EXHIBIT 2.3.48
OWNER'S ENVIRONMENTAL ACTION PLAN

TSAVO POWER
COMPANY

ENVIRONMENTAL ACTION PLAN (EAP)

This Environmental Action Plan defines the Environmental Management Policy of Tsavo Power Company Limited. It enables construction and operation of the Kipevu II Power Plant to be carried out in an environmentally responsible manner, within guidelines specified by the World Bank Group and described in the Environmental Assessment Report produced for Tsavo Power Company Limited by ESG International of Ontario, Canada.

Tsavo Power Company Limited
9th Floor IPS Building, Kimathi Street, Nairobi, Kenya

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ENVIRONMENTAL ACTION PLAN

SECTION ONE

INTRODUCTION

This Environmental Action Plan (EAP) establishes the main principles and obligations in relation to the overall project, together with an effective monitoring and mitigation policy that enables long-term compliance with the Environmental Assessment Report.

Tsavo Power Company Limited (TPC) has developed this EAP from the Environmental Assessment Report (EAR) produced for TPC by ESG International of Ontario, Canada, in July 1999. In order to reach as wide an interested audience as possible, the "Environmental Review Summary (ERS), Kenya: Kipevu II, June 21, 1999" was prepared by IFC, approved by TPC, and disclosed to the general public through the World Bank InfoShop by IFC and locally by TPC. The ERS provides historical backgrounds and general approaches agreed between IFC and TPC on major issues such as sulphur dioxide (SO_x) exhaust stack emissions, ambient air quality monitoring, this Environmental Action Plan, and high-voltage transmission lines associated with the power plants in the Kipevu area.

This EAP adopts a format whereby the linkages between environmental issues (or potential impacts), management measures (or mitigation), net effects (or residual impacts) and management information (or monitoring) are made explicitly. A comprehensive summary of these factors and their linkages is presented in the tables at the end of this plan and deal with both the construction and operational phases of the project.

Issues identified as requiring a greater level of information or analysis than can be conveyed solely in tabular format are discussed as narrative below. Also discussed is compliance with IFC Environmental and Social Safeguard Policies.

SECTION TWO

ENVIRONMENTAL MANAGEMENT POLICY

TPC will operate in an environmentally responsible manner and will comply with all applicable environmental laws and regulations. It will communicate to individual employees the nature of their environmental responsibilities, and will provide any training necessary for effective environmental performance.

TPC will put in place programs to reduce the probability of any environmental incidents and will develop contingency plans in advance for dealing with such incidents, should they occur.

TPC will assign a senior manager to be responsible for environmental management and will have the necessary trained personnel for environmental mitigation and monitoring procedures and policies.

TPC will assign a member of staff to be Community Relations Officer during the construction and operational phases of the project. This officer will be the principal link between the Kipevu II power plant and the general public.

TPC will demand the same level of commitment and performance of environmental management from all its agents, suppliers and contractors, and will stipulate this in any legally binding agreements it enters into with these parties. With the sole exception of compliance with the ambient air quality limit, which is a TPC responsibility, compliance with

this EAP will be contractually binding upon the Engineer, Procure and Construct (EPC) Contractor throughout the life of the EPC Agreement and upon the Operation and Maintenance (O&M) Operator throughout the life of the O&M Agreement.

SECTION THREE

IFC ENVIRONMENTAL AND SOCIAL SAFEGUARD POLICIES

This EAP is designed to enable the Kipevu II power project to comply with all applicable IFC Environmental and Social Safeguard Polices, and World Bank Group Environmental and Health and Safety guidelines. The policies and a brief statement indicating the requirements and methodology for compliance with each policy are provided in Table 1 below.

Table 1 Compliance of Kipevu II with IFC Environmental and Social Safeguard Policies

Policy	Status
OP 4.01, Environmental Assessment	Environmental Assessment Report has been produced in accordance with the requirements for a Category B project and has been approved by the IFC and the environmental authorities in Kenya.
OP 4.04, Natural Habitats	Kipevu II is located in an industrial area away from critical natural habitats.
OP 4.09, Pest Management	No significant pest management activities are necessary and will not be undertaken.
OP 4.10, Indigenous Peoples	Kipevu II is located in an industrial/metropolitan area removed from any indigenous peoples settlements.
OP 4.11, Safeguarding Cultural Property	Relic structures found on the site were of minor historic interest. They have been documented by the Mombasa City Council, who authorised their disposal.
OP 4.12, Involuntary Resettlement	The site is located on vacant land that is leased by KPLC. It is understood that KPLC will compensate any persons affected along the route for the transmission line between the Kipevu II site area and the Rabai sub-station.
OP 4.36, Forestry	No deforestation is needed to establish the project.
OP 4.37, Safety of Dams	The project does not involve any dam construction.
OP 7.50, Projects on International Waterways	The project is not situated on an international waterway.
Labour Standards	The project will not utilise forced or child labour.
Disclosure of Information Policy	An Environmental Review Summary has been posted on IFC's InfoShop, and a notice of its local availability placed in Kenyan newspapers by TPC. To date no adverse reaction has been received.

SECTION FOUR

IDENTIFICATION OF ENVIRONMENTAL IMPACTS

WORLD BANK GUIDELINES

The World Bank guidelines for new thermal power plants summarise the key production and emission control practices required for compliance. The following subsections identify the applicable issues and describe the TPC response during planning and development of the Kipevu II power project.

