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AES OASIS LIMITED AND MITSUI & CO

AMMAN EAST IPP PROJECT

**ENVIRONMENTAL AND SOCIAL
IMPACT ASSESSMENT**

EXECUTIVE SUMMARY

DECEMBER 2006

PB POWER
in association with
**Arab Centre for Engineering
Studies**



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CONTENTS

	Page
LIST OF ABBREVIATIONS	
1. INTRODUCTION	1.1
1.1 The project	1.1
1.2 Environmental and Social Impact Assessment	1.1
2. POLICY AND LEGAL AND ADMINISTRATIVE FRAMEWORK	2.1
2.1 Energy sector administrative framework	2.3
2.2 Institutional Framework and Mandate	2.3
2.3 Compliance with Jordanian and World Bank/IFC guidance and policies	2.5
2.3.1 Key issues from consideration of World Bank Guidance	2.7
2.3.2 Conclusion	2.9
3. ANALYSIS OF ALTERNATIVES	3.1
3.1 Identification of the need for additional power generation in Jordan	3.1
3.2 Selection of the Amman East site	3.1
3.3 Choice of plant	3.1
3.4 Pipeline routing	3.2
3.5 Transmission line routing and alternatives	3.2
4. THE PROJECT	4.1
4.1 The developer	4.1
4.2 The site	4.1
4.2.1 The proposed development	4.2
4.2.2 Decommissioning	4.7
5. ENVIRONMENTAL AND SOCIAL BASELINE	5.1
5.1 Air quality	5.1
5.1.1 Ambient air quality	5.2
5.2 Water quality	5.3
5.3 Geology, soils and wastes	5.4
5.4 Noise	5.4
5.5 Visual	5.5
5.6 Traffic and infrastructure	5.5
5.7 Socio-economics	5.6
5.8 Ecology	5.6
5.9 Cultural heritage	5.7
6. ENVIRONMENTAL AND SOCIAL IMPACTS	6.1
6.1 Air quality	6.1
6.2 Water quality	6.3

	Page
6.3 Geology, soils and wastes	6.4
6.4 Noise	6.4
6.5 Visual impact	6.5
6.6 Traffic and infrastructure	6.5
6.7 Socio-economics	6.6
6.8 Ecology	6.7
6.9 Cultural heritage	6.7
6.10 Electric and magnetic fields (EMF)	6.8
6.11 Health and safety	6.8
6.12 Associated infrastructure and cumulative impact	6.9
7. ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN	7.1
8. INTERAGENCY, PUBLIC AND NGO CONSULTATION	8.1
8.1 Scoping exercise	8.1
8.2 Additional public consultation	8.2
8.2.1 Consultation methodology	8.2
8.2.2 Survey findings	8.3
8.2.3 Residents opinion	8.3
8.3 Conclusion and recommendation	8.4
8.4 Conclusions	8.4
9. CONCLUSIONS	9.1

A. ENVIRONMENTAL MITIGATION AND MONITORING PLAN	Appendix A

LIST OF ABBREVIATIONS

ACC	air cooled condenser
ACES	Arab Centre for Engineering Studies
ADMS	Atmospheric Dispersion Modelling System
AERMOD	American Meteorology Society/Environmental Protection Agency Meteorology Processor
ASTM	American Society for Testing Materials
bar	barometric pressure
BAT	best available techniques
BRef	BAT reference
BS	British Standard
BTU	British thermal unit
CCGT	combined cycle gas turbine
CD ROM	compact disk read only memory
Co	Company
CO ₂	carbon dioxide
DCS	Distributed Control System
DLN	Dry low NOx
DFO	distillate fuel oil
ESIA	Environmental and Social Impact Assessment
EMMP	Environmental Management and Monitoring Plan
EU	European Union
ES	Environmental Statement
FGC	Fajer Gas Company
FGD	flue gas desulphurization
g	grams
GW	Gigawatt
HCl	hydrochloric acid
HRSG	heat recovery steam generator
IEMA	Institute of Environmental Management and Assessment
IFC	International Finance Corporation
IOA	Institute of Acoustics
ISO	International Organization for Standardization
JBIC	Japan Bank of International Cooperation
J/g	joules per gram
K	degrees Kelvin
kg	kilograms
km	kilometre
kV	kilovolt
LCV	lower calorific value
LNG	liquefied natural gas
M	metre
m ³ ,	metres cubed
mg/l	milligrams per litre
mg/Nm ³	milligrams per normal cubic metre
MoE	Ministry of Environment
mol	mole
MW	Megawatt
MWth	megawatt thermal
NaOH	caustic soda
NEPCO	Jordan National Electric Company
NSR	noise sensitive receptor
NO _x	oxides of nitrogen
OPIC	Overseas Private Investment Corporation
PBP	PB Power
ppm	parts per million
SO ₂	sulphur dioxide

ToR	Terms of Reference
TSP	Total suspended particulates
TSS	Total Suspended Solids
t/yr.	tonnes per year
UK	United Kingdom
wt	weight
WAJ	Water Authority of Jordan

1. INTRODUCTION

This document provides a summary of the findings of the Environmental and Social Impact assessment (ESIA) undertaken for the Amman East IPP project. Full details of these studies are provided in the ESIA report.

1.1 The project

AES Oasis Limited and Mitsui & Co propose to construct the East Amman IPP combined cycle gas turbine (CCGT) plant near the village of Al-Manakher, about 4 km to the east of Amman on a site to be leased from the Ministry of Finance/Department of Lands and Survey. The plant will involve the construction of a CCGT power plant with a nominal output of 370 MW at specified site rated conditions. The location of the site is shown in Figure 1.1.

The plant will consist of two gas turbines, primarily fuelled by gas, complete with associated heat recovery steam generator (HRSG) and a single steam turbine. A preliminary layout of the plant is shown in Figure 1.2.

The plant will, during normal operation fire on natural gas that will be supplied via a dedicated gas pipeline that will tee in to 'Arab Gas Transmission Pipeline', which provides natural gas from Egypt to Jordan. The gas pipeline will be installed owned and operated by Fajer Gas Company (FGC) who will be responsible for installation of the pipeline from the main gas pipeline to the site boundary approximately 800 m to the west.

The electricity generated by the Project will be exported to the Jordanian national grid network via a 400 kV substation that will be constructed, owned, and operated by NEPCO and located adjacent to the Project Site.

The plant will include equipment necessary to receive power from NEPCO's 400 kV HV substation and transform it to the voltage required by the station for start-up of the gas turbines and other needs. The Facility shall be provided with a black start capability to allow for start up of the plant in the event of a power failure to the site.

The Water Authority of Jordan (WAJ) will supply drinking quality water as raw water for all the Facility's needs through an 18 km pipeline.

A more detailed discussion of the plant and project site is included in Section 4.

1.2 Environmental and Social Impact Assessment

PB Power, assisted by the Arab Centre for Engineering Studies (ACES) have undertaken an Environmental and Social Impact Assessment (ESIA) for the proposed Amman East CCGT to determine the impact that the construction, operation and where possible decommissioning will have on the receiving environment.



● SITE LOCATION

AMMAN EAST IPP PROJECT



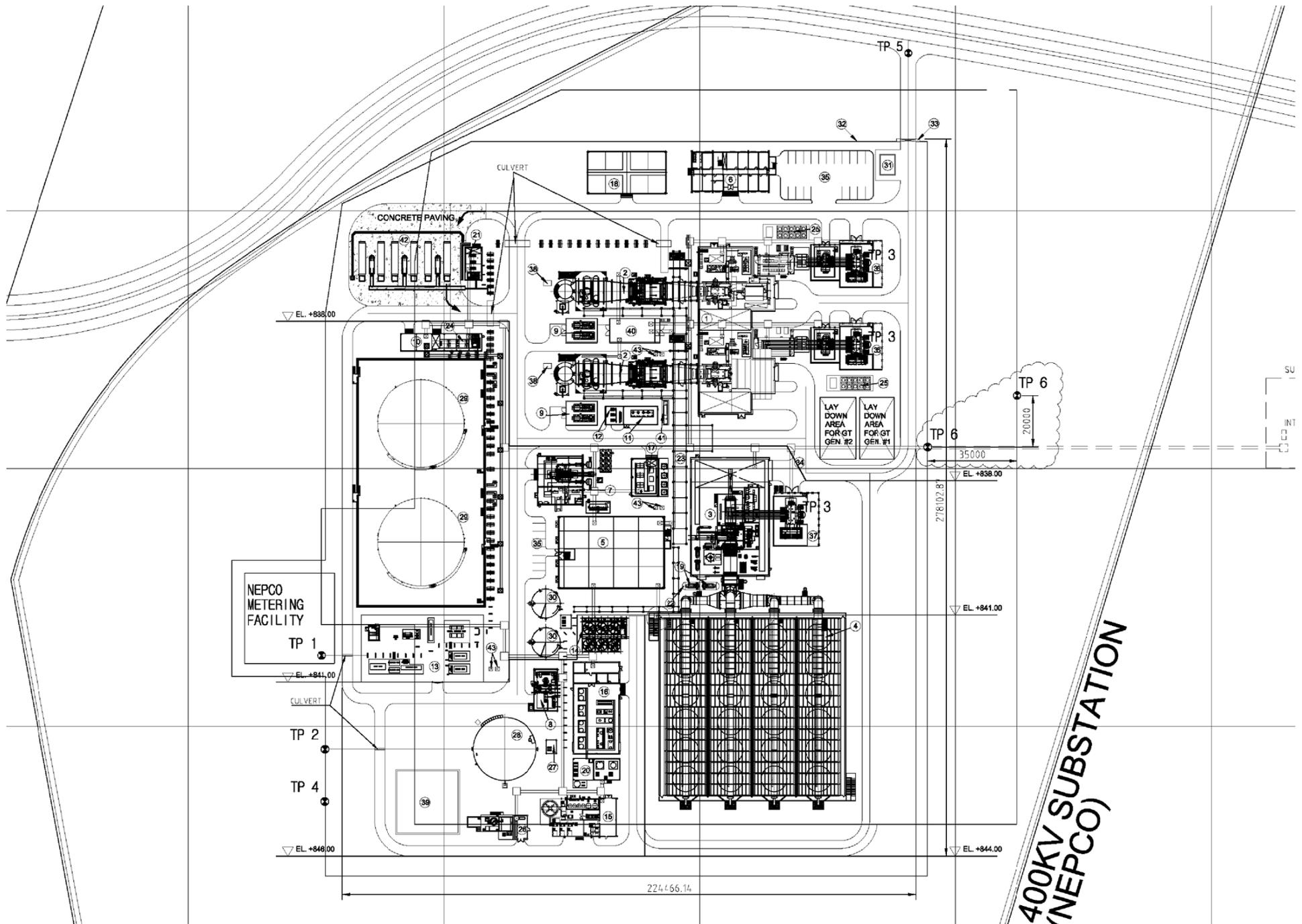
SITE LOCATION

Drawn: RC
 Checked: PDO
 Approved: EA
 Date: 05.09.06

Scale: NTS

Drawing No. FIGURE 1.1

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The project is categorized as a Category A project under the Equator Principles requiring a full ESIA to be undertaken to assess the plants impact to the natural and human environment and the ESIA undertaken has reflected this.

The ESIA has comprised a comprehensive study of the baseline environmental conditions of the proposed power station location, the predicted impact of the plant and the mitigation measures necessary to protect the environment from the impact of the project. The ESIA has included:

1. Screening stage, which concluded that a full ESIA was required to satisfy the MoE and the World Bank laws and criteria.
2. Scoping stage, described above to allow interested and affected parties to participate in the ESIA process. Their concerns relating to the project were documented and were used to inform the ESIA process.
3. Collection of baseline data against which the environmental impacts of the project was assessed.
4. Environmental and Social Impact Assessment stage to determine the impact of the proposed project on the receiving environment.
5. Identification of mitigation and monitoring of impacts where appropriate. Including the preparation of an Environmental Monitoring and Mitigation Plan (EMMP) for the project.
6. Summary of the above in an Environmental Statement (ES) for consideration by the relevant Jordanian Ministries and World Bank.

The findings of the ESIA have been reported in an Environmental Statement and are summarized in this executive summary.

2. POLICY AND LEGAL AND ADMINISTRATIVE FRAMEWORK

The ESIA has considered all legislation identified as being relevant to the project including that identified by the ESIA team and participants at the scoping session. The relevant legislation is summarized below.

Applicable Jordanian laws and standards

- Environment protection law (No.1, 2003).
- Environmental Impact Assessment by-law (No.37, 2005).
- Air emissions from stationary sources standard (No. 1189,1998)
- Ambient Air Quality (No .1140,2005)
- Public Health law (No. 54, 2002)
- Noise Preventions and Limitations Instructions Paragraph (d) issued in accordance to Act No. (1)/2003 Act No. (1)/2003 and Noise Level Control Regulation for 1997
- Water Authority's Act (No. 62,2001)
- Water Authority Law (No. 18,1988)
- Underground -water Monitoring By-law (No.85, 2002)
- Archaeology Act (No.32, 2004)
- Civil Defence Act (No.90,2003)
- Dimensions, Total weights and Vehicles' Engine Horse Power By-law issued in accordance with paragraph (a) from article (19) & article (64) from The Traffic Act (47)/2001
- Labour law (No.51,2002)
- Ministry of Agriculture Law (No. 44,2002)
- Waste oil management instruction.
- Hazardous substances Law (No.16/1953)
- Management of solid waste.

Applicable/potentially applicable World Bank and IFC standards and guidance

Performance Standards

- International Finance Corporation's Guidance Notes: Performance Standards on Social & Environmental Sustainability April 2006 including the following guidance notes:

Safeguard Policies

- IFC Operational Policy OP 4.01 Environmental Assessment October 1998
- IFC Operational Policy OP 4.04 Natural Habitats November 1998
- World Bank Operational Policy Note OPN 11.03 Cultural Property September 1986

Guidance notes

- Guidance Note 1: Social and Environmental Assessment and Management Systems
- Guidance Note 2: Labor and Working Conditions
- Guidance Note 3: Pollution Prevention and Abatement
- Guidance Note 4: Community Health, Safety and Security
- Guidance Note 5: Land Acquisition and Involuntary Resettlement
- Guidance Note 6: Biodiversity Conservation and Sustainable Natural Resource Management
- Guidance Note 7: Indigenous Peoples
- Guidance Note 8: Cultural Heritage

Sector guidelines

- World Bank Pollution Prevention and Abatement Handbook: General Environmental Guidelines July 1998
- World Bank Pollution Prevention and Abatement Handbook: New Thermal Power Plants July 1998
- IFC Guidelines: Hazardous Materials Management December 2001
- IFC General Health and Safety Guidelines July 1998

Manuals

- IFC A Good Practice Manual – Doing Better Business Through Effective Public Consultation and Disclosure.

Draft Guidelines

- Environmental, health & safety General Guidelines.

2.1 Energy sector administrative framework

The electricity sector within Jordan has been undergoing a continuous process of reform since as early as 1996. In September 1996, the Government of Jordan enacted Law No. (10) of 1996, the General Electricity Law (“1996 GEL”). Under the GEL, the Government took its first step in privatizing the national electricity industry by converting the Jordan Electricity Authority to a public shareholding company called the National Electric Power Company (NEPCO). The GEL also provided for the issuance of licenses for the generation of electricity to private companies. Such licenses were to be issued by the Council of Ministers.

In 1999, the 1996 GEL was amended and replaced by the General Electricity Law No. (13) of 1999. One of the principal features of the 1999 GEL was the establishment of the Electricity Sector Regulatory Commission (“Commission” or “ERC”). The Commission was charged with the responsibility for issuing licenses to companies for the generation, transmission and distribution of electricity. This law also envisaged the issuance of licenses to developers of electric power stations planned for capacity in excess of 5 MWe through a competitive tendering process.

The Government of Jordan has taken steps to enact a new electricity law, the General Electricity Law for the Year 2002 (2002 GEL) that clarifies the role and function of the Commission as an independent agency responsible for regulating the power sector in three areas – generation, transmission and distribution. Although the 2002 GEL envisages issuance of licenses for generation of electricity pursuant to applications to the Commission, initial independent power producers will be granted licenses pursuant to the applicable license form and the Electricity Companies Licensing By-Law and the terms of the concession (or implementation) agreement entered into with the Ministry of Energy and Mineral Resources. It is under this statutory regime that the first IPPs in Jordan, including the Amman East Project will be established.

AES and Mitsui & Co as the successful Project Sponsor will be required to form and incorporate a Project Company in Jordan prior to Financial Close. This Project Company will construct, own, and operate the Facility throughout the Term of the PPA, and will pay taxes and fees as any other corporate entity would within the relevant legal structures and incentive programs. AES and Mitsui & Co will mobilize project or other financing sufficient to develop and construct the Facility using both equity and debt resources. Funding may also be available from multi- and bi-lateral sources of funding, export credit agencies, and commercial sources of finance.

2.2 Institutional Framework and Mandate

A summary of responsibilities of governmental authorities is outlined below and in Table 3.1.

TABLE 2.1
SUMMARY OF RESPONSIBILITIES OF SOME RELEVANT REGULATORY
AUTHORITIES

Authority	Responsibility
Ministry of Environment	Permitting prior to operation (ESIA report is required). Inspection during operation.
Ministry of Labor	Permitting prior to operation (after occupational health and safety measures). Inspection during operation.
Water Authority	Permitting prior to construction (identification of intersection with water piping distribution system). Supplying water needs for hydraulic test.
Department of Antiquities	Permitting in case of existence of Archaeological remains (ESIA report would be needed).
Ministry of Energy and Mineral Resources	Responsible for energy sector.
Civil Defences	Approval for construction plans. Permitting prior to operation.
Ministry of Housing and Public Works	Permitting prior to construction
Department of Land and Survey	Permitting prior to construction

Ministry of Environment

Ministry of Environment (MOE) was established in 2003 to replace administratively the General Corporation for Environment Protection that was in effective since 1995.

MOE has an authority to prepare the environmental by-laws, regulations, directives and guidelines. MOE will also, in coordination with other concerned authorities, establish a policy for environmental protection and elucidate the strategy for its implementation.

The ESIA Directorate in the Ministry is responsible for licensing of the projects. The projects are referred to the ESIA Directorate, and submitted to a Central Licensing Committee that consists of representatives of the relevant governmental authorities such as Ministries of Environment, Health, Water and Agriculture. An approval from the committee is required for licensing, which may have conditions attached to it, before the relevant authorities can grant permission.

Department of Antiquities

The Law of Antiquities (No. 21, 1988) calls for immediate reporting of any found remnants. The Department then has the right to assess the significance of any discovered remnants/antiquities and puts its recommendations accordingly.

Water Authority (WAJ)

According to the Water Authority Law No. 18, 1988; WAJ is responsible for water distribution network in the Kingdom and supplying projects with the required quantity of water needed. Additionally, WAJ is responsible for monitoring water quality (surface and ground water and industrial discharges).

Directorate of Civil Defense

The Directorate of Civil Defense grants approval on safety measures for industries and projects including emergency plan, occupational health and safety plans, and storage and handling of hazardous materials. The Directorate issues its final approval after an inspection visit has taken place to the project facilities to ensure conformity with the set requirements.

2.3 Compliance with Jordanian and World Bank/IFC guidance and policies

The project fully complies with all relevant Jordanian and World Bank/IFC guidance and policies. For clarity these are summarized in below for Jordanian legislation in Table 2.2 and for the World Bank Table 2.3 .

