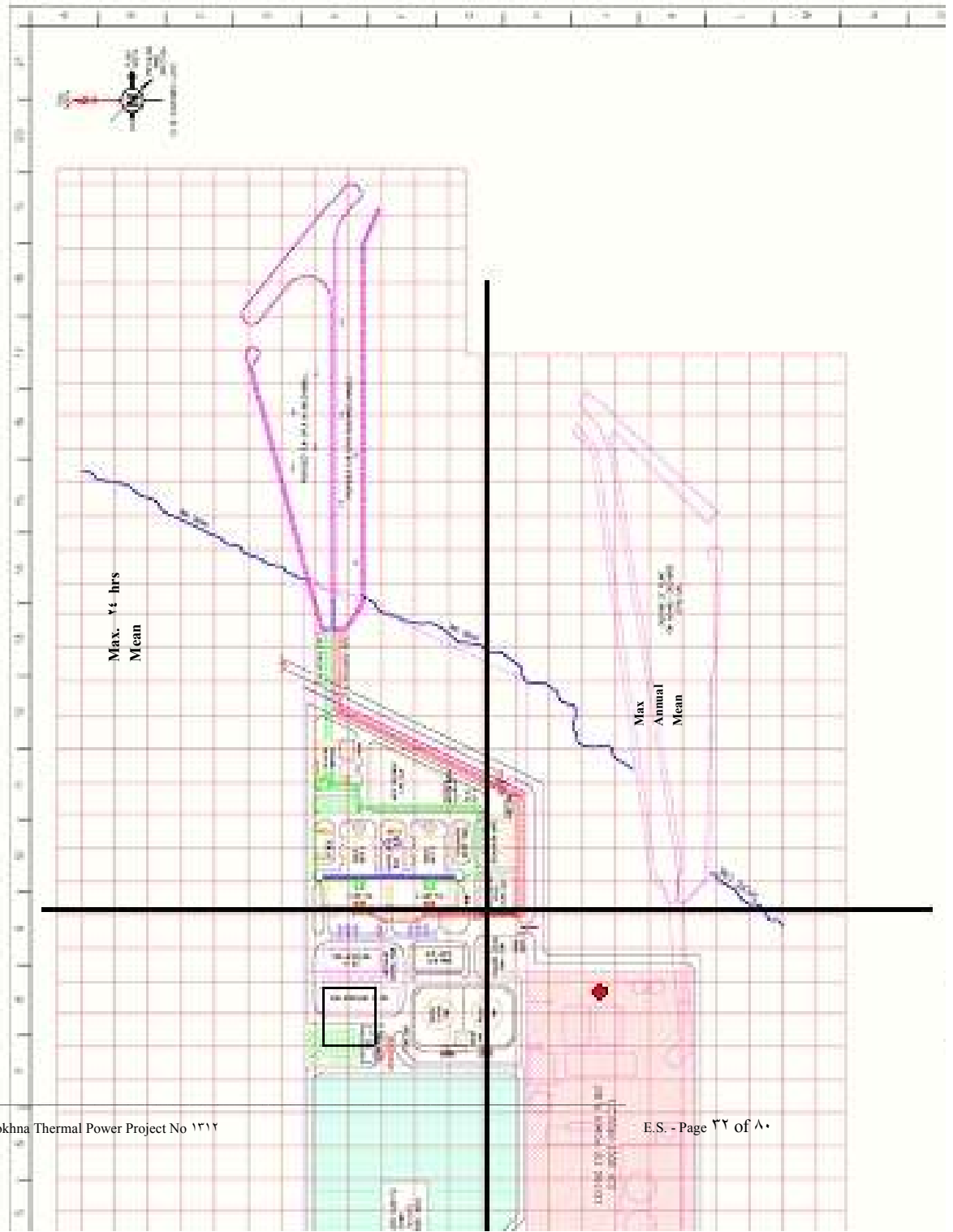
٦٩. The power plant will burn natural gas as its primary fuel. As a result, the principle pollutant during normal operation will be NO_x. During emergency operation (and for not more than ٢% of operating time), the burning of heavy fuel oil will result in emissions of particulate matter and SO₂, along with trace amounts of other pollutants. Emissions from the plant will meet Egyptian and World Bank Guidelines.

٧٠. 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.

٧١. The assessment indicates that the highest concentrations for each of the averaging periods under consideration (hourly, daily, annual) are found to the north-north-west, north-west, and south-south-west of the site, respectively. This is because the winds are exposed to the atmospheric prevailing conditions, although they are overwhelmingly from the north and northwest for most of the time. Maximum annual concentration of NO_x emissions in the ambient atmosphere due to operation of both of the Al-Sokhna power plant and the Suez Gulf BOOT power plant will not exceed ٤٤,٨ µg/m³ (highest annual maximum is ٤٤,٨ µg/m³ at the location [-١٤١,٥m, -٦٥٨,٨m]) and the maximum daily reaches ١٣٠ µg/m³ at a distance of ٢٧١,٢ m north-west the origin point intermediating the stacks. Also, Maximum "One-hour Average" concentration of NO_x emissions in the ambient atmosphere reaches ٣٢٢,١ µg/m³ at the location [-١٤١,٥m, ٤٦١,٢m] (see Figure ٥). **It is recommended that an air quality monitoring system composed of ٢ or ٣ 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 ٥

El-Ain Al-Sokhna Air Quality Monitoring Locations



٦,٣

Aquatic Environment

٧٢. Cooling water and process water for power plant operation will be drawn from the Suez Gulf via an intake structure. The quantity of the cooling water that will be returned back to the Suez Gulf is about ٤٦ m^٣/sec. Process water that will be abstracted from the Suez Gulf is about ٠,٠٧% of this quantity. Potable water will be supplied to the power plant via Suez potable water system. Cooling water will be returned to the Suez 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 System (CWDS). Sanitary waste water will be disposed of -after treatment- via plantation irrigation network. 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.

٧٣. The aquatic environment surrounding the project site is characterized by generally fair water quality. The aquatic flora is characterized by poor biodiversity and no sensitive ecosystems. No commercial fishing and very limited fishing activity occurs in the vicinity of the project.

٧٤. 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.

٧٥. Power plant operation will result in a heated plume of waste cooling water being discharged into the Suez 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.