Issue: *Choose the cleanest fuel economically available (natural gas is preferable to oil, which is preferable to coal)*

Response: TPC plans to use the cleanest fuel economically available in Kenya. Natural gas is not available for power generation leaving heavy fuel oil (HFO) as the next most economical fuel. During most of the planning and development phases of the project, World Bank guidelines (in September 1997) limited SO_x emissions to 2,000 mg/Nm^3 (which can be

met by using HFO with a sulphur content of 2.5% or lower). However, the finalised guidelines (in July 1998) issued late in the project development phase were changed to limit SO_x emissions to 2,000 mg/Nm^3 plus 0.2 tonne per day per MW (which can be met by using HFO with a sulphur content of 1.9% or lower). Agreement was reached with the World Bank to continue implementation of the project using 2.5% sulphur HFO as major commitments had already been made and a substantial overall reduction of sulphur emissions in Kenya could be achieved under certain conditions.

The only domestic source of HFO in Kenya is the Kenya Petroleum Refinery in Mombasa, a few kilometres from the Kipevu II site. Importing HFO from outside Kenya would have impacted adversely on the commercial future of the refinery and on the cost of electricity generated by the plant. Refinery management advised TPC that it could reliably provide 2.5% sulphur HFO, even though it historically produced HFO with up to 3.7% sulphur and was already supplying this fuel to the Kipevu I power plant. The refinery also advised TPC that obtaining a contract to supply 2.5% sulphur HFO for Kipevu II would help to secure the refinery's future. The contract would also enable it to supply 2.5% sulphur HFO to the Kipevu I plant which, after commissioning, would be consuming approximately 110,000 metric tonnes of HFO per year.

A major upgrade at the refinery is at the detailed planning stage and an application for development funds is under consideration. The upgrade would enable the refinery to reduce the sulphur content of diesel fuel for road vehicles from 1% to 0.2%, but this is conditional upon a secured future for the refinery. The current consumption in Kenya of diesel fuel in road vehicles is approximately 750,000 metric tonnes per year.

The use of 2.5% sulphur HFO in the Kipevu II plant would therefore achieve a substantial and widespread overall reduction in sulphur emission in Kenya, much of which is released by uncontrolled vehicle engines in urban areas. The total reduction in sulphur emissions in Kenya is estimated to be approximately 4,500 tonnes per year.

The upgrade would also include technology to produce unleaded fuel. This should greatly reduce the emissions of highly toxic lead elements into the atmosphere of Kenya, given the capability of vehicle engines to accept unleaded petrol.

For these reasons 2.5% sulphur HFO is considered to be the cleanest economically available fuel. Plant sulphur emissions using 2.5 % sulphur HFO will meet the emission requirements of the 1997 World Bank guidelines and in all other respects the 1998 guidelines will be met. Using 2.5% sulphur HFO will result in SO_X concentrations in the exhaust stack of about 1450 mg/Nm^3, well below the 1997 guideline value of 2000 mg/Nm^3.

***Issue**: Select the best power generation technology for the fuel chosen to balance the environmental and economic benefits. The choice of technology and pollution control systems will be based on the site-specific environmental assessment.*

Response: Wärtsilä diesel technology provides:

Low fuel consumption and emissions: The Wärtsilä 18V38 range of engines provides high power output with low fuel consumption and emission levels. Low emissions are achieved through an advanced fuel injection system and a specially designed combustion chamber.

Short construction time: The power station is scheduled to be completed and in full commercial operation within 20 months of the signing of the Power Purchase Agreement and within 13 months of the start of on-site construction activity.

Practicality of on-site maintenance: The 18V38 engines have 40% fewer parts than the previous generation of Wärtsilä engines. All parts are easily accessible, minimising the complexity and extent of maintenance required. Local personnel will be trained to operate and maintain the plant.

Attractive capital and operating costs: Diesel power plants are based on proven existing technology and do not require extensive site-specific engineering. The 18V38 engine is "short and low" helping to minimize space requirements and the costs of transportation, site development, and plant construction. Automated systems will control and monitor all engine and plant functions, as well as provide operational alarms and protection from hazards. These systems will greatly increase plant reliability and security while freeing operating staff to perform other important duties.

***Issue**: For pollution control, consider the following: Particulates smaller than 10 microns in size are most important from a health perspective, and acceptable levels of particulate matter removal are achievable at relatively low cost.*

Response: The Kipevu project will meet World Bank guidelines for particulate matter emissions. The project has only a minor effect on predicted ground level concentrations.

***Issue**: For pollution control, consider the following: NOx reduction can be achieved by low NOx burners and other combustion modifications.*

Response: The Wärtsilä 18V38 engines will be fitted with Wärtsilä's latest low NO_x combustion control technology. The Plant will meet the NO_x emission guidelines of the World Bank.

***Issue**: 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.*

Response: Use of 2.5% sulphur fuel in the plant will drive the sulphur content of the country standard HFO down from approximately 3.7% to 2.5%. Scheduled changes in refinery technology may also reduce sulphur levels in the lighter diesel fuel oil from 1% to 0.2%. Together, these reductions will achieve a widespread overall reduction in mass sulphur emissions in Kenya, particularly in urban areas. Start-up of Kipevu II will also allow the ageing HFO fire boilers at the existing Kipevu Steam Plant to be retired. When these offsets are considered, ambient concentrations of sulphur are predicted to be within World Bank guidelines.