**TABLE 2.2
COMPLIANCE OF AMMAN EAST IPP WITH RELEVANT JORDANIAN
STANDARDS**

Jordanian law/ standard	Compliance/rational
Environment protection law (No.1, 2003)	Project Complies: The project will not pose an unacceptable impact to the environment and complies with all relevant Jordanian legislation.
Environmental Impact Assessment by-law (No.37, 2005)	Project Complies :An Environmental Impact Assessment has been undertaken for the project
Air emissions from stationary sources standard (No. 1189,1998)	Project Complies: The project will comply with the relevant emissions standards
Ambient Air Quality (No .1140,2005)	Project Complies: The project will comply with all relevant Jordanian ambient air quality requirements
Public Heath law (No. 54, 2002)	Project Complies: The Project will not pose any public heath issues

Jordanian law/ standard	Compliance/rational
Noise Preventions and Limitations Instructions Paragraph (d) issued in accordance to Act No. (1)/2003 Act No. (1)/2003 and Noise Level Control Regulation for 1997	Project Complies: The Project will broadly comply with the criteria of the Act
Water Authority's Act (No. 62,2001)	Project Complies: All water will be provided by WAJ with no water taken from other sources. No water will be released to sensitive surface or ground waters.
Water Authority Law (No. 18,1988) Underground -water Monitoring By-law (No.85, 2002)	Project Complies: All water will be provided by WAJ with no water taken from other sources. No water will be released to sensitive surface or ground waters.
Archaeology Act (No.32, 2004)	Project Complies: No significant archaeological interests were identified at site.
Civil Defence Act (No.90,2003)	Project Complies: The project will not pose a safety hazard to the general public
Dimensions, Total weights and Vehicles' Engine Horse Power By-law issued in accordance with paragraph (a) from article (19) & article (64) from The Traffic Act (47)/2001	Project Complies: The project will comply with the requirements of the law.
Labour law (No.51,2002)	Project Complies: The project will operate under the requirements of this law
Ministry of Agriculture Law (No. 44,2002)	Project Complies: The project will not include the removal of large areas of agricultural land from its current use or impact on these during construction or operation.
Waste oil management instruction.	Project Complies: The project will handles all waste oils in accordance with the instruction.
Hazardous substances Law (No.16/1953)	Project Complies: The project will ensure the proper storage and use of any hazardous substances to be used by the plant.
Management of solid waste.	Project Complies: The project will ensure proper and appropriate handling of waste materials during the construction, operational and decommissioning phases.

TABLE 2.3
COMPLIANCE OF AMMAN EAST IPP WITH IFC OPERATIONAL POLICIES AND STANDARDS

Policy	Compliance/Rational
OP 4.01: Environmental Assessment	Project Complies: an environmental assessment is being prepared following the requirements for a Category A project.
OP 4.04 and Annex A Natural Habitats	Project Complies: the power plant will not impact significantly on local habitats
OP 4.10: Indigenous Peoples	Project Complies: the power plant is located so as not to require the resettlement of indigenous peoples
OP 4.11: Management of Cultural Property	Project Complies: no historic or culturally significant features were identified on the project site.
OP 4.12 and Annex A: Involuntary Resettlement	Project Complies: the power plant is located on land that is leased from the government. Where appropriate, a Resettlement Policy Framework has been established and a Resettlement Action Plan will be prepared for those people identified as project affected person.
Labour Standards	Project Complies: no person will be harmfully or unwilling employed by the project sponsor.
Disclosure of Information Policy	Project Complies: the project sponsor has implemented the necessary Public Consultation to facilitate the transfer of information to project stakeholders.

2.3.1 Key issues from consideration of World Bank Guidance

The World Bank guidelines for new thermal power stations (1998) summarize the key production and emission control practices necessary to achieve compliance. This section identifies the applicable issues and describes how each has been addressed during project planning activities.

Issue 1: Choose the cleanest fuel economically available.

As natural gas is available domestically and is cleaner-burning than oil or coal, the power station will utilize natural gas for fuel with DFO as back up.

Issue 2: Select the best power generation technology for the fuel.

Selection of the power generation technology and pollution control systems should be balanced with the environmental and economic costs and benefits based on the site-specific ESIA. Combined cycle technology, utilizing dry low NO_x burners, will be used to generate power. Combined cycle technology possesses the most efficient process for producing power from natural gas, in addition to minimizing the rate of air emissions per unit of power produced. The ESIA identified no significant environmental costs that could be alleviated by using alternative power generation technology.

Issue 3: For pollution control, consider that particulate matter smaller than 10 microns in size (PM₁₀) are most important from a health perspective, and acceptable levels of removal are achievable at relatively low cost.

The emission rate of PM₁₀ will be well below both the emission guidelines of the World Bank and the emission standards of Jordan.

Issue 4: For pollution control, consider that low NO_x burners and other combustion modifications can achieve NO_x reductions.

The gas turbines will be equipped with dry, low NO_x burners that at loads above 50 per cent have NO_x emissions well below emission guidelines of the World Bank and the emission standards of Jordan.

Issue 5: Before adopting expensive control technologies, consider the option of achieving offsetting reductions in emissions of critical pollutants at other sources within the airshed to achieve acceptable ambient levels.

Preliminary baseline ambient air quality monitoring indicates that the project site is located in a relatively clean airshed, as defined in the World Bank guidelines (1998). The combination of combined cycle technology, sulphur and dust-free natural gas, with dry, low NO_x burners will allow the power station to operate within ambient air quality guidelines and preclude the need for offsetting emission reductions.

Issue 6: Sulphur oxides removal systems that generate less wastewater are normally preferred.

The sulphur-free natural gas being used precludes the need for desulphurization technologies.

Issue 7: Ash disposal and reclamation should be managed to minimize environmental impacts.

Ash will not be generated by the proposed CCGT plant.

Issue 8: Consider re-circulating cooling systems where thermal discharge to water bodies may be of concern.

The CCGT plant will be air cooled and therefore there will be no issues associated with thermal recirculation etc.

Issue 9: A comprehensive monitoring and reporting system is required.

The Project Sponsor will follow the comprehensive monitoring program that has been set out in the Environmental Monitoring and Mitigation Plan for the project (see summary in Section 6).

2.3.2 Conclusion

Following a full environmental and social impact assessment the project has been identified as being fully compliant with all Jordanian, World Bank and IFC. The remainder of this document summarizes the impact assessments undertaken that underpins this conclusion.

3. ANALYSIS OF ALTERNATIVES

3.1 Identification of the need for additional power generation in Jordan

The location of the plant, close to the principle centre of electricity demand in Jordan (Amman) will help Jordan to generate electricity in a manner that will minimize the transmission losses associated with long transmission lines from areas such as Aqaba.

3.2 Selection of the Amman East site

The site has been selected by the Ministry of Energy as being potentially suitable to house a CCGT development of up to 400 MWe. There are many advantages of the proposed site that make it an ideal location for power generation. These include amongst others:

- An existing transport infrastructure in the form of the Zarqa to Sahab road that will readily accommodate construction traffic;
- Availability of sufficient land to house the CCGT development;
- The close proximity of the existing Jordanian national grid transmission system;
- The close proximity of the 'Arab Gas Transmission Pipeline', which provides natural gas from Egypt to Jordan and is located some 800 m to the west of the proposed site;
- Proximity to centre of electricity demand in Jordan in the form of Amman which located just 14 km to the west; and
- A site removed from highly populated areas.

It is therefore considered that the Amman East site is therefore highly suitable for the intended use of power generation.

3.3 Choice of plant

There are a number of options available for the generation of 370 MWe but the proposed CCGT plant is considered to represent the most appropriate option for generation of the energy required.

The generation of the electricity required by conventional thermal plant is not considered to be desirable given that such plant would be expected to be less efficient than the proposed CCGT plant and more costly to construct. In addition such plant are more expensive to construct with the typical capital cost being as much as double that for a CCGT plant.

In order to provide of the order of 370 MW at Amman East any waste to energy plant constructed at the site would need to incinerate at least 22 200 tonnes of waste per day based on the consumption of waste to energy plant in other parts of the world. This is clearly impracticable in terms of collection and transport of such quantities of waste.

The installation of 370 MW of renewable energy generation plant is not considered to be the best more most practical way to generate 370 MW in Jordan. Due to constraints with regards to fuel availability and transport it would not be feasible to install a biomass plant of this scale either at the Amman East site or indeed elsewhere in Jordan. The installation of 370 MW of wind turbines would be possible however the intermittent nature of generation from wind would not allow wind turbines to operate in a manner that would meet the electricity requirements of Jordan.

Solar photovoltaic panels convert light energy directly into direct current (DC) current suitable for charging a battery. Due to their small scale they are not considered feasible for providing up to 370 MWe in Jordan. As with generation from wind turbines there would be an intermittency associated with generation of electricity from photovoltaic panels that would render the use of such technology unsuitable for the electricity needs of the nation.

A gas-fired CCGT plant with distillate fuel oil backup will, therefore, offer the best available technology for the proposed project.

Due to the lack of a suitable cooling water source at Amman East only ACCs can provide a practical cooling system for the new CCGT. The use of ACC's will help limit the projects use of water to an absolute minimum and avoid consumption of large quantities of water that is at a premium in Jordan.

3.4 Pipeline routing

The plant will be served by two new pipelines that will provide water and gas to the project site. The routing of these pipelines have been designed so as to run along the side of public roads so as to minimize the need for any confiscation of lands/displacement of peoples.

3.5 Transmission line routing and alternatives

The plant will be served by a 400 kV overhead transmission line the routing of which has been carefully chosen so as to avoid unnecessary impact through proximity to sensitive receptors such as ecologically sensitive or residential areas.

The burial of the transmission is not considered to be feasible due to the cost and greater potential for environmental impact associated with the burial and any future excavation of the line.

4. THE PROJECT

AES Oasis Limited and Mitsui & Co propose to construct the East Amman IPP combined cycle gas turbine (CCGT) plant near the village of Al-Manakher, about 14 km to the east of Amman on a site to be leased from the Ministry of Finance/Department of Lands and Survey. The plant will involve the construction of a CCGT power plant with a nominal output of 370 MW at specified site rated conditions.

The proposed plant will normally burn natural gas, though distillate fuel oil (DFO) will be burnt at times of interruption to the gas supply.

The electricity generated by the Project will be exported to the Jordanian national grid network via a 400 kV substation that will be constructed, owned, and operated by the Jordan National Electric Company 'NEPCO' and located adjacent to the Project Site.

The Water Authority of Jordan (WAJ) will supply drinking quality water as raw water for all the Facility's needs through an 18 km pipeline.

The plant will operate within all relevant Jordanian national environmental limits as well as complying with the guideline emissions limits of the World Bank and guidelines of Japan Bank of International Cooperation (JBIC), Overseas Private Investment Corporation (OPIC) and Sumitomo Mitsui Banking Corporation (SMBC) the Project Lenders.

4.1 The developer

The developer is AES Oasis Limited and Mitsui & Co is a joint venture company and independent power producer (IPP) wholly owned by the AES Electric and Mitsui & Co groups.

4.2 The site

The Amman East site is located near the village of Al-Manakher, about 14 km to the east of Amman on a site to be leased from the Ministry of Finance/Department of Lands and Survey. The plant will involve the construction of a CCGT power plant with a nominal output of 370 MW at specified site rated conditions. The site location is shown on Figure 1.1.

The site comprises some 170 000 m³ of land which is currently unused at an elevation of some 840 m AOD (above ordinance datum).

There are no other industrial plants in the immediate vicinity of the Amman East site with the majority of the surrounding land either farmed (for cereal crops) or unused. There are a number of scattered houses in the area.

The main Zarqa to Sahab road runs immediately to the north of the site and is considered to be of a high standard for the area. It is understood that the new Amman ring road may eventually run north-south about 500 m or so from the project site though construction of this road close to the site has not yet commenced.

The topography of the area is undulating with many small hills and valleys. The project site is fairly elevated in relation to the surrounding area but is afforded some screening by small hills to the south and east. A small wadi runs along the side of the Zarqa to Sahab road towards the west.

The geology of the site is typical of that in the surrounding area consisting of sedimentary rocks and relatively fertile soils. There is no sign of any ground contamination at the site, which is not known to have been used in the past for any purpose that would likely have lead to contamination of the soils on site.

The 'Arab Gas Transmission Pipeline', which provides natural gas from Egypt to Jordan runs north-south about 800 m to the west of the site. Whilst the nearest existing 400 kV transmission lines are located a few kilometres to the west.

The proposed site is not located in or near to any ecologically designated area with the on site ecology being typical of the area. There are no notable species (of fauna or flora) located within the site boundary.

There are some protected archaeological sites in the area but these are located outside a 5 km radius of the proposed power station site.

4.2.1 The proposed development

The plant will consist of two gas turbines, primarily fuelled by gas, complete with associated heat recovery steam generator (HRSG) and a single steam turbine. The thermal input of the proposed plant will be approximately 790 MWth. Approximately 63 per cent of the 370 MWe power generated at the station will be produced by the gas turbines with the steam turbine providing the remaining 37 per cent. The development of the project will be such that the plant may operate in open cycle mode to provide electricity to NEPCO whilst the HRSGs and steam turbine is being installed.

The plant's gas turbines will burn fuel in a combustion chamber from where the hot combustion gases expand through the gas turbine, which in turn drives an electrical generator to generate electricity. The hot exhaust gases still contain recoverable energy and will therefore be used in a HRSG to generate steam. The high-pressure steam produced will be used to drive steam turbine to generate additional electricity.

The spent steam leaving the steam turbine plant will pass to a condenser where it will be condensed. The resultant condensate will be returned to the HRSGs for reuse. The condenser will be cooled by an air cooled system helping to reduce the plants water consumption. The air cooled condensers will act in a similar manner to a car radiator. The use of air cooled condensers means that there is no need for cooling towers or a once-through cooling water system, thereby eliminating the environmental impacts associated with such systems, which include a visible plume from a cooling tower and abstraction from, or discharge to, a local water course.

Figure 4.1 shows a schematic representation of the combined cycle gas turbine principle.

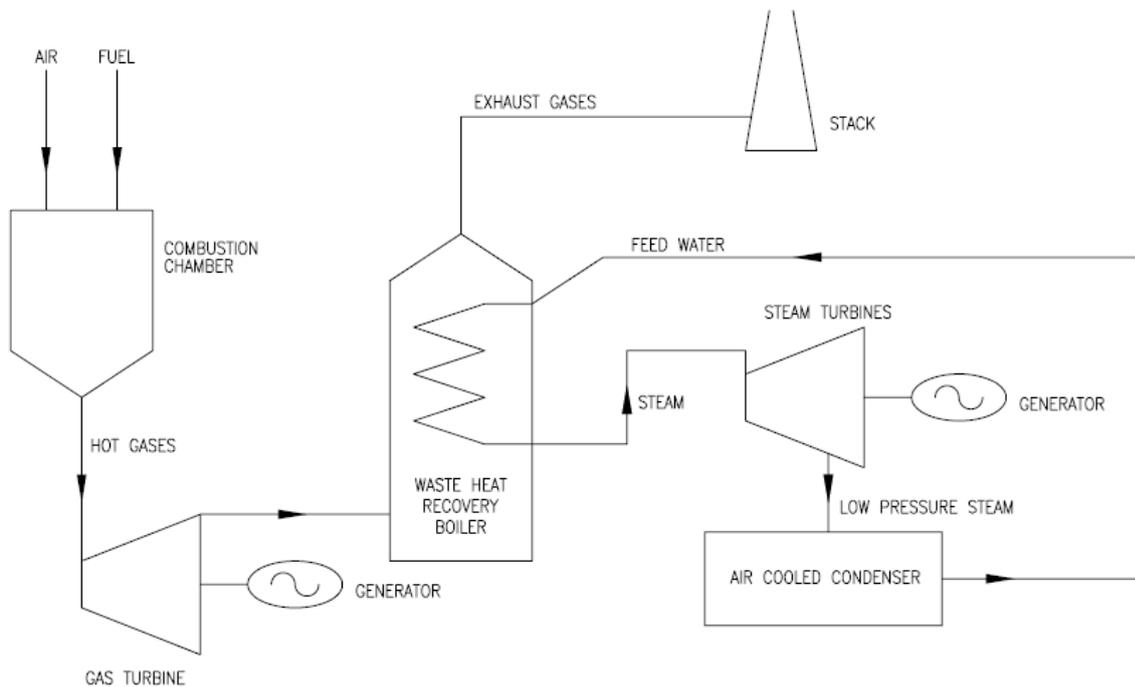


FIGURE 4.1: Schematic Diagram

The plant will, during normal operation fire on natural gas that will be supplied via a dedicated gas pipeline that will tee in to 'Arab Gas Transmission Pipeline', which provides natural gas from Egypt to Jordan. The gas pipeline will be installed owned and operated by Fajer Gas Company (FGC) who will be responsible for installation of the pipeline from the main gas pipeline to the site boundary approximately 800 m to the west. FGC will sell gas to NEPCO who will be the supplier of natural gas to the proposed CCGT.

During times of interruption to the natural gas supply the plant will operate on distillate fuel oil (DFO) which will be stored on site in 2 x 13 500 m³ storage tanks of suitable size to allow for fourteen days operation. This fuel will be brought to site by road tanker. Annual consumption of DFO is not likely to exceed 21 000 t/yr though this will depend on the number of day interruptions to the natural gas supply to the site.

It is expected that for the majority of its life the Amman East CCGT will operate continuously throughout the year, except for essential maintenance and statutory inspections. The plant will be capable of two shifting in the event that the plant is required to operate in this fashion. It will be designed and constructed with an high average annual availability ie above 90 per cent. The plant will also be capable of operation in open cycle mode as necessary.

The emissions of oxides of nitrogen from the gas turbines will be controlled by the use of dry low NO_x (DLN) burners. There will also be emissions of sulphur dioxide (SO₂) during DFO firing. The level of SO₂ emitted is dependent on the sulphur in the fuel. The flue gases from each CCGT module will be discharged to a single 45 m stack. Flue gases emitted during open cycle operation will be emitted

through a bypass stack, which will also measure 45 m. Figure 4.2 shows a schematic diagram of a typical DLN combustion chamber.

