CHAPTER 6

PRELIMINARY ENVIRONMENTAL IMPACT ASSESSMENT

6.1 INTERODUCTION

This Preliminary Environmental Impact Assessment of the Sidi Krir Combined Cycle Power Plant Project is based on a typical conceptual plant design and the known characteristics of the Sidi Krir site. When the actual detailed plant design is established, a Final Environmental Impact Assessment will be prepared. Where appropriate, this preliminary assessment provides guidance on the detailed design information and environmental analyses that should be provided in the final assessment.

6.2 POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

6.2.1 Government of Egypt Requirements

Beginning in the 1950s, the Government of Egypt has promulgated several laws and regulations concerning protection of the environment. Requirements for environmental impact assessment are found in the following documents:

- Law Number 4 for the Year 1994, "Law for the Environment"
- Prime Minister's Decree Number 338 for the Year 1995, "Promulgating the Executive Regulations of the "Law for the Environment"

These documents require 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 (LA)" for the project in question.

Egyptian laws and regulations specify the technical scope and contents of an environmental impact assessment. This has been clearly identified by the EIA guidelines published by the EEAA in 1997.

As a matter of fact, environmental impact assessments for power plant projects typically have a scope and organization similar to World Bank environmental assessments, which are described in the next section.

In addition to environmental impact assessment requirements, the Government of Egypt has established air pollution and water pollution limits applicable to Power Project. These limits are discussed in Item 6.5, along with actual air and water pollution levels expected from the Sidi Krir Combined Cycle Power Plant.

6.2.2 World Bank Guidelines

The World Bank guidelines include environmental impact assessment as an integral part of the evaluations that the World Bank performs before financing a proposed project. The World Bank's Operational Directive 4.10 (October 3, 1991) provides guidance on the types of assessments that should be performed for different types of projects, and on the scope and content of those assessments. According to Operational Directive 4.10, thermal power plant projects require a full Environmental Assessment (EA).

Annex B to Operational Directive 4.10 provides an outline of the information that should be included in a full EA. This Preliminary Environmental Impact Assessment follows the organization and scope of Annex B as much as is possible without a detailed plant design. When the detailed design has been determined, EEA will fully address all of the items outlined in Annex B.

In addition to environmental impact assessment guidelines, the World Bank has established guidelines concerning air pollution and water pollution from thermal power plants.

Comprehensive guidelines were published in 1988, and officially revised in 1998. The current World Bank guidelines are discussed in Section 6.5, along with the actual air and water pollution levels expected from the Sidi Krir Combined Cycle Power Plant.

6.3 PROJECT MAIN FEATURES

The proposed Sidi Krir Combined Cycle Power Plant Project involves the construction and operation of one electric generating combined cycle module at the proposed site. The site location is shown in Figure 6-1. The general site arrangement is shown in Figure 6-2. The following sections describe the technical and environmental aspects of the proposed Power Plant Project.

6.3.1 Technical Aspects

The Power Plant will consist of one electric generating combined cycle module, with a rated capacity of 750 MW composed of two 250 MW capacity gas turbines and one 250 MW capacity heat recovery steam turbine via Heat Recovery Steam Generator (HRSG). Each gas turbine will be capable of firing natural gas or sollar (oil no. 2), but sollar will be used only as an emergency fuel. Under normal circumstances, the module will fire 100% natural gas.

The Power Plant will be constructed at Sidi Krir, a developed flat land located at the existing Sidi Krir power plant site.

Condenser cooling water for the proposed module will be withdrawn from and returned to the sea via a once-through cooling system. Potable water will be obtained from a water supply network of the Alexandria city area reaching to the site. Treatment of water from the sea may be needed to supply other plant freshwater requirements. Natural gas will be obtained from an existing gas supply pipeline located near the site. sollar will be delivered by truck. No new electric transmission lines will be required to transmit the electricity generated by the power plant to national unified power supply system. Sidi Krir C.C. power plant will use the existing network infrastructure at the site. There are no plans to construct railroad connections or ship docking facilities for the plant.

Except for the conceptual information provided above, the specifications of the equipment of the Sidi Krir C.C. Power Plant has not yet been established. Therefore, this Preliminary Environmental Impact Assessment is based on the impacts that would be expected from a typical plant with the conceptual features described above. When the project design is developed, the detailed environmental impacts expected to result from that design will be assessed. In order to document the basis for the detailed assessment of environmental impacts, the following plant design information in the Final Environmental Impact Assessment will be provided:

- General description of the plant layout, buildings, and facilities.

Figure 6-1

The Site Location

Figure 6-2

The General Site Arrangement

- Detailed description of the location and design of cooling water intake and discharge structures.

- Detailed description of wastewater treatment facilities and other pollution control equipment.

- Detailed water balance diagram and estimates of wastewater discharge quantities, temperature, and composition.

- Detailed description of facilities and practices for the disposal of water treatment sludges, used paints and solvents, and other wastes.

- Detailed description of facilities and practices for the storage and handling of oil and chemicals.

- Detailed description of the chimney design (location, height, number of flues, flue diameter, liner material, etc.).

- Detailed data on flue gas emissions (flow rate; exit velocity and temperature; emissions of sulfur dioxide, nitrogen oxides, and total particulate matter in milligrams per cubic meter of flue gas and in monograms per joule of heat input).

- Detailed data on noise levels at various distances from operating plant equipment.

- Detailed description of equipment and provisions for monitoring air pollution emissions, wastewater discharges, and noise during plant operation.

- Detailed description of the location and design of any offsite facilities or connections to be constructed by EEHC.

- Detailed description of the practices that will be used to control noise, dust, erosion, and other adverse environmental impacts during construction of the power plant and any offsite facilities.

- Detailed description of the facilities (housing, transportation, drinking water, sanitation, etc.) that will be provided for workers involved in the construction of the power plant and offsite facilities.

- Summary of the expected construction schedule and manpower requirements through-out the construction period.

6.3.2 Fuel Supply

As mentioned above, the primary fuel for the Sidi Krir Combined Cycle Power Plant will be natural gas, with sollar (fuel oil no. 2) as an emergency fuel. New discoveries of natural gas reserves in the last few years have resulted in abundant fuel supplies. Identified natural gas reserves have increased from 12 trillion cubic feet to about 40 trillion cubic feet in the late 1999. Based on this, all anticipated fuel demand by the power sector (including the Sidi Krir C.C Power Plant) will be met. The fuel will be purchased from the Egyptian General Petroleum Corporation (EGPC), under a Fuel Supply Agreement to be signed by the Electricity Company and the EGPC. Tables 6-1 and 6-2 present specifications of natural gas and sollar available for Sidi Krir C.C. power plant.

6.3.3 Environmental Aspects

The construction and operation of any power plant produces certain impacts on the environment. Some of these impacts may be negative or adverse, while others may be positive or beneficial. The major aspects of the Sidi Krir Combined Cycle Power Plant project that are expected to impact the environment include the following:

- Temporary disturbance of the land surface during construction of the power plant and offsite facilities.

- Occupation of the land surface with permanent power plant structures and offsite facilities.

- Temporary disturbance of the bottom of the sea during the construction of cooling water intake and discharge structures and during any maintenance dredging that may be required for the intake and discharge.

- Occupation of a small portion of the bottom of the sea with permanent intake and discharge structures.

- Withdrawal of substantial quantities of water from the sea for cooling and other plant uses, and the return of most of this water with an increased temperature.

- Discharge of wastewaters containing sanitary wastes and chemical contaminants into the sea.

- Handling and combustion of natural gas and sollar.

- Emission of exhaust gases containing combustion products into atmosphere.

- Employment (and attraction into the local site area) of substantial numbers of workers for power plant construction and operation.

The nature and significance of the environmental impacts expected to result from these aspects of the Sidi Krir Combined Cycle Power Plant Project are discussed in Item 6.5.