***Issue**: Sulphur oxides removal systems which generate less wastewater are normally preferred, but the environmental and cost characteristics both of inputs and wastes should be assessed on a case-by-case basis.*

Response: Sulphur oxides removal (desulphurisation) is not considered a feasible technology for the Kipevu II project. The size of the site is inadequate to house the equipment and storage space required for the technology, and a disbenefit of the process is that higher ground level concentrations of NO_2 occur, since the cooled exhaust gases disperse less effectively

***Issue**: Ash disposal and reclamation should be managed to minimise environmental impacts, especially the migration of toxic metals if present, to the nearby surface and groundwater bodies in addition to the transport of suspended solids in surface runoff. Reuse of ash in building materials should be considered.*

Response: Ash will not be generated by the diesel engines. A minimal amount of ash will be generated as a result of the occasional operation of a small on-site high-temperature incinerator. The small amount of ash will be disposed of at the nearby Makupa landfill.

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

Response: The plant will be cooled using closed circuit air radiators, thereby avoiding thermal discharges to water bodies and excessive consumption of water by evaporative coolers.

Issue: A comprehensive monitoring and reporting system is required.

Response: TPC will follow the comprehensive monitoring program that has been set out in this EAP.

PROJECT SPECIFIC ISSUES

Stack Emissions

Stack emissions from the power plant are affected by both the fuel burned and by the nature of the combustion process. SO_X emissions relate primarily to the sulphur content of the fuel, whereas the factors affecting NO_X emissions relate primarily to the temperature, pressure and timing of the combustion process.

TPC intends to use the cleanest fuel economically available in Kenya; HFO containing 2.5% sulphur. As described above, this approach complies with the approach for project planning and implementation set out in the World Bank guidelines.

The World Bank guidelines applicable for particulate matter and NO_X are those set out in the 1998 Handbook. The applicable guidelines for SO_X are those set out in the 1997 draft version of the Handbook, these being applicable at the bidding stage and during negotiations for the power purchase agreement (PPA).

The World Bank makes provision for variances from the targets outlined in its Pollution Prevention and Abatement Handbook. In the forward to the Handbook it states: *"...the guidelines contained in this Handbook will apply to all World Bank Group funded projects approved on or after 1 July 1998, unless the project sponsor can demonstrate that a significant investment has been made (or that a legally binding agreement has been entered into) in reliance on the 1988 guidelines."*

In the case of the Kipevu II project, fixed agreements were entered into as a result of Wärtsilä's successful bid for the project in November 1996 and negotiated in good faith on the basis of guidelines in place at the IFC between 1996 and July 1998. There are no applicable Kenyan guidelines limiting power plant stack emissions.

TPC believe the Kipevu II power plant will meet the applicable guidelines for SO_X, NO_X, and particulate matter described in Table 2 below.

Table 2 World Bank Guidelines and Predicted Emissions for the Kipevu II Power Plant[1]

Substance	World Bank Guidelines	Predicted Emissions
NO_X	2300 mg/Nm^3 [2]	2300 mg/Nm^3 (N in fuel < 0.4%)
Particulate Matter	75 mg/Nm^3 [2]	75 mg/Nm^3
SO_X	2000 mg/Nm^3 [3]	1450 mg/Nm^3

1. Measured dry at a reference level of 15% vol. O_2
2. World Bank Pollution Prevention and Abatement Handbook – Part III Thermal Power – Guidelines for New Plants. (World Bank, July 1, 1998)
3. World Bank Pollution Prevention and Abatement Handbook – Annual Meeting Version (World Bank, September 1, 1997).

The Power Purchase Agreement for Kipevu II also specifies emission rates. In the definitions section of the PPA it states that the World Bank guidelines refer to: *The parts of the "World Bank Pollution Prevention and Abatement Handbook - Part III, Thermal Power-Guidelines for New Plants" dated 1 September 1997 which are relevant to diesel or engine driven power plants.*

Exhaust Stack Configuration

The environmental review report prepared for Kipevu I by the consultants Mott MacDonald in 1996 recommended that the stack for Kipevu II be similar to the single 50 m stack recommended for Kipevu I. That recommendation assumed a certain design for Kipevu II including a powerhouse of similar dimensions. The actual powerhouse proposed for Kipevu II is much lower than Kipevu I – about 12 m in height compared to 20 m or more for Kipevu I.

World Bank guidelines recommend that power plants should not use stack heights less than the GEP (Good Engineering Practice) recommended values. For Kipevu II the good engineering value is calculated as 2.5 times the building height (12 m), which corresponds to a stack height of 30 m. Subsequent examination indicated that the size of the Kipevu 1 powerhouse should be included in the determination of the stack height for Kipevu II. This analysis determined that the stack height should equal the height of the stack for the Kipevu I plant. As the ground level for Kipevu II is 5 m higher than Kipevu I, a stack height of 45 m would put both stack tops at the same elevation above sea level.

Previous experience has shown that grouping together of the individual exhaust stacks from each engine into a stack bundle generally results in a reduction in ground level concentrations compared to ungrouped stacks. For Kipevu II it was decided to maximise this effect by grouping all the stacks into a single bundle.

The air quality calculations made in this report have been based on a 45 m single stack bundle configuration.

Ambient Air Quality

Air quality considerations were a primary focus of the EAR study team's impact assessment activities. Existing ground-level concentrations of NO_x and SO_x were monitored to establish background levels. The following subsections describe the methods used to analyse impacts, the effects related to operation of Kipevu II, and the cumulative effects on regional air quality.