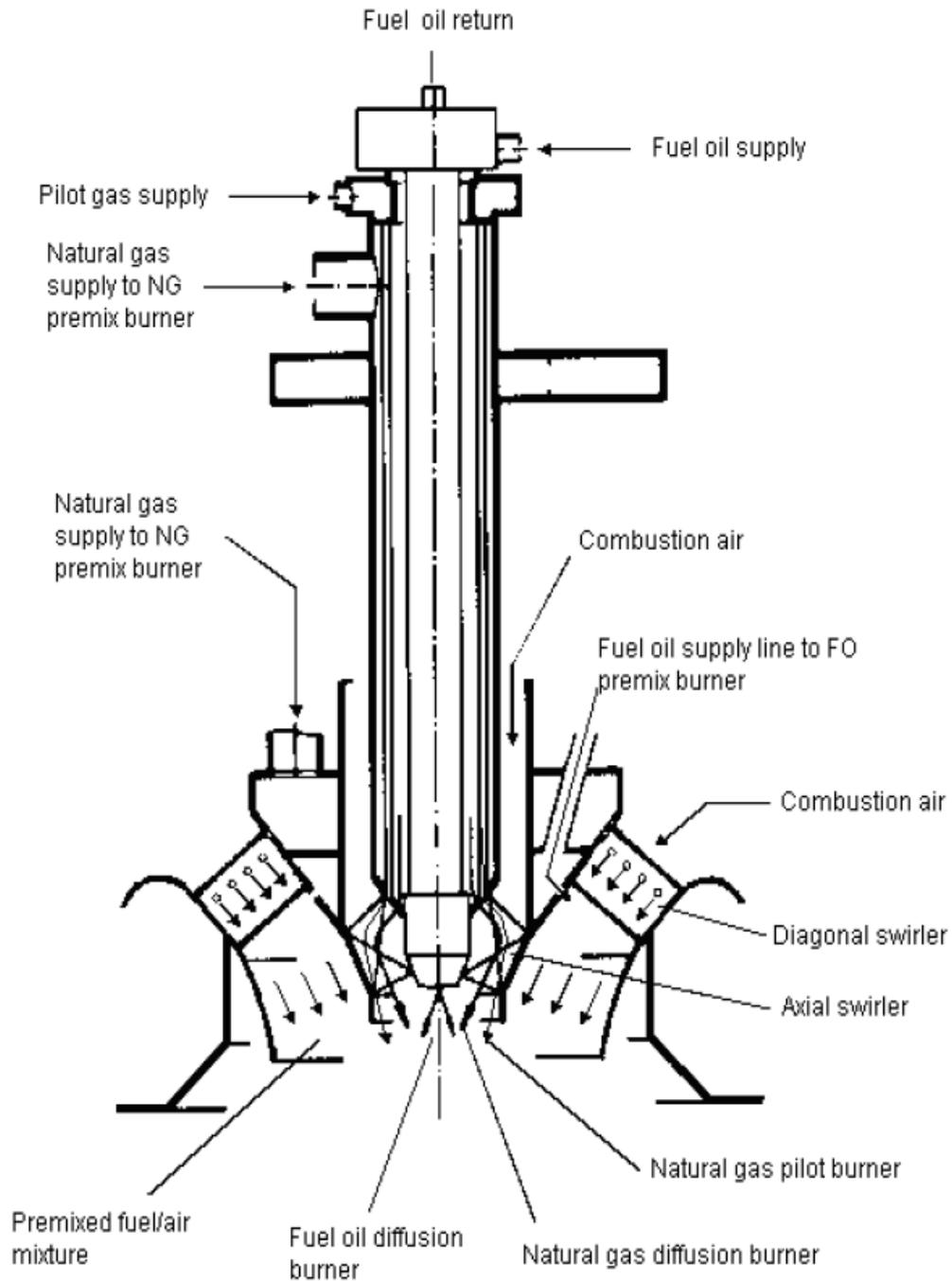


FIGURE 4.2: Schematic of a Typical Dual Fuel DLN Hybrid Burner

The Water Authority of Jordan (WAJ) will supply drinking quality water as raw water for all the Facility's needs through an 18 km pipeline. This water will require treatment via a water treatment plant prior to use.

The raw water will be treated and demineralized on site in an on site water treatment plant. The effluent from the water treatment plant will contain salts removed from the raw water, which will provide the make-up to the water treatment plant, and also some additional sodium sulphate produced by neutralization of the spent regenerants.

Water supplies will be required for make-up water for the closed cooling system and the boiler feed water system as well as for service waters (drinking and washing water etc). A water treatment plant will be used to treat the water required for use in the heat recovery steam generator.

The water treatment plant will consist of the following: a raw water tank, treated water (demin) storage tanks with a combined capacity of 2000 m³, sand filters, active carbon filters, ion exchange streams, an acid storage tank, a caustic storage tank, an automatic effluent neutralizing system, a control panel and all interconnecting pipe work. The water used for boiler make up will be treated in mixed bed units before being used in the boilers.

The treatment process to be used involves sand filters, active carbon filters prior to reverse osmosis followed by the exchanging of cations in the supply (calcium, magnesium, sodium, etc) for hydrogen ions by using cation exchange resins and then exchanging the anions in the decationized water (sulphate, chloride, carbonate, silicate, etc) for hydroxyl ions by using anion exchange resins. When the resins are exhausted the resin beds are backwashed, regenerated with dilute acid (for the cation resin) and with dilute caustic soda (for the anion resin), rinsed to remove any excess regenerant and returned to service.

The effluent discharged from the project will comprise the effluent from the water treatment plant and blowdown. These effluents will be treated in the effluent treatment plant prior to discharge to an on site evaporation pond. The treatment of effluent will include cooling, neutralization to adjust pH, coagulation, settling and clarification prior to discharge to evaporation pond. The sludge will be collected to the sludge pond which will be disposed of by truck at an approved disposal site.

Small quantities of boiler water (boiler blowdown) will be discharged to avoid the build-up of impurities. This effluent will be virtually pure water, containing very small quantities of various chemicals that are used to prevent corrosion and scaling in the boiler. Boiler blowdown will be re-used where possible such as plant internal irrigation.

The plant will include adequate sanitary facilities to treat sanitary sewage prior to disposal of in the on site evaporation pond. Sludge will be removed from the sludge collection pond by road tanker and disposed of at an appropriate disposal site.

A comprehensive fire protection system will be installed to cover equipment on site, which could constitute a significant fire risk. For the protection of equipment within the gas turbine package, where water or foam spray would cause damage, a total flood carbon dioxide system will be used. An automatic foam spray system for the protection of the DFO storage tanks, turbine lubricating oil tank, fuel handling areas and associated pipework will also be provided. Heat sensors or smoke detectors will be used in conjunction with automatic spray nozzles.

The plant will employ the standard mechanical and electrical protective devices, including emergency relief valves, shut down sequence controls, safety interlocks, fault detection and alarm systems.

Operating procedures will be implemented to ensure that safety is maintained under all likely circumstances.

Venting and emergency relief valves will be provided on the natural gas system to enable safe start up, shut down and operation of the natural gas supply system.

Stack emissions will be monitored continuously for NO_x, O₂ and CO. Emissions of SO₂ will be calculated from the sulphur content of the fuel as unlike the emissions of CO and NO_x emissions of SO₂ directly correspond with the sulphur present in the fuel supply.

This project will be link in to the national 400 kV transmission system, which connects the electrical network of Jordan with the electrical networks of Egypt and Syria. At present, double circuit 400 kV transmission lines connect Aqaba, Amman South, Amman North, Qatrana and Samra 400kV substations.

The transmission line will connect the proposed Amman East 400 kV AIS substation to the existing 400 kV network at Amman North and Amman South 400 kV substation via a double circuit overhead transmission line, which will result in reinforcing the Jordanian electricity network

The preferred route of the overhead transmission line passes through the territories of Abo Alanda Al-Sharki, Al-Baidaa village, and finally between Al-Baidaa village and Al-Maddona area before reaching the substation in Al-Manakher village. The line will traverse mainly arid land with small agricultural field structures and passes by near small rural communities (near Al-Baidaa village).

The total length of the new transmission lines will be about 16 km requiring 30 transmission towers. All towers shall be lattice steel and self supporting carrying a double circuit overhead line. The towers will be sized and positioned so as to guarantee an appropriate ground clearance for the overhead lines.

The substation will be an AIS 400 KV outdoor substation and will contain eight bays (double busbar) comprising three generator transformer circuit bays, four overhead transmission line circuit bays designated for export to the Amman North 1 and 2 and Amman South 1 and 2 substations.

Construction of the new plant is expected to commence in February 2007. The construction workforce will likely peak at about 1,000 with an average of between 600-700. The target date for simple (open) cycle operation is June 2008 and full combined cycle operation is June 2009. Operational staff for the new plant will be of the order of 40-50 permanent personnel.

The construction contractor will be required to prepare and implement a Construction Environmental Management Plan (CEMP). This Plan will identify the mitigating measures and management procedures that will be put in place to adequately control the environmental impacts of the construction stage, incorporating the relevant sections in this Environmental Statement (ES) and the Environmental Management and Monitoring Plan (EMMP) prepared for the project.

4.2.2 Decommissioning

At the end of the useful life of the power station, in approximately 30 years, the plant will be decommissioned in accordance with legislative guidelines current at that time. Alternatively, if market conditions and/or electricity supply constraints at that time indicate that it would be appropriate to extend the life of the plant, then decommissioning may be deferred to a later date. In order to ensure continuing adequate plant conditions and environmental performance, the plant would be re-engineered and re-permitted as required, dependent of the legislative requirements at that time.

In order to facilitate decommissioning much of the plant on site will be made of materials suitable for recycling.

A full environmental departure audit will be carried out. This will examine, in detail, all potential environmental risks existing at the site and make comprehensive recommendations for remedial action to remove such risks. Following completion of the demolition, a final audit will be carried out to ensure that all remedial work has been completed. The audit reports will be made available to future users of the site.

5. ENVIRONMENTAL AND SOCIAL BASELINE

5.1 Air quality

The plant will be required to comply with all applicable Jordanian and World Bank ambient air quality standards. The Jordanian standards that are considered to be applicable to the plant are detailed in Jordanian Standard (1140/1999) and are shown in Table 5.1.

**TABLE 5.1
JORDANIAN EMISSION STANDARDS FOR AMBIENT AIR QUALITY
(1140/1999)**

Pollutant	Averaging period	Maximum limit	Number of exceedences
SO ₂	1 hour	0.3 ppm (786 µg/m ³)	3 times during any 30 successive days in the year
	24 hours	0.14 ppm (370 µg/m ³)	Once during any 12 months
	Annually	0.04 ppm (114 µg/m ³)	
CO	1 hour	26 ppm (30160 µg/m ³)	3 times during any 30 successive days in the year
	8 hours	9 ppm (10440 µg/m ³)	3 times during any 30 successive days in the year
TSP	24 hours	260 mg/Nm ³	3 times during any 12 months
	Annually	75 mg/Nm ³ geometrical average	
NO ₂	1 hour	0.21 ppm (400 µg/m ³)	3 times during any 30 successive days in the year
	24 hours	0.08 ppm (150 µg/m ³)	3 times during any 30 successive days in the year
	Annually	0.05 ppm (95 µg/m ³)	
PM ₁₀	24 hours	120 mg/Nm ³	3 times during any 30 successive days in the year
	Annually	70 mg/Nm ³	

In addition as a Banks financed project the Amman East CCGT will be required to meet the emissions guidelines of the World Bank as specified in the 1998 Pollution Prevention and Abatement Handbook. These are shown in Table .

**TABLE 5.2
WORLD BANK AIR QUALITY STANDARDS
FOR NEW THERMAL POWER PLANT**

Parameter	Reference period	Ground level concentration limit values ($\mu\text{g}/\text{m}^3$)
Nitrogen dioxide	24 hourly	150
	Annual	100
Sulphur dioxide	24 hourly	125
	Annual	80
Particulates	24 hourly	70
	Annual	50

The ESIA has considered the harshest limits where the Jordanian and World Bank limits overlap.

5.1.1 Ambient air quality

Air quality was monitored at two locations one at Al-Manakher Primary School to represent the project site and a second in the eastern part of the village, chosen to represent residential areas. Both monitoring stations recorded data on the observed levels of sulphur dioxide (SO_2), hydrogen sulphide (H_2S), oxides of nitrogen (NO_x), nitrogen oxide (NO), nitrogen dioxide (NO_2), carbon monoxide (CO) total suspended particulates (TSP) and particulate measuring less than 10 microns (PM_{10}). Monitoring was undertaken from June 2005 to June 2006. Of these only NO_2 , SO_2 , CO and PM_{10} are relevant to the day to day operation of the plant as it will not emit H_2S or give rise to significant emissions of TSP during operation on either natural gas or DFO.

The study found that air quality in the vicinity of the proposed plant was good. Low air pollution levels were obtained throughout the majority of the monitoring exercise. The monitoring did identify exceedences of the Jordanian air quality limits on a few occasions of a number of the pollutants monitored. This was however considered to be attributable to sources local to the monitoring stations, for example traffic, and was not considered to present a significant issue.

The monitoring undertaken for the study showed that there were no exceedences to the Jordanian standards for SO_2 . At the school the maximum daily and hourly averages were 0.017 ppm and 0.069 ppm respectively, well below the limits of 0.3 ppm and 0.14 ppm.

Monitoring of H_2S showed five exceedences of the 24 hour limit with 37 exceedences of the 1 hour limit at the school. This was in compliance with the Jordanian limits as no three or more exceedences occurred during 30 consecutive days.

Low NO, NO_2 , and NO_x levels for the 24 hour averaging period were recorded in the study which were 0.101 ppm, 0.071 ppm and 0.070 ppm respectively. Hourly maximum were 1.975 ppm, 1.476 ppm and 0.498 ppm at the school with the NO_2 maximum recorded representing an exceedence of the

Jordanian limit of 0.21 ppm. This result was not replicated in any of the monitoring at the other monitoring location and is likely the result of a highly localized source of NO₂.

The levels of CO recorded were low with the maximum 1 and 8 hour average concentrations being 3.55 ppm and 3.38 ppm respectively representing a fraction of the allowed limits of 26 ppm and 9 ppm.

Dust levels recorded showed four exceedences to the TSP limit of 260 µg/m³. PM₁₀ results showed five exceedences of the 24 hour limit at the school site and six exceedences at the Al-Manakher village site.

5.2 Water quality

The proposed site is located within the Amman Governorate in the central parts of the Hashemite Kingdom of Jordan, near the village of Al Al-Manakher. The is situated within in the most important and the largest ground water basin in Jordan (Amman- Zerqa Basin) which supplies water to the cities of Amman, Zerqa, and their surrounding areas.

The Amman-Zarqa basin in which the site is located has a predominantly Mediterranean type climate, characterized by hot dry summer and cool to cold rainy winters. As in most semi-arid areas, temperatures exhibit large seasonal and diurnal variation with daily temperatures may be exceeding 40°C while in winter temperatures can drop at night to reach 0°C.

The project area is affected by a dry wind in summer, which is from east to south east and south west direction, while in winter it is affected by a humid wind from west and south west.

Cold and warm fronts steered from depressions occurring over Cyprus cross Jordan in south westerly to north easterly direction, and cause rainfall in Jordan. In the warmer months, April, May and sometimes October, thunderstorm precipitation can occur. Total yearly rainfall over the project area according to data from Sahab rainfall station located some 8 km to the south-west of the site varies between 396.1 mm/year in the year 2000 to 52.9 mm/year in the year 1998.

The basin consists of two main aquifers in the project area; the deep Hummer formation (A4) and the shallow complex consisting of Wadi Sir Amman silicified unit (B2/A7). The basin is divided into two parts; an eastern part to northeast of Wadi Zarqa that flows to the west, and a western part extending to the west of Wadi Zarqa and that flows to the east. The average renewable groundwater quantity in the basin is about 88 MCM/Year, of which about 35 MCM/Year return to the surface as base flow along Zarqa River the remaining 53 MCM/Year pumped through wells distributed over the basin area. The static water level in local wells is about 158-218 m below the surface.

Surface water in the project area is limited to flash storms occurring during the winter months. This surface water is not exploited as most of it either evaporates or percolates into the ground.

5.3 Geology, soils and wastes

The geology of the area is dominated by sedimentary rocks related to Cretaceous age that subdivided in two main sequences, Lower and Upper Cretaceous rocks.

The Amman East site is situated on the Muwaqar Chalk Marl (B3) geologic formation according to the Jordan Geologic Map. The formation consists of marl, soft thick-bedded chalky limestone with hard beds of microcrystalline limestone, pale chert, and local phosphorite. The lithologies suggest that the rocks were formed through on a sea bed with pelagic sedimentation.

The site consists of undulating terrain sloping from the northeast to the southwest. The site is sparsely vegetated with rock outcrops in the more elevated north-easterly parts. The rock outcrops consist of pale grey to beige microcrystalline limestone with chert concretions.

The road to the north of the site passes through a cutting in the surface soil as it passes the north-eastern portion of the site. The cutting reveals the presence of marl and chalky limestone layers below existing ground surface in addition to microcrystalline limestone with chert outcrops and intercalations.

There is also a rather deep gully in a ravine to the west of the site which reveals the presence of some dark brown silty clay and clayey silts with varying amounts of limestone rock fragments up to about 1 m below ground surface.

The soil which underlies the site is considered to be relatively impermeable and not conducive to the mobility or transport of heavy metals constituents etc.

5.4 Noise

Following careful inspection of the site and surrounding area the following NSR locations were selected for monitoring.

- Location 1 – Adjacent to property 560m to north-west of site boundary
- Location 2 – Adjacent to property 200m to North of site boundary
- Location 3 – Adjacent to property 600m to north-east of site boundary
- Location 4 – Adjacent to property 100m to East of site boundary
- Location 5 – Adjacent to property 20m to South of site boundary.

All monitoring was conducted using a Class 1 Sound Level Meter. A field calibrator was used to calibrate and check the meter before and after the measurement period with no change in level recorded.

The lowest recorded noise levels at each NSR and boundary position, during the daytime and night-time periods are summarized below.

**TABLE 5.3
SUMMARY OF LOWEST RECORDED L_{Aeq}
AT EACH MEASUREMENT POSITION**

Measurement position	Lowest recorded L_{Aeq} (dB(A))	
	Daytime	Night-time
Location 1	57	33
Location 2	60	33
Location 3	54	33
Location 4	48	33
Location 5	48	33

The night time measurements were taken from a proxy location toward the centre of the site. The lowest measured worst case night time L_{Aeq} of 33 dB has been used for assessment purposes. Any significant variance from this measured level is considered unlikely due to the rural surroundings of the proposed site.

5.5 Visual

Topography in the area is typical of the Highlands Topographic Region in which the site is located. The Highlands region extends from Um Qais in the north passing through Ajlun Mountains, the hills of Amman and Moab regions, and the Edom mountains region. Many creeks and wadies drain from these hills from north to south and lead to the river Jordan, Dead Sea and Wadi Araba. The southern highlands are higher than those in the north, though they are home to fewer species of vegetation types that also have a lower density.

The project site comprises of north/west shallow slopes of Al-Manakher hills that crossed by rainfall drainage small wadies toward south. There are a number of scattered houses to the north whilst the village of Al Al-Manakher is located 1 km to the south.

5.6 Traffic and infrastructure

The project site that is located in the Al-Manakher area the roads of which fall under the management of the Sahab municipality. The Zarqa to Sahab road runs along the northern boundary of the site with traffic flows averaging about 1900 vehicles/day the majority of which are associated with the rush hours at 6.30 am and 4.30 pm. The road is wide and appears to be of good quality.

At some point in the near future it is understood that a ring road around Amman will be constructed that will pass the site immediately to the west.

There are no railways or airports within the vicinity of the proposed plant.

5.7 Socio-economics

The site lies in a sparsely populated area to the east of Amman close to the village of Al-Manakher. There is little to no industry in the immediate vicinity of the site with the nearest residential properties located about 1km to the north and south. There is some agricultural activity in the area, including some olives and wheat crops and goat herds.

Al-Manakher is a very small village , most of its employment is within governmental post. I would assume the number of employment seeker from Al-Manakher will be less than 50 people, most of them are unskilled labour

There are health clinics available at Sahab city about 4-5 km away from the site. Major hospitals are available in Amman.

With regard to the local economy the village of Al-Manakher is home to just a few shops with the major marketing areas being located in Sahab city and Amman.

5.8 Ecology

The proposed project area is represented in one major ecosystem, the Scrap and Highland ecosystem. This consists of escarpments and mountains, hills and undulating plateaus, which extend mainly from Irbid in the north to Ras Al Naqab in the south, and, from Rift Valley region in the west to the Badia in the east.

The Mediterranean type woodland of pine and oak, with juniper and cypress that can be found in the ecosystem area is believed to have originally covered large tracts of the Jordanian highlands, but the human and climatic factors have resulted in high deforestation and replacement of natural vegetation by species that would not necessarily have been found in the area in the past.. There are two predominating vegetation types, Steppe and Mediterranean non-forest vegetation.