Table 6-1

Specification of Natural Gas
Available for Sidi Krir C.C. Power Plant

Composition	% Vol	%WT
Nitrogen	0.21	0.32
Carbon Dioxide	1.89	4.49
Methane	88.11	76.33
Ethane	6.55	10.64
Propane	2.74	6.53
I-Butane	0.19	0.60
N-Butane	0.20	0.63
I-Pentane	0.05	0.19
N-Pentane	0.02	0.08
Hexane	0.03	0.14
Heptane Plus	0.01	0.05
TOTAL	100.00	100.00

- Molecular Weight		18.51
- Relative Density (air=1) AT 60 F		0.6393
- Density AT 60 F & 1 ATM	gm/L	0.7815
- Density AT N.T.P	gm/L	0.8267
- DEW Point C		< 0
- Total Sulfur Content PPM WT (MAX)		10
- Hydrogen Sulphide Content PPM WT (MAX)		5
-Gross Calorific Value	BTU/LB	22411

- Gross Calorific Value AT 60 F & 1 ATM

	BTU/CUF	1092
	KCAL/M3	9718
	KCAL/KG	12435

- Gross Calorific Value AT N.T.P

	BTU/CUF	1154
	KCAL/M3	10270
	KCAL/KG	12423

Source: Egyptian General Petroleum Corporation

Table 6-2

Specification of LFO (Sollar) Available for Sidi Krir C.C. Power Plant

Parameter	**Value**
Specific Gravity at 13.4^{o}C, t/m3	0.82 - 0.87
Colour ASTM,-	4.5 max.
Flash Point P.M. Closed ^{o}C	55 min.
Viscosity Redwood I at 100^{o}F (**), E	30 – 45
Pour Point in Winter (**), ^{o}C	4.5 max.
Pour Point in Summer, ^{o}C	10 max.
Sediment, % wt.	0.01 max.
Water Content, % vol.	0.15 max.
Ash Content, % wt.	0.01 max. (*)
Conradson Carbone, % wt.	0.1 max.
Total sulfur Content, % wt.	1.5 max.
Inorganic Acids & Bases, mgKOH/g	Nil
Distilled at 350^{o}C, % vol.	80 min.
Diesel index, -	48 min.
Hot filtration at 100^{o}C, -	-
Before Storage, % wt.	-
After 24 her storage, %wt	-
Solid Asphalt, %wt	-
Copper Strip Test at 100^{o}C, -	Division 1 mix.
Calorific Value (Gross), Kcal/kg	10,550 min.

(*) On 10% residue from distillation.
(**) Winter; From 1st of November to end of March.
Summer, 1st of April to end of October.
(1) Source : Egyptian General Petroleum Corporation.

6.4 BASELINE DATA

6.4.1 General Setting

The proposed site is located on the Mediterranean sea coastline, 30 Km west of Alexandria at approximately 10m above mean sea level. The site is situated 500m north of the coastal road connecting Alexandria and Marsa Matruh (the Alexandria – Marsa Metruh Coastal Road).

The topography of the coastline is flat, rising only 10m over the first 500m inland. The coastal road lies approximately 1.5 km from the coastline in a slight depression. Approximately 4 km away from the coastline, the land rises to form a ridge approximately 30m high. To the south of the ridge lies a depression which runs approximately parallel to the coastline, forming a series of lakes, collectively known as lake Maryut.

The proposed site forms part of a compound owned by the WDEPC which is bordered to the east by Sumed Oil Terminal. The Sidi Krir Units 1&2 power plant, owned and operated by WDEPC, occupies the north – east quadrant of the compound. The south–west and south–east quadrants are currently used by the worker colony for the Sidi Krir Units 1 & 2.

The area surrounding the site has a small scattered population, principally located in the village of Sidi Krir. However, there are numerous residential properties, mosques, shops and light industrial units located along the main road corridors and some illegal settlements have grown up on land owned by the WDEPC between the Sidi Krir compound and the coast road.

The main transport infrastructure in the Sidi Krir area is principally based on the road network. The main road network comprises:

- Alexandria - Marsa Metruh Coastal Road.
- Cairo – Alexandria Desert Road.
- 21 Km Road.
- Wadi El – Qamar Road.
- Borg El – Arab Road.

The road network links the main industrial centres in the region to the civilian and military port facilities near Alexandria. The road network is supplemented by rail and canal systems to the south and east of the proposed site respectively.

The beaches running along the Mediterranean Sea coastline west of Alexandria attract large number of tourists during the summer months. This is reflected by the presence of a rest and relaxation facility and tourist accommodation, including apartments and a motel approximately 300 m west of the site. The holiday apartments are supplemented by a private beach approximately 300 m west of the site.

The arid nature of the area and the low levels of irrigation provide little opportunity for agricultural production, although the scattered dwellings in the area cultivate some fig and palm trees. The principal industrial activities in the Sidi Krir area are the power plants at Sidi Krir (ie the Sidi Krir Units 1 & 2 and Sidi Krir InterGen Units 3 & 4) and the Sumed Oil Terminal. In the wider area, industrial activities comprise aquaculture and fishing, salt works, extraction and cement production and tourism.

The proposed site lies within the administrative boundary of the Alexandria Governorate. The Alexandria Governorate produced its *Comprehensive Development Plan-Alexandria 2005* (hereafter referred to as “the CDP”) for land use management and planning. This document is currently being revised and a new development plan is expected to be published setting out proposals up to the year 2017; however, in the absence of the publication of the revised development plan, the 2005 CDP remains valid. The 2005 CDP sets out the policy to control development in the Alexandria region, and the proposed land uses set out in the CDP incorporate Sidi Krir power facilities. The proposed land uses include a new business development, an Olympic Village and residential areas.

6.4.2 Population and Demography

There are no main residential cities or towns in the Sidi Krir area, there is a small population located 3 km west of the site in the Sidi Krir Village. Further settlement has occurred in the road corridors, and shops, mosques and small light industrial units have developed to meet local community requirements. Immediately to the south of the proposed site, at approximately 100 m, a workers colony for the staff at Sidi Krir Units 1 & 2 is currently existed. To the south of the Sidi Krir Units 1 & 2 workers colony, some agreed upon settlement has occurred on land owned by the WDEPC.

In the region surrounding the proposed site there are 5 main cities, towns and villages, which comprise Alexandria, El Ameriya, Borg El Arab, King Maryut and Bahig. Under the proposals set out in the 2005 CDP, the population of the areas is likely to increase with the development of new residential areas. Population in the region according to 2000 statistics is as follows:

Main Population Centers in the Vicinity of the Proposed Site

Principal Population Centers	Population	Distance and Direction form site (km)
Alexandria	2,270.000	20Km East
El Ameriya	22.000	15Km east south east
Borg El Arab	4.000	10Km south west
King Maryut	2.600	6km south west
Bahig	2.000	10Km south
Sidi Krir	Unknown	3 Km west

6.4.3 Indigenous Populations and Traditional Tribal Lands

The Egyptian Western Desert is the home to approximately 7 or 8 Bedouin tribes. The relevance of the proposed site with regard to the movements of these tribes is uncertain, although the available evidence indicates that it is not significant.

6.4.4 Employment and the Labour Market

The principal employment in the Sidi Krir area is focused around the proposed power plant site which locates at the existing complex comprising Sidi Krir Units 1 & 2 and Units 3 & 4, and the Sumed Oil Terminal. Additional employment is offered from the local tourist trade, shopping facilities and small scale agricultural enterprises.

Employment opportunities exist in the wider surrounding area at a cement works, salt processing center, port facilities at Alexandria and fish farms.

The proposals outlined in the 2005 CDP will potentially offer greater employment through the construction and operation of the proposed business, industrial and tourist developments.

6.4.5 Income Distribution and Socio-economic Profile

There is no published information available concerning the income distribution and socio-economic profile of the population within the Sidi Krir area. However, from fieldwork it would appear that the population is a mixture of professional and manual workers.

6.5 ENVIRONMENTAL IMPACTS

This item discusses the environmental impacts expected to result from construction and operation of the Sidi Krir combined cycle power plant at the Sidi Krir site. Because the detailed design of the power plant has not yet been established, this assessment of environmental impacts is based on plant characteristics considered typical of the conceptual Sidi Krir C.C. plant. Where specific numerical plant parameters were needed for quantitative impact analysis, typical parameters were assumed. The specific parameters that were assumed are identified in the discussion of environmental impacts.

The following sections discuss the major, or potentially most significant, impacts expected to occur in each aspect of the environment.

6.5.1 Air Quality and Meteorology

The potential air quality and meteorology impacts of the Sidi Krir C.C. Power Plant will result primarily from the emission of combustion products (turbine exhaust gas) through the plant chimneys or stacks. Because the power plant will burn only natural gas and sollar, there will be no fugitive emissions from the plant. The primary source of fugitive dust will be soil that is disturbed during plant construction, and these impacts will be temporary and confined to the immediate site area. Therefore, the only potentially significant air quality impacts that need to be analyzed are the impacts of air pollution emissions through the plant stacks.

In order to evaluate the impact of stack emissions from the Sidi Krir C.C. power plant, certain emission parameters were assumed. These parameters were then input into the Industrial Source Complex (ISC) program, a computerized air quality impact model developed by the United States Environmental Protection Agency (U.S. EPA). The ISC model predicts the concentration of each pollutant that would occur in the ground-level ambient air as a result of the specified stack emissions, considering site-specific terrain and meteorology.

The results of the ISC modeling are shown, and compared with the Egyptian and World Bank ambient air quality standards, in Table 6-3. It can be seen that the predicted pollutant concentrations comply with all of the standards except when the units at the Sidi Krir site (proposed module 1 & 2) burn approximately 100% sollar. When the module burn 100% sollar, the maximum predicted 24-hour SO2 concentrations exceeds both the Egyptian and the World Bank standards. When the module burn 100% natural gas, the maximum predicted 24-hour SO2 concentrations are considerably under the Egyptian and World Bank standards.

Also, when the module burns 100% sollar, the max. predicted 24-hour NOx concentrations exceeds dramatically both the Egyptian and the World Bank standards.