Air Dispersed Pollutants

Computer modelling techniques were used to predict the incremental effect of the proposed power plant. The results indicate that the World Bank guidelines for ambient air quality will be met. A summary of the results presented in the EAR is as follows.

The computer model predicts pollutant concentrations for a range of averaging times (e.g., maximum 1-hour average, maximum 24-hour average and annual average). In addition, useful information on the frequency of occurrence and spatial distribution (zone of impact) of undesirable concentrations can be generated. The spatial distribution takes the form of contour plots of ground-level pollutant concentrations (isopleths). In the EAR, isopleths of air contaminant concentration were plotted on a polar grid representing a radius of 17.5 km centred on the Kipevu II power plant site.

The computer model input parameters were optimised to account for multiple source plume rise effects and the relationship between NO_x emissions and NO_2 in the atmosphere.

Further optimisation was carried out to account for the specific characteristics of the terrain in the vicinity of the site. At any given time, the spread and rise of a stack plume can be significantly different over urban and rural areas. Urban heat island effects and increased mechanical turbulence in large urban areas limit the development of a stable atmosphere at night-time, leading to greater horizontal and vertical spread of emissions from a stack. To differentiate between urban and rural areas, the model is equipped with a separate set of dispersion parameters for each case.

The terrain surrounding the Kipevu II power plant was classified as rural for the purposes of modelling, because of the significant amount of open terrain and water surrounding the plant and the relatively low aspect of settled areas within 3 km of the stacks.

The potential for shoreline fumigation phenomena was considered; a phenomenon occurring occasionally on nearby shorelines, when unusually high ground level concentrations of pollutants from tall stacks are produced. The site of Kipevu II is well removed from the shoreline of the Indian Ocean (approximately 6 km) but is within 350 m of the Port Reitz Harbour, a body of water 2 km wide. The site is also on a hill about 50 m above sea level. This is not a typical setting for shoreline fumigation events and the probability and severity of such events is lower than for a typical setting. For this reason fumigation was not considered to be a significant issue for the analysis of air emissions from Kipevu II.

Air Quality Impact from Operation of Kipevu II

Contribution to Ground Level Concentrations

The maximum predicted ambient concentrations of air pollutants associated with the operation of the power plant alone, ignoring the effect of background concentrations of pollutants, are shown in Table Three below. The results are based on the Plant operating on 2.5% sulphur HFO fuel available from the Kenya Petroleum Refinery.

The key parameters of interest are the 24-hour ambient concentrations for SO_2 and NO_2, and the predicted isopleths of these air pollutants due to operation of the plant alone are shown in Figures 5.1 and 5.2 of the EAR. The isopleths for the annual averages are provided in Appendix F to the EAR.

The isopleths show that the power plant has a small contribution to ground level concentrations in the urban area of Mombasa, with higher levels being contributed in the rural area well inland and to the east of the plant.

Table 3 Predicted Maximum Ground Level Concentrations of SO_2, NO_2 and PM contributed by Kipevu II, operating at 100% load on 2.5% sulphur HFO

Pollutant	Averaging Period	Ground Level Concentrations ($\mu g/m^3$)	World Bank (July 1, 1998)
SO_2	24 hours	45	150
	1 year	6	80
NO_2	24 hours	40	150
	1 year	5	100
PM	24 hours	3	150
	1 year	0.3	50

Background plus Contribution from of Kipevu II

Predictions of air quality in various parts of the study area, when both existing background ambient concentrations and the effects of Kipevu II are taken into account are provided in Table 5.3 of the EAR.

The results show that Kipevu II plus background levels are within the World Bank guidelines expect for the 24-hour SO_2 levels in the urban core area. In this area Kipevu II has a minimal effect – exceedance of the World Bank guideline being due to the high background level.

For cases where background air quality is moderate, the World Bank guidelines state that the power plant contribution to the annual mean of particulates, SO_2 or NO_2 should not exceed 5 $\mu g/m^3$. As shown in Table 5.4 of the EAR, the power plant will contribute about 2 $\mu g/m^3$ to annual mean concentrations of particulates, NO_2 or SO_2.

Cumulative Effects on Air Quality

Kipevu II is situated next to Kipevu I, a similarly sized diesel power plant. Computer modelling was undertaken as part of the EAR to ascertain the cumulative effect on ground level concentrations of SO_2, NO_2 and particulate matter from the simultaneous operation of both plants.

While the Kipevu I plant can operate with HFO with a sulphur content up to 3.2%, it is expected that the plant will actually use 2.5% sulphur HFO following the refinery upgrade, as that will be the only fuel available locally. The aggregate effects have been modelled and the results are shown in Table 4 below.