٧٦. The returned cooling water will be released at a temperature of no more than ١,٦ 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 ٠ C° above ambient, lies at approximately ١٠٠ m

from the point of discharge. The mixing zone has been defined by the HRI/MWRI to be 100 m from the point of discharge.

٧٧. 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 Suez Gulf water temperature are likely to create new or improved habitats for flora and fauna.

٧٤. Physical aquagraphy, Al-Sokhna Shoreline access, fishing and navigation are not predicted to be significantly affected by the presence of the intake and discharge structures.

٦,٤

Noise Impacts

٧٨. The construction of the Al-Sokhna power plant is expected to generate a maximum noise level of 90 dB(A) during the day at the fence of the power plant and 85 dB(A) at night. These worst-case construction noise levels are both within Egyptian and World Bank guidelines, and for most of the construction periods, the noise levels will be lower than these values. There are no residential receptors within 1000 m of the plant.

٧٩. 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 1,2dB(A) above ambient levels. This magnitude of increase is generally not perceptible to the human ear, consequently no construction traffic impacts are predicted.

٨٠. The potential noise emissions from the Al-Sokhna 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.

٦,٥

Flora and Fauna

٨١. 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 sabkha. 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.

٦,٦

Land Use, Landscape and Visual Impacts

٨٢. 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 since ١٩٩٩, therefore there is not significant land use impacts due to the Al-Sokhna power project.

٨٣. The surrounding land use is generally industrial. As the land is highly industrialized with almost no vegetation, all existing views will be insignificantly influenced by the power plant and given the surrounding industrial context, particularly the existing Suez Gulf power plant and industrial facilities of Al-Sokhna port, the visual intrusion of the power plant will be minimal.

٨٤. Visual impacts of the power plant from the residential (tourist) areas to the north and south are also not expected to be significant given the long distance of their locations from the site and orientation of the facilities. The potential landscape and visual impacts of the project are therefore expected to be minor and not significant.

٦,٧

Soils, Geology and Hydrology

٨٥. 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. However, soil sample testing is recommended for further geotechnical investigation.

٦,٨

Traffic

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

٨٧. 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.

٨٨. During operation, a small number of workers and HGVs are associated with operating the power plant and no impacts are predicted to occur.

٦,٩

Socio-economics and Soico-cultural effects

٩٩. 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 (٩٥% 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.

٩٠. 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 within the area belonging to the EDEPC, i.e. there will be no off-site activities or associated land acquisition during construction.

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

٩٢. The effects on the fisheries of warmer water returned to the Suez Gulf from similar power plants along the sea coasts are well known. Experience from about ١٠ other power plants located on the shorelines of both of the Mediterranean and Red seas that have operated in Egypt for a number of years indicates that the overall impacts on fisheries of slightly warmer water actually are positive, and consultations with the fishermen indicate that the catches in these areas have increased rather than decreased. Since this is part-time, small-scale fisheries no statistics are available, but after many years the warmer water around the various points of discharge, is clearly perceived by the fishermen to have positive effects.

٩٣. 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.

٦,١٠

Archaeology, Historic and Cultural Heritage

٩٤. 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.

٩٥. 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.

٦,١١

Natural Disaster Risks

٩٦. 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.

٩٧. Furthermore the power plant will be designed to conform to the Uniform Building Code Zone ٢ 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.

٩٨. The risks of flooding during power plant construction and operation were also examined. However, 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.

٦,١٢

Major Accident Hazards

٩٩. Given the wider land surrounding the Al-Sokhna 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.

٦,١٣

Solid and Hazardous Waste Management

١٠٠. 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 ٤/١٩٩٤ and the Governorate of Suez.

١٠١. Private sector contractor will be assigned via general bidding process and the contract will include detailed environmental procedures, according to Law ٤/١٩٩٤ and Governorate of Suez regulations, for disposing debris materials. The contract covers all fees required.

١٠٢. 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 ٤/١٩٩٤ and the Governorate of Suez.

١٠٣. Solid and hazardous waste management is not predicted to cause any significant impacts.

٦,١٤

Occupational Health and Safety

١٠٤. 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.

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Associated Infrastructure

١٠٥. Connections to existing gas and electrical facilities will be the responsibility of "City Gas", EETC and the EDEPC respectively. In regard to the gas connection with the gas reducing station of the site and oil pipeline to the oil tanks on the site no environmental or social impacts are anticipated.

١٠٦. EEHC has already submitted a request to City Gas for their needs for the new plant which will necessitate a bigger diameter pipeline, or an additional pipeline, which will follow the same existing pipeline.

١٠٧. The electricity generated by the proposed power plant will be exported via the ٥٠٠ and ٢٢٠ kV electricity transmission system. The power plant will be connected to the ٥٠٠ kV switchyard via step-up transformers.

١٠٨. The electricity generated by the proposed El-Ain Al-Sokhna power plant will be exported by the EETC electricity network, via two transmission systems, double circuit ٢٢٠ kV and ٥٠٠ kV lines. The first will be connected to the unified network upward direction towards Suez city with approximately ٤٠ km length, while the second will be extended to the west direction, approximately ٩٠ km until it meets the ٥٠٠ kV transmission line connecting El-Kureimat and El-Tebbin ٥٠٠ kV substations. Construction and operation of this infrastructure will be the responsibility of the EETC. No routes have as yet been defined.

١٠٩. Although land take or resettlement will most probably be not associated to the power interconnecting lines (because the areas in question are largely uninhabited public land), a Resettlement Policy Framework (RPF) is prepared separately as part of this ESIA in order to handle any potential future changes and to satisfy the requirement of WB and provide specific answer to questions relating to the potential triggering of WB-OP ٤,١٢, i.e. land acquisition and/or resettlement.

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

٦,١٦

Global Impacts

١١١. Natural gas has been selected as the main fuel for the power plant. Compared to other fossil fuel generating technologies, gas fired steam generators have a relatively low emissions of carbon dioxide (CO₂), moderate emission levels of nitrogen oxides (NO_x) and the lowest emission levels (almost traces) of sulfur dioxide (SO₂) and particulates.

١١٢. 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.

١١٣. The efficiency of the proposed steam power plant is ٤٥% with natural gas, with associated CO₂ emissions of ٠,٥٥kg/kWh. This compares with the efficiency of a typical CCGT power plant of ٥٣-٥٤% .