It should be noted that all other predicted pollutant concentrations (that is, the SO2 annual concentration and the NOx and TSP concentrations for all averaging times) comply with the air quality standards even when all of the units burn 100% sollar. The only predicted exceedance of the standards is for the short-term (that is, the 24-hour and 1-hour) SO2 & NO2 concentrations.

At this, the predicted exceedance of the short-term SO2 & NO2 standards does not appear to be a significant problem, but it should be evaluated further when the detailed plant design is determined. sollar will be used only as an emergency fuel; therefore, the plant is expected to burn sollar only infrequently, and a situation may never arise in which the module burn 100% sollar for a significant period of time. However, it seems intuitively possible that in the event of a gas supply problem, the module might burn 100% sollar for a short period such as 1 hour. During such periods, the actual ground-level SO2 & NO2 concentrations would depend on the prevailing meteorological conditions, but the concentrations could exceed the Egyptian and World Bank short-term standards.

Generally, air quality standards are set at levels believed to be necessary in order to protect human health. In particular, short-term SO2 and NO2 standards generally are intended to protect people with asthma and other preexisting respiratory problems that cause them to be sensitive to SO2 & NO2. Exceeding the short-term SO2 & NO2 standards, therefore, could have serious health effects on certain people. However, any individual short-term exceedance of the standards may occur in a location and at a time when no sensitive people are present. For this reason, infrequent exceedances of the short-term SO2 & NO2 standards may not cause any problems. This fact is recognized by the U.S. EPA, which allows each part of the United States to experience one exceedance of the short-term standards per year.

The important questions for the Sidi Krir C.C. project are how often the units will burn 100% sollar for periods of 1-hour or longer, and how often meteorological conditions at the Sidi Krir site will result in SO_2 & NO_2 concentrations that exceed the short-term standards. The first question should be answered by the Electricity Company. The second question should be answered through air quality modeling that makes use of sequential hourly meteorological data collected at an appropriate meteorological station. The meteorological monitoring that the Egyptian General Meteorological Authority is conducting in the Sidi Krir region is expected to be an excellent source of such data. At least one year of data should be used for the modeling.

When the detailed plant design is established, the Electricity Company will reanalyze the expected air quality impacts incorporating the information described above. If this analysis indicates that exceedances of the short-term SO_2 & NO_2 standards might occur more frequently than considered acceptable by the appropriate Egyptian governmental authorities, the Electricity Company will consider design modifications that would reduce ground-level SO_2 & NO_2 concentrations. One such design modification would be the incorporation of flue gas desulfurization equipment, but this option is likely to be much more expensive than could be justified by the amount of sollar the units are expected to use. Another, and probably more cost-effective, option would be a taller stack. The preliminary air quality modeling discussed in this assessment assumed a stack height of 80 meters, which is expected to be approximately near to the "good engineering practice" (GEP) stack height determined according to U.S. EPA guidelines. Use of a stack height taller than the GEP height may be appropriate for the Sidi Krir C.C. plant, if necessary to avoid occasional exceedances of the short-term SO_2 and NO_2 standards when all of the units burn sollar.

For informational purposes, Table 6-3 also shows the results of air quality modeling with a stack height of 80 meters.

Overall, the air quality impacts predicted in this preliminary assessment appear to be acceptable. During the normal conditions under which the Sidi Krir C.C. plant is expected to operate, all pollutants are expected to comply with Egyptian and World Bank air quality standards. Compliance with the standards is expected to ensure that air pollution emissions from the Sidi Krir C.C. plant will not have adverse impacts on human health or the environment.

It should be noted that, in addition to the ambient air quality standards discussed above, the Government of Egypt and the World Bank have also established standards for stack emissions of air pollutants. These emission standards are summarized in Table 6-4. When the Electricity Company determines the detailed plant design, the EIA study will ensure that the air pollution emission rates comply with these standards.

6.5.2 Water Quality and Hydrology

The potential water quality and hydrology impacts of the Sidi Krir C.C. power plant will result primarily from the construction of water intake and discharge structures in the sea, and the withdrawal of water from and discharge of wastewaters to the sea. Other potential sources of water quality impacts are run-off of loose soil during rainstorms (which can cause turbidity and sedimentation in nearby bodies of water that receive the run-off) and leaks or spills of oil or chemicals (which can soak into the ground and contaminate both groundwater and surface water that is in contact with the groundwater). The significance of these potential impacts for the Sidi Krir C.C. project are discussed in the following subsections.

6.5.2.1 Water Intake and Discharge Structures

Intake and discharge structures will be needed to withdraw water for condenser cooling and other plant uses from the sea and to discharge wastewaters to the sea. The construction and presence of the intake and discharge structures will produce impacts on the water quality and hydrology of the sea. The significance of these impacts will depend in large part on the design of the intake and discharge structures. Because the design of the Sidi Krir C.C. power plant has not yet been determined, the potential impacts of the intake and discharge structures are discussed below in a conceptual manner.

Construction of the intake and discharge structures inevitably will disturb parts of the shoreline and the bottom of the sea. This disturbance will produce a temporary increase in the turbidity of the water. If the bottom sediments are contaminated with oil or toxic chemicals from previous industrial activities, disturbing the sediments will also produce a temporary increase in the concentration of these contaminants in the water. The degree of these impacts will depend on the size of the structures and the amount of time required for their construction. However, because the impacts will be restricted to a relatively limited area and a temporary time frame, the impacts are not likely to be significant. Within a relatively short time after construction activities have ended, water quality will return to its previous condition. If periodic dredging is required to maintain the intake and discharge structures, similar water quality impacts will occur during the dredging, but these impacts probably will be restricted to an even smaller area and shorter time frame than the original construction impacts.

The physical presence of the intake and discharge structures could affect currents in the site area. Changes in these currents could affect the transport and deposition of sediments in the site area. The nature of these changes will depend on the size and orientation of the structures relative to existing currents. However, it is unlikely that the structures would be so large as to produce significant impacts on currents or sediment deposition.

6.5.2.2 Water Withdrawal and Wastewater Discharge

During operation of the Sidi Krir C.C. power plant, substantial quantities of water will be withdrawn from the sea for condenser cooling and other plant uses. Some of this water will be lost to evaporation and consumptive uses, but the water loss will be very insignificant compared to the amount of water available. Most of the water will be returned to the sea in the form of wastewater discharges, but the wastewater that is discharged will be at a higher temperature than the ambient water and will contain certain chemical pollutants.

The activities that are expected to generate wastewaters at the Sidi Krir C.C. power plant include the following:

- Once-through condenser cooling (including the addition of chemicals to prevent biofouling and scaling)
- Demineralization of fresh water for use in boilers.
- Chemical cleaning of boilers.
- Washdown of equipment and floors.
- Collection of sanitary wastes from plant employees and housing colony residents.
- Collection of rainfall runoff from oil storage tanks and other contaminated areas.

Appropriate measures should be included in the plant design to ensure that all wastewaters can be discharged safely and without adverse environmental impacts. These measures generally should include the following:

- Re-use of wastewaters as much as possible to minimize the volume of wastewater discharges.

- Design of the condenser cooling system to minimize chemical treatment requirements and to keep the temperature rise within an acceptable range.

- Neutralization of any wastewaters that may exhibit a pH outside the range of 6 to 9.

- Oil separation of any wastewaters that may be contaminated with oil or grease.

- Settling and coagulation of any wastewaters that may contain high concentrations of suspended solids.

- Tertiary treatment of all sanitary wastes.

The environmental impacts of wastewater discharges will depend on the detailed design of the plant and its wastewater treatment systems. For informational purposes, Table 6-5 shows the composition of the wastewater discharges from a similar plant. The column labeled “Treated Wastewater” refers to the effluent that will be produced by treatment of plant wastewaters except condenser cooling water. The column labeled “Station Effluent Discharge” refers to the mixture of the treated wastewaters and condenser cooling water, which is the combined effluent that will be discharged to the sea.

Table 6-5 also shows the Egyptian standards for wastewater discharges and for ambient sea water quality. The discharge standards must be met at the point where wastewaters are discharged to the environment, while the sea water quality standards must be met at the edge of an appropriate mixing zone, which is not defined. It can be seen that the wastewater discharge is expected to comply with all of the discharge standards and with all of the water quality standards (except for pH and possibly temperatare, which certainly can be met after mixing with the ambient sea water). Therefore, the discharge is expected to have no significant adverse environmental impacts.

The discharge temperature for the plant is considered acceptable if thermal plume modeling predicts that the temperature increase will be less than 5 ^{o}C within a relatively small mixing zone (specifically, will decrease to about 3 ^{o}C at a max. Distance of 100 meters of the discharge point). If the Sidi Krir C.C. plant is designed with a similarly small mixing zone, it should be acceptable under the Egyptian standards for the mixing zone.

6.5.2.3 Soil Run-Off

Water quality impacts due to soil run-off during rainstorms occur primarily when vegetation is removed and soil is disturbed for construction activities. At these times, soil that would normally remain in place during a rainstorm can be washed away and carried into nearby bodies of water.