The proposed site for the power plant has shown clear evidence of past and current use of the site for agriculture practices. This agriculture is restricted to the annual crops like wheat and hey that used for livestock feed. The continuous ploughing of the project site has removed the natural vegetation cover that almost disappeared from proposed site and only remnants of that vegetation cover is found at the small depression wadies that cross the site which are not used for agriculture, in addition to the side of the old road found at the site.

Only two species of natural plant found in the proposed site of the power plant that are representative of the two vegetation types found in the surrounding area. Both of the recoded plant species are not conservation importance since it is common at its vegetation type.

Due to the deterioration and the absence of the natural vegetation at the proposed site for the power plant, the faunal diversity recorded at the site is minimal. Just one species of reptiles, three species of mammals and five species of birds where recorded at the proposed site of the Amman East CCGT and the surrounding area within 500 m from the site borders. None of these were considered to be of a rare or endangered nature.

5.9 Cultural heritage

An archaeological survey was conducted in the project area conducted by a team composed of two archaeologists who surveyed the project area, registered and mapped all features that may be affected by the project. The summary of tasks undertaken is as follows:

1. Jadis Searching/Department of Antiquities of Jordan (DOA).
2. Library Searching/DAJ/ACOR/BCRL.
3. Field visit.
4. Field Survey.
5. Field Documentation.
6. Data Analysis/computer
7. Report preparation.
8. Final Report issue with recommendations.

The investigation revealed the presence of no archaeological sites in the area of the power plant project, which may be affected by field activities. There are some archaeological sites in the area but these are located outside a 5 km radius of the proposed power station site.

The survey revealed no seen archaeological sites. Only a few scattered flints, that are potentially man made, were noticed on the surface and are likely present as a result of being washed away from the nearby hills during the winter season.

The desk based studies did not identified any known sub surface archaeology at the proposed Amman East CCGT site. There is however the potential for sub surface archaeology to exist at the site.

6. ENVIRONMENTAL AND SOCIAL IMPACTS

This section discusses the impact of the proposed Amman East IPP to the baseline environment identified in Section 4.

6.1 Air quality

Dust may be generated during several activities associated with the construction works, for example excavation work for the plant and associated infrastructure. It is very unlikely during most weather conditions, using the proposed dust mitigation measures, that dust generated at the site will cause nuisance at houses in the area.

The proposed plant will operate for the majority of its operational lifetime on natural gas supplied from the national gas transmission system. Natural gas is an inherently clean burning fuel that does not give rise to significant quantities of sulphur dioxide (SO₂) or particulate matter during combustion.

At times, when natural gas is unavailable, the plant will operate on distillate fuel oil (DFO). Combustion of DFO gives rise to atmospheric emissions of SO₂ and very low levels of particulate matter, in addition to atmospheric emissions of oxides of nitrogen (NO_x). As currently designed, the proposed plant will store sufficient quantities of DFO to allow for 14 days operation in the event of an interruption to the natural gas supply. It is not proposed that the plant is designed to allow for water injection as the turbines selected will be able to meet the relevant Jordanian and World Bank emissions limits for NO_x using low NO_x burners.

The main gaseous pollutant emitted from the proposed CCGT plant will therefore be NO_x of which 95 per cent is nitric oxide (NO) and 5 per cent nitrogen dioxide (NO₂). NO oxidizes to NO₂ in the presence of ozone. The CCGT plant will therefore contribute to background concentrations of NO₂. To assess this contribution, a dispersion modelling exercise has been carried out. Detailed information is provided in this section on CCGT plant emissions (and their control), the analysis of NO oxidation rates and the dispersion modelling. The emissions of SO₂ during DFO firing have also been assessed using dispersion modelling.

It is proposed that the gas turbines chosen for the proposed plant will be equipped with the proven pollution control technology, which will limit the production of NO_x to a maximum of 125 mg/Nm³ during gas firing and a maximum of 165 mg/Nm³ during oil firing at full loads. The technology known as the dry low NO_x system, limits emissions of NO_x to atmosphere. This technique represents the Best Available Technique (BAT) for limiting emissions of NO_x to atmosphere from gas turbines.

A dispersion modelling exercise has been undertaken to predict the impacts of the proposed plants operation quantifying the contributions the proposed CCGT plant will make to the existing background concentrations of NO₂ and SO₂ in order to determine the overall effect on a number of receptors in the area. The assessment of the impact on air quality due to emissions from the proposed CCGT plant is based on the predicted changes of the ground level concentrations of pollutants in accordance with the relevant Jordanian and World Bank limits, which have set standards and objectives for these ambient concentrations.

A conservative view of the operation of both plant has been adopted in the modelling so that a “worst case” is presented under specific scenarios. The model assumes base load operation both CCGT plant thereby assuming that the maximum emissions from the overall site coincide with the meteorological conditions leading to the highest impact. In reality the operation of the plant with maximum output may not coincide with worst case meteorological conditions as the operation of the new plant on distillate fuel oil is limited.

Consideration has also been given to significance of any cumulative impact between the proposed Amman East plant and the CCGT plant recently constructed at Samra.

The result of using this conservative approach is to ensure that the maximum predicted impact within the potential operating regime of the proposed plant is considered. This ensures that there is a “factor of safety” built into all of the air quality assessment, giving a high degree of confidence that the actual impacts will be less than those presented in this assessment. The results of the modelling have been compared to relevant air quality limits and standards.

The results of the modelling have been compared to appropriate objectives. Key findings from the analysis are:

- The maximum predicted annual average NO₂ concentration for firing on natural gas is 0.8 µg/m³ at a point 1.1 km to the south east of the proposed site to the east of the village of Al-Manakher. This figure represents just 0.8 per cent of the Jordanian limit and World Bank standards. This assumes the plant operates for 14 days per year on DFO.
- The maximum predicted 3rd highest hourly NO₂ concentration during gas firing is 55.9 µg/m³, which represents 13.9 per cent of the Jordanian limit and occurs 3 km to the south east of the site. During oil firing the maximum predicted 3rd highest hourly average is 51.6 µg/m³ which represents 12.8 per cent of the Jordanian limit.
- The highest 24 hour NO₂ concentration during gas firing is 5.8 µg/m³, which represents 3.9 per cent of the World Bank limit and occurs just under 1 km to the north east of the site. During oil firing the maximum predicted 3rd highest hourly average is 5.4 µg/m³ which represents 3.6 per cent of the World Bank limit.
- The maximum predicted 3rd highest hourly SO₂ concentration during DFO firing is 743.9 µg/m³, which represents 95 per cent of the Jordanian limit and occurs 3 km to the south east of the site. Due to the limited nature of DFO firing it is not appropriate to predict the impact for daily averages for comparison with World Bank standard.
- The maximum predicted 3rd highest 24-hour particulate concentration during oil firing is 17.7 µg/m³, which represents 15.5 per cent of the Jordanian limit. The maximum occurs at a point 568 m to the east of the proposed plant. The maximum 24 hourly particulate concentration during oil firing represents 25.3 per cent of the World Bank limit of 70 µg/m³.

- The maximum predicted 3rd highest hourly CO concentration during DFO firing is 117.8 µg/m³, which represents 0.4 per cent of the Jordanian limit and occurs 3 km to the south east of the site. The maximum predicted 3rd highest 8 hour CO concentration during DFO firing is 63.9 µg/m³, which represents 0.6 per cent of the Jordanian limit and occurs 568 m to the south east of the site.
- In all cases the maximum ground level concentrations associated with operation of the plant in OCGT mode are significantly less than those for CCGT operation. In all but the hourly averaging periods the peak ground level concentrations observed are located within 1 km of the proposed site.
- The cumulative impact assessment of the Amman East and Samra plant does not show a significant cumulative impact associated with the two plants despite the modelling assuming an absolute worst case.

In conclusion, the impact of the atmospheric emissions from the proposed Amman East CCGT will be well within the Jordanian limits and World Bank guidelines.

6.2 Water quality

The discharge of any effluents during construction, including site drainage, will be the responsibility of the construction contractor, who will be required by the developer to dispose of any construction effluents in a responsible manner. Standard good working practices should ensure that any impacts due to the water discharging from the site would be insignificant.

All water required by the plant will be provided by the Water Authority of Jordan (WAJ) who will construct a dedicated pipeline to the Amman East site. The agreement with WAJ will allow the plant to use up to 250 m³ of water per day though the plant may ultimately use less than this during operation. During operation, water will only be required on a day to day basis for make-up to the boiler water system and for service water (drinking water etc).

On a day-to-day basis, the only effluent produced by plant will comprise the effluent from the water treatment plant. This effluent will be discharged to an evaporation pond following treatment in pH adjustment, coagulation and clarifier tanks. There will be no discharges of process water to any local water course.

Small quantities of boiler water (boiler blowdown) are discharged in order to avoid the build-up of impurities in the boiler water. This discharge is virtually pure water, containing very small quantities of various chemicals that are used to prevent corrosion and scaling in the boiler. The boiler blowdown will be recovered and reused if possible, perhaps for irrigation purposes if practical. Any remainder will be discharged to the evaporation pond. Sewage will be treated on site with the treated water discharged to the evaporation pond. Sludge generated from the sewage will be removed from site by tanker and discharged to either a local sewer or appropriate land fill site.

Any areas of the site that are likely to be contaminated with oil will drain to oil interceptor(s) to limit visible oil in the water.

The installation of the gas and water pipeline and transmission line and substation will have a negligible impact on water quality.

In conclusion the environmental impact of the Amman East CCGT Power Station with regard to water quality is not considered to be significant.

6.3 Geology, soils and wastes

Investigation of the site has not identified the potential for any contamination to be present at the proposed Amman East CCGT site, at the site of the proposed substation or along the routes of the gas/water pipelines or transmission line. The project site has not understood to have been used in the past for any industrial purpose that could have lead to contamination of the site that could be mobilized by any future site works.

The propose plant will be operated in such a manner as to minimize the generation of solid wastes. CCGT plant represent an inherently clean and efficient manner of electricity generation and the solid wastes produced by the plant will be minimal.

Where possible wastes will be recycled or reused with those that cannot be disposed of by an appropriately licensed contractor at an appropriate disposal site.

6.4 Noise

The impact of construction noise has been predicted using a noise model incorporating various items of plant and construction equipment at a distance of 250 m. This is the distance from the centre of the power plant site to the nearest sensitive receptor. The model does not consider any screening, directivity or absorptive effects and therefore represents a worst case. The majority of construction equipment has been predicted to fall under the daytime project limit of 50 dB(A). However, it is possible that residents in this area may experience an increase in noise levels above the daytime project limit of 50 dB(A) during construction.

The impact of predicted operational noise has been assessed for the proposed plant against background noise levels, which have been recorded as part a baseline monitoring exercise. The noise model has predicted the potential for a 1 dB exceedence to the night-time project limit of 40 dB(A) at the closest noise sensitive receptor to the site boundary. It is noted that this is a worst-case noise level assuming that 100 per cent of plant equipment will be running during the night which might not ultimately occur. The predicted noise level increase of 1 dB is therefore not considered to be significant.

There is a potential that the installation of the transmission line could generate exceedences of the Jordanian noise limits during construction though this will be for a short time only.

The noise impact associated with the construction and operation of the proposed plant is therefore considered to be acceptable.

6.5 Visual impact

The substantial buildings envisaged on site are the turbine hall, 2 × heat recovery steam generators (HRSGs), air cooled condensers, control room and storage tanks. The remaining plant and equipment will, in the main, be housed in relatively low buildings, of the order of 3 to 6 m in height. The tallest structure on site will be the 45 m stacks.

All reasonable measures shall be taken to minimize visual impact of the plant. Structures and buildings shall meet the standards generally accepted for a facility of this type and shall be in accordance with all applicable local and national consents relating to appearance. Final architectural arrangements shall be submitted for approval to the Owner/Engineer.

The visual impact of the 400 kV substation is not considered to be especially significant given the project setting.

6.6 Traffic and infrastructure

Road access to the proposed site is via a new access road that will link to the Zarqa to Sahab road immediately to the north of the project site.

The 28-month construction phase of the CCGT plant will give rise to additional traffic movements. In addition to staff transport movements construction traffic will consist of civil works traffic, mechanical works traffic and a small number of abnormal loads for components such as the gas and steam turbines. Approximately 50 heavy commercial vehicles per day will be expected on average with 70-100 per day at the peak of the construction period. Vehicles bringing deliveries to site are likely to be spread throughout the working day. This will not represent a significant increment to the existing traffic movements on the Zarqa to Sahab road which averages at about 1900 vehicles/day the majority of which are associated with the rush hours at 6.30 am and 4.30 pm.

The installation of the gas and water pipelines and transmission lines will only give rise to small amounts of construction traffic that will not have a significant impact on local traffic and infrastructure.

The exact number of abnormal loads would depend on the configuration of the plant that will only be finalized during the tendering process. However, this is likely to be of the order of 15 to 20 over the 28-month construction period. The transport of abnormal loads, which may lead to delays and cause inconvenience to other road users, would be timed following consultation with the relevant authorities to minimize disruption to the other road users.

Normal operation of the plant will give rise to traffic movements associated with the 50 personnel working at the site. There may be a slight increase over a 2-4 week period per annum during major inspection and outage work. At times of interruption to the natural gas supply, distillate fuel oil (DFO) required would be taken from the on-site storage tanks, which will be sized to contain 14 days DFO supply. In the event that firing on DFO occurred the storage tanks would then be refilled using road tankers. The potential for the tanks to hold 14 days DFO supply means that tanks can be refilled over a longer period of time (unless the interruption is serious in nature). It is estimated that the total

number of transporting diesel trucks from Jordan Petroleum Refinery to the project location will be about 2–3 trucks/day assuming each truck load is 32 to 42 tonnes.

Traffic movements associated with the decommissioning of the plant would likely be less frequent than that associated with the construction of the plant.

It can therefore be concluded that there will be no significant increase in the daily traffic to and from the site due to the proposed power plant and there will be no effect on local traffic patterns and infrastructure in the construction, operation or decommissioning phases.

6.7 Socio-economics

At the peak of the construction phase the proposed Amman East combined cycle gas turbine (CCGT) plant will employ of the order of 1,000 construction workers with an average of between 600-700. Construction of the new plant is expected to commence in February 2007. The construction workforce will likely peak at about 1,000 with an average of between 600–700.

The plant will be constructed, installed and commissioned and be operable and maintainable in full compliance with all relevant health and safety at work orders, all related acts, regulations, codes and statutory requirements.

The plant will operate continuously throughout the year and will be designed to have an expected operational life of 25 years though could potentially continue generation beyond this. Maintenance of the Facility shall be scheduled for the months of November through May, and not during June through October to reflect the likely peak demands. The Civil infrastructure, on site roads etc will be designed to have a minimum working life of 30 years.

The Amman East CCGT will be designed to operate with a significant amount of automatic control but will require up to 40-50 staff. These jobs will be permanent, non-seasonal jobs lasting for the lifetime of the power station.

The power station project will not involve the displacement of local peoples or removal of livelihood of an individual with the site being currently unused and in the ownership of Ministry of Finance/Department of Lands and Surveys. The transmission line installation will lead to the confiscation of some small areas of land but not to resettlement of households businesses etc. Where lands are confiscated NEPCO will pay a fair level of compensation agreed through due process of Jordanian law.

Development of the site is predicted to bring money in to the area that will be to the advantage of local merchants who will could expect too see increased revenues through the provision of services to the construction and operational staff and to the plant itself though service contracts for e.g. vehicle maintenance etc.

The Amman East CCGT is therefore expected to have a positive socio economic impact on the area through the provision of jobs and investment throughout its predicted 30 year lifetime.

6.8 Ecology

The ecological surveys undertaken have assessed the direct and indirect impacts of the project on various aspects of terrestrial biological environment in the project area during the three phases of the project; construction, operation and decommissioning.

In making this assessment a number of different methods were employed to assess the existing biological baseline in the project area and to evaluate the expected impacts of the plant on the baseline with regard to the nature of the subject being studied.

The proposed project area is located in one major Jordanian ecosystem, the Scrap and Highland ecosystem. This ecosystem consists of escarpments and mountains, hills and undulating plateaus, which extend mainly from Irbid in the north to Ras Al Naqab in the south, and, from Rift Valley region in the west to the Badia in the east.

The site itself is typical of the area and there are no notable species (of fauna or flora) located within the site boundary. The project is not located in an area that would require it to be classified as a critical natural habitat by the IFC (such as a Jordanian nationally protected site) and therefore does not contravene the policies of the World Bank and IFC with regard to such habitats.

The ecological studies undertaken concluded that whilst the construction of the plant would result in the destruction of all or much of the existing habitat on site, the habitat does not represent a source of any notable fauna or flora when considered in the context of the surrounding area. It is therefore considered that the plant would have an insignificant impact to ecology in the area.

The construction of the gas and water pipelines and the transmission lines and substation will not result in any significant impact to the ecology of the areas through which they pass.

6.9 Cultural heritage

An archaeological assessment has been undertaken of the Amman East CCGT site and of the gas and water pipeline and transmission line routes to allow for the identification of any archaeological remains on site or in the surrounding area that could be impacted upon by the construction and operation of the proposed plant.

Work has taken in to consideration the relevant Jordanian legislation regarding the protection of archaeological remains (Archaeology Act (No.32, 2004)). In making the impact assessment consideration has also been made to the Guidance Note 8 of the World Bank.

The assessment concluded that there was no obvious or likely on site archaeological remains that would be impacted upon by the plant and that due to the nature and history of the site the potential for an impact on archaeological is low. The project does not therefore contravene Guidance Note 8. In addition the project is outside the 1 km radius of any sites protected by the Archaeology Act and will therefore not impact on the sites protected by the act.

It is proposed that if any archaeological remains are found during construction and would otherwise be damaged by construction activities, the Department of Antiquities will be invited to site to assess the discovered remains and allowed to carry out an emergency salvage excavation if considered necessary.

6.10 Electric and magnetic fields (EMF)

The proposed transmission line would pass through mainly undeveloped lands with the nearest inhabited village to the line route being Al-Baidaa (with an approximate 1 km separation). However along the route there is a school is located about 165 m and few dwellings are located about 165-500 m from the line in some places.

EMF levels in the project area would not increase during construction of the Project. However when the transmission lines are energized, there would be some permanent increase in the level of EMF to the baseline environment. These will be localized in significance. The maximum magnetic field is estimated to be 5.5 mG, which is below the permissible 830 mG set for the 64 WHO/INRC.

6.11 Health and safety

A major hazard assessment has been undertaken for the project to identify potential hazards and the manner in which the risks associated with these will be mitigated. None of the hazards identified are considered to represent a significant hazard to human health or the environment so long as the mitigation identified is implemented.

The health and safety procedures and policies that will be prepared for the CCGT plant will contain the performance levels and measures that are normally acceptable to the IFC and those required by Jordanian law.

A Health Safety and Environmental (HSE) Plan will be prepared by the EPC contractor for the construction works prior to commencement of the construction activities. Workers will be provided with personal protective equipment and training and will be required to use these as necessary. Guidelines for maintaining hygienic conditions and appropriate shelter at eating, resting, drinking and washing facilities on project site will be established.

Precautions will be taken to keep the risk of exposure to hazardous materials as low as possible. Work processes, engineering and administrative control measures will be designed, maintained and operated so as to avoid or minimize the release of hazardous substances into the working environment.