١١٤. Emissions of carbon dioxide are estimated to be up to ٣,٥٠٠ kilotonnes per year (expressed as CO₂). This assumes that the plant operates for the whole year and consumes around ١٢٠ tonnes of gas per hour. The emissions of CO₂ from fuel burning in Egypt amounted to around ١٢٠,٦٢٠ kilotonnes in ٢٠٠٤/٢٠٠٥ (Ref: EEAA: 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 ١,٥٩% of the total Egyptian CO₂ emissions in ٢٠٠٤/٢٠٠٥. This is an upper estimate as the plant will not operate ١٠٠% of the year or at full load ١٠٠% of the time.

١١٥. Natural gas, which is the main fuel to be used in the Al-Sokhna 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.

١١٦. Natural gas fuel also has the significant benefit of being able to be delivered by an existing pipeline (even though it may be enlarged in capacity).

٧. **ENVIRONMENTAL MITIGATION AND MONITORING:
THE ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN
(ESMP)**

٧.١ **Enhancement and Mitigation Plan**

١١٧. 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).

١١٨. 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 ٦ 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.

١١٩. All the mitigation, monitoring and management measures proposed below and in Section ٨ 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.

١٢٠. 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 ٤ and ٦ 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 burners, noise silencers and water discharge controls are for example integral to the design of the power plant.

١٢١. 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 ٤, ٥, ٦ and ٧* which relate to construction and operational phases respectively. *Table ٨* summarizes the cost of ESMP which will require to be included in the project financial plan.

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Table 4
Institutional Arrangements for El-Ain Al-Sokhna Power Project

Mitigation Measures	Implementation Schedule	Type and Frequency of Reporting / Monitoring	Implementation	Responsibility Supervision	Monitoring Indicators	Budget
Establishment of the Environmental Management Unit (EMU), construction phase.	Prior to starting construction.	Quarterly to EEHC Environmental Management (EEM) and EEHC Chairman	EDEPC/SPP	EEHC EEHC Environmental management (EEM)	Training programs Compliance with ESMP	Air quality quarterly will start with the commencement of 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.	Ongoing training					Air quality continuous monitoring will start ahead of commissioning. Training since that included in air quality monitoring package.
Establishment of the Environmental Management Unit (EMU), 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 & manuals	Prior to starting operation. Ongoing training	Quarterly to EEHC & EEHC Environmental Management (EEM)	EDEPC/SPP	EEHC EEHC-EEM	Training programs Compliance with ESMP	Included in air quality monitoring package. EDEPC responsibility
Availability means that training and capacity building activities are included in the company organizational structure and budget.						

Table 9 (Contd.)

Construction Impact Mitigation, Monitoring and Management Measures

Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting / monitoring	Management and Training	Implementation
			Implementation	Supervision				
<p>The following measures will be taken:</p> <ul style="list-style-type: none"> Construction method statement to be produced by the Contractor; dredged areas limited to minimum area required; disposal of dredged sediments to an agreed site; all works will be made clearly visible using flags, beacons and/or signals; shore area will be reinstated following construction. 	During construction of intake and discharge structures	<p>Off shore line survey undertaken along 90° profiles fronting the site.</p> <p>Report to be maintained for monitoring and evaluation during operation.</p> <p>Continuous visual inspection</p> <p>During dredging sediment and surface water will be monitored at four locations (two downstream of the intake and two upstream of the discharge) twice a month.</p> <p>During construction sampling will be conducted at two sites, unless preliminary monitoring campaign shows strong variations in water quality.</p> <p>Water samples will be tested for temp., PH, CO₂, BOD, TOC, DO, TSS, oil & grease, residual chlorine and heavy metals .</p> <p>Sediment will be tested for oil & grease and heavy metals.</p>	Implementation of Good Site Management practices shall be the responsibility of all contractors on site and under supervision of the Assistant Plant Manager.	EEHC Environmental Management & Studies Sector.	Shore line Dredged areas & dredging waste material.	Quarterly reporting (or more if requested) and submitted to the EEHC and other concerned authority. (e.g. EEEA, WB, AfDB, etc.).	EDEPC to ensure all contractors and subcontractors working on site are aware of ESMP and all employees are given induction training on good construction and site management practice.	
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Table ° (Contd.)

Construction Impact Mitigation, Monitoring and Management Measures

Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting / monitoring	Management and Training	In Es
			Implementation	Supervision				
Mitigation activities will include the following:	During construction	Continuous visual inspection will be	Implementation of Good Site	EEHC Environmental	Fluid effluents within the site.	Quarterly reporting of summary results	EDEPC to ensure all contractors and	Man and
(*) no discharge of effluents into the Suez Gulf - all effluents shall be collected and removed off site for treatment by approved firms;			practices shall be the responsibility of all contractors on site under	Studies Sector.	Soil erosion	requested) and submitted to the EEHC and any other concerned	working on site are aware of ESMP and all employees are given basic	cost)
(*) development of site drainage plan which reduces flow velocity and sediment load;			Assistant Plant Manager.		Surface water runoff.	EEAA, WB, A/DB, etc.), if required.	on good construction and site management practices.	
(*) 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;					Sewage effluents.			
(†) maintenance of well kept construction site.					Earth, mud and debris depositions on roads.			

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Table 9 (Contd.)

Construction Impact Mitigation, Monitoring and Management Measures

Mitigation Measures	Implementation Schedule	Monitoring	Implementation	Responsibility Supervision	Monitoring Indicators	Type and Frequency of Reporting/ monitoring	Management and Training	Implementation
Implementation of good site practices including: (*) enforcement of vehicle speed limits; (*) strict control of vehicle routing; (*) diesel engine construction plant equipment to be fitted with silencers; (*) limited noisy construction activities at night; (*) prohibition of heavy vehicle movements at night; (*) use of protective hearing equipment for workers.	During construction	Monthly monitoring and supervision by EDEPC is required to ensure the implementation of good site management practices by all contractors during construction. Third party audit, conducted every 3 months.	Implementation of Good Site Management practices shall be the responsibility of all contractors on site under supervision of the Assistant Plant Manager. Auditor (Noise Expert)	EEHC Environmental Management & Studies Sector. 1-monthly audit.	Noise complaints register to identify and check validity using noise measuring devices.	EDEPC/SPP will produce a Quarterly log of valid complaints and actions taken to EDEPC. Quarterly reporting of summary results (or more if requested) and submitted to the EEHC and any other concerned authority (e.g. EEAA, WB, AfDB etc.), if required.	EDEPC 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.	Management and in co... Third... (abo...
(*) 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.	During construction.	Periodic inspection and supervision by EDEPC is required to ensure the implementation of good site management practices by all contractors during construction.	Implementation of Good Site Management practices shall be the responsibility of all contractors on site under supervision of the Assistant Plant Manager.	EEHC Environmental Management & Studies Sector.	Good conservation of floral wealth.	Quarterly reporting No. of floral species conserved or planted, if any.	EDEPC 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.	Management and in co...