At the Sidi Krir site, soil runoff is not expected to produce significant impacts on any water bodies because the site area receives virtually no rain during at least half of the year, and the normal ground cover on the site is primarily prepared ground, so plant construction will not require removal of any vegetation that normally would keep soil in place. However, as long as standard good construction and engineering practices are used, the water quality impacts of soil run-off will be negligible.

6.5.2.4 Oil and Chemical Contamination

The Sidi Krir C.C. power plant will handle and store large quantities of sollar and probably chemicals (such as, for water and wastewater treatment). If oil or chemicals were leaked or spilled, they could soak into the ground and contaminate both groundwater and surface water that is in contact with the groundwater. However, the potential for contamination problems can be effectively eliminated by standard design practices that are expected to be incorporated in the design of the Sidi Krir plant. These design practices include the following:

- Oil and chemical storage tanks should be located inside of berms sized to hold the entire contents of the largest tank. The ground inside the berm and the inner surface of the berm should be lined with an impervious material.
- Storage tank loading and unloading areas should be inside the containment berms, but the tanks should be protected from accidental collisions with vehicles.
- Storage tank loading and unloading connections should be fitted with valves that automatically stop the flow of material in the event of an accidental disconnection.
- Storage tanks should be equipped with level detectors capable of alerting plant personnel to potential leaks and accidental overfilling of the tanks.

These design practices will be important for the Sidi Krir C.C. plant.

6.5.3 Aquatic Resources

Impacts on aquatic resources result primarily from changes in water quality and hydrology. As discussed in the previous section, the Sidi Krir C.C. Power Plant is expected to have insignificant impacts on water quality and hydrology. Therefore, impacts on aquatic resources also are expected to be insignificant.

Another reason that impacts on aquatic resources are expected to be insignificant is the general lack of aquatic resources in the area. Biodiversity of sea water organisms anticipated to be low in the site area. No sensitive organisms are known to occur. The site area is not known to be used for commercial fishing or other significant aquatic activities.

The only potentially significant issue that might be raised regarding impacts on aquatic resources is the discharge of heated cooling water to the sea water. If these discharges significantly increase ambient water temperatures over a large area, they might interfere with the reproduction of fish and other aquatic organisms. Therefore, the potential impact of thermal discharges should be evaluated in detail when the design of the plant has been established.

Thermal modeling performed for previous similar projects indicates that, during warm weather conditions, the area within which cooling water discharges raise ambient temperatures by 5 ^{o}C extends less than 50 meters from the discharge point. The area within which cooling water discharges raise ambient temperatures by 3 ^{o}C extends less than 100 meters from the discharge point. These distances are very small compared with the dimensions of the sea downstream path, even in the immediate site vicinity. If the impacts of the Sidi Krir C.C. power plant are found to be similarly small, any concern over significant biological impacts due to cooling water discharges can be eliminated.

6.5.4 Terrestrial Resources

The Sidi Krir C.C. power plant will have no significant impact on terrestrial resources. Ground cover in the immediate area where the Sidi Krir C.C. plant will be constructed consists almost entirely of prepared ground. Therefore, construction of the Sidi Krir C.C. plant will have virtually no impact on vegetation or animals on the site proper.

A new electric transmission lines will be required to transmit electricity from the Sidi Krir C.C. plant to the EEHC power system, but the existing network infrastructure will be utilized. However, no impact on vegetation or other terrestrial resources will be generated.

6.5.5 Land Use

The Sidi Krir C.C. power plant will have no significant impact on land use. The plant site does not currently contain any structures, agricultural activities, or other significant land uses. Therefore, the Sidi Krir C.C. plant will not displace or disturb any productive land uses on the site proper.

6.5.6 Socioeconomic and Cultural Features

Because the Sidi Krir C.C. power plant will have no significant impact on land use or terrestrial resources, it will have no significant socioeconomic impacts except for providing jobs in the local area. The exact number of plant employees will be determined by the Electricity Company , but it is expected that a workforce of more than 2000 people will be needed for plant construction, and at least 800 people probably will be employed during plant operation.

The jobs that will be provided by the Sidi Krir C.C. project will greatly benefit the economy of the local region. In addition to the power plant jobs themselves, the increased income probably will stimulate the development of other businesses, which will provide still more jobs. The Electricity Company will maximize these positive impacts by attempting to hire as much of the plant workforce as possible from the local site region.

When large numbers of workers move into a rural area, as sometimes happens during construction of a power plant, problems can arise due to social and cultural conflicts, monetary inflation, and over-crowding of public services. These problems are not expected to occur with the Sidi Krir C.C. project, because the site is within the very urbanized metropolitan area of Sidi Krir region.

Because no significant historical, archaeological, or cultural features are known to be located in the site area, the Sidi Krir C.C. plant is not expected to have any impact on such features.

6.5.7 Conclusions

Based on a typical conceptual plant design, the Sidi Krir C.C. power plant is expected to have no significant adverse impacts on any aspect of the environment. The jobs that will be provided by the project are expected to have significant beneficial impacts on the economy of the site region.

Although none of the possible impacts that have been identified appear to be potentially significant, issues involving short-term concentrations of SO2 and the thermal impacts of cooling water discharges cannot be completely resolved until the detailed plant design has been established. The Electricity Company will provide a detailed quantitative analysis of these potential impacts in the Final Environmental Impact Assessment.

Table 6-3

Comparison of the Predicted Ground Level Pollutant Concentrations for Emissions from Normal Operation (750 MW ISO-Rating Gas Combined Cycle plant at 70% Load + 283.6 MW Sidi Krir Comb at 70% Load + 90 MW H. Oil Sidi Krir Steam & 420 MW H. Oil / N.G Sidi Krir Steam at 100% Load) of the Proposed and Existing Power Plant with Air Quality Criteria (Stack Height 80 m)

Statistical Parameter	Maximum Predicted Ground Level Concentration (μgm^{-3})	Assessment Criterion (μgm^{-3}) EEAA	WB	EPA
Nitrogen Dioxide [e]				
Maximum 1 hour mean				
• 70% load, natural gas(f)	(d)	400 [a]	No Limit	N/A
• 70% load, sollar (f)	(d)	400 [a]	No Limit	N/A
Maximum 24 hour mean				
• 70% load, natural gas (f)	89.66	150 [a]	150	N/A
• 70% load, sollar (f)	412.40	150 [a]	150	N/A
Maximum annual mean				
• 70% load, natural gas (f)	15.73	N/A [b]	100	100
Sulphur Dioxide				
Maximum 1 hour mean				
• 70% load, natural gas (f)	(d)	350 [a]	No Limit	
• 70% load, sollar (f)	(d)	350 [a]	No Limit	
Maximum 24 hour mean				
• 70% load, natural gas (f)	7.45	150 [a]	150	365
• 70% load, sollar (f)	170.20	150 [a]	150	365
Maximum annual mean				
• 70% load, natural gas (f)	2.95	60 [a]	80	80
Particulate Matter [c]				
Maximum 24 hour mean				
• 70% load, natural gas (f)	6.43	230 [a]	230	150
• 70% load, sollar (f)	13.56	230 [a]	230	150
Maximum annual mean				
• 70% load, natural gas (f)	0.59	90 [a]	80	50

Notes:
(a) Egyptian standard
(b) N/A = Not Available
(c) Maximum predicted concentrations are for total suspended particulates. The standards refer to PM_{10}, which will represent a fraction of the total, so the assessment is worst case.
(d) It is not applicable to predict maximum 1 hour mean concentrations for normal operation.
(e) As a worst case, it has been assumed that all NOx is in the form of NO2.
(f) 70% Load for gas turbines.

Table 6-4

Inventory of Emissions to Air from
Existing and Proposed Power Plant (average per unit)
(All values Comply with Stipulated Regulations)

Power Facility / Fuel		Emission Concentration (mg/m^3)			
		Nitrogen Oxides (Nox)	*Carbon Monoxide (CO)*	*Sulphur Dioxide (SO_2)*	*Particulate Matter (PM)*
Existing Sidi Krir Steam (2 x 210) MW Fuel: Natural Gas (Measured: October 200)		**260**	**17**	**2**	**Trace**
Proposed Module (1x750)MW	**Natural Gas**	**40.6**	**20.3**	**0.4**	**7.7 (PM_{10})**
	Sollar Oil	**69.7**	**17.7**	**667.3**	**4.6 (PM_{10})**

Egyptian Standards		**300**	**2500**	**2500**	**200**
World Bank Regulations	**Natural Gas**	**125**	**-**	**2000**	**50**
	Sollar Oil	**165**			

Table 6-5

Egyptian Emission Standards for Fossil-Fueled Electric Utility Steam Generation Units

Pollutant	Emission Standards (milligram/m3 of exhaust)
SO_2	2500
TSP	200
NO_2	300