Table 4 Maximum predicted 24-hour and Annual Ground Level Concentrations of SO_2, NO_2 and particulates in the Mombasa Area with the addition of Kipevu II ($\mu g/m^3$)

Parameter	Urban Core[1]			Suburban and Industrial[1]			Rural[2]			WB
	Back-ground	Plant Effect	Total	Back-ground	Plant Effect	Total	Back-ground	Plant Effect	Total	
SO_2 (24 hrs)	180	5	185	50	15	75	50	49	99	150
SO_2 (Annual)	14	2	16	8	5	13	5	9	14	80
NO_2 (24 hr)	40	5	45	22	10	32	16	39	55	150
NO_2 (Annual)	10	2	12	7	6	13	5	7	12	100
PM (24 hr)	N/A	2.8	N/A	N/A	2	N/A	N/A	3	N/A	150
PM (Annual)	N/A	0.5	N/A	N/A	0.1	N/A	N/A	0.5	N/A	50

1. visual estimate from isopleth diagrams
2. maximum value returned by model

The contribution of both plants operating simultaneously result in ground level concentrations of SO_2, NO_2 and particulate matter that are within the World Bank guidelines for ambient air quality. Predictions of 24-hour ground level in the study area, when both existing background ambient concentrations and the effects of Kipevu I and II are taken into account, are provided in Table 5 below.

Table 5 Predicted Maximum Ground Level Concentrations of SO_2, NO_2 and PM contributed by Kipevu I and Kipevu II ($\mu g/m^3$) operating on 2.5% sulphur HFO

Pollutant	Averaging Period	Plant Contribution ($\mu g/m^3$)	World Bank (July 1, 1998)
SO_2	24 hours	96	150
	1 year	18	80
NO_2	24 hours	79	150
	1 year	15	100
PM	24 hours	6.1	150
	1 year	1.1	50

In the urban core, background 24-hour ground level concentrations of SO_2 already exceed World Bank Guidelines. The combined effects of Kipevu I and II are small in this area, and will increase the existing 24 hour average concentrations by a maximum of 25 $\mu g/m^3$ as

shown in Table 5. However, this worst case effect will occur infrequently – estimated on less than 5 days per year. The maximum effect in the suburban/industrial and rural areas is similarly infrequent (refer to Figure 5.3 of the EAR). Figure 5.4 of the EAR shows the isopleths for the 24-hr maximum ground level concentrations for the study area, as well as the locations of the receptors that were used for the frequency calculations.

The minor and infrequent effects on 24-hour concentrations described above would not effect the categorisation of the airshed as 'Good to Moderate Air Quality' under the World Bank guidelines. The guidelines also indicate that in areas of Moderate Air Quality the power plant should not increase the annual average of SO_2, NO_2 or particulate matter by more that 5 $\mu g/m^3$. As Table 6 below shows, the combined contribution to annual averages in the urban area by Kipevu I and II operating together is below 5 $\mu g/m^3$, complying with the World Bank guidelines.

Table 6 Maximum Predicted 24-hour Ground Level Concentrations of SO_2, NO_2 and PM in the Mombasa Area with the addition of Kipevu I and Kipevu II ($\mu g/m^3$)

	Urban Core			Suburban and Industrial			Rural		
	Back-ground	Plant Effect[1]	Total	Back-ground	Plant Effect[1]	Total	Back-ground	Plant Effect[1]	Total
SO_2: both Kipevu I & II using 2.5% S HFO									
24 hr	180	20	200	50	40	90	50	90	140
Annual	14	4	18	8	6	14	5	12	17
NO_2									
24 hr	40	10	50	22	25	47	16	70	86
Annual	10	2	12	7	4	11	5	9	14
Particulate Matter									
24 hr	N/A	1	N/A	N/A	1	N/A	N/A	5	N/A
Annual	N/A	>.2	N/A	N/A	0.2	N/A	N/A	0.8	N/A

1. Plant effect value a visual estimate from the EAR isopleth diagrams

Noise Emission

Predictions of noise levels in the areas surrounding the power plant were calculated using the Environmental Noise Model (ENM) software developed by RTA Technology Pty Ltd of Sydney, Australia. This software has been frequently used to successfully estimate power plant environmental noise effects in other diesel power projects.

The model was run assuming an ambient temperature of 25 °C and an atmospheric humidity of 75%. Ground topography, surrounding buildings and wind were not included as variables in the calculation model.

The main noise sources at the power plant are the engines and power house, the exhaust stacks, the charge air intakes, the radiators, and the ventilation system. These sound sources are presented in sound power levels including directivity information. The calculation model presents the noise contributed by the power plant while operating at 100% load. The calculation model predicts the maximum environmental noise effect of the power plant, but measured values are expected to be below the predicted values. The calculation area takes in 1 sq km based approximately on 500 m along each cardinal point from the corner of the power house. The predicted noise contours within this area shown in Figure 5.5 in the EAR.

The World Bank guidelines indicate that for industrial and commercial areas, noise levels should not exceed 70 dB(A) or a maximum increase in background levels of 3 dB(A) where background noise already exceeds 70 dB(A).

The noise model predicts that the power plant will meet the World Bank guideline of 70 dB(A) for all industrial and commercial areas surrounding the site. The initial noise modelling indicated that noise levels in excess of 70 dB(A) might occur in a relatively small area immediately south of the site and in a second small area immediately east of the plant. This was addressed during the development stage of the project by switching from "standard-design" radiators to "low-noise" radiators, to reduce noise levels by about 5 dB(A).

The World Bank guidelines indicate that for residential, institutional and educational areas noise levels should not exceed 55 dB(A) during the day and 45 dB(A) during the night or a maximum increase in background levels of 3 dB(A) where background noise already exceeds the guideline figure.

There were no institutions or schools identified in the area of noise influence of the plant.

The nearest formal residential area is the Changamwe Settlement Area north-west of the site. Noise from the power plant at the closest residences in this area will be below 45 dB(A), and thus meet World Bank guidelines.