Table ° (Contd.)

Construction Impact Mitigation, Monitoring and Management Measures

Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting/ monitoring	Management and Training	In
			Implementation	Supervision				
<p>The potential for impacts are largely dependent on management of the construction site and activities. The following mitigation measures will be implemented:</p> <ul style="list-style-type: none"> • 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 solid 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. 	During construction.	Daily visual inspection is required to ensure the implementation of good management practices during construction.	Implementation of Good Site Management practices shall be the responsibility of all contractors on site under supervision of the Assistant Plant Manager.	EEHC Environmental Management & Studies Sector.	<ul style="list-style-type: none"> • site drainage. • access only to construction site areas. • spoils. • waste materials. • oily waters. • drainage pathways. • potential spillage in operational areas. 	Quarterly reporting of summary results (or more if requested) and submitted to the EEHC and any other concerned authority (e.g. EEAA, WEAFDB etc.), if required.	EDEPC 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.	Costs may include US\$ dependent on measures

Table ° (Contd.)

Construction Impact Mitigation, Monitoring and Management Measures

Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting/ monitoring	Management and Training	In Es
			Implementation	Supervision				
Standard good practice measures will be implemented as follows: <ul style="list-style-type: none"> adherence of abnormal load movements to prescribed routes, outside peak hours and advance construction shifts will be staggered; scheduling of traffic to avoid peak hours on local roads; transportation of construction workers by contract bus. 	During construction	Monitoring traffic entering the site during morning & evening peaks to ensure the implementation of good site management practices by all contractors during construction.	Good Site Management practices shall be the responsibility of all contractors on site under supervision of the Assistant Plant Manager.	EFHC Environmental Management & Studies Sector.	Increased congestion Travel time compared to (commute)	Three times per month Quarterly reporting of summary results (or more if requested) and submitted to the EEHC and other concerned authority (e.g. EEAA, WB, AfDB etc.), if required.	EDEPC to ensure all contractors and subcontractors working on site are aware of ESMP and employees are given basic induction training on good construction and site management practices.	

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Table ° (Contd.)

Construction Impact Mitigation, Monitoring and Management Measures

Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting/monitoring	Management and Training	In Es
			Implementation	Supervision				
<p>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 of associated land.</p> <p>The entire labor force will be daily commuters, thus no worker housing or associated facilities will be erected on site during construction.</p> <p>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.</p> <p>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.</p>	During construction.	Record of employment provided by the project.	EDEPC/SPP Assistant Plant Manager	EEHC Environmental Management & Studies Sector.	Workers satisfaction as measured by staff interviews and submitted.	Editing a special report	Responsibility of EDEPC.	Resp EDE

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Table ° (Contd.)

Construction Impact Mitigation, Monitoring and Management Measures

Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting/ monitoring	Management and Training	In ES
			Implementation	Supervision				
<p>The project site does not lie on, or in the immediate vicinity of any known archaeological areas of interest.</p> <p>If remains are found to:</p> <ul style="list-style-type: none"> cease activities and consult Antiquities Authority; excavation areas where protection not feasible; preparation of a Chance Finds Procedure and Method Statement. 	During construction.	Supervision of construction activities.	Construction contractors	EEHC Environmental Management & Studies Sector.	Chance finds (see annex II)	Daily inspection Quarterly reporting of summary results (or more if requested) and submitted to the EEHC and other concerned authority (e.g. EEAA, WEAFDB etc.), if required.	EDEPC 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.	Mitig mea man Shou finds prote add the c
<p>Good engineering design will incorporate the following mitigation measures:</p> <ul style="list-style-type: none"> drainage system designed to direct flood water from main plant areas into the sea and direct potentially contaminated waters through the oil interceptor. 	During construction.	No monitoring measures are envisaged.	EDEPC/SPP Assistant Plant Manager	EEHC Environmental Management & Studies Sector.		Quarterly reporting of summary results (or more if requested) and submitted to the EEHC and other concerned authority (e.g. EEAA, WEAFDB etc.), if required.	EDEPC to ensure that all workers on site receive training in emergency preparedness and response procedures.	Rele inclu cons

Table 9 (Contd.)

Construction Impact Mitigation, Monitoring and Management Measures

Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting/ monitoring	Management and Training	Implementation
			Implementation	Supervision				
<p>Good practice measures such as the following:</p> <ul style="list-style-type: none"> all waste taken on-site will be undertaken by a licensed contractor and EDEPC will audit disposal procedures; 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. 	During construction	Periodic inspection is required to ensure the implementation of good management practices during construction.	Implementation of Good Site Management practices shall be the responsibility of the contractor.	EEHC Environmental Management & Studies Sector.	Management contract in place Functional transfer station.	Quarterly reports from management contractor, EDEPC and then to EEHC. These reports are to be submitted to any other concerned authority (e.g. EEEA, WB, AfDB, etc.), if required.	EDEPC to ensure all contractors and subcontractors working on site are aware of ESMP and that they are given basic induction training on good construction and site management practices.	Management plus (< US

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Table 9 (Contd.)