World Bank Air Emission Guidelines for Thermal Power Plants

Pollutant	Emission Limits
SO_2	0.2 t/d per MWe for first 500 MWe plus 0.1 t/d for each additional MWe, and 0.2 000 mg/Nm3, and 500 t/d
Particulates TSP	50 mg/Nm3
NO_2 <u>Gas</u> **<u>Oil</u>** **<u>Coal</u>**	86 ng/J or or 320 mg/Nm3 or 155 ppm 130 ng/J or or 460 mg/Nm3 or 225 ppm 260 ng/J or or 750 mg/Nm3 or 365 ppm

Table 6-6

Egyptian Standards and Predicted Wastewater Discharges from the Plant

Parameter	Nile Water (Intake)	Treated Wastewater	Station Effluent Discharge	Egyptian Discharge Standards (Law 4-94)	Egyptian Nile Water Quality Standards (Law 48-82)*
Temperature, ^oC	-	-	5^oC increase at 20 meters	10^oCincrease	5^oC increase
PH	7.3-8.1	6-9	6-9	6-9	7
Sodium (na+ion), mg/l	12,400	178.0	12,414.9	-	-
Chloride (Cl-ion), mg/l	21,700	9.8	21,726.0	-	-
Sulfate (SO4 ion), mg/l	3,100	362.8	3,103.8	-	-
Phosphate, mg/l	0.0	0.0	0.0	5	-
TDS, mg/l	214	551.8	39,782.3	2,000 increase	650 increase
TSS, mg/l	40	5.6	40.05	60	50
Iron, mg/1	0.14	0	0.14	1.5	-

* Applicable at the edge of an undefined mixing zone.

6.6 ANALYSIS OF ALTERNATIVES

This chapter discusses the primary alternatives that were considered in developing the conceptual plans for the Sidi Krir C.C. power plant, and the additional alternatives that should be considered in developing the detailed plant design.

6.6.1 No Action

One alternative to the Sidi Krir C.C. power plant would be to do nothing. This alternative would avoid all of the impacts associated with Sidi Krir C.C. project, including the beneficial impacts on the economy of the Sidi Krir site region. In addition, this alternative would have adverse consequences for the Egyptian electricity supply system.

A number of load forecasting studies have shown that Egypt will need additional electric generating capacity by the time the Sidi Krir C.C. plant is expected to begin operation. The rate of growth in electricity demand has exceeded 6.5% per year over the last 10 years, and is projected to be approximately 5% to 6% over the next 15 years. Meeting this increased demand and maintaining system reliability will require the addition of more than 13,000 MW of new generating capacity over the next 15 years. The Sidi Krir C.C. power plant is an integral part of EEHC’s plan to meet the need for additional generating capacity. Therefore, the “no action” alternative would involve a deficiency or shortfall in the supply of electricity. Such a deficiency could impede economic growth and lead to a deterioration in the quality of life for people in the Sidi Krir region and in other parts of Egypt.

Considering that Egypt is a developing country and that its continued progress requires an adequate and dependable supply of electricity, the “no action” alternative does not appear to be feasible.

6.6.2 Alternative Designs

During the development of the detailed plant design, the Electricity Company should consider and evaluate appropriate alternative designs. Plant features that will have a potential impact on the environment, and for which alternative designs should be evaluated, include the following:

- Main stack (height, diameter, liner material, etc.)
- Cooling water intake and discharge structures.

- Wastewater treatment facilities.
- Oil and chemical storage tanks and secondary containment structures
- Air pollution and water pollution monitoring instruments

The evaluation of alternative designs should include both environmental and economic factors. As much as possible, the monetary costs and the environmental advantages and disadvantages of each alternative should be quantified. The basis for selecting the proposed design should be clearly stated.

6.7 ENVIRONMENTAL IMPACT MITIGATION PLAN

As long as the Sidi Krir C.C. power plant incorporates standard design features included as good practice in most international projects, the plant is not expected to have significant adverse impacts on any aspect of the environment. Therefore, no special impact mitigation measures are expected to be necessary. The following sections summarize the standard design features that should be included in the project in order to minimize potential adverse impacts in each environmental area.

6.7.1 Air Quality and Meteorology

Natural gas will be the primary fuel of the Sidi Krir C.C. power plant. Natural gas is the cleanest fossil fuel available, and its use will automatically tend to minimize air pollution emissions.

Because natural gas will be used almost exclusively, no special air pollution control equipment will be necessary. The results of preliminary air quality modeling indicate that the Sidi Krir C.C. plant generally will comply with Egyptian and World Bank ambient air quality standards without the use of flue gas desulfurization equipment or particulate control equipment. The Electricity Company will set the stack height at a level that ensures the plant will comply with the air quality standards, based on detailed air quality modeling using the actual plant design. Potential violations of short-term sulfur dioxide standards should be evaluated and resolved.

6.7.2 Water Quality and Hydrology

The Sidi Krir C.C. power plant is expected to employ a once-through cooling system, which will require the withdrawal of substantial quantities of sea water and the use of relatively large intake and discharge structures. The design of the cooling system should incorporate the following design features to minimize potential adverse impacts:

- Water intake and discharge structures should be located and designed to avoid interference with navigation and to minimize impacts on existing sea water current patterns and existing aquatic organisms.

- Water intake velocity should be no more than 0.3 meters per second, so as to minimize entrainment of fish and erosion of bottom sediments.

- Temperature rise across the condensers should be limited to ensure compliance with applicable discharge temperature restrictions (see discussion in Subsection 6.5.2.2).

- Water discharge structures should be located and designed to provide efficient dispersion of heated effluents.

All plant water systems should be designed to minimize water consumption and to maximize reuse and recycling of wastewaters. All wastewater discharges should be designed to comply with applicable discharge standards established by the Government of Egypt and the World Bank. Provisions should be made in the design for the following types of wastewater treatment:

- Neutralization of any wastewaters that may exhibit a pH outside the range of 6 to 9.

- Oil separation of any wastewaters that may be contaminated with oil or grease (including rainfall run-off from sollar storage and transfer areas).

- Settling and coagulation of any wastewaters that may contain high concentrations suspended solids.

- Collection and tertiary treatment of all sanitary wastes generated by plant employees and residents of housing colonies (if any).

Provisions should be made in the plant design for the following features to prevent accidental leaks or spills of oil or chemicals that might contaminate groundwater or surface water:

- Oil and chemical storage tanks should be located inside of berms or dikes sized to contain the entire contents of the largest tank. The ground inside the berm and the inner surface of the berm should be lined with an impervious material.

- Drains inside the containment berms should lead to an oil separator, but should be equipped with remote shut-off valves so that a large leak or spill could be retained.

- Storage tank loading and unloading areas should be located inside the containment berms, but the tanks should be protected from collisions with vehicles.

- Storage tank loading and unloading connections should be equipped with valves that prevent accidental backflow and that automatically stop the flow in the event of an accidental disconnection.

- Storage tanks should be equipped with level detectors capable of alerting plant personnel to underground leaks or accidental overfilling of the tanks.

- Underground piping should be protected from corrosion and damage due to surface loads.

Finally, provisions should be made in the design and operation of the plant for the proper disposal of wastes such as water treatment sludge and oil separator sludge.

6.7.3 Aquatic Resources

Impacts on aquatic resources will be minimized primarily by the location of the plant and by the water quality provisions described above. In addition, good construction practices should be employed during the construction of water intake and discharge structures to minimize the time period within which the canal bottom will be disturbed.

6.7.4 Terrestrial Resources

Impacts on terrestrial resources will be minimized primarily by the location of the plant and by the air quality and water quality provisions described above. In addition, good construction practices should be employed during the construction of the plant and any offsite facilities to minimize noise, dust, and soil erosion.

6.7.5 Land Use

Impacts on land use will be minimized by the plant location and the design and construction provisions described above.

6.7.6 Socioeconomic and Cultural Features

Adverse impacts on socioeconomic and cultural features will be minimized primarily by the plant location and the design and construction provisions described above. In addition, the Electricity Company will take the necessary actions to ensure that any people who are displaced by any offsite features are adequately compensated.

The Electricity Company will attempt to maximize the beneficial impacts of the project by implementing a deliberate policy to hire and train local site area residents for power plant jobs as much as possible. Construction crews should be instructed to stop work if evidence is found to indicate that historical or archaeological sites are located in construction areas.

6.8 ENVIRONMENTAL MONITORING PLAN

Environmental monitoring must be conducted in order to ensure that the Sidi Krir C.C. power plant is designed, constructed, and operated with proper regard for environmental conditions. Environmental monitoring will be the responsibility of the Electricity Company, and the Electricity Company will present the details of an appropriate monitoring plan in the

Final Environmental Impact Assessment. However, the environmental monitoring conducted for new EEHC power plants can provide guidance on appropriate monitoring for the Sidi Krir C.C. plant. This chapter describes the monitoring typically conducted for new EEHC plants, and notes the areas where modifications to such monitoring may be appropriate for the Sidi Krir C.C. plant.

Different environmental monitoring programs typically are conducted before plant operation and during plant operation. The objectives and content of the monitoring programs typically conducted during these phases are described in the following sections.