An Environmental Management and Monitoring Plan (EMMP) has been prepared for the project. This document provides information on the mitigation measures that are discussed in detail in the ES and identifies any monitoring that will be necessary in order to ensure that these are being successfully implemented. This is provided for both the construction and operational phases. The EPC Contractors HSE Plan and the Operations EMS will be prepared at a later date and will include further details on the manner in which the aims of the EMMP will be implemented.

An environmental and safety manager will be appointed for the construction and operational phases to ensure that the EMMP and other environmental policies are properly adhered to and that all national laws are complied with.

It is considered that so long as the proponent implements the mitigation and monitoring measures outlined in the ES and the EMMP the project will comply fully with all relevant health and safety requirements with regard to staff and members of the general public required in the relevant Jordanian legislation as well as the requirements of the World Bank and International Finance Corporation.

6.12 Associated infrastructure and cumulative impact

The installation of the support infrastructure including the transmission line, substation and water and gas pipelines is not expected to give rise to significant environmental impacts. In all cases the responsibility for the consenting, construction and operation of these lies completely outside the control of AES Oasis Limited and Mitsui & Co. In all cases there is an obligation on the relevant parties to install the infrastructure to allow for the operation of the Amman East CCGT. There are no legal implications associated with the consenting, construction and operation of this infrastructure.

There is not considered to be a potential for the Amman East to give rise to significant cumulative environmental impacts when considered with the construction of infrastructure associated with the plant, or for that matter with any other industrial activities existing or proposed.

7. ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

The Environmental Management and Monitoring Plan (EMMP) prepared for the project provides information on the mitigation measures and monitoring that will be employed to minimize the environmental and social impact of the project in both the construction and operational phases.

In preparing the EMMP consideration has been given as appropriate to the IFC's Policy and Performance Standards on Social and Environmental Sustainability. Consideration has also been given to the relevant Jordanian legislation as necessary including:

- *Instruction for management and handling of hazardous waste*
- *Civil Defence Act (No.90,2003)*
- *Public Health Act (No. 54,2002)*
- *Instruction of managing and circulating of the waste oils*
- *Hazardous substances Law (No.16/1953)*

Due to the proven nature of CCGT technology the plant to be constructed will be able to take advantage of many years of development in the process that make CCGT plants an inherently clean and safe way of generating electricity. As a result of this there is little by way of mitigation and monitoring additional to that which is inherent in the plant design necessary and therefore little by way of additional expense.

All monitoring and mitigation measures during the construction phase will be the responsibility of the EPC contractor who will pay for these as necessary. The cost of this mitigation is negligible and is in any case part of best working practices. The only expenses identified as being especially significant are the measures to prevent release of oil and other liquids into local water courses and the ground (\$140,000), a Health and Safety Plan (\$20,000) and any land reinstatement (\$100,000). The total incurred expense for mitigation measures by the contractor will be of the order \$535,000, however many of these measures are standard practice on projects of this nature and therefore are integrated into the overall EPC Contract value as standard, many items are included in order to fulfil separate functions in addition to the environmental benefit.

In addition to this the plant may need to be equipped with noise enclosures for all plant items where practicable, not overlooking smaller plant items such as compressors and pumps the cost to the construction (and the proponent) would be about \$2 m. The Proponent will also need to prepare/commission an emergency response plan for spillage of hazardous materials, leaks for fuel tanks etc which could cost of the order of \$10,000. These prices would cover the full construction and operational phases of the project.

The total cost for mitigation and monitoring, excluding the noise abatement referenced above, is expected to be of the order of \$1,500,000 for the construction and operation.

No other additional mitigation expenses are predicted for the proponent and contractor. There are not expected to be any expenses incurred by any government ministries with regard to mitigation.

Monitoring costs would be minimal and would principally be associated with the purchase of monitoring equipment and the employment of the relevant environmental managers. It is not expected that the cost of monitoring will exceed \$10,000 with regard to the expenses incurred by the contractor and a similar amount by the proponent (annually). The cost of the most expensive monitoring device the continuous emission monitoring device would likely be of the order of \$300,000 but is part of the plant design and must therefore be discounted from the additional costs associated with the plants operation.

Key mitigation and monitoring objectives of the EMMP include:

- use of DLN burners, which ensure NO_x levels to be in accordance with Jordanian and World Bank requirements;
- the use of natural gas to fuel the CCGT which has an inherently low sulphur level and will therefore minimize the emission of SO₂;
- Use of a stack of sufficient height and flue gases of sufficient temperature and velocity to ensure good dispersion.
- The bunding of all storage tanks and containers with 110 per cent impermeable bunds to ensure that in the event that a tank were to leak all material is contained and could be safely removed and the tank was repaired;
- The use of dust suppression measures such as the use of water bowsers to minimize the potential for dust creation during the construction period;
- The encouraging of the use of public transport, car sharing or use of minibuses to minimize the impact of the projects construction and operational activities on the local traffic infrastructure;
- The installation of a continuous emissions monitoring system (CEMS) in the stack of the power station during operation to ensure that all emissions limits are adhered to; and
- The installation of fire protection measures to ensure that any fire can be combated effectively.

A full EMMP is provided in Appendix A.

To ensure that the monitoring and mitigation measures outlined in the EMMP are successfully implemented a environmental and safety manager will be appointed during the construction and operational phases to oversee the process.

It is considered that so long as the plant implements the mitigation and monitoring measures outlined in the EMMP the project will comply fully with all relevant Jordanian Laws as well as the requirements of the World Bank and International Finance Corporation.

8. INTERAGENCY, PUBLIC AND NGO CONSULTATION

This section summarizes the measures taken in order to facilitate the involvement of Government ministries/agencies, Non-Governmental Organizations and members of the general public in the ESIA process for the proposed Amman East IPP project. It also details the projects compliance with

8.1 Scoping exercise

A Scoping Study for the project was undertaken by PB Power and ACES in July 2006. This described the key environmental issues that, in PB Power's opinion, would require detailed evaluation as part of this Environmental and Social Impact Assessment process.

The principle objectives of the scoping study were to:

- Identify the key environmental issues to be included in the assessment.
- Identify the legal requirements and framework for the project through the course of its lifetime.
- Identify the relevant component studies to establish the relevant baseline for the project.
- To finalize the proposed Terms of Reference (ToR).

A formal scoping session was held on the 4 July 2006 in the Holiday Inn, Amman on the request of the Ministry of Environment (MoE) in accordance with MoE ESIA regulation. The MoE invited relevant and potentially relevant stakeholders to this scoping session including organizations from the public and private sectors in addition to NGO's and neighbouring residents. The scoping session was also advertised in the Jordanian Times on the 3 July 2006 (see Appendix A) to allow interested members of the general public to attend the meeting. A list of the participants at this event is provided in Appendix B.

As part of the scoping session members of the ESIA team gave a presentation detailing the project activities, facilities, and processes. Graphics and diagrams were included in the presentation highlighting the importance of the project and the need to identify potential interactions between the project activities and the receiving environment.

The participants were asked to review the legal requirements in the proposed ToR, which were presented on a slide to help identify any additional legislation that could be considered applicable to the project.

The participants were provided with a comments form to detail their concerns regarding the project (if any) with sufficient time was allowed for any comments to be noted. Upon completion all forms were collected by a MoE representative who subsequently provided copies of the forms to the ESIA team to allow these to be considered as part of the ESIA. A summary of the concerns raised in included in Appendix C.

8.2 Additional public consultation

Following completion of the ESIA AES and Mitsui & Co have undertaken additional public consultation to allow members of the general public to become better informed on the projects.

Key objectives of the public consultation process were:

- To disclose the ESIA to people of Al Manakhar village and convey the findings of ESIA in an appropriate manner.
- To comply with World Bank requirements.
- To study and consider the public opinion on the ESIA and any further concerns.
- Build strong relationship with the surrounding people, and improve Community relationship.

8.2.1 Consultation methodology

The public consultation process allowed for the discussion of the project directly between members of the ESIA project team and members of the local community (principally residents of the village of Al-Manakher).

The consultation process ran from the 10th October 2006 to the 20th October 2006 in Al-Manakher village. The village was selected as the most appropriate location for the consultation as it represents the nearest community to the project site and as a result the residents of the village will be most affected by the construction and operation of the project. Al-Manakher village is a small village with population around 2000 person depends mainly on governmental jobs and agricultural activities for their livelihoods.

The consultation process employed two assessment methods to gauge the opinion of the village residents on the project affording them the chance to express and concerns relating to the proposed development.

The consulting process started with house to house meeting with local people to explain the nature of the project and the expected effects and benefits on the surrounding environment and people and ended with public hearing conducted in the school of Al-Manakher village.

A survey was also undertaken of local opinion. This included:-

1. Provision of a leaflet discussing the project which was distributed to the village people in Arabic. This included:
 - An introduction to the project and nature of the plant processes.
 - Comparison between the combined cycle gas turbine and the traditional methods of electricity production, with discussion of the process benefits.

- The positive affects of the project on the surrounding area and people.
2. A brief verbal description of the project, and its positive affects on them and on their village. Complains and fears (where these were expressed) were discussed to allow for a better understanding of the project and its impacts as necessary.
 3. Finally participants were invited to fill the survey questionnaire form in Arabic language. Where the interviewee was illiterate they were helped by the consultants and literate people from the local community to fill the forms.
 4. On the last day of the consultation around fifty members of the local community attended a Eftar banquet held by the proponent which allowed the members of the ESIA and development team to meet many of the local residents an discuss the project in a less formal setting.
 5. A survey questionnaire containing 11 questions was distributed to participants in the consultation process. Where a question generated a 30 per cent negative response this has been considered in detail to determine if a solution can be found to the concern expressed.

8.2.2 Survey findings

Some 72 members of the community chose to complete the survey 22 of whom were consulted by house to house visits. If the 72 survey participants, 12 were women.

The principle concerns were found to be the desire for lower electricity prices and concerns relating to the potential impact on land prices in the area.

With regard to electricity prices 54 per cent of the public meeting participant did not believe that the electricity prices will go down. The consensus was that the residents of the village should pay just 30 per cent of the actual electricity price. The potential to accommodate such a community benefit will be explored during the development of the project.

57 per cent of the participants initially believe that the land value will be less and it will lose its value due to construction and any environmental impacts of the power plant. During the consultation period there was an open discussion and it was explained that plant is being constructed under strict guide lines of World Bank and Jordanian Regulations and there is no similarity between this plant and existing oil fired plants currently operating in the kingdom. The majority of people believed following discussion of the project that the plant may actually boost property prices and that there is a potential for additional commercial activity in the area encouraged by the construction of the plant that will generate a positive socio-economic impact..

8.2.3 Residents opinion

During the consultation process a number of residents of Al Manakher asked about the basis how and why this particular site is selected for this power plant and is it not feasible to have a plant further away from the village. It was explained to the people that location of the plant is at reasonable

distance away from the village and site was selected based on availability of roads, available government land, proximity to the natural gas pipeline (just a under 900 m to the west) and 400 KV transmission line (6km to the west).

The principle concern of residents were those relating to air, and noise emissions and any potential for waste chemicals to be generated. It is considered that the measures outlined in the EMMP should be sufficient to mitigate the impacts identified.

8.3 Conclusion and recommendation

It is considered that most of the village residents now have a much better understanding of the project and the environmental and social impact associated with the construction and operation of the plant.

With regard to the expectations of the local community there is a clear hope that if possible staff for the construction and operation of the plant should be drawn from the local community. Where ever practical this will be accommodated by the proponent.

The community also expressed a desire for social benefits from the project such as repair and extension of the mosque, scholarships for outstanding local students from the community and also training courses for their unskilled and illiterate people so that they can qualify for jobs during construction phase of the project. Again where ever possible and practical the proponent will seek to make provision for these desires.

In order to continue the good relationship established with the local community AES have nominated one of their local employees to act as a direct point of contact with the local community. It is hoped that this will afford the local community easy access to AES management to raise their concerns in the event that concerns arise.

8.4 Conclusions

The Project has allowed for full and proper public disclosure to Government ministries/agencies, Non-Governmental Organizations and members of the general public in the ESIA process for the proposed Amman East IPP project. In addition the Amman East IPP has been found to fully comply with the relevant Jordanian and World Bank standards and requirements.

9. CONCLUSIONS

Following the undertaking of the Environmental and Social Impact Assessment for the proposed Amman East IPP and gas and water pipelines it is considered that the plant will not give rise to an unacceptable impact the environment, in isolation, when considered against the existing background or with potential future developments within the projects sphere of influence. This is also true of the transmission line and substation associated with the plant that has been the subject of a separate ESIA.

To ensure that the environmental impact is minimized mitigation measures have been identified and where appropriate monitoring of environmental performance in both the construction and operational periods.

The Project has allowed for full and proper public disclosure to Government ministries/agencies, Non-Governmental Organizations and members of the general public in the ESIA process for the proposed Amman East IPP project.

It has been found that in addition the Amman East IPP has been found to fully comply with the relevant Jordanian and World Bank standards and requirements.

In conclusion the construction and operation of the proposed Amman East IPP project and associated infrastructure is considered to be environmentally acceptable.

**APPENDIX A
ENVIRONMENTAL MITIGATION AND MONITORING PLAN
(57 pages)**

Construction impact mitigation, monitoring, and management measures

CONCERN	SIGNIFICANCE	MITIGATION MEASURE	MONITORING
Air Quality			
Dust creation from soil movements, emissions from vehicles etc	Moderate Significance	A Water Bowser will be used if required (following tests to determine the moisture content of material)	To ensure that atmospheric dust, contaminants or dust deposits generated by the construction do not exceed levels which could constitute a health hazard or nuisance to those persons working on the site or living nearby a dust monitoring programme will be carried out throughout the construction period.
		Excavation faces not being worked will, if required, be either sheeted or treated with a chemical dust suppressant	
		All operatives working in areas of potential dust emission will be provided with paper facemasks.	
		All stockpiles will be located away from sensitive receptors wherever possible.	
		Materials deposited on stockpiles on site will be closely monitored for any possible emission of dust and if required they will be damped down, covered or treated with a dust suppressant.	
		All vehicles carrying bulk materials into and out of the site will be sheeted so as to contain any material that may be dispersed during transit. Minimum drop heights will be used during material transfer	Daily visual inspections will be made to ensure that good practice is employed at all times. Inspections will include monitoring of exit points and the immediate area outside the site entrance. The inspections will be made against the EPC contractors CEMP.
		If finely ground materials are delivered, these will be in bag form or stockpiled in specified locations where the material can be suitably covered.	

CONCERN	SIGNIFICANCE	MITIGATION MEASURE	MONITORING
		Engines will be switched off when not in use. All vehicles will be properly maintained to reduce air emissions	
Water Quality and Soil			
Protection of ground waters	Moderate Significance	Water inflows to excavated areas to be minimized by the use of lining materials, good house keeping techniques and by the control of drainage and construction materials in order to prevent the contamination of ground water. Site personnel to be made aware of the potential impact on ground and surface water associated with certain aspects of the construction works to further reduce the incidence of accidental impacts.	
Potential leakage of storage tanks	Moderate Significance	Refuelling of construction vehicles and equipment to be restricted to a designated area with properly designed fuel tanks and bunds and proper operating procedures.	Daily visual inspection of bunded areas will be made to ensure the effectiveness of these systems.
Protection of ground and surface waters	Moderate Significance	No materials will be disposed of in the wadi to the north-west of the site.	
		Spill kits will be kept on site to clean up any spills of fuels or oils. Spills would be reported and responded to as quickly as possible.	
		Maintenance of construction machinery will not be allowed on site unless absolutely necessary to help to prevent the accidental leakage of lubricating and hydraulic fluids.	
		Construction contractor to dispose of any construction effluents in a responsible manner.	

CONCERN	SIGNIFICANCE	MITIGATION MEASURE	MONITORING
		<p>Storage of construction materials will be in assigned areas and follow standard best working practices.</p> <p>Disposal of excavated materials will either be off site at an appropriate landfill site or in areas of the site that will not give rise to surface run off during wet periods.</p> <p>Portable toilets will be provided during the construction period with any waste tankered of site and disposed of in an appropriate manner.</p> <p>Water inflows to excavated areas to be minimized by the use of lining materials, good house keeping techniques and by the control of drainage and construction materials in order to prevent the contamination of ground water.</p> <p>Reuse excavated material within the site boundary where practicable which would reduce the volume of excavated material going off site to landfill.</p> <p>No materials will be disposed of in the wadi to the north-west of the site.</p> <p>Segregation of contaminated excavated material (should this be encountered), from non-contaminated excavated material would be made with the contaminated soils removed to an appropriate disposal site.</p>	

CONCERN	SIGNIFICANCE	MITIGATION MEASURE	MONITORING
Noise			
Construction noise	Moderate significance	<p>All construction activities would be carried out in accordance with the recommendations of BS 5228</p> <p>All vehicles and mechanical plant used for construction would be fitted with effective exhaust silencers, and regularly maintained.</p>	Daily auditory inspection/walk round to ensure best practicable means are being employed
		<p>Inherently quiet plant would be used where appropriate</p> <p>All major compressors would be sound-reduced models fitted with properly lined and sealed acoustic covers which would be kept closed whenever the machines are in use, and all ancillary pneumatic percussive tools would be fitted with mufflers or silencers of the type recommended by the manufacturers.</p> <p>All ancillary plant such as generators, compressors and pumps would be positioned so as to cause minimum noise disturbance. If necessary, temporary acoustic barriers or enclosures would be provided.</p>	
Ecology			
Aqueous effluent and runoff	Moderate Significance	Potential aqueous effluent and runoff from site activities will be kept to an absolute minimum so as to ensure that there is no contamination of habitats and ecosystems outside the project boundary.	Visual inspection to ensure that construction impacts do not spread onto other land.

CONCERN	SIGNIFICANCE	MITIGATION MEASURE	MONITORING
Removal of existing natural vegetation	Low Significance	Unnecessary removal of existing natural vegetation will be avoided. Workers will be required not to cut down plants in the surrounding area for fires etc.	
Destruction of bird nests	Low Significance	The destruction of bird nests will be prohibited. Any ground nests found inside the site will be moved in coordination with Ministry of Environment and the Royal Society for Conservation of Nature (RSCN) to an appropriate area.	
Disturbance to wildlife	Low Significance	Construction activity will be kept to a minimum during night-time to decrease disturbance on wildlife in the area.	
Planting of exotic or invasive plants	Low Significance	The planting of exotic or invasive plants for landscaping inside and around the plant will be prohibited	
Hunting or killing of animals	Low Significance	The contractor will not allow workers to hunt or kill animals. Any accidents resulting in the death of wild life will be reported to the Ministry of Environment and RSCN.	Any accidents resulting in the death of wild life will be reported to the Ministry of Environment and RSCN.
Visual impact			
Visual impact of construction	Moderate Significance	Construction equipment such as cranes etc that will be sized so as to serve their intended use without presenting an overly intrusive visual impact.	
		The contractor will be required to provide areas for the disposal of wastes during the construction period so as to prevent these escaping to the surrounding area and becoming unsightly.	Visual inspections will be made to ensure that plant wastes are not escaping to the surrounding environment.

CONCERN	SIGNIFICANCE	MITIGATION MEASURE	MONITORING
		Land not required for permanent use by the power station will be reinstated to original or better condition.	
Traffic and infrastructure			
Construction traffic	Moderate Significance	Car sharing and the use of minibuses and public transport will be encouraged	
		The contractors appointed would be encouraged to provide a minibus service for construction staff	
		Car sharing and the use of minibuses and public transport will be encouraged by all staff	
Vehicle emissions	Moderate Significance	Regular servicing and maintenance of vehicles will be employed to help minimize emissions to air	
Dust and dirt generation	Moderate Significance	Wheel washing may be employed to help prevent mud and earth being carried from the site on to local roads	Visual checks will be made to ensure that dust creation and mud carry are not encountered to any significant degree.
		In dry periods onsite roads may be dampened to reduce the potential for dust creation	
Road Safety		Adequate signage will be put in place as necessary.	The plant operator will check that all signage is in place as necessary.
		Drivers accessing the site will be obliged to comply with all Jordanian road safety laws	Where locals report cases of law breaking by staff with regard to speed limits etc this will be internally investigated as necessary.
Construction traffic management	Moderate Significance	A Traffic Management plan will be prepare to help minimize the impact to the local traffic network.	