There is a small informal residential area that has sprung up alongside the port access road north-west of the plant site. The closest inhabitants in this informal area are about 440 m from the site. In order to minimise environmental noise in this residential area the power plant has been laid out with the quietest side facing to the north. This revised layout reduces noise levels in the residential area by about 5 dB(A). Based on this "northward" facing layout the World Bank guideline of 55 dB(A) for day time noise in residential areas is met (refer to Figure 5.5 of the EAR). At night-time, noise in much of the informal residential area will also be less than the World Bank guideline of 45 dB(A). However, at the closest residences (about 440 m to 540 m north-west of the site) noise may reach 47 dB(A) in worst case conditions. This is very unlikely to be a detectable difference from the guideline figure of 45 dB(A).

Night-time background noise levels in the informal settlement area have not been precisely established but are expected to be between 45 and 50 dB(A). The model is also expected to provide conservative results as it is based on worst case conditions. Thus, it is expected that if noise occurs above 45 dB(A) it will be barely noticeable above the existing noise environment and thus will be in compliance with World Bank guidelines.A noise-monitoring program will be carried out once the plant is constructed, to measure the noise contributed by the power plant. The monitoring will include measurements at the formal and informal residential areas.

Noise will also be contributed by the Kipevu I power plant currently under construction. No data is available of the noise levels expected from Kipevu I. As Kipevu I is also a diesel engine power plant, noise emission levels are expected to be similar to Kipevu II. However the contribution from the Kipevu I plant to noise levels in the residential area is expected to be considerably less than Kipevu II due to the shielding afforded by the Kipevu II plant and the increased distance of the Kipevu I site from the effected areas.

High Voltage Transmission Line

Kenya Lighting and Power Company Limited (KPLC), the power purchaser, plans to construct an additional 18 km of 132 kV double circuit transmission line from the Kipevu power generation complex (of which Kipevu II is one of four power plants) to Rabai along an existing 132 kV transmission line corridor. The existing corridor will be widened by 25 m to 50 m to accommodate the new line. KPLC plans to clear the 50 m right-of-way of all dwellings and people for safety and security reasons. This will necessitate resettlement of an estimated 1000 people (in about 200 houses), most of whom reside in an area covering

approximately one km of the right-of-way. Construction of the transmission lines will be carried out between May 1999 and December 2000.

The KPLC transmission line is not directly attributable to, nor essential for, operation of Kipevu II. Accordingly, IFC policy on resettlement (World Bank OD 4.30) will not apply to the proposed transmission lines. IFC is, nevertheless, concerned about the resettlement associated with this KPLC project. To this end, an IFC Social Specialist met with KPLC during appraisal, and KPLC has expressed interest in having this resettlement meet IFC policy (OD 4.30, on Involuntary Resettlement). IFC Trust Funds will be used to provide KPLC with an expert resettlement consultant who will assist in the preparation of a resettlement plan. Terms of Reference (TOR) have been prepared in collaboration with KPLC. Both the KPLC officer responsible for co-ordination of resettlement and the implementing consultancy will work closely with IFC. It is IFC's view that this will improve the investment climate in the Kenya power sector by building capacity within KPLC. In addition, IFC has obtained agreement in principle from the sponsors to cooperate with KPLC in its implementation of the resettlement plan.

SECTION FIVE

ENVIRONMENTAL MANAGEMENT, MITIGATION AND MONITORING

Impact mitigation and monitoring requirements were discussed in Chapter 5 of the EAR without specific reference to the methodology for their implementation, and Chapter 6 recommended a framework for the Environmental Action Plan (EAP).

A comprehensive summary of the potential environmental impacts during the construction phase of the project and the monitoring and mitigation policies to be undertaken by TPC is provided in Table 7. A comparable summary of the impacts and the monitoring and mitigation policies for the operational phase of the project is provided in Table 8.

TSAVO POWER COMPANY COMMITMENT

TPC is committed to effective environmental management throughout the life of the project and has adopted the framework recommended in the EAR. It includes the following elements, which will be applied equally to the construction and operational stages of the project:

- an effective environmental management system for the life of the project;
- an firm implementation and reporting schedule;
- an effective monitoring and mitigation programme;
- robust plans for further development; and
- detailed plans for integrating the EAP with the project.

At the time of preparation of the EAR, certain detailed planning and design activities had not been completed, and some work still remains to be done on the EAP. This report describes the EAP at the level of detail available at January 2000.

TPC intends to update the EAP as the individual programs are developed. These updates will be made available to IFC and the appropriate Kenyan government authorities as they are completed.

LOCAL BENEFITS PROGRAM

Progress on the implementation of the Local Benefits Program will be documented in TPC's annual monitoring reports.

AMBIENT AIR QUALITY

TPC or a specialist consultant appointed by it will provide a monitoring station, capable of continual NO_X and SO_X measurements using electronic analysers and of periodic 24-hour average particulate matter measurements using a high volume particulate matter sampler. The monitoring station will be located as shown in Figure 1 below. The site is at or very close to location 'R1' on Figure 5.4 of the EAR, the place at which the predicted maximum 24-hour concentration of SOx will occur, and resulting from operation of both Kipevu I and II power plants. The monitoring station will operate for a period of approximately six months prior to commissioning of the Kipevu II plant, to enable TPC to collect pre-operational background ambient air quality data.