6.8.1 Before Plant Operation

Environmental monitoring is conducted before plant operation primarily in order to provide data necessary for detailed plant design and to establish a baseline of existing environmental conditions against which future changes can be judged. The parameters that need to be monitored for these purposes typically include the following:

- **Meteorology.** Meteorological data are monitored continuously for one year at the power plant site. Air temperature, wind speed, wind direction, and barometric pressure are monitored at a height of 10 meters above grade. Solar radiation and temperature differential are monitored at grade. Air temperature, wind speed, wind direction, and atmospheric mixing height are monitored at selected elevations, including the stack heights, using a Doppler Sodar System (if needed).

- **Ambient air quality.** Ground-level concentrations of SO2, NOx, CO, and total suspended particulates (TSP) are monitored continuously for one year at the points where maximum concentrations due to existing pollution sources are believed to occur and the point where maximum concentrations due to power plant operation are expected to occur (based on air quality impact modeling).

- **Ambient water quality.** Water temperature, pH, chemical oxygen demand (COD), total suspended solids (TSS), oil and grease, and concentrations of potential chemical pollutants are monitored quarterly during the preoperation period at points representative of the power plant water intake and discharge areas. If the initial monitoring shows elevated values of some parameters (such as COD), monitoring may be required for additional parameters (such as biological oxygen demand, total organic carbon, and dissolved oxygen) in order to fully characterize the water quality.

All environmental monitoring is conducted using standard techniques and equipment. All equipment is operated, calibrated, and maintained in accordance with manufacturer instructions. Care is taken to avoid contamination or degradation of samples. Simple analyses are performed at the sampling location, using portable equipment, while more complicated analyses are performed in a certified laboratory.

Reports on all environmental monitoring performed by the Electricity Company will be submitted to EEAA every six months during the preoperational period.

6.8.2 During Plant Operation

Environmental monitoring is conducted during plant operation primarily in order to assess the environmental impacts caused by the plant and to evaluate the performance of wastewater treatment facilities and other pollution control equipment. The parameters that need to be monitored for these purposes typically include the following:

- **Meteorology.** Parameters, frequency, duration, and locations as described in Section 6.8.1.

- **Ambient air quality.** Parameters, frequency, duration, and locations as described in Section 6.8.1.

- **Ambient water quality.** Parameters, frequency, duration and locations as described in Section 6.8.1.

- **Air pollution emissions.** Flue gas flow rate, opacity, and concentrations of SO2, NOx, and CO are monitored continuously during plant operation at a representative point in each chimney flue.

- **Water pollution discharges.** Temperature, pH, COD, TSS, oil and grease, and concentrations of potential chemical pollutants are monitored monthly during plant operation at a representative point before wastewater effluents are discharged into the environment.

As in the preoperational phase, all environmental monitoring is conducted using standard techniques and equipment. All equipment is operated, calibrated, and maintained in accordance with manufacturer instructions.

Care is taken to avoid contamination or degradation of samples. Simple analyses are performed at the sampling location, using portable equipment, while more complicated analyses are performed in a certified laboratory.

Reports on all environmental monitoring activities should be submitted to EEAA every six months throughout the operation of the Sidi Krir C.C. power plant.

Table 6.6 summarizes the environmental monitoring conducted during the preoperational and operational phases of a typical power plant project.

Table 6.6

Typical Environmental Monitoring Plan

Type of Monitoring	Parameters	Frequency / Duration	Location
Meteorology	Air temperature Wind speed Wind direction Barometric pressure Mixing height	Continuously for 1 year before plant operation and during plant operation	Power plant site, 10 meters above grade
Ambient Air Quality	Sulfur dioxide Nitrogen oxides Carbon monoxide Total particulates	Continuously for 1 year before plant operation and during plant operation	Points of maximum existing and predicted ground-level concentrations
Air Pollution Emissions	Flue gas flow Sulfur dioxide Nitrogen oxides Carbon monoxide Opactity	Continuously during plant operation	Representative point in each chimney flue
Ambient Water Quality	Water temperature pH,COD, TSS Oil & grease Trace chemicals	Quarterly before plant operation and during plant operation	Representative power plant water intake and discharge areas
Oceanography	Tides Currents Substrate conditions	Quarterly for 1 year before plant operation	Representative power plant water intake and discharge areas
Water Pollution Discharges	Temperature pH,COD, TSS Oil & grease Trace chemicals	Monthly during plant operation	Representative point before wastewater effluents are discharged

6.9 ENVIRONMENTAL MANAGEMENT AND TRAINING

In order to properly implement the environmental mitigation and monitoring plans described in items 6.7 and 6.8, appropriate organizational structures and personnel training will be required. The Electricity Company will be responsible for establishing the necessary environmental management organization and training. This chapter provides guidance on the environmental organization and training that have been used successfully by EEHC and other companies on previous projects, and notes on some of the areas where interface between EEHC and the Electricity Company will be required.

6.9.1 Environmental Management Organization

Key functional responsibilities within a typical environmental management organization are shown in Figure 6-3. These functional responsibilities will change as the project moves from the preoperation (engineering and construction) phase to the operation phase; both sets of responsibilities are shown in Figure 6-3.

During both the preoperation and operation phases of the project, the primary responsibility for environmental compliance should rest with a dedicated Environmental Director within the Electricity Company 's organization. However, coordination with EEHC's environmental staff will be important. Therefore, the Electricity Company 's Environmental Director should maintain contact with EEHC's Environmental Coordinating Committee. This committee brings together the various groups within EEHC that are concerned with environmental compliance or are affected by environmental programs. It includes members from EEHC's operations, studies and research, testing laboratories, and projects groups.

The following subsections discuss the key functional responsibilities that should be addressed in the Electricity Company 's organization during the preoperation and operation phases of the project.

6.9.1.1 Before Operation

The primary responsibility for environmental compliance before operation should rest with a dedicated Environmental Director who reports directly to the Electricity Company 's Project Manager. The Environmental Director should supervise the staff responsible for collecting and evaluating environmental data and preparing documents related to environmental compliance.

During the engineering stage of the project, environmental data are required primarily to support plant design and to establish a baseline against which future environmental changes can be judged. Environmental documents are required primarily for compliance with the requirements of the Government of Egypt or involved lending institutions such as the World Bank. The major functional responsibilities during this stage include the following:

- Collecting ambient air quality and meteorology data.

- Providing air quality/meteorology data reduction and impact analysis (air quality modeling).

- Collecting ambient water quality data.

- Providing water quality data reduction and impact analysis (thermal plume modeling).

- Preparing a Final Environmental Impact Assessment and any other environmental documents required for compliance with government lending institution requirements.

- Developing procedures to manage and minimize environmental impacts during plant construction, such as the following:
    - Control of noise, dust, and erosion.
    - Handling and storage of fuels and hazardous chemicals.
    - Minimization of traffic disruption.
    - Disposal of construction debris, used paints and solvents, and other wastes.
    - Provision of sanitary facilities for construction workers.

During the construction stage of the project, environmental management activities are related primarily to developing and monitoring compliance with environment-related internal project procedures. The major functional responsibilities during this stage include the following:

- Auditing compliance with procedures to manage and minimize environmental impacts during plant construction.

- Developing procedures to ensure environmental compliance during plant operation, such as the following:
  - Operation and maintenance of wastewater treatment facilities and other pollution control equipment.
  - Operation, calibration, and maintenance of in-stack flue gas monitors and other pollution sampling equipment.
  - Handling and storage of oil and hazardous chemicals, and response to leaks, spills, or other emergencies.
  - Disposal of water treatment sludges, used paints and solvents, and other wastes.
  - Implementation of measures for protecting worker safety and health.

6.9.1.2 <u>During Operation</u>

The primary responsibility for environmental compliance during plant operation should rest with a dedicated Environmental Director who is based at the power plant and reports directly to the Plant Manager. The Environmental Director should supervise the staff responsible for operating and maintaining pollution-related equipment and for auditing compliance with environment-related procedures.

During plant operation, the most critical responsibilities are the operation and maintenance of the equipment used to control and measure pollution discharges. In addition, for a period of time after the plant begins to operate, ambient air and water quality data will be collected for comparison with the baseline data collected during the preoperation phase. Reports on the results of environmental monitoring and other activities may have to be prepared and submitted to the Government of Egypt and lending institutions. Finally, compliance with all activities related to environmental compliance should be audited periodically throughout plant operation. The major functional responsibilities during plant operation include the following:

- Operating and maintaining wastewater treatment facilities and other pollution control equipment.

- Operating, calibrating, and maintaining in-stack flue gas monitors and other equipment for sampling and measuring measuring pollution discharges.

- Collecting and evaluating data on ambient air and water quality.

- Auditing compliance with procedures to ensure environmental compliance during plant operation.

- Preparing reports on environmental compliance required by the government or lending institutions.

6.9.2 Environmental Training

The personnel responsible for the functions described in the previous section must be properly trained and qualified. At a minimum, all personnel assigned to these positions should have the following qualifications:

- A college degree in engineering or a relevant science.

- At least one year of directly related work experience.