CONCERN	SIGNIFICANCE	MITIGATION MEASURE	MONITORING
Archaeology			
Archaeological site finds	Moderate Significance	<p>Construction staff will report any finds that may have cultural or archaeological significance.</p> <p>If any site is found during construction and will be damaged by construction activities, the DOA will be invited to assess the discovered remains and may carry out an emergency salvage excavation salvage excavation which entails that archaeological excavation is conducted during construction phase. The contractor would be obliged to wait for a period of 10 days before commencing construction activities in the vicinity of an archaeological find to allow the DOA to respond to the sites identification.</p>	Construction staff will be requested to report any archaeological finds to an appropriate manager.
		The Contractor shall seek the written approval of the Department of Antiquities before the removal of any chance find building, foundation, structure, fence and other obstruction over 50 years old, any portion of which is in the quarrel.	
Socioeconomics			
Worker rights	NA	Labour law (No.51,2002) will be applied and complied with throughout the duration of the project as necessary.	
On site Health and Safety			
Safety	NA	Equipment, tools and substances will be suitable for their use and selected to minimize dangers to safety or health when used correctly.	

CONCERN	SIGNIFICANCE	MITIGATION MEASURE	MONITORING
		<p>Work places will where possible receive natural light and be supplemented with sufficient artificial illumination, and signage will appropriately mark hazards, exits, materials etc.</p>	
		<p>Ventilation design factors will consider physical activity, substances in use and process related emissions. Temperatures will be maintained at levels appropriate for the purpose of the facility.</p>	
		<p>Fire prevention and protection will be adequate for the dimensions and use of the premises, equipment installed, physical and chemical properties of substances present, and the maximum number of people present. Fire detection and protection systems will be provided throughout the plant and site area. These will include fixed foam protection systems, fire alarms, portable appliances, etc.</p>	
		<p>The plant will also store firewater sufficient to meet the requirements of the Jordan Fire Department and the local fire code requirements.</p>	
		<p>Places of work, traffic routes and passageways shall be kept free from waste and spillage, regularly cleaned, and maintained. First aid facilities will be provided and will be easily accessible throughout the place of work. Welfare facilities will include locker rooms, an adequate number of toilets with washbasins, and a room dedicated for eating. An ample supply of drinking water will be provided at all places of work.</p>	

CONCERN	SIGNIFICANCE	MITIGATION MEASURE	MONITORING
		Buildings and structures will be designed according to local and internationally recognized standards. They will be structurally safe, provide appropriate protection against the climate and have acceptable light and noise conditions.	
		Personal protection equipment will be identified and provided, that will offer adequate protection to the worker, co-workers and occasional visitors without incurring unnecessary inconvenience. The use of PPE will be actively enforced if alternative technologies, work plans or procedures cannot eliminate or sufficiently reduce a hazard or exposure. The employer shall ensure that PPE is cleaned when dirty, properly maintained and replaced when damaged or worn out. Proper use of PPE shall be part of the recurrent training programs for employees.	Daily visual inspection of use of PPE equipment would be made.
		Exposure to vibration from equipment will be controlled through selection of equipment and limitation of time of exposure. The limits for vibration and action values will conform to those provided by the IFC guidelines for OHS.	
		Indoor temperatures will be maintained such that they are reasonable and appropriate for the work at site. Risks of heat related stress will be adequately addressed and feasible control measures implemented for work.	

CONCERN	SIGNIFICANCE	MITIGATION MEASURE	MONITORING
		First aid facility adequately and appropriately stocked	A register of accidents on site would be maintained with prevention training sessions held.
		A health and safety plan would be prepared with the aim of preventing accidents and injuries for both and construction and operation stages of the project.	Review site specific health and safety plan would be made on an appropriately regular basis.
		Sufficient training will be provided to all workers to ensure health and safety in the work place	A training register for Employees would be maintained and kept up to date with evaluation of training sessions made.
Community Health and Safety			
Community Health and Safety	NA	The plant will be located within a security fence ensuring to prevent trespass or accidental entry of the site by local peoples. The plant will also be fitted with security cameras	
		Construction materials will be managed safely with any stockpiles etc placed in areas to prevent any risk to local communities such as the materials becoming airborne through exposure to the wind.	
		Transport during all phases of the project will be managed so as to minimize impact to the local community.	Accidents and incidents involving the public will be documented and reported to management.
		The transport of raw materials and the transport and disposal of waste will be undertaken in an appropriate manner.	

CONCERN	SIGNIFICANCE	MITIGATION MEASURE	MONITORING
		Project vehicles and equipment will be well maintained with project-related traffic will be requested to travel no faster than the speed limit.	
		The contractor will allow for a means of complaints regarding on site activities to be made by members of the local community.	A complaints register will be maintained as necessary.

Construction monitoring programme

MONITORING ISSUE	MONITORING METHOD	MONITORING FREQUENCY
Air Quality		
Dust creation from soil movements, emissions from vehicles etc	Dust monitoring programme will be carried out	Upon receipt of complaint from local peoples/MoE etc
Inspections will include monitoring of exit points	Visual inspections	Daily during construction contract
inspection of bunded areas	Visual inspections	Daily during construction contract
Construction noise	Auditory inspection/walk round to ensure best practicable means are being employed	Daily during construction contract
Aqueous effluent and runoff	Visual inspection to ensure that construction impacts do not spread onto other land.	Daily during construction contract
Hunting or killing of animals	Any accidents resulting in the death of wild life will be reported to the Ministry of Environment and RSCN.	As necessary
Visual impact of construction	Visual inspections will be made to ensure that plant wastes are not escaping to the surrounding environment.	Daily during construction contract
Dust and dirt generation	Visual checks will be made to ensure that dust creation and mud carry are not encountered to any significant degree.	Daily during construction contract

MONITORING ISSUE	MONITORING METHOD	MONITORING FREQUENCY
Road Safety	The plant operator will check that all signage is in place.	As necessary
	Where locals report cases of law breaking by staff with regard to speed limits etc this will be internally investigated.	As necessary
Archaeological site finds	Construction staff will be requested to report any archaeological finds to an appropriate manager.	As necessary
Safety	Visual inspection of use of PPE equipment would be made.	Daily
	A register of accidents on site would be maintained with prevention training sessions held.	As necessary
	Review site specific health and safety plan would be made on an appropriately regular basis.	Annually
	A training register for Employees would be maintained and kept up to date with evaluation of training sessions made.	As necessary
	Accidents and incidents involving the public will be documented and reported to management.	As necessary
	A complaints register will be maintained.	As necessary

Operational impact mitigation, monitoring, and management measures

CONCERN	SIGNIFICANCE	MITIGATION MEASURE	MONITORING
Air Quality			
Emissions to air from burning of natural gas and DFO	High significance	The use of DLN Burners, which ensures NO _x levels to be in accordance with Jordanian and World Bank requirements	Stack emissions will be monitored continuously for NO _x , O ₂ and CO by the proponent. Sampling points and safe access adjacent to the continuous monitoring points will be installed.
		Operation on natural gas as primary fuel	
		Operation on a relatively low sulphur DFO fuel during gas supply interruption	
		A stack of sufficient height and flue gases of sufficient temperature and velocity to ensure good dispersion.	
Fugitive dust emissions	Low significance	General good housekeeping to prevent fugitive dust emissions	
Water Quality and Soils			
Potential leakage of storage tanks	High significance	All oil and chemical storage tanks and areas where drums are stored will be surrounded by an impermeable bund. Single tanks will be within bunds sized to contain 110 per cent of capacity and multiple tanks or drums will be within bunds sized to contain 110 per cent of the capacity of the largest tank. Permanently fixed taps, filler pipes, pumping equipment, vents and sight glasses will also be located within the bunded area.	Daily visual inspection of bunded areas will be made to ensure the effectiveness of these systems. All elements of the treatment systems will be regularly monitored to ensure optimum performance and maintenance.

CONCERN	SIGNIFICANCE	MITIGATION MEASURE	MONITORING
		Taps and valves will be designed to discharge downwards and will be shut and locked in that position. Manually started electrically operated pumps will remove surface water collected within the bund and its composition will be verified prior to disposal (for maintenance of the system)	The inspection of oil interceptors will be undertaken on a regular basis.
		An oily waste water drainage system will drain all areas where oil spillages could occur. The design will incorporate oil interceptors and traps. These will discharge with the other surface water discharge to the storm water discharge system. The discharge from each oil interceptor will contain no visible oil or grease.	
Waste disposal	Low significance	<p>Disposal of the sludge from the evaporation ponds will be undertaken by an appropriate contractor and disposed of off site at an appropriate disposal site.</p> <p>Sludge removed in the oily waste separation pond will be removed by road tanker and disposed of at an appropriate disposal site.</p> <p>Wastewater containing detergent will be discharged to the oily waste separation pond and oil separators prior to discharge to an on site chemical wastewater storage pond.</p> <p>All evaporation ponds will be appropriately bunded to ensure that no water leaches in to the ground.</p>	
Hazardous substances	Moderate significance	Emergency response plans will be developed for the leaking of any hazardous substances stored/used on site.	

CONCERN	SIGNIFICANCE	MITIGATION MEASURE	MONITORING
Flood risk	Low significance	The plant will be designed taking into consideration the danger of flash floods. This may include such measures as construction of a diversion channel or berm surrounding the plant facilities.	
Proper waste water treatment	Moderate significance	All elements of the treatment systems will be regularly monitored to ensure optimum performance and maintenance.	
Waste disposal	Low significance	Designated waste areas will be used to store the minimal amounts of waste (principally office wastes generated by the plant).	
Noise			
Operational noise	Moderate significance	Since tonal or impulsive noises are considered more annoying than continuous noise sources, plant items will be silenced or otherwise controlled through regular maintenance to ensure no such emissions are audible at NSR locations	Provisions to be put in place for the monitoring of noise at sensitive receptors (on and off site) in the event that there is a complaint or reason for concern.
		High performance acoustic enclosures will be considered for all plant items where practicable, not overlooking smaller plant items such as compressors and pumps	Site walkover surveys and occasional noise monitoring at sensitive receptors will be undertaken as deemed appropriate
		Internal surfaces within the turbine hall will be treated to control internal reverberant noise levels. An appropriate treatment would consist of dense mineral wool panel behind perforated sheet steel, or a spray on cellulose fibre treatment	

CONCERN	SIGNIFICANCE	MITIGATION MEASURE	MONITORING
Ecology			
Removal of existing natural vegetation	Low Significance	The proponent will avoid any unnecessary removal of existing natural vegetation.	
Unauthorized/ inappropriate parking	Low Significance	Use of machinery will be restricted to the proposed site as will parking of vehicles.	
Contamination by vehicle maintenance	Moderate Significance	Any maintenance of vehicles or machinery will be performed off site unless strictly necessary.	
Hunting or killing of animals	Low Significance	The proponent will not allow workers to hunt or kill animals.	Any accidents resulting in the death of wild life will be reported to the Ministry of Environment and RSCN.
Destruction of bird nests	Low Significance	The destruction of bird nests will be prohibited.	
During night disturbance of wildlife	Low Significance	Construction activity will be kept to a minimum during night time to decrease disturbance on wildlife in the area.	
Planting of exotic or invasive plants	Low Significance	The planting of exotic or invasive plants for landscaping inside and around the plant will be prohibited with a preference given to the planting of native species where landscaping is deemed necessary	
Disposal of domestic or industrial wastes	Moderate Significance	Disposal of domestic or industrial wastes will be to appropriate disposal sites.	

CONCERN	SIGNIFICANCE	MITIGATION MEASURE	MONITORING
		No materials will be disposed of on site and in the in the surrounding area especially at the near shallow wadies.	
Unauthorized/ inappropriate parking	Low Significance	Parking on areas outside the project area will not be allowed unless strictly necessary.	
Light pollution	Moderate Significance	Directional lighting and buffer planting to screen the plant.	
Visual impact			
Visual impact of power station	Moderate Significance	The architectural design of the buildings will be carefully considered to provide a high standard of visual amenity, given practical and economic constraints.	Visual inspection will be made to check for any degradation of the power stations appearance.
		The development generally will be in materials to match nearby buildings and particularly at upper levels colours will be neutral and subdued to provide the least visual intrusion and to minimize contrasts with the existing environment.	Visual inspections will be made to ensure that plant wastes are not escaping to the surrounding environment.
		The external structures of the buildings will be designed such that there will be no deterioration in the power station's appearance over the 30 years lifetime of the plant with steel structures of the plant painted with surface protected suitable for local conditions in accordance with the standards and practices of the Steel Structures Painting Council.	
Light pollution	Moderate Significance	Directional lighting will be employed to minimize light pollution.	

CONCERN	SIGNIFICANCE	MITIGATION MEASURE	MONITORING
		Light will be switch off lights when not required for safety, security.	
Screening	NA	Trees and bushes may be planted to provide screening for local receptors.	
Traffic and Infrastructure			
Vehicle emissions	Moderate Significance	Regular servicing and maintenance of vehicles will be undertaken to minimize emissions to air, noise, leaks etc.	
Safety	Moderate Significance	Safety training may be provided to vehicle drivers if considered necessary	
Traffic management	Moderate Significance	Transport of DFO to the site would endeavour to avoid the peak traffic congestion rush hours at 6:30 am and 4.30 pm to minimize the impact to the local traffic network.	
		Drivers will be instructed to obey all relevant speed limits and other relevant laws.	
Socioeconomics			
Worker rights	NA	Labour law (No 51,2002) will be applied and complied with throughout the duration of the project as necessary.	

CONCERN	SIGNIFICANCE	MITIGATION MEASURE	MONITORING
Safety			
Safety	NA	<p>Equipment, tools and substances will be suitable for their use and selected to minimize dangers to safety or health when used correctly.</p> <p>Work places will where possible receive natural light and be supplemented with sufficient artificial illumination, and signage will appropriately mark hazards, exits, materials etc.</p> <p>Ventilation design factors will consider physical activity, substances in use and process related emissions. Temperatures will be maintained at levels appropriate for the purpose of the facility.</p> <p>Fire prevention and protection will be adequate for the dimensions and use of the premises, equipment installed, physical and chemical properties of substances present, and the maximum number of people present. Fire detection and protection systems will be provided throughout the plant and site area.</p> <p>These will include fixed foam protection systems, fire alarms, portable appliances, etc. The plant will also store firewater sufficient to meet the requirements of the Jordan Fire Department and the local fire code requirements.</p>	

CONCERN	SIGNIFICANCE	MITIGATION MEASURE	MONITORING
		<p>Places of work, traffic routes and passageways shall be kept free from waste and spillage, regularly cleaned, and maintained. First aid facilities will be provided and will be easily accessible throughout the place of work. Welfare facilities will include locker rooms, an adequate number of toilets with washbasins, and a room dedicated for eating. An ample supply of drinking water will be provided at all places of work.</p> <p>Buildings and structures will be designed according to local and internationally recognized standards. They will be structurally safe, provide appropriate protection against the climate and have acceptable light and noise conditions.</p> <p>Personal protection equipment will be identified and provided, that will offer adequate protection to the worker, co-workers and occasional visitors without incurring unnecessary inconvenience. The use of PPE will be actively enforced if alternative technologies, work plans or procedures cannot eliminate or sufficiently reduce a hazard or exposure. The employer shall ensure that PPE is cleaned when dirty, properly maintained and replaced when damaged or worn out. Proper use of PPE shall be part of the recurrent training programs for employees.</p> <p>Exposure to vibration from equipment will be controlled through selection of equipment and limitation of time of exposure. The limits for vibration and action values will conform to those provided by the IFC guidelines for OHS.</p>	

CONCERN	SIGNIFICANCE	MITIGATION MEASURE	MONITORING
		<p>Indoor temperatures will be maintained such that they are reasonable and appropriate for the work at site. Risks of heat related stress will be adequately addressed and feasible control measures implemented for work.</p> <p>First aid facility adequately and appropriately stocked</p> <p>A health and safety plan would be prepared with the aim of preventing accidents and injuries for both and construction and operation stages of the project.</p>	
Safety			
Community Health and Safety	NA	The plant will be located within a security fence ensuring to prevent trespass or accidental entry of the site by local peoples. The plant will also be fitted with security cameras	
		Construction materials will be managed safely with any stockpiles etc placed in areas to prevent any risk to local communities such as the materials becoming airborne through exposure to the wind.	
		Transport during all phases of the project will be managed so as to minimize impact to the local community.	Accidents and incidents involving the public will be documented and reported to management.
		The transport of raw materials and the transport and disposal of waste will be undertaken in an appropriate manner.	A complaints register will be maintained as necessary.

CONCERN	SIGNIFICANCE	MITIGATION MEASURE	MONITORING
		Project vehicles and equipment will be well maintained with project-related traffic will be requested to travel no faster than the speed limit.	