TPC will work with the Kenya Electricity Generating Company Limited (KenGen) - operator of Kipevu I - to combine resources on the environmental monitoring programme. Also, the Ministry of the Environment has indicated its interest in developing an air-quality monitoring programme for Kenya, including the Mombasa area. TPC will work with the Ministry, and advise on any necessary training, so that it can take over responsibility for the programme. The Ministry could then build up its expertise and expand the monitoring programme into other areas of the country.

NOISE

During Commissioning the EPC contractor will, in accordance with the Testing Procedures, undertake a comprehensive field measurement programme to determine compliance with the plant design specifications and World Bank Group guidelines. The position and number of receptors will be as shown in Figure 2 below, to confirm that the actual Plant noise measurements at nearby commercial and residential areas are no greater than the predictions given in the EAR. The O&M Operator will repeat the field measurement programme annually and following any significant change to the Plant that could impact on external noise levels.

WATER QUALITY

Water discharge will occur from the oily-water treatment systems, rainwater run off, and other sources. Discharges from the plant will be monitored by the O&M Operator for pH using a continuous sampler and for oil and grease using quarterly grab samples taken for laboratory analysis. On a quarterly basis the O&M Operator also will undertake laboratory analysis of samples from the Site water discharge culvert to ascertain the levels of all contaminates specified in World Bank Group guidelines and in Kenyan environmental regulations.

SOCIAL CONCERNS

Project related traffic, noise and dust generated during construction and operation has potential to disrupt the local community. TPC will appoint a Community Relations Officer to work with the community and community leaders to promptly resolve any issues that might arise.

STACK EMISSIONS

The EPC Contractor and O&M Operator will measure exhaust stack emissions, in accordance with the Testing Procedures. Direct measurements of stack emissions will be carried out by the EPC Contractor during commissioning and by the O&M Operator on an annual basis thereafter. Surrogate methods will be employed by the O&M Operator to monitor stack emissions of the following three parameters.

- SO_2 emissions will be indirectly monitored when operating the plant with each new batch of HFO and at least every three months, using the sulphur content and lower heating value (LHV) of the fuel, according to the ISO/CD 8178-1 Standard. The HFO sulphur content will be analysed by the Fuel Supplier according to the procedures set out in the Fuel Supply Agreement.

- Dry particulate matter (DPM) will be monitored using similar testing and analysis methods for the ash content of the fuel.

- Oxides of nitrogen (NO_X) will be monitored by measuring and recording the fuel injection timing and the charge air cooling water temperature.

For the latter two parameters the surrogate testing provides indicative results only. This is due to the fact that there are a number of parameters affecting both the DPM and NO_X levels and the cumulative effect of them is difficult to predict accurately. For example, NO_X levels may drop slightly with increasing operating hours if peak combustion pressures fall and components wear.

The power plant is equipped with seven identical engines, each with a separate exhaust gas duct. Even though all engines have identical operating requirements, emissions from each engine will be measured. The specific measurement plan for each parameter follows, and the results of emission monitoring will be provided in the yearly environmental management report produced by TPC.

Emission testing will also be carried out by the O&M Operator following any significant change to engine configuration and any significant service modifications, such as changes to injection or valve timing and cylinder firing pressures.

Sulphur Dioxide (SO_2) Emissions

Sulphur in the fuel reacts with combustion air to form sulphur dioxide, and the sulphur dioxide emission can be calculated from the fuel consumption rate and the sulphur content of the fuel. Analyser methods for directly measuring SO_2 in the exhaust gas do not achieve higher accuracy than the calculation method.

The applicable measurement standard is ISO/CD 8178-1 chapter 7.4.3.7: Calculation of SO_X Emissions from Sulphur Content in Fuel. The accuracy of the method is dependent on the sulphur analysis method and on the fuel consumption measurement. Typically, an accuracy of ±10 % can be achieved.

Oxides of Nitrogen (NOx) Emissions

NOx emissions will be measured in the exhaust stack using an instrument analysis procedure. The applicable measurement standard is EPA Method 7E, USA: Determination of Nitrogen Oxides Emissions from Stationary Sources (Instrumental Analyser Method).

The typical achievable accuracy for NO_X testing at a given oxygen level is ±15%, if the inaccuracies from both the oxygen analyser and the nitrogen oxide analyser are included.

Particulate Emissions

Particulate matter emissions will be measured by an in-stack gravimetric method with iso-kinetic sampling. The applicable measurement standard is ISO 9096: Determination of Concentration and Mass Flow Rate of Particulate Material in Gas-carrying Ducts - Manual Gravimetric Method, and typical best achievable accuracy is ±20%.

EVALUATION OF RESULTS

A measurement shall be deemed to exceed the applicable threshold value if the measured value minus the estimated inaccuracy exceeds the allowable limit.

MONITORING

Environmental monitoring, which started with the collection of background data as part of the EAR study, will continue with appropriate follow-up procedures during commercial operation of the plant. Monitoring will provide data on key environmental, social and occupational health and safety aspects and on the effectiveness of mitigation measures of the project.

The monitoring links to the described impacts and the mitigation measures are addressed in Chapter 5 of the EAR and in this management plan.

TPC and its contractors will implement as indicated the monitoring and follow-up programs set out in Table 9, and the detailed monitoring processes are described below.

Once a year, a summary of the monitoring information will be submitted by TPC to IFC and to the local authorities in Kenya. Compilation of the report will be the responsibility of TPC. The report will follow the format of the form provided as Appendix One.