- A workable knowledge of Arabic and English.

The Environmental Director should have at least three years of directly related work experience, plus specific knowledge of all the tasks required for the functional responsibilities described in the previous section.

Generally, the Environmental Director should be responsible for ensuring that all personnel performing environmental tasks have the proper qualifications and receive appropriate training in the specific tasks they will perform. However, during the preoperation phase of the project, it may be more cost-effective to contract an outside consultant for environmental data collection than to maintain data collection personnel within the Electricity Company 's organization. In that case, the Environmental Director should confirm that the outside consultant has appropriate qualifications for the work he will perform.

During plant operation, the Electricity Company will maintain a sufficient number of trained personnel at the power plant to perform all of the required environmental functions. The number of workers for operation and maintenance of environmental equipment, and for other environmental activities, should be about 2-3 people, trained in the following functions:

- Environmental Director.

- Pollution control equipment operation and maintenance.

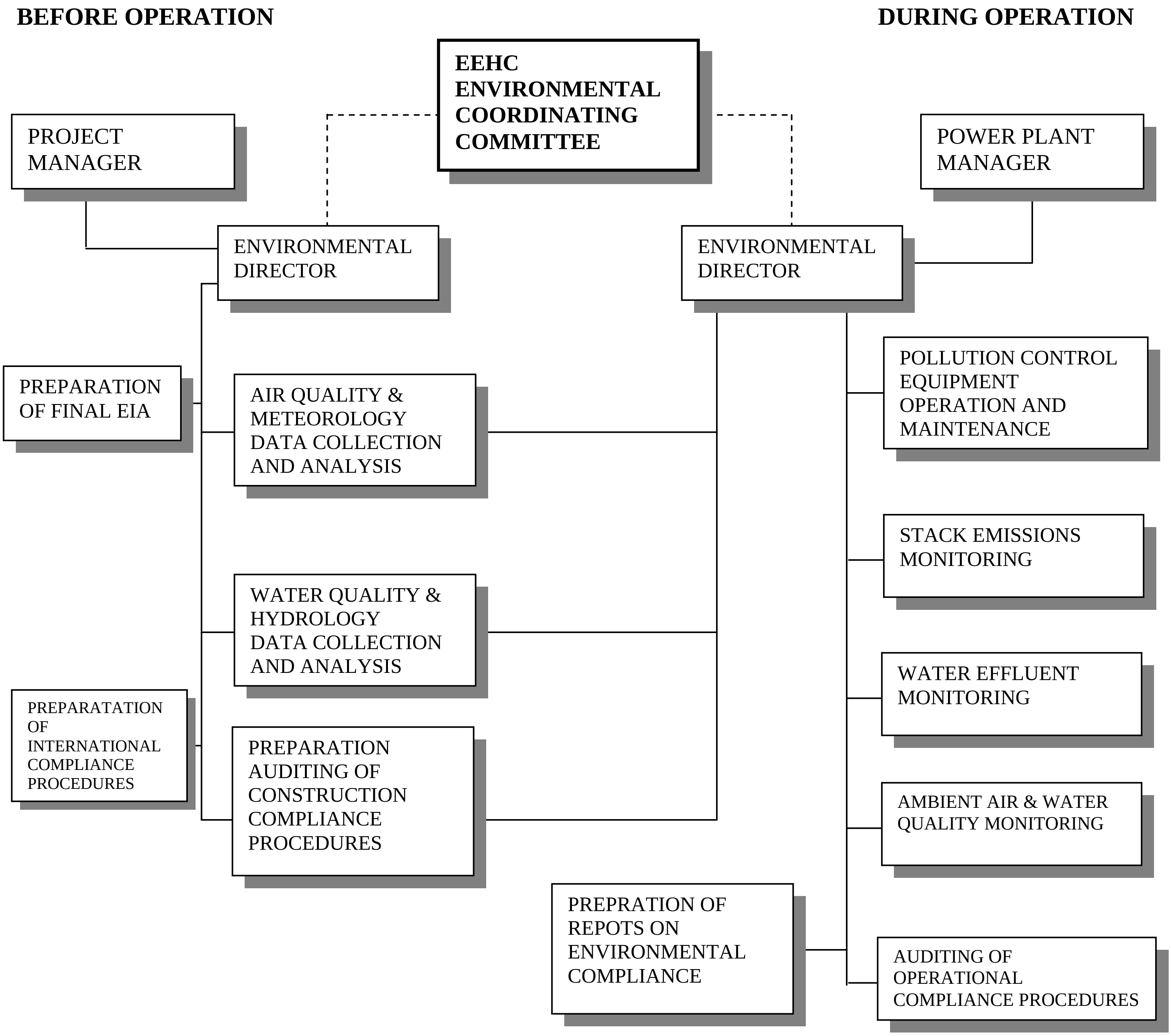
- Ambient air and water quality data collection and evaluation.

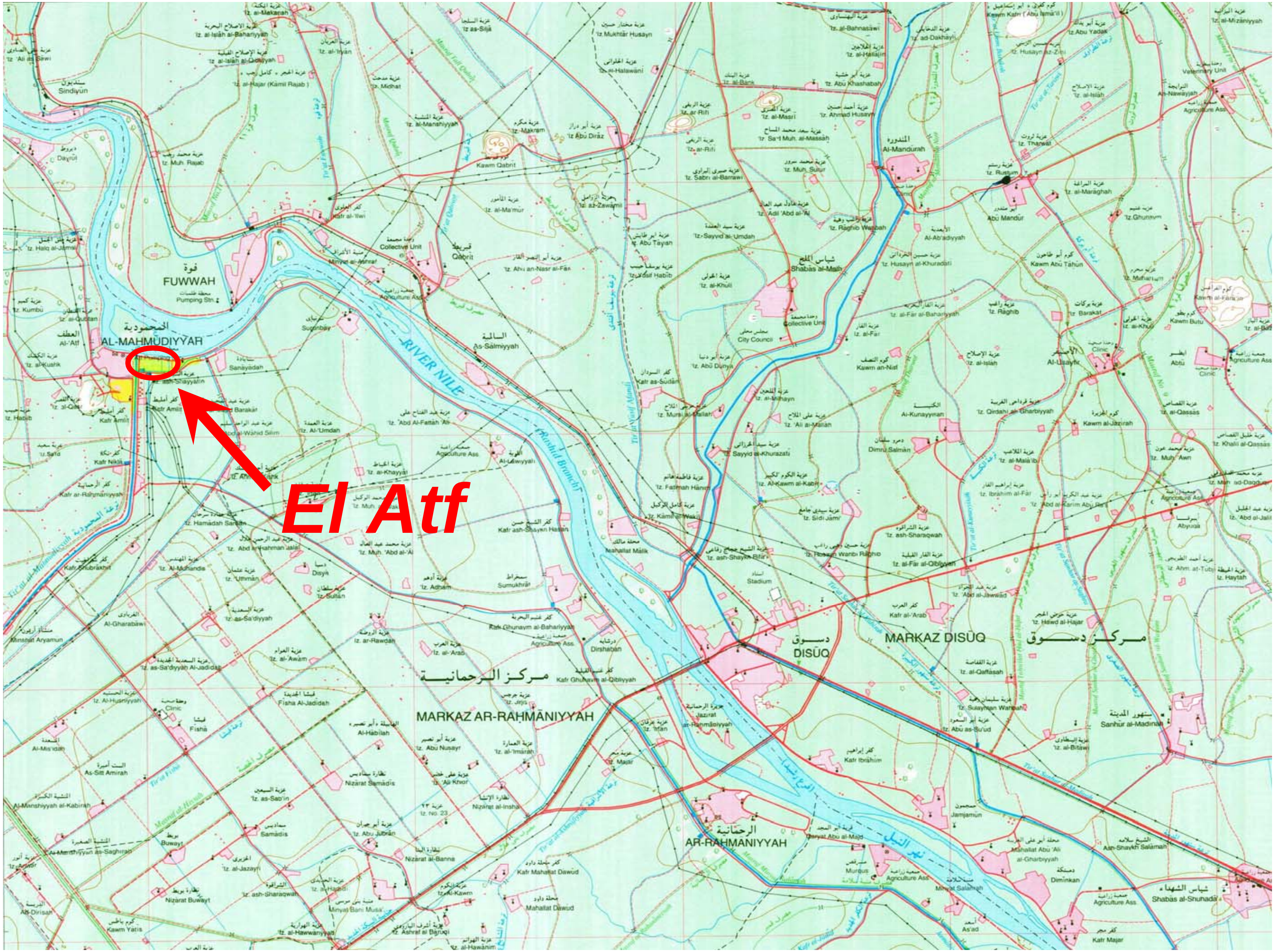
- Environmental procedure compliance auditing and document preparation.

Training in the use of pollution control and pollution monitoring equipment generally will be provided by the vendors supplying the equipment. The Environmental Director should confirm that the appropriate personnel successfully complete the training sessions before operating or maintaining the equipment.