Operational monitoring programme

MONITORING ISSUE	MONITORING METHOD	MONITORING FREQUENCY
Air Quality		
Emissions to air from burning of natural gas and DFO	Stack emissions will be monitored for NO _x , O ₂ and CO	Continuous
Water Quality		
Potential leakage of storage tanks	Visual inspection of bunded areas will be made to ensure the effectiveness of these systems.	Daily
Poor performance of the water treatment system	All elements of the treatment systems will be regularly monitored to ensure optimum performance and maintenance.	Weekly
Effectiveness of the oil interceptors	The inspection of oil interceptors will be undertaken on a regular basis.	Weekly
Noise		
Operational noise	Provisions to be put in place for the monitoring of noise at sensitive receptors (on and off site) in the event that there is a complaint or reason for concern.	As necessary
	Site walkover surveys and occasional noise monitoring at sensitive receptors will be undertaken as deemed appropriate	Weekly/As necessary
Ecology		
Hunting or killing of animals	Any accidents resulting in the death of wild life will be reported to the Ministry of Environment and RSCN.	As necessary

MONITORING ISSUE	MONITORING METHOD	MONITORING FREQUENCY
Visual Impact		
Visual impact of power station	Visual inspection will be made to check for any degradation of the power stations appearance.	Monthly
	Visual inspections will be made to ensure that plant wastes are not escaping to the surrounding environment.	Weekly
Community Health and Safety		
Community Health and Safety	Accidents and incidents involving the public will be documented and reported to management.	As necessary
	A complaints register will be maintained.	As necessary

Construction implementation schedule and cost estimates

CONCERN	MITIGATION/ MONITORING MEASURE	IMPLEMENTATION PROCEDURES	RESPONSIBILITY	CAPITAL COST	RECURRENT COSTS/YEAR
Air Quality					
Dust creation from soil movements, emissions from vehicles etc	Water Bowser	Following tests to determine the moisture content of material	Contractor	\$4,500 (period of contract)	N/A
	Materials deposited on stockpiles on site will be closely monitored for any possible emission of dust and if required they will be damped down, covered or treated with a dust suppressant.	If identified as an issue	Contractor	\$3,000 (period of contract)	N/A
	All operatives working in areas of potential dust emission will be provided with paper facemasks.	Automatically applied for on site staff as appropriate	Contractor	\$3,000 (period of contract)	N/A
	All stockpiles will be located away from sensitive receptors wherever possible.	Environmental manager will ensure that staff are aware of the requirement as necessary and that the procedure is properly implemented.	Contractor	\$500 (period of contract)	N/A
	All vehicles carrying bulk materials into and out of the site will be sheeted so as to contain any material that may be dispersed during transit. Minimum drop heights will be used during material transfer	Automatically applied to all applicable vehicles, Environmental manager will ensure that staff are aware of the requirement as necessary and that the procedure is properly implemented.	Contractor	\$500 (period of contract)	N/A

CONCERN	MITIGATION/ MONITORING MEASURE	IMPLEMENTATION PROCEDURES	RESPONSIBILITY	CAPITAL COST	RECURRENT COSTS/YEAR
	If finely ground materials are delivered, these will be in bag form or stockpiled in specified locations where the material can be suitably covered.	Environmental manager will ensure that staff are aware of the requirement as necessary and that the procedure is properly implemented.	Contractor	\$1,000 (period of contract)	N/A
	Engines will be switched off when not in use.	Environmental manager will ensure that staff are aware of the requirement as necessary and that the procedure is properly implemented.	Contractor	Part of best working practice Minimal cost	N/A
	All vehicles will be properly maintained to reduce air emissions	As necessary	Contractor	\$15,000 (period of contract)	N/A
	To ensure that atmospheric dust, contaminants or dust deposits generated by the construction do not exceed levels which could constitute a health hazard or nuisance to those persons working on the site or living nearby a dust monitoring programme will be carried out throughout the construction period.	Daily visual inspections with implementation of dust suppression measures as necessary.	Contractor	\$500 (period of contract)	N/A
	Daily visual inspections will be made to ensure that good practice is employed at all times. Inspections will include monitoring of exit points and the immediate area outside the site entrance.	Daily visual inspections with implementation of wheel washing/dust suppression measures as necessary.	Contractor	Minimal cost (part of Environmental managers remit).	N/A

CONCERN	MITIGATION/ MONITORING MEASURE	IMPLEMENTATION PROCEDURES	RESPONSIBILITY	CAPITAL COST	RECURRENT COSTS/YEAR
The inspections will be made against the EPC contractors CEMP.					
Water Quality					
Water Quality	DFO storage tanks to be located on an impervious base provided with bund walls to give a containment capacity of at least 110 per cent of the tank volume. All valves and couplings to be contained within the bunded area.	Automatically applied as part of plant design	Contractor	\$70,000 (single payment)	N/A
	Portable toilets will be provided during the construction period with any waste tankered of site and disposed of in an appropriate manner.	Sufficient toilets will be provided based on the number of staff with regular tankering of waste.	Contractor	\$10,000 (period of contract)	N/A
	Any surface water contaminated by hydrocarbons, which are used during the construction phase, to be passed through oil/grit interceptor(s) prior to collection and removal off site to an appropriate disposal site.	Automatically applied as part of plant design	Contractor	\$1,000 (period of contract)	N/A

CONCERN	MITIGATION/ MONITORING MEASURE	IMPLEMENTATION PROCEDURES	RESPONSIBILITY	CAPITAL COST	RECURRENT COSTS/YEAR
	Measures to be taken to ensure that no leachate or any surface water that has the potential to be contaminated to be allowed to enter directly or indirectly any water course, underground strata or adjoining land.	Automatically applied as part of plant design	Contractor	\$2,000 (period of contract)	N/A
	Provisions to be made so that any existing drainage systems continue to operate.	As necessary, where these are encountered this will be addressed.	Contractor	\$10,000 (period of contract)	N/A
	Water inflows to excavated areas to be minimized by the use of lining materials, good house keeping techniques and by the control of drainage and construction materials in order to prevent the contamination of ground water. Site personnel to be made aware of the potential impact on ground and surface water associated with certain aspects of the construction works to further reduce the incidence of accidental impacts.	Environmental manager will ensure that staff are aware of the requirement as necessary and that the procedure is properly implemented.	Contractor	\$7,500 (period of contract)	N/A
	Refuelling of construction vehicles and equipment to be restricted to a designated area with properly designed fuel tanks and bunds and proper operating procedures.	Environmental manager will ensure that staff are aware of the requirement as necessary and that the procedure is properly implemented.	Contractor	\$500 (period of contract)	N/A
	No materials will be disposed of in the wadi to the north-west of the site.	Environmental manager will ensure that staff are aware of the	Contractor	Part of best working practice Minimal cost	N/A

CONCERN	MITIGATION/ MONITORING MEASURE	IMPLEMENTATION PROCEDURES	RESPONSIBILITY	CAPITAL COST	RECURRENT COSTS/YEAR
		requirement as necessary and that the procedure is properly implemented.			
	Spill kits will be kept on site to clean up any spills of fuels or oils. Spills would be reported and responded to as quickly as possible.	Staff will be required to report this as and when it occurs	Contractor	\$5,000 (period of contract)	N/A
	Maintenance of construction machinery will not be allowed on site unless absolutely necessary to help to prevent the accidental leakage of lubricating and hydraulic fluids.	Environmental manager will ensure that staff are aware of the requirement as necessary and that the procedure is properly implemented.	Contractor	\$10,000 (period of contract)	N/A
	Construction contractor to dispose of any construction effluents in a responsible manner.	Environmental manager will ensure that staff are aware of the requirement as necessary and that the procedure is properly implemented.	Contractor	\$5,000 (period of contract)	N/A
	Storage of construction materials will be in assigned areas and follow standard best working practices.	Environmental manager will ensure that staff are aware of the requirement as necessary and that the procedure is properly implemented.	Contractor	\$500 (period of contract)	N/A
	Disposal of excavated materials will either be off site at an appropriate landfill site or in areas of the site that will not give rise to surface run off during wet periods.	As necessary	Contractor	\$2,000 (period of contract)	N/A

CONCERN	MITIGATION/ MONITORING MEASURE	IMPLEMENTATION PROCEDURES	RESPONSIBILITY	CAPITAL COST	RECURRENT COSTS/YEAR
	Water inflows to excavated areas to be minimized by the use of lining materials, good house keeping techniques and by the control of drainage and construction materials in order to prevent the contamination of ground water.	Automatically applied as part of plant design	Contractor	\$1,000 (period of contract)	N/A
	Reuse excavated material within the site boundary where practicable which would reduce the volume of excavated material going off site to landfill.	Part of best working practice	Contractor	Minimal cost	N/A
	No materials will be disposed of in the wadi to the north-west of the site.	Environmental manager will ensure that staff are aware of the requirement as necessary and that the procedure is properly implemented.	Contractor	Part of best working practice Minimal cost	N/A
	Segregation of contaminated excavated material (should this be encountered), from non-contaminated excavated material would be made with the contaminated soils removed to an appropriate disposal site.	Environmental manager will ensure that staff are aware of the requirement as necessary and that the procedure is properly implemented.	Contractor	\$500 (period of contract)	N/A
	Daily visual inspection of bunded areas will be made to ensure the effectiveness of these systems.	Daily visual inspection of bunded areas will be made and effectiveness noted.	Contractor	Part of best working practice Minimal cost	N/A

CONCERN	MITIGATION/ MONITORING MEASURE	IMPLEMENTATION PROCEDURES	RESPONSIBILITY	CAPITAL COST	RECURRENT COSTS/YEAR
Noise					
	All construction activities would be carried out in accordance with the recommendations of BS 5228	Part of EPC contract requirements, any complaints would be investigated.	Contractor	\$500 (period of contract)	N/A
	All vehicles and mechanical plant used for construction would be fitted with effective exhaust silencers, and regularly maintained.	Automatically applied as best working practice.	Contractor	Part of best working practice Minimal cost	N/A
	Inherently quiet plant would be used where appropriate	Automatically applied as best working practice.	Contractor	Inherent in design	N/A
	All major compressors would be sound-reduced models fitted with properly lined and sealed acoustic covers which would be kept closed whenever the machines are in use, and all ancillary pneumatic percussive tools would be fitted with mufflers or silencers of the type recommended by the manufacturers.	Automatically applied as part of plant design	Contractor	\$3,000 (one off payment)	N/A
	All ancillary plant such as generators, compressors and pumps would be positioned so as to cause minimum noise disturbance. If necessary, temporary acoustic barriers or enclosures would be provided.	Automatically applied as part of plant design	Contractor	\$5,000 (period of contract)	N/A
	Daily auditory inspection/walk round to ensure best practicable means are	Daily auditory inspection/walk round. Complaints would be	Contractor	Part of best working practice Minimal cost	N/A

CONCERN	MITIGATION/ MONITORING MEASURE	IMPLEMENTATION PROCEDURES	RESPONSIBILITY	CAPITAL COST	RECURRENT COSTS/YEAR
	being employed	investigated.			
Ecology					
	Potential aqueous effluent and runoff from site activities will be kept to an absolute minimum so as to ensure that there is no contamination of habitats and ecosystems outside the project boundary.	Environmental manager will ensure that staff are aware of the requirement as necessary.	Contractor	\$800 (period of contract)	N/A
	Unnecessary removal of existing natural vegetation will be avoided.	Environmental manager will ensure that staff are aware of the requirement as necessary.	Contractor	Part of best working practice Minimal cost	N/A
	Workers will be required not to cut down plants in the surrounding area for fires etc.	Environmental manager will ensure that staff are aware of the requirement as necessary.	Contractor	Part of best working practice Minimal cost	N/A
	The destruction of bird nests will be prohibited. Any ground nests found inside the site will be moved in coordination with Ministry of Environment and the Royal Society for Conservation of Nature (RSCN) to an appropriate area.	Environmental manager will ensure that staff are aware of the requirement as necessary and that the procedure is properly implemented.	Contractor	Part of best working practice Minimal cost	N/A
	Construction activity will be kept to a minimum during night-time to decrease disturbance on wildlife in the area.	Part of project implementation plan	Contractor	Part of best working practice	N/A
	The planting of exotic or invasive plants for landscaping inside and	Part of plant design.	Contractor	Part of best working	N/A

CONCERN	MITIGATION/ MONITORING MEASURE	IMPLEMENTATION PROCEDURES	RESPONSIBILITY	CAPITAL COST	RECURRENT COSTS/YEAR
	around the plant will be prohibited			practice	
	The contractor will not allow workers to hunt or kill animals. Any accidents resulting in the death of wild life will be reported to the Ministry of Environment and RSCN.	Environmental manager will ensure that staff are aware of the requirement.	Contractor	Part of best working practice	N/A
	Visual inspection to ensure that construction impacts do not spread onto other land.	Visual inspection	Contractor	Part of best working practice Minimal cost	N/A
Visual impact					
	The contractor will be required to provide areas for the disposal of wastes during the construction period so as to prevent these escaping to the surrounding area and becoming unsightly.	Part of EPC Contract	Contractor	Part of best working practice	N/A
	Land not required for permanent use by the power station will be reinstated to original or better condition.	Part of EPC Contract, will be checked before handover of the plant	Contractor	\$1,000 (period of contract)	N/A
	Visual inspections will be made to ensure that plant wastes are not escaping to the surrounding environment.	Visual inspections	Contractor	ca~ \$100,000 part of EPC contract (period of contract)	N/A
Transport and infrastructure					
	Car sharing and the use of minibuses	The EPC Contractor will encourage	Contractor	Part of best working	N/A

CONCERN	MITIGATION/ MONITORING MEASURE	IMPLEMENTATION PROCEDURES	RESPONSIBILITY	CAPITAL COST	RECURRENT COSTS/YEAR
	and public transport will be encouraged	staff to do so		practice	
	The contractors appointed would be encouraged to provide a minibus service for construction staff	As necessary	Contractor	\$30,000 (period of contract)	N/A
	Car sharing and the use of minibuses and public transport will be encouraged by all staff	The EPC Contractor will encourage staff to do so	Contractor	Part of best working practice	N/A
	Regular servicing and maintenance of vehicles will be employed to help minimize emissions to air	As necessary	Contractor	\$15,000 (period of contract)	N/A
	Wheel washing may be employed to help prevent mud and earth being carried from the site on to local roads	Visual inspections will be used to confirm or otherwise the need for this.	Contractor	\$500 (period of contract)	N/A
	In dry periods onsite roads may be dampened to reduce the potential for dust creation	Visual inspections will be used to confirm or otherwise the need for this.	Contractor	\$1000 (period of contract)	N/A
	A Traffic Management plan will be prepare to help minimize the impact to the local traffic network.	Part of EPC Contract	Contractor	\$10,000 (one off payment)	N/A
	Visual checks will be made to ensure that dust creation and mud carry are not encountered to any significant degree.	Visual checks	Contractor	Part of best working practice Minimal cost	N/A
	The plant operator will check that all signage is in place as necessary.	Visual checks	Contractor	Part of best working practice Minimal cost	N/A

CONCERN	MITIGATION/ MONITORING MEASURE	IMPLEMENTATION PROCEDURES	RESPONSIBILITY	CAPITAL COST	RECURRENT COSTS/YEAR
	Where locals report cases of law breaking by staff with regard to speed limits etc this will be internally investigated as necessary.	As necessary	Contractor	Part of best working practice Minimal cost	N/A
	Visual checks will be made to ensure that, emissions and dust creation and mud carry are not encountered to any significant degree.	Visual checks	Contractor	Part of best working practice Minimal cost	N/A
Archaeology					
	If any site is found during construction and will be damaged by construction activities, the DOA will be invited to assess the discovered remains and may carry out an emergency salvage excavation salvage excavation which entails that archaeological excavation is conducted during construction phase. The contractor would be obliged to wait for a period of 10 days before commencing construction activities in the vicinity of an archaeological find to allow the DOA to respond to the sites identification.	Environmental manager will ensure that staff are aware of the requirement as necessary and that the procedure is properly implemented.	Contractor	\$1,500 (period of contract)	N/A

CONCERN	MITIGATION/ MONITORING MEASURE	IMPLEMENTATION PROCEDURES	RESPONSIBILITY	CAPITAL COST	RECURRENT COSTS/YEAR
	The Contractor shall seek the written approval of the Department of Antiquities before the removal of any chance find building, foundation, structure, fence and other obstruction over 50 years old, any portion of which is in the quarrel.	As necessary	Contractor	Part of best working practice	N/A
	Construction staff will be requested to report any archaeological finds to an appropriate manager.	Environmental manager will ensure that staff are aware of the requirement as necessary and that the procedure is properly implemented.	Contractor	Part of best working practice Minimal cost	N/A
Socioeconomics					
	Labour law (No.51,2002) will be applied and complied with throughout the duration of the project as necessary.	Managers will be made aware of the requirements of the law	Contractor/proponent	Part of best working practice Minimal cost	N/A
On-site health and safety					
	Equipment, tools and substances will be suitable for their use and selected to minimize dangers to safety or health when used correctly.	Part of EPC Contract. Guidance and training will be provided on equipment use etc as necessary.	Contractor	\$40,000 (one off payment)	N/A

CONCERN	MITIGATION/ MONITORING MEASURE	IMPLEMENTATION PROCEDURES	RESPONSIBILITY	CAPITAL COST	RECURRENT COSTS/YEAR
	Work places will where possible receive natural light and be supplemented with sufficient artificial illumination, and signage will appropriately mark hazards, exits, materials etc.	Part of plant design and best working practice	Contractor	\$10,000 (one off payment)	N/A
	Ventilation design factors will consider physical activity, substances in use and process related emissions. Temperatures will be maintained at levels appropriate for the purpose of the facility.	Part of plant design and best working practice, will be automatically applied	Contractor	Inherent in design	N/A
	Fire prevention and protection will be adequate for the dimensions and use of the premises, equipment installed, physical and chemical properties of substances present, and the maximum number of people present. Fire detection and protection systems will be provided throughout the plant and site area. These will include fixed foam protection systems, fire alarms, portable appliances, etc. The plant will also store firewater sufficient to meet the requirements of the Jordan Fire Department and the local fire code requirements.	Part of plant design and best working practice, will be automatically applied	Contractor/ proponent	\$300,000 (one off payment)	N/A

CONCERN	MITIGATION/ MONITORING MEASURE	IMPLEMENTATION PROCEDURES	RESPONSIBILITY	CAPITAL COST	RECURRENT COSTS/YEAR
	Places of work, traffic routes and passageways shall be kept free from waste and spillage, regularly cleaned, and maintained. First aid facilities will be provided and will be easily accessible throughout the place of work. Welfare facilities will include locker rooms, an adequate number of toilets with washbasins, and a room dedicated for eating. An ample supply of drinking water will be provided at all places of work.	Visual inspections will be made as necessary to ensure that facilities remain adequate	Contractor/propone nt	\$10,000 (one off payment then part of best working practice)	N/A
	Buildings and structures will be designed according to local and internationally recognized standards. They will be structurally safe, provide appropriate protection against the climate and have acceptable light and noise conditions.	Part of plant design and requirement of EPC Contract.	Contractor	Inherent in design	N/A
	Personal protection equipment will be identified and provided, that will offer adequate protection to the worker, co-workers and occasional visitors without incurring unnecessary inconvenience. The use of PPE will be actively enforced if alternative technologies, work plans or procedures cannot eliminate or sufficiently reduce a hazard or	Personal protection equipment will be identified and provided. The use of PPE will be actively enforced by site managers/foremen etc.	Contractor	\$15,000 (initially then replaced as necessary)	\$1000

CONCERN	MITIGATION/ MONITORING MEASURE	IMPLEMENTATION PROCEDURES	RESPONSIBILITY	CAPITAL COST	RECURRENT COSTS/YEAR
	<p>exposure. The employer shall ensure that PPE is cleaned when dirty, properly maintained and replaced when damaged or worn out. Proper use of PPE shall be part of the recurrent training programs for employees.</p>				
	<p>Exposure to vibration from equipment will be controlled through selection of equipment and limitation of time of exposure. The limits for vibration and action values will conform to those provided by the IFC guidelines for OHS.</p>	<p>Exposure to vibration from equipment will be controlled through selection of equipment and limitation</p>	<p>Contractor</p>	<p>\$50,000 (one off payment)</p>	<p>\$1000</p>
	<p>Indoor temperatures will be maintained such that they are reasonable and appropriate for the work at site. Risks of heat related stress will be adequately addressed and feasible control measures implemented for work.</p>	<p>Part of plant design.</p>	<p>Contractor</p>	<p>\$150,000 (one off payment then minimal additional costs)</p>	<p>\$1000</p>
	<p>First aid facility adequately and appropriately stocked</p>	<p>Visual inspections and reordering of supplies as necessary</p>	<p>Contractor</p>	<p>\$15,000 (one off payment then minimal additional operational costs)</p>	<p>\$500</p>

CONCERN	MITIGATION/ MONITORING MEASURE	IMPLEMENTATION PROCEDURES	RESPONSIBILITY	CAPITAL COST	RECURRENT COSTS/YEAR
	A health and safety plan would be prepared with the aim of preventing accidents and injuries for both and construction and operation stages of the project.	A health and safety plan would be prepared	Contractor	\$20,000 (one off payment)	N/A
	A training register for Employees would be maintained and kept up to date with evaluation of training sessions made.	A training register for Employees will be maintained	Contractor	Responsibility of Project Manager/ plant manager Zero cost	N/A
	Daily visual inspection of use of PPE equipment would be made.	Daily visual inspection by site managers/foremen etc	Contractor	Responsibility of safety Manager Zero cost	N/A
	A register of accidents on site would be maintained with prevention training sessions held.	As necessary accidents will be registered.	Contractor	Responsibility of safety Manager (Zero cost)	N/A
	Review site specific health and safety plan would be made on an appropriately regular basis.	Annual review by safety manager/officer	Contractor	\$2000	\$2000
Off-site health and safety					
	The plant will be located within a security fence ensuring to prevent trespass or accidental entry of the site by local peoples. The plant will also be fitted with security cameras	Part of EPC contract/plat design	Contractor	\$120,000 (one off payment then minimal additional operational costs)	\$500