Construction Impact Mitigation, Monitoring and Management Measures

Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting / monitoring	Management and Training	In ES
			Implementation	Supervision				
<p>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:</p> <ul style="list-style-type: none"> • 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	<p>daily inspections required to ensure the implementation of EHS plans and practices during construction.</p>	<p>Implementation of Good Site Management practices and the EHS policies shall be the responsibility of all contractors on site under supervision of the Assistant Plant Manager.</p>	<p>Environmental Management & Studies Sector.</p>	<p>management procedures in place.</p> <p>Workers health and safety as measured by no. of incidents.</p>	<p>Daily inspection</p> <p>Quarterly reporting of summary results (or more if requested) and submitted to the EEHC and any other concerned authority (e.g. EEEA, WB AfDB, etc.), if required.</p>	<p>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.</p> <p>Contractors are responsible for ensuring that a Fire Safety Plan, which conforms to NFPA 800, is prepared and implemented prior to commissioning of any part of the plant under supervision of EDEPC/SPP.</p>	<p>meas requ mana plus USS imple EHS</p>
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**Table 6
Operational Impact Mitigation, Monitoring and Management**

Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting/monitoring	Management and Training	Implementation
			Implementation	Supervision				
<p>Mitigation measures have already been included in the design of the plant and, given EDEPC/SPP's strict commitment to use mazout fuel oil for <1% of operating time, no further mitigation measures are proposed.</p> <p>EDEPC/SPP will however demonstrate the validity of the conclusions drawn in the ESIA report.</p> <p>EDEPC/SPP will demonstrate the validity of the conclusions drawn in the ESIA report. If ground level concentrations are found to be above local and World Bank standards options for further mitigation will be discussed.</p>	<p>During first three years of operation.</p>	<p>Automatic monitoring of stack emissions for NO_x, SO_x, particulate matter and carbon monoxide (CO) via testports installed in the main stacks.</p> <p>Install two continuous NO_x, SO_x, CO, PM₁₀ & TSP monitoring stations to monitor short-term concentrations in the area predicted to have the highest impacts on humans (as 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).</p> <p>The analyzer stations will be electronically connected to the EEAA ambient monitoring system.</p>	<p>The analyzer stations will be owned and operated by EDEPC/SPP.</p> <p>Assistant Plant Manager</p>	<p>EEHC Environmental Management & Studies Sector.</p> <p>Report introduced to EEAA as requested.</p> <p>Third party inspection.</p>	<p>Stack emissions (at least PM NO_x, SO_x and CO).</p> <p>Ambient air pollutants concentrations (at least TSP, PM NO_x, SO_x and CO).</p>	<p>Continuous Hourly data acquisition.</p> <p>Quarterly reporting to EEHC.</p> <p>Reports are to be available to and if the concerning authorities (EEAA, WB, AfDB, etc.)</p>	<p>Records must be kept and summary data (including any deviations from Egyptian and World bank standards) will be submitted to the Government, AfDB and WB on annual basis (or more frequently if required).</p> <p>Annual reporting by EDEPC/SPP to Government, AfDB and WB etc. (or more frequently if required) highlighting key features and comparing results with air quality standards and prediction in ESIA report</p>	<p>Automatic monitoring</p> <p>Management for cost performance</p> <p>Monitoring and operation</p> <p>Purchasing and maintenance</p> <p>Annual calibration and running</p> <p>operation</p>

Table 6 (Contd.)

Operational Impact Mitigation, Monitoring and Management

Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting/ monitoring	Management and Training
			Implementation	Supervision			
<p>The design of the intake and cooling water structures have already</p> <p>impacts. In addition, good site management practices including the following will be implemented:</p> <ul style="list-style-type: none"> • neutralization, oil separation, flocculation and filtration of any • 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 discharge will comply with local Egyptian and World Bank guidelines. <p>In addition, EDEPC/SPP 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.</p>	Lifetime of the plant	<p>Prepare regular water quality monitoring program including:</p> <ul style="list-style-type: none"> • 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 (1- 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 1 km radius of the discharge point (over a 1 year period) • Weekly monitoring of fish catches on intake screens including species, numbers and size (over a 1 year period). 	EDEPC/SPP Manager.	EEHC Environmental Measurement & Studies Sector.	Basic parameters Law 471 and Law 197/1997	<p>Monthly reports from EDEPC/SPP</p> <p>Continuous monitoring of water quality etc.</p> <p>1-monthly monitoring of heavy metals and other pollutants.</p> <p>1-monthly monitoring of the plume.</p> <p>Annual monitoring of benthic environment (over a 1 year period).</p> <p>Weekly monitoring of Fish Catches on intake screens (over a 1 year period).</p> <p>Reports are to be available to any of the concerning authorities (EEAA, WB, AfDB, etc.).</p>	<p>Records will be kept and compared against Egyptian, AfDB and World Bank standards and impacts predicted in ESIA.</p> <p>Summary reports (with any exceptions identified) will be submitted to the Government, AfDB and WB etc. on annual review basis (or more frequently if required).</p> <p>EDEPC/SPP to ensure that all employees are given basic induction training on the requirements of the ESMP, good site management practices and H&S procedures. The Assistant Plant Manager will ensure implementation of procedures.</p>

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Table 6 (Contd.)
Operational Impact Mitigation, Monitoring and Management

Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting/ monitoring	Management and Training	In ES
			Implementation	Supervision				
Specific design mitigation measures to minimize noise impacts include:	During first year of operation.	When the plant is fully operational, noise audit	EDEPC/SPP Third party audit	EEHC Environmental Management & Studies Sector.	Power plant compliance with ESMP.	Quarterly to EDEPC and EEHC.	Should any complaints be received regarding	Minim US\$ annu
<ul style="list-style-type: none"> Steam turbine generators, all compressors, pumps and emergency diesel engines are enclosed in buildings; air compressors are equipped with silencers; noisy outdoor equipment are designed to at 1 m. <p>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.</p>		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	Supervised by Assistant Plant Manager			Monthly reporting of summary results (or more if requested) and submitted to the EEHC and any other concerned authority (e.g. EEAA, WE, etc.), if required.	noise, these will be logged and the Assistant Plant Manager will investigate problem.	provi US\$ annu (inclu oper No fu mitig moni envis exce man Noise 1 - 2 oper
							EDEPC/SPP to ensure that all employees are given basic induction training on the requirements of the ESMP, good site management practices and H&S procedures. The Assistant Plant Manager will ensure implementation of procedures.	

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Table 6 (Contd.)