Figure 6-3

Environmental Management




El Atf
فوة
FUWWAH
المحمودية
AL-MAHMUDIYYAR
RIVER NILE
Rashid Branch
دسوق
DISŪQ
MARKAZ DISŪQ
مركز دسوق
مركز الرحمانية
MARKAZ AR-RAHMĀNIYYAH
الرحمانية
AR-RAHMĀNIYYAH
نهر النيل


البحر المتوسط
MEDITERRANEAN SEA
Sidi Krir
Al-Hānūvil and 6 October Beach
Abu Talat
Sidi Barakat
Engineer s Beach
Somid Oil Tanks
Ash-Shaykh Mabruk
Armed Forces Beach
Ash-Shaykh Ruhayyim
Maryut Co for Fish Farms
Oil Pipe line
SĪDĪ KIRAYR
Ash-Shaykhah Marzuqah
Military Engineer s Beach
Sidi 'Atiyyah
Custom s Area
BUḤAYRAT MARYŪṬ
Sidi Kirayr
Fish Farms

El Atf
Sidi Krir
Mediterranean Sea
Alexandria
El Iskandarīya
Rosetta Mouth
Rosetta
Abū Qīr Bay
Abū Qīr
Idku
Idfina
Lake Idkū
Lake Burullus
Al Burj
Balṭīm
Damietta Branch
Dumyat Masabb
DUMYAT GOVERNORATE
Port Said
Būr Saʿīd
Ṭīnah Bay
Bardawīl Salt Flat
Lake Manzilah
BŪR SAʿĪD
DAKAHLIA GOVERNORATE
El Mansura
Damanhūr
Kafr ad Dawwār
Kafr ash Shaykh
NILE DELTA
Lower Egypt
Al Maḥallah al Kubrā
AL GHARBĪYAH
Ṭanṭā
AL MINŪFĪYAH
Shibīn al Kawm
Benha
ASH SHARQĪYAH
Az Zaqāzīq
Ismailia
EGYPT
ISMAILIA GOVERNORATE
NORTH SINAI
SINAI PENINSULA
ISTHMUS OF SUEZ
AL ISKANDARĪYAH
MUḤĀFAẒAT AL BUḤAYRAH
AL QALYŪBĪYAH
Shubrā al Khaymah
Cairo
Giza
AL QĀHIRAH
Great Pyramid
Memphis
Dahshūr
Ḥulwān
AS SUWAYS
Suez
El Suweis
Suez Bay
Suez Canal
MAṬRŪḤ
GIZA GOVERNORATE
AL FAYYŪM
Mount Qaṭrānī
Lake Qārūn
ARABIAN DESERT
Gulf of Suez
SOUTH SINAI
JALĀLAH AL BAHRĪYAHH MOUNTAINS
Raʾs Matārimah
31° 30'
31°
30° 30'
30°
29° 30'
32° 30'
33°
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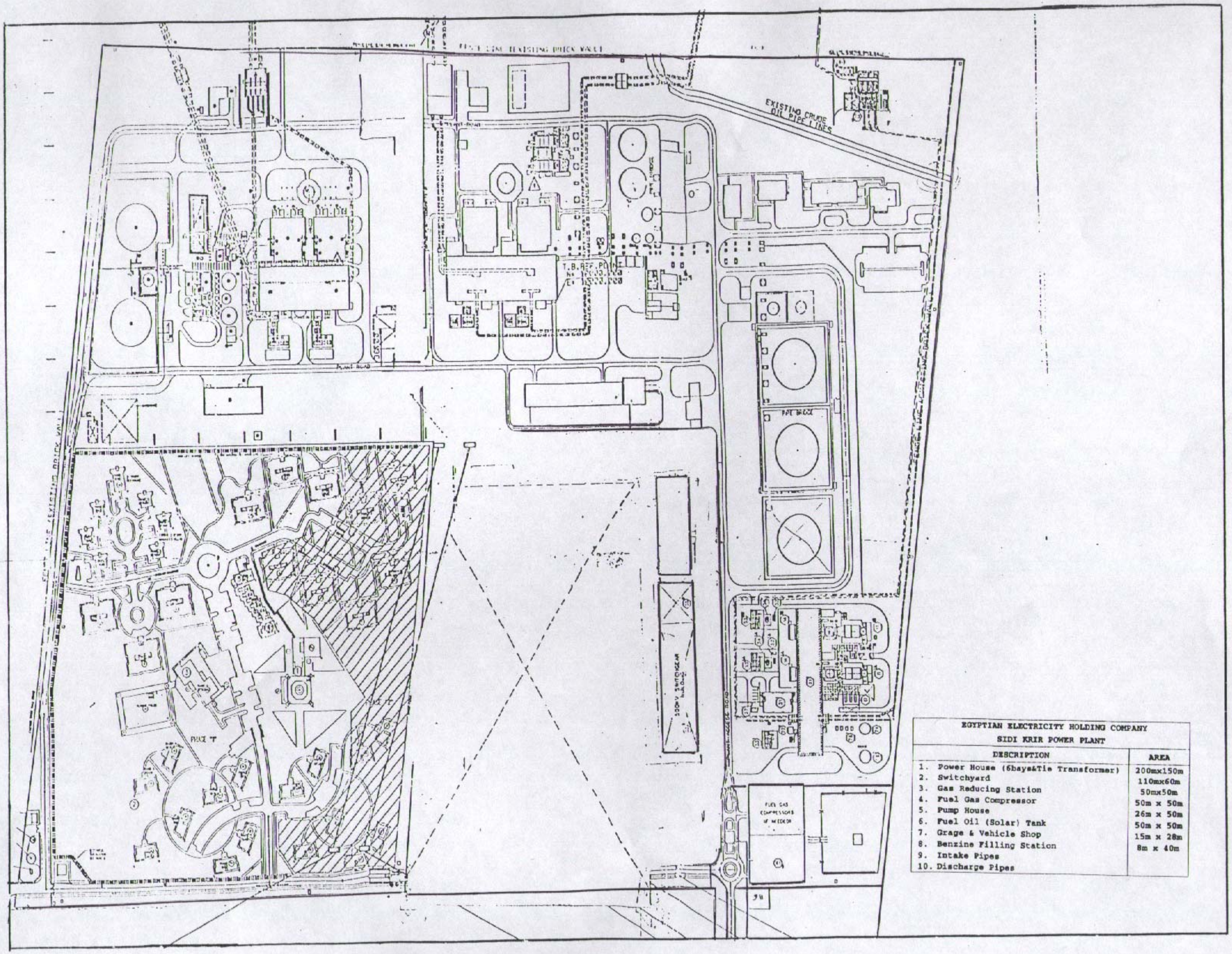
Sidi Krir
El Atf
Mediterranean Sea
Tobruk
Marsá Maţrūḩ
Alexandria
El Iskandarîya
Kafr ad Dawwār
Damanhūr
Ţanţā
Damietta
NILE DELTA
Port Said
Būr Sa'īd
Ashdod
Beersheba
Be'er Sheva
West Bank (disputed)
Amman
Jerusalem
Al Quds
Al Karak
ISRAEL
JORDAN
Aţ Ţafīlah
NEGEV
Ma'ān
El 'Arîsh
NORTH SINAI
SOUTH SINAI
SYRIAN DESERT
Shibīn al Kawm
Suez
El Suweis
Cairo
CYRENAICA
MATRŪḨ
El Faiyum
Beni Suef
Gulf of Suez
Mount Sinai 2285 m
Mughayra'
NAJD
ARABIAN PENINSULA
Al 'Assafiyah
GIZA GOVERNORATE
MUḨĀFAZAT AL MINYĀ
El Minya
El Tur
SAUDI ARABIA
Taymā'
ARABIAN DESERT
Hurghada
Qaşr al Farāfirah
Asyūţ
Al Badārī
Jirna
Akhmīm
Ţahţā
Sawhaj
Jirjā
Qinā
Farshūţ
Luxor
LIBYA
EGYPT
LIBYAN DESERT
Madā'in Şāliḩ
Al 'Ulá
AL HIJAZ
Al Wajh
El Kharga
AL BAḨR AL AḨMAR
Idfū
AL WĀDĪ AL JADĪD
Al Jawf
Aswān
Berenice
Red Sea
Tropic of Cancer
NUBIAN DESERT
HALA'IB TRIANGLE (DISPUTED)
Hala'ib
NUBIA
SUDAN
30°
28°
26°
24°
22°
34°
36°
38°

Fig I

Site Location



EGYPTIAN ELECTRICITY HOLDING COMPANY SIDI KRIR POWER PLANT	
DESCRIPTION	AREA
1. Power House (6bays&Tie Transformer)	200mx150m
2. Switchyard	110mx60m
3. Gas Reducing Station	50mx50m
4. Fuel Gas Compressor	50m x 50m
5. Pump House	26m x 50m
6. Fuel Oil (Solar) Tank	50m x 50m
7. Grage & Vehicle Shop	15m x 28m
8. Benzine Filling Station	8m x 40m
9. Intake Pipes	
10. Discharge Pipes	