Opportunities to combine environmental monitoring and mitigation with KenGen, operator of Kipevu I and the Kipevu Steam Plant, are being explored by TPC to avoid duplication of effort and maximise the effectiveness of the environmental control program. Initial discussions have already taken place with KenGen at Plant Manager level and an approach to the University of Nairobi is underway. This should develop an agreed way forward for effective environmental management of the four power plants in the Kipevu area.

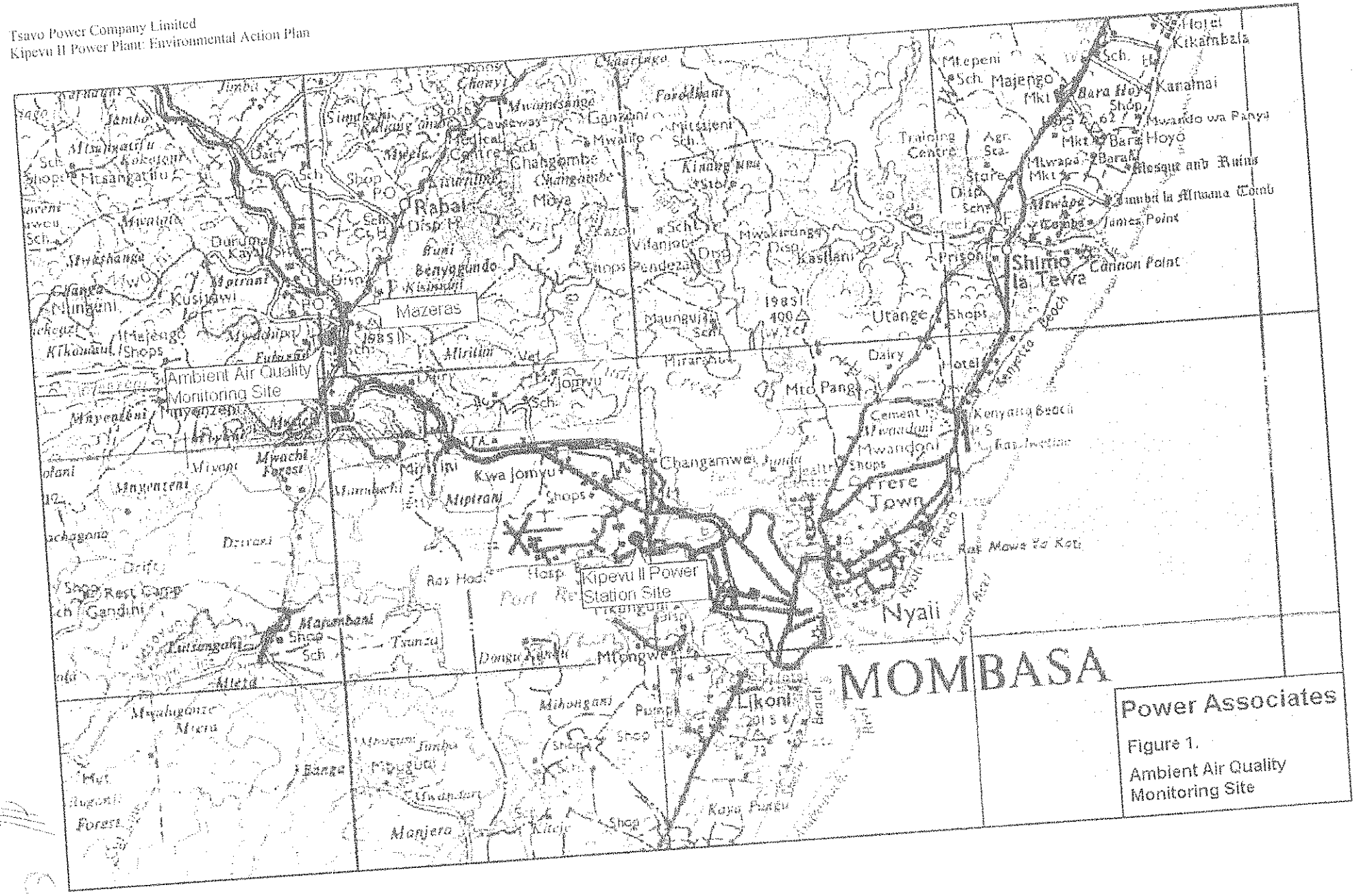
IMPLEMENTATION SCHEDULE AND RESPONSIBILITIES

Table 10 provides details of those organisations responsible for the implementation of the mitigation and monitoring measures necessary for compliance with the IFC Guidelines.

INTEGRATION OF THE MANAGEMENT PLAN

During project mobilisation, personnel responsibilities and authorities will be clearly defined, documented, and communicated. TPC will provide support for environmental management including adequate human and financial resources, and appropriate technology and skills.

TPC will prepare an environmental compliance schedule, which will clearly state its environmental responsibilities and those of its agents, suppliers and contractors. One senior person at the TPC office in Kenya will be nominated as responsible for environmental management, including overall co-ordination of environmental issues. That person will take overall responsibility for mitigation measures, for monitoring programs, for supervision of personnel, suppliers and contractors, for monitoring laboratories, and for reporting the results within the company and to relevant authorities.


Mazeras
Ambient Air Quality Monitoring Site
Kipevu II Power Station Site
MOMBASA
Power Associates
Figure 1.
Ambient Air Quality Monitoring Site