Operational Impact Mitigation, Monitoring and Management

Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting/ monitoring	Management and Training	Implementation
			Implementation	Supervision				
<p>The following mitigation measures will be implemented:</p> <ul style="list-style-type: none"> 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/SPP Assistant Plant Manager	EEHC Environmental Management & Studies Sector.	Good plantation	Yearly	EDEPC/SPP to ensure that all employees given basic induction training on the requirements of ESMP, good site management practices and H&S procedures. The Assistant Plant Manager will ensure implementation of procedures.	
<p>The visual effect of the power plant will be improved through:</p> <ul style="list-style-type: none"> creation of landscaped boundary along the fence of the power plant. <i>Ficus elastica</i> var <i>decora</i> and <i>Ficus nitida</i> 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 individual plants from a single tree. 	Lifetime of the plant.	No monitoring is envisaged.	EDEPC/SPP Assistant Plant Manager	EEHC Environmental Management & Studies Sector.	Improved visual image		Considered management of landscaped areas to maximize visual image and habitat creation. EDEPC/SPP to contract a suitable firm to manage landscaped areas.	Approved measures (including operation)

Table 6 (Contd.)
Operational Impact Mitigation, Monitoring and Management

Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting/monitoring	Management and Training	In Es
			Implementation	Supervision				
Good site management measures as 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.	Lifetime of the plant	The Assistant Plant Manager will continuously monitor application of ESMP and good site management practices and take corrective action if required.	EDEPC/SPP Assistant Plant Manager	EEHC Management & Studies Sector.	Quality of bunds systems. Efficiency of operation.	1-monthly reports to EEHC. Annual reporting of summary results (or more if requested) and submitted to the EEHC and any other concerned authority (e.g. EEEA, WB etc.), if required.	EDEPC/SPP, Assistant Plant Manager, will implement a Spills Response Plan and all employees will receive corresponding training.	Man
Good practice measures undertaken during the construction phase will be continued into the operation phase (see Table 6).	Lifetime of the plant	Continuous monitoring is required to ensure the implementation of good management practices during operation.	EDEPC/SPP Implementation of Good Site Management practices shall be conducted under supervision of the Assistant Plant Manager.	EEHC Environmental Management & Studies Sector.	Management contract in place. Functional transfer station.	1-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. EEEA, WB etc.), if required.	EDEPC/SPP to ensure all employees are given basic induction training on good operation and site management practices.	Man and 1-K (inclu oper

Table 6 (Contd.)

Operational Impact Mitigation, Monitoring and Management

Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting/monitoring	Management and Training	Implementation	Supervision
			Implementation	Supervision					
Standard international practice on EHS issues shall be employed on site. The mitigation measures summarized in construction management Table apply.	Lifetime of the plant	Regular training.	on-site staff	EDEPC/SPP Assistant Plant Manager	EEHC Environmental Management & Studies Sector.	Management procedures in place.	Monthly reports from management to EEHC	EDEPC/SPP to ensure that all employees are given basic	Man and (< US annu
In addition, the following measures will be undertaken: <ul style="list-style-type: none"> 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. 		Regular checks and field tests of emergency procedures by on-site management.				and safety measured by incidents, injuries and illnesses.	summary results (or more if requested) and submitted to the EEHC and any other concerned authority (e.g. EEAA, WB etc.), if required.	on H&S policies and procedures, Emergency Preparedness and Response Plan and a Spills Response Plan. The Assistant Plant Manager is to ensure implementation of procedures.	oper
								EDEPC/SPP is responsible for ensuring that the site emergency response plan is complete and implemented prior to commissioning any part of the power plant.	

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Table V
Transmission System Impact Mitigation, Monitoring and Management

Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting/ monitoring		Management and Training
			Implementation	Supervision				
<ul style="list-style-type: none"> Utilize appropriate clearing techniques, (e.g., hand clearing versus mechanized clearing). Maintain native ground cover beneath lines. Replant disturbed sites. Manage ROWs to maximize wildlife benefits. 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. 	During Construction and Operation	<p>Visual inspections of the materials being used, construction practices and mitigation measures.</p> <p>Short-term monitoring to assure that negative land use and/or ecological impacts are avoided and proper mitigation measures are employed.</p> <p>Occurs along the line as it is constructed.</p> <p>Monitoring of ROW/ maintenance activities to assure proper control methods.</p>	Egyptian Electricity Transmission Company (EETC)	EEHC management EEHC	Effects on environmental and human resources	Weekly (during construction).	Environmental training and management will be	Incl con and cos
			EDEPC/SPP	Management and Studies Sector	(negative land uses, ecological damage) Degree to which they are affected.	time (during operation)	<p>ROW maintenance techniques, including the proper use of chemical and mechanical clearing methods.</p> <p>Training will be conducted by EETC and EDEPC with assistance from environmental consultant.</p> <p>Staff workers should have an understanding of the rationale for the recommended mitigation and monitoring that they may be implementing.</p>	

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Table V (Contd.)

Transmission System Impact Mitigation, Monitoring and Management

Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting/monitoring	Management and Training
			Implementation	Supervision			
<ul style="list-style-type: none"> 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. 							
<ul style="list-style-type: none"> 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 & AfDB 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. 							

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Table V (Contd.)

Transmission System Impact Mitigation, Monitoring and Management

Impact	Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting/monitoring	Management and Training
				Implementation	Supervision			
	<ul style="list-style-type: none"> Select ROW to avoid important bird habitats and flight routes. Install towers and lines to minimize risk for avian hazards. Install deflectors on lines in areas with potential for bird collisions. 							
Visual	<ul style="list-style-type: none"> Select ROW to avoid airport flight paths. Install markers to minimize risk of low-flying aircraft. Select ROW to avoid areas of human activity. Select ROW to avoid sensitive areas, including tourist sites and vistas. Construct visual buffers. Select appropriate support structure design, materials, and finishes. Use lower voltage, DC system, or underground cable to reduce or eliminate visual impacts of lines, structures, and ROWs. 							

Table ٧ (Contd.)

Transmission System Impact Mitigation, Monitoring and Management

Mitigation Measures	Implementation Schedule	Monitoring	Responsibility		Monitoring Indicators	Type and Frequency of Reporting/ monitoring	Management and Training
			Implementation	Supervision			
<ul style="list-style-type: none"> • Provide comprehensive plans for handling induced development. • Construct facilities to reduce demand. • Provide technical assistance in land use planning and control to local governments. • Route ROW away from sensitive lands. • Provide access control. 							