CONCERN	MITIGATION/ MONITORING MEASURE	IMPLEMENTATION PROCEDURES	RESPONSIBILITY	CAPITAL COST	RECURRENT COSTS/YEAR
	Construction materials will be managed safely with any stockpiles etc placed in areas to prevent any risk to local communities such as the materials becoming airborne through exposure to the wind.	Environmental manager will ensure that staff are aware of the requirement as necessary and that the procedure is properly implemented.	Contractor	\$2,000 (period of contract)	N/A
	Transport during all phases of the project will be managed so as to minimize impact to the local community.	Preparation of traffic management plan and consideration of any complaints as necessary	Contractor	Part of best working practice Minimal cost	N/A
	The transport of raw materials and the transport and disposal of waste will be undertaken in an appropriate manner.	Best working practices will be applied and any complaints investigated.	Contractor	\$7,000 (period of contract)	N/A
	Project vehicles and equipment will be well maintained with project-related traffic will be requested to travel no faster than the speed limit.	Staff will be made aware of the requirement. Preparation of traffic management plan will be made and consideration of any complaints as necessary	Contractor	Part of best working practice Minimal cost	N/A
	Accidents and incidents involving the public will be documented and reported to management.	As necessary	Contractor	Responsibility of Project Manager/ plant manager Zero cost	N/A
	A complaints register will be maintained as necessary.	As necessary	Contractor	Responsibility of Project Manager/ plant manager Zero cost	N/A

Operational implementation schedule and cost estimates

CONCERN	MITIGATION/ MONITORING MEASURE	IMPLEMENTATION PROCEDURES	RESPONSIBILITY	CAPITAL COST	RECURRENT COSTS/YEAR
Air Quality					
Emissions to air from burning of natural gas and DFO	The use of DLN Burners, which ensures NO _x levels to be in accordance with Jordanian and World Bank requirements	Part of plant design and requirement of EPC Contract	Contractor	\$160,000	N/A
	Operation on natural gas as primary fuel	Part of plant design and requirement of EPC Contract	Proponent	Inherent in design	N/A
	Operation on a relatively low sulphur DFO fuel during gas supply interruption	Sourcing of appropriate fuel	Proponent	Inherent in design	N/A
	A stack of sufficient height and flue gases of sufficient temperature and velocity to ensure good dispersion.	Part of plant design and requirement of EPC Contract	Contractor	Inherent in design	N/A
	Stack emissions will be monitored for NO _x , O ₂ and CO	Part of plant design and requirement of EPC Contract. The proponent will ensure that the monitor is properly calibrated on an annual basis.	Proponent	\$5000	\$5000
Fugitive dust emissions	General good housekeeping to prevent fugitive dust emissions	The environmental manager will make staff aware of the requirement.	Proponent	\$3,000	\$3,000

CONCERN	MITIGATION/ MONITORING MEASURE	IMPLEMENTATION PROCEDURES	RESPONSIBILITY	CAPITAL COST	RECURRENT COSTS/YEAR
Water Quality					
	<p>All oil and chemical storage tanks and areas where drums are stored will be surrounded by an impermeable bund. Single tanks will be within bunds sized to contain 110 per cent of capacity and multiple tanks or drums will be within bunds sized to contain 110 per cent of the capacity of the largest tank. Permanently fixed taps, filler pipes, pumping equipment, vents and sight glasses will also be located within the bunded area. Taps and valves will be designed to discharge downwards and will be shut and locked in that position. Manually started electrically operated pumps will remove surface water collected within the bund and its composition will be verified prior to disposal. (for maintenance of the system)</p>	<p>Part of plant design and requirement of EPC Contract</p>	<p>Contractor/ proponent</p>	<p>\$500 (one off payment)</p>	<p>N/A</p>
	<p>An oily waste water drainage system will drain all areas where oil spillages could occur. The design will incorporate oil interceptors and traps. These will discharge with the other surface water discharge to the</p>	<p>Part of plant design and requirement of EPC Contract</p>	<p>Contractor/ proponent</p>	<p>Inherent in design no additional cost</p>	<p>N/A</p>

CONCERN	MITIGATION/ MONITORING MEASURE	IMPLEMENTATION PROCEDURES	RESPONSIBILITY	CAPITAL COST	RECURRENT COSTS/YEAR
	storm water discharge system. The discharge from each oil interceptor will contain no visible oil or grease.				
	Disposal of the sludge from the evaporation ponds will be undertaken by an appropriate contractor and disposed of off site at an appropriate disposal site.	Disposal to appropriate disposal site as necessary.	Proponent	\$2,000	\$2,000
	Sludge removed in the oily waste separation pond will be removed by road tanker and disposed of at an appropriate disposal site.	Disposal to appropriate disposal site as necessary.	Proponent	\$500	\$500
	Waste water containing detergent will be discharged to the oily waste separation pond and oil separators prior to discharge to an on site chemical waste water storage pond.	Part of plant design and requirement of EPC Contract	Proponent	\$1,000	\$1,000
	All evaporation ponds will be appropriately banded to ensure that no water leaches in to the ground.	Part of plant design and requirement of EPC Contract	Contractor	Inherent in design	N/A
	Emergency response plans will be developed for the leaking of any hazardous substances stored/used on site.	Emergency response plans will be developed	Proponent	\$10,000	N/A
	The plant will be designed taking into consideration the danger of flash floods. This may include such	Part of plant design and requirement of EPC Contract	Contractor	\$70,000	N/A

CONCERN	MITIGATION/ MONITORING MEASURE	IMPLEMENTATION PROCEDURES	RESPONSIBILITY	CAPITAL COST	RECURRENT COSTS/YEAR
	measures as construction of a diversion channel or berm surrounding the plant facilities.				
	All elements of the treatment systems will be regularly monitored to ensure optimum performance and maintenance.	All elements of the treatment systems will be regularly monitored by the plant staff as necessary	Proponent	Part of best working practice	N/A
	Designated waste areas will be used to store the minimal amounts of waste (principally office wastes generated by the plant).	Part of plant design and requirement of EPC Contract	Proponent	\$400	N/A
	Visual inspection of bunded areas will be made to ensure the effectiveness of these systems.	Visual inspection of bunded areas will be made.	Proponent	Part of best working practice	N/A
	The inspection of oil interceptors will be undertaken on a regular basis.	Inspection of oil interceptors will be undertaken	Proponent	Part of best working practice	N/A
Noise					
	Since tonal or impulsive noises are considered more annoying than continuous noise sources, plant items will be silenced or otherwise controlled through regular maintenance to ensure no such emissions are audible at NSR locations	Part of plant design and requirement of EPC Contract	Contractor	\$2,000	\$2,000

CONCERN	MITIGATION/ MONITORING MEASURE	IMPLEMENTATION PROCEDURES	RESPONSIBILITY	CAPITAL COST	RECURRENT COSTS/YEAR
	High performance acoustic enclosures will be considered for all plant items where practicable, not overlooking smaller plant items such as compressors and pumps	Part of plant design and requirement of EPC Contract if required	Contractor	\$2,000,000	N/A
	Internal surfaces within the turbine hall will be treated to control internal reverberant noise levels. An appropriate treatment would consist of dense mineral wool panel behind perforated sheet steel, or a spray on cellulose fibre treatment	Part of plant design and requirement of EPC Contract	Contractor	\$30,000	N/A
	Provisions to be put in place for the monitoring of noise at sensitive receptors (on and off site) in the event that there is a complaint or reason for concern.	Monitoring in the event of complaint as necessary	Proponent	\$500 (equipment purchase)	minimal
	Site walkover surveys and occasional noise monitoring at sensitive receptors will be undertaken as deemed appropriate	Site walkover surveys and occasional noise monitoring.	Proponent	(equipment purchase above)	minimal
Ecology					
	The proponent will avoid any unnecessary removal of existing natural vegetation.	Environmental manager will ensure that staff are aware of the requirement as necessary.	Proponent	Part of best working practice	N/A

CONCERN	MITIGATION/ MONITORING MEASURE	IMPLEMENTATION PROCEDURES	RESPONSIBILITY	CAPITAL COST	RECURRENT COSTS/YEAR
	Use of machinery will be restricted to the proposed site as will parking of vehicles.	Managers will ensure that staff are aware of the requirement as necessary.	Proponent	Part of best working practice	N/A
	Any maintenance of vehicles or machinery will be performed off site unless strictly necessary.	Environmental manager will ensure that staff are aware of the requirement as necessary.	Proponent	\$2,000	\$2,000
	The proponent will not allow workers to hunt or kill animals.	Environmental manager will ensure that staff are aware of the requirement as necessary.	Proponent	Part of best working practice	N/A
	The destruction of bird nests will be prohibited.	Environmental manager will ensure that staff are aware of the requirement as necessary.	Proponent	Part of best working practice	N/A
	The planting of exotic or invasive plants for landscaping inside and around the plant will be prohibited with a preference given to the planting of native species where landscaping is deemed necessary	Environmental manager will ensure that staff are aware of the requirement as necessary.	Proponent	Part of best working practice	N/A
	Disposal of domestic or industrial wastes will be to appropriate disposal sites.	Disposal of domestic or industrial wastes to appropriate disposal sites as necessary	Proponent	\$2,000	\$2,000
	No materials will be disposed of on site and in the in the surrounding area especially at the near shallow wadies.	Environmental manager will ensure that staff are aware of the requirement. Any materials found will be removed	Proponent	\$500	\$500

CONCERN	MITIGATION/ MONITORING MEASURE	IMPLEMENTATION PROCEDURES	RESPONSIBILITY	CAPITAL COST	RECURRENT COSTS/YEAR
	Parking on areas outside the project area will not be allowed unless strictly necessary.	Managers will ensure that staff are aware of the requirement as necessary.	Proponent	Part of best working practice	N/A
	Directional lighting and buffer planting to screen the plant.	Part of plant design and requirement of EPC Contract	Proponent	\$40,000	N/A
	Any accidents resulting in the death of wild life will be reported to the Ministry of Environment and RSCN.	Environmental manager will ensure that staff are aware of the requirement.	Proponent	Part of best working practice	N/A
Visual Impact					
	The architectural design of the buildings will be carefully considered to provide a high standard of visual amenity, given practical and economic constraints.	Part of plant design and requirement of EPC Contract	Contractor	Inherent in design	N/A
	The development generally will be in materials to match nearby buildings and particularly at upper levels colours will be neutral and subdued to provide the least visual intrusion and to minimize contrasts with the existing environment.	Part of plant design and requirement of EPC Contract	Contractor	\$25,000	N/A

CONCERN	MITIGATION/ MONITORING MEASURE	IMPLEMENTATION PROCEDURES	RESPONSIBILITY	CAPITAL COST	RECURRENT COSTS/YEAR
	The external structures of the buildings will be designed such that there will be no deterioration in the power station's appearance over the 30 years lifetime of the plant with steel structures of the plant painted with surface protected suitable for local conditions in accordance with the standards and practices of the Steel Structures Painting Council.	Part of plant design and requirement of EPC Contract	Contractor	\$80,000	N/A
	Directional lighting will be employed to minimize light pollution.	Part of plant design and requirement of EPC Contract	Contractor	Inherent in design	N/A
	Light will be switch off lights when not required for safety, security.	Staff will be made aware of this requirement by the management	Proponent	Part of best working practice	N/A
	Trees and bushes may be planted to provide screening for local receptors.	Part of plant design and requirement of EPC Contract	Proponent	\$5,000	N/A
	Visual inspection will be made to check for any degradation of the power stations appearance.	Visual inspection will be made to check for any degradation of the power stations appearance.	Proponent	Part of best working practice	N/A

CONCERN	MITIGATION/ MONITORING MEASURE	IMPLEMENTATION PROCEDURES	RESPONSIBILITY	CAPITAL COST	RECURRENT COSTS/YEAR
	Visual inspections will be made to ensure that plant wastes are not escaping to the surrounding environment.	Visual inspections will be made to ensure that plant wastes are not escaping to the surrounding environment.	Proponent	Part of best working practice	N/A
Traffic and Infrastructure					
	Regular servicing and maintenance of vehicles will be undertaken to minimize emissions to air, noise, leaks etc.	As necessary	Proponent	\$15,000 (period of contract)	N/A
	Safety training may be provided to vehicle drivers if considered necessary	As necessary	Proponent	\$500	\$500
	Transport of DFO to the site would endeavour to avoid the peak traffic congestion rush hours at 6:30 am and 4.30 pm to minimize the impact to the local traffic network.	Plant Manager to ensure compliance	Proponent	N/A	N/A
	Drivers will be instructed to obey all relevant speed limits and other relevant laws.	Drivers will be made aware of the requirement and complaints investigated	Proponent	N/A	N/A

CONCERN	MITIGATION/ MONITORING MEASURE	IMPLEMENTATION PROCEDURES	RESPONSIBILITY	CAPITAL COST	RECURRENT COSTS/YEAR
Socioeconomics					
	Labour law (No.51,2002) will be applied and complied with throughout the duration of the project as necessary.	Managers will be made aware of the requirements of the law	proponent	Part of best working practice Minimal cost	N/A
On-site health and safety					
	Equipment, tools and substances will be suitable for their use and selected to minimize dangers to safety or health when used correctly.	Part of EPC Contract. Guidance and training will be provided on equipment use etc as necessary.	Contractor/ proponent	Equipment supplied by EPC see above tables	N/A
	Work places will where possible receive natural light and be supplemented with sufficient artificial illumination, and signage will appropriately mark hazards, exits, materials etc.	Part of plant design	Contractor	N/A	N/A
	Ventilation design factors will consider physical activity, substances in use and process related emissions. Temperatures will be maintained at levels appropriate for the purpose of the facility.	Part of plant design, then regulation of plant conditions though monitoring of temperatures	Proponent	\$200	\$200

CONCERN	MITIGATION/ MONITORING MEASURE	IMPLEMENTATION PROCEDURES	RESPONSIBILITY	CAPITAL COST	RECURRENT COSTS/YEAR
	<p>Fire prevention and protection will be adequate for the dimensions and use of the premises, equipment installed, physical and chemical properties of substances present, and the maximum number of people present. Fire detection and protection systems will be provided throughout the plant and site area. These will include fixed foam protection systems, fire alarms, portable appliances, etc. The plant will also store firewater sufficient to meet the requirements of the Jordan Fire Department and the local fire code requirements.</p>	<p>Part of plant design and best working practice, will be automatically applied</p>	<p>Contractor/proponent</p>	<p>\$300,000 (one off payment)</p>	<p>N/A</p>
	<p>Places of work, traffic routes and passageways shall be kept free from waste and spillage, regularly cleaned, and maintained. First aid facilities will be provided and will be easily accessible throughout the place of work. Welfare facilities will include locker rooms, an adequate number of toilets with washbasins, and a room dedicated for eating. An ample supply of drinking water will be provided at all places of work.</p>	<p>Visual inspections will be made as necessary to ensure that facilities remain adequate</p>	<p>Contractor/proponent</p>	<p>\$10,000 (one off payment then part of best working practice)</p>	<p>N/A</p>

CONCERN	MITIGATION/ MONITORING MEASURE	IMPLEMENTATION PROCEDURES	RESPONSIBILITY	CAPITAL COST	RECURRENT COSTS/YEAR
	Buildings and structures will be designed according to local and internationally recognized standards. They will be structurally safe, provide appropriate protection against the climate and have acceptable light and noise conditions.	Part of plant design and requirement of EPC Contract.	Contractor	Inherent in design	N/A
	Personal protection equipment will be identified and provided, that will offer adequate protection to the worker, co-workers and occasional visitors without incurring unnecessary inconvenience. The use of PPE will be actively enforced if alternative technologies, work plans or procedures cannot eliminate or sufficiently reduce a hazard or exposure. The employer shall ensure that PPE is cleaned when dirty, properly maintained and replaced when damaged or worn out. Proper use of PPE shall be part of the recurrent training programs for employees.	Personal protection equipment will be identified and provided. The use of PPE will be actively enforced by site managers/foremen etc.	Proponent	\$15,000 (initially then replaced as necessary)	\$1000

CONCERN	MITIGATION/ MONITORING MEASURE	IMPLEMENTATION PROCEDURES	RESPONSIBILITY	CAPITAL COST	RECURRENT COSTS/YEAR
	Exposure to vibration from equipment will be controlled through selection of equipment and limitation of time of exposure. The limits for vibration and action values will conform to those provided by the IFC guidelines for OHS.	Exposure to vibration from equipment will be controlled through selection of equipment and limitation	Contractor/ Proponent	\$50,000 (one off payment)	\$1000
	Indoor temperatures will be maintained such that they are reasonable and appropriate for the work at site. Risks of heat related stress will be adequately addressed and feasible control measures implemented for work.	Part of plant design.	Contractor/ Proponent	\$150,000 (one off payment then minimal additional costs)	\$1000
	First aid facility adequately and appropriately stocked	Visual inspections and reordering of supplies as necessary	Proponent	\$15,000 (one off payment then minimal additional operational costs)	\$500
	A health and safety plan would be prepared with the aim of preventing accidents and injuries for both and construction and operation stages of the project.	A health and safety plan would be prepared	Contractor/ Proponent	\$20,000 (one off payment)	N/A
	A training register for Employees would be maintained and kept up to date with evaluation of training sessions made.	A training register for Employees will be maintained	Proponent	Responsibility of Project Manager/ plant manager Zero cost	N/A

CONCERN	MITIGATION/ MONITORING MEASURE	IMPLEMENTATION PROCEDURES	RESPONSIBILITY	CAPITAL COST	RECURRENT COSTS/YEAR
	Daily visual inspection of use of PPE equipment would be made.	Daily visual inspection by site managers/foremen etc	Proponent	Responsibility of safety Manager Zero cost	N/A
	A register of accidents on site would be maintained with prevention training sessions held.	As necessary accidents will be registered.	Proponent	Responsibility of safety Manager (Zero cost)	N/A
	Review site specific health and safety plan would be made on an appropriately regular basis.	Annual review by safety manager/officer	Proponent	\$2000	\$2000
Off-site health and safety					
	The plant will be located within a security fence ensuring to prevent trespass or accidental entry of the site by local peoples. The plant will also be fitted with security cameras	Part of EPC contract/plat design	Contractor/ Proponent	\$500 for camera operation (fence part of EPC Contract)	\$500
	The transport of raw materials and the transport and disposal of waste will be undertaken in an appropriate manner.	Best working practices will be applied and any complaints investigated.	Proponent	\$2000	\$2000
	Project vehicles and equipment will be well maintained with project-related traffic will be requested to travel no faster than the speed limit.	Staff will be made aware of the requirement. Preparation of traffic management plan will be made and consideration of any complaints as necessary	Proponent	Part of best working practice Minimal cost	N/A

CONCERN	MITIGATION/ MONITORING MEASURE	IMPLEMENTATION PROCEDURES	RESPONSIBILITY	CAPITAL COST	RECURRENT COSTS/YEAR
	Accidents and incidents involving the public will be documented and reported to management.	As necessary	Proponent	Responsibility of Project Manager/ plant manager Zero cost	N/A
	A complaints register will be maintained as necessary.	As necessary	Proponent	Responsibility of Project Manager/ plant manager Zero cost	N/A