Table A

Summary of Implementation Cost of the ESMP

No.	Phase of Implementation	Cost in US\$	
		Measures	Monitoring
1	Construction Phase	120 K	1638 K
2	Operation Phase	70	2
	Sub. Total	190 K	1640 K
	Total	1848 K	
122	Table A shows that the total implementation cost of the Environmental and Social Management Plan is about US\$ 1,848 million, which amounts to about 0.44% of the total project cost.		
123	MONITORING PROGRAM		

Stack Emissions

123. 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.

124. 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.

125. Concentrations will be recorded as hourly rolling averages and reports on stack emissions monitoring will compare recorded emissions against predicted levels and Egyptian and WB, AfDB guidelines (as given in Section 2). Reports will be submitted to the EEAA, the WB, AfDB and any other concerned authority on an annual basis (or as required).

Ambient Air Quality - Validation of Modeling Predictions Using Continuous NO_x, SO₂ and TSP Analyzer

126. The use of a continuous NO_x, 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.

١٢٧. The construction and operational monitoring of air quality around the Al-Sokhna power project will include the parameters summarized in *Table 9*.

Aquatic Environment

١٢٨. Monitoring of impacts of the power plant on the aquatic environment will include monitoring of the quality of the discharge water, Suez 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 May-June ٢٠٠٨. The survey will include the area affected by the thermal plume (i.e. ١٠٠-١٥٠ m from the discharge point).

Table 9

Monitoring Program for Ambient Air Quality, Noise and Vibration

Item	Monitoring Parameters	Sampling Frequency	Monitoring Locations	Indicative Cost Estimate (US\$)
Construction Phase				
Air Quality				
Dust emissions caused by construction activities, construction vehicle movements, and transport of friable construction materials.	NO _x , SO ₂ , CO, TSP and PM ₁₀	Quarterly during most of the construction period.	On site of the project and its surroundings.	Measurement cost: US\$70K
		Quarterly during monitoring during 3 months ahead of commissioning.	Two locations: maximum predicted pollution concentration and downwind. Third location, if any, will be 1 km upwind.	US\$100K
Noise	Decibels (dB) A	Monthly	2 locations minimum: at nearest residences	Management time and costs (US\$10K)
Operation Phase				
Air Quality				
Emissions from stack are not expected to exceed standards.	Automatic monitoring of stack emissions for NO _x , SO ₂ , particulate matter and carbon monoxide (CO) via test ports installed in the main stack. In addition, conduct surrogate performance monitoring .	Continuous and/or 24 hour average Continuous and/or passive samples every 1/2 weeks	2 locations minimum: at maximum predicted pollution concentration and downwind. Third location, if any, will be 1 km upwind.	Included in the plant operation
Ambient air quality affected by emissions from the power plant.	Install (at least two) continuous monitoring stations to monitor short-term concentrations of pollutants 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).	The analyzer stations will be electronically connected to the plant controlling room and EDEPC Chairman's office.		
Noise		Bi-annually to annually	2-3 sites at nearest receptors and fence around the plant	Noise audit US\$100K (included in operation cost) Third party (e.g. NRC) Measuring instruments and equipment.
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١٢٩. The operational monitoring of cooling water and effluent discharge will include the parameters summarized in *Table ١٠* below.

Table ١٠
Monitoring of the Aquatic Environment During Operation

Issue	Parameter	Method	Frequency of measurement
Water Quality	Temperature & pH of all discharged water	Continuous automatic monitor in discharge structure	Continuous
	COD, TSS, Oil & Grease, residual chlorine of effluent	Sample taken from water in discharge structure and submitted for lab. Analysis	Daily
	Heavy metals & other pollutants of effluent	As above	Monthly
Ambient Water Quality	Temperature, pH, COD, BOD, TOC, DO, TSS, oil & grease, residual chlorine, heavy metals & other pollutants	Grab sampling and analysis predicted to be affected by the discharge plume	٣-monthly
Flora & Fauna ^(١)	Benthic flora & fauna	Transect sampling (following same method as in baseline monitoring) within a ٢ km radius of the discharge point	Annual
Entrainment ^(٢)	Fish entrainment on screens	Removal and analysis of any debris caught in intake screens	Weekly
Notes: (١) To be undertaken for the first ٣ years of plant operation. (٢) 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			
١٣٠. Monitoring data will be analyzed and reviewed at regular intervals and compared with Egyptian and World Bank guidelines (as given in Section ١١). 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 WB and AfDB or any other concerned authority as required. As a result, the project company, in discussion with the EEAA, EEHC, the WB 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

١٣١. 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.

٨.

PUBLIC CONSULTATION AND DISCLOSURE

١٣٢. In order to ensure that the views and interests of all project stakeholders are taken into accounts, public consultation has been 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 has been undertaken as part of the Environmental Impact Assessment process.

١٣٣. 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.

١٣٤. The adopted methodology for the public consultation, which conforms with the 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 the scoping meeting organized in the Suez Governorate, and preparation of this ESIA-Report;

Phase II

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

١٣٥. As far as public disclosure is concerned, major initiatives to inform the public and interested parties about the Al-Sokhna 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 Report;
- 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.

١٣٦. The full methodology for consultation and disclosure is presented in the project's Public Consultation and Disclosure Activities (PCDA), given in Annex D. The purpose of the activities is to establish the process by which

EDEPC/SPP will consult and involve stakeholders in the planning, development, construction and operation of the power plant.

١٣٧. During the preparation of an ESIA-Report for local permitting requirements, ECG, 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 Suez Governorate and the District Council of Ettaqa Zone, Egyptian General Authority for Shore Protection, Hydraulics Research Institute and local population leaders.

١٣٨. 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.

١٣٩. A scoping session for this ESIA undertaken by ECG in collaboration with the EEHC and EDEPC, took place on Wednesday, ٢ June ٢٠٠٨ during which a wide selection of personnel from different orientations contributed actively to its activities.

١٣٩. 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 ECG/EEHC/EDEPC consultation activities and to identify their immediate concerns.

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

١٤١. Mini-meetings were held with fishermen on the Suez area, Regional Branch of the Egyptian Environmental Affairs Agency (EEAA), Suez Governorate officials, Local People's Council's leaders, General Authority for Fish Resources Development and some active NGOs in Suez zone, namely the Environment Protection Society, El-Kheir Society, Specific Federation of Civil Societies in Suez and Association of Tourism Investors in Suez.

١٤٢. The key environmental issues raised during this consultation process are summarized in *Table ١١* and these issues were subsequently taken into account in the preparation of ESIA documentation both for local permitting requirements and this ESIA report.

١٤٣. The main results of phase ١ 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.

Table 11

Key Issues Raised During ESIA Scoping Meeting

Key issue discussed	Comments
Overall Project	All parties consulted expressed their overall approval for the project.
Social and Economic Impact	<p>Local Stakeholders commented that the power plant will be central to securing power supply for the industrial and commercial activities in the area and will benefit the local economy through labor opportunities.</p> <p>Local stakeholders and council leaders considered the social and economic impact of the plant to be wholly positive.</p> <p>There was an emphasize on the necessity of hiring most of the plant workers from the Suez Region because many of project's employment in the Suez Region have been drawn from the outside of the area.</p>
Waste water discharge and the aquatic environment	All local stakeholders expressed concern about the quality and quantity of water in the Suez Gulf Al-Sokhna 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 system.
Cooling Water	<p>El-Tagamoaa Party representative and representative of the National Institute for Oceanographic Studies & Fisheries raised the issue of algae suppression at the intake structure using chlorine with dosage designed for cold waters & not for local Egyptian waters.</p> <p>There was a recommendation to PEGSCo's representatives to review and check chlorine dosage system on the basis of local Egyptian marine environment.</p>
Air Quality	<p>There was big concern over the following issues:</p> <ul style="list-style-type: none"> compliance with air quality standards and the effect that non-compliance and subsequent plant closure could have on security of employment in the area; accumulated effects of the relatively degraded air quality in the Ettaqa atmosphere and the impact of the power project; back up heavy fuel oil is prohibited in residential areas, but El-Ain Al-Sokhna, as identified in several physical planning schemes for Suez Region, belongs to an industrial setting. Impact of four power plants located all together on the Gulf of Suez (Oyoun Moussa, Ettaqa, Suez Gulf & El-Ain Al-Sokhna) on air quality in the Suez region.
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.
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١٤٤. 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.

١٤٥. A public meeting will be held in the Suez Governorate on Wednesday, ٦th August ٢٠٠٨. 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.

١٤٦. The key environmental issues that will be raised during this public consultation meeting will be summarized also in *Table ١١*.

Ongoing Consultation and Disclosure

١٤٧. Sokhna Power Plant's (SPP'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.

١٤٨. The process and results of the public consultation activities held to date are documented in the EISA, Chapter ٩ and Annexes A, B, C and D.

١٤٩. 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.

٩. RESPONSIBILITIES AND INSTITUTIONAL ARRANGEMENTS

٩.١ Environmental Management Organization

During Design and Construction

١٥٠. 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.

١٥١. During construction, EDEPC/SPP 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.

١٥٢. Implementation of these measures will be enforced and supervised by the Assistant Plant 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

١٥٣. During operation, direct responsibility for environmental compliance and the implementation of the mitigation, management and monitoring measures described in this Summary and in Section V of the Main Report, will continue to be with the Assistant Plant Manager. This position, will report directly to the Chairman/General Manager of EDEPC/SPP.

١٥٤. 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.

١٥٥. 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.

١٥٦. Chemicals used during plant operation are process-related. Hazardous chemicals to be used include chlorine (٥٥٠٠ kg/hr), sulfuric acid (٧٠٠٠ kg/day infrequency once per day). Handling, storage and application of these

chemicals will be used under strict regulations of handling hazardous materials stipulated by Law ٤/١٩٩٤.

١٥٧. The Assistant Plant Manager will also have lead responsibility for maintaining a written Environmental Register with respect to environmental impacts as required under Egyptian and World Bank 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, EDEPC/SPP, through the Assistant Plant Manager, will immediately inform the EEAA and disclose the procedures being taken to rectify non-conformity.

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

١٥٩. 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.

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Environmental Training

١٦٠. The Project Company will ensure that the power plant is manned ٢٤ hours a day, ٧ 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.

١٦١. Training will include:

- induction training on appointment;
- specialist training (as required for their prescribed job role); and
- refresher training as required.

١٦٢. 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.

١٦٣. 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.

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Occupational Health and Safety

١٦٤. EDEPC/SPP 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 and World Bank guidelines as given in Section ٢ 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.

١٦٥. 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.

١٦٦. 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.

١٦٧. 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.

١٦٨. 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.

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Emergency Procedures and Accident Response

١٦٩. 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

١٧٠. 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 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.

١٧١. 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

١٧٢. As Good practice and part of the ESMP, EDEPC/SPP will prepare an Oil Spill Contingency Plan.

١٧٣. Heavy fuel oil will be delivered to the site by road and stored in:

- two ٤٥٠٠٠٠ m^٣ tanks for the mazout oil (oil no. ٦).

١٧٤. Light fuel oil will be delivered to the site by road and stored in:

- one ٢٠٠٠٠ m^٣ tank for the light fuel oil (oil no. ٧ / solar).

١٧٥. These tanks are surrounded contained within separate retention area which is designed to contain ١١٠% of one tank.

١٧٥. The plan will cover the following activities.

- delivery;
- handling;
- spills; and
- cleanup.

١٧٦. The plan will detail procedures, responsibilities, chains of command, information flows, monitoring and documentation. *Table ٤* presents institutional arrangements for El-Ain Al-Sokhna power project.

١٠. IMPLEMENTATION SCHEDULE AND REPORTING

١٧٧. 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 Bank.

١١. CONCLUSIONS

١٧٨. The Project Company proposes to develop a new thermal power plant of total capacity ٢٨٦٥٠ MWe at the area reserved for the Al-Sokhna Power Plant on land owned by the EDEPC Company. The site is an Industrial Setting and does not contain significant residential environmental sensitivity of importance.

١٧٩. 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.

١٨٠. 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.

١٨١. 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.

١٢.

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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 ٢٤ 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 archeologists of the General Authority of Antiquities (within ٢٢ 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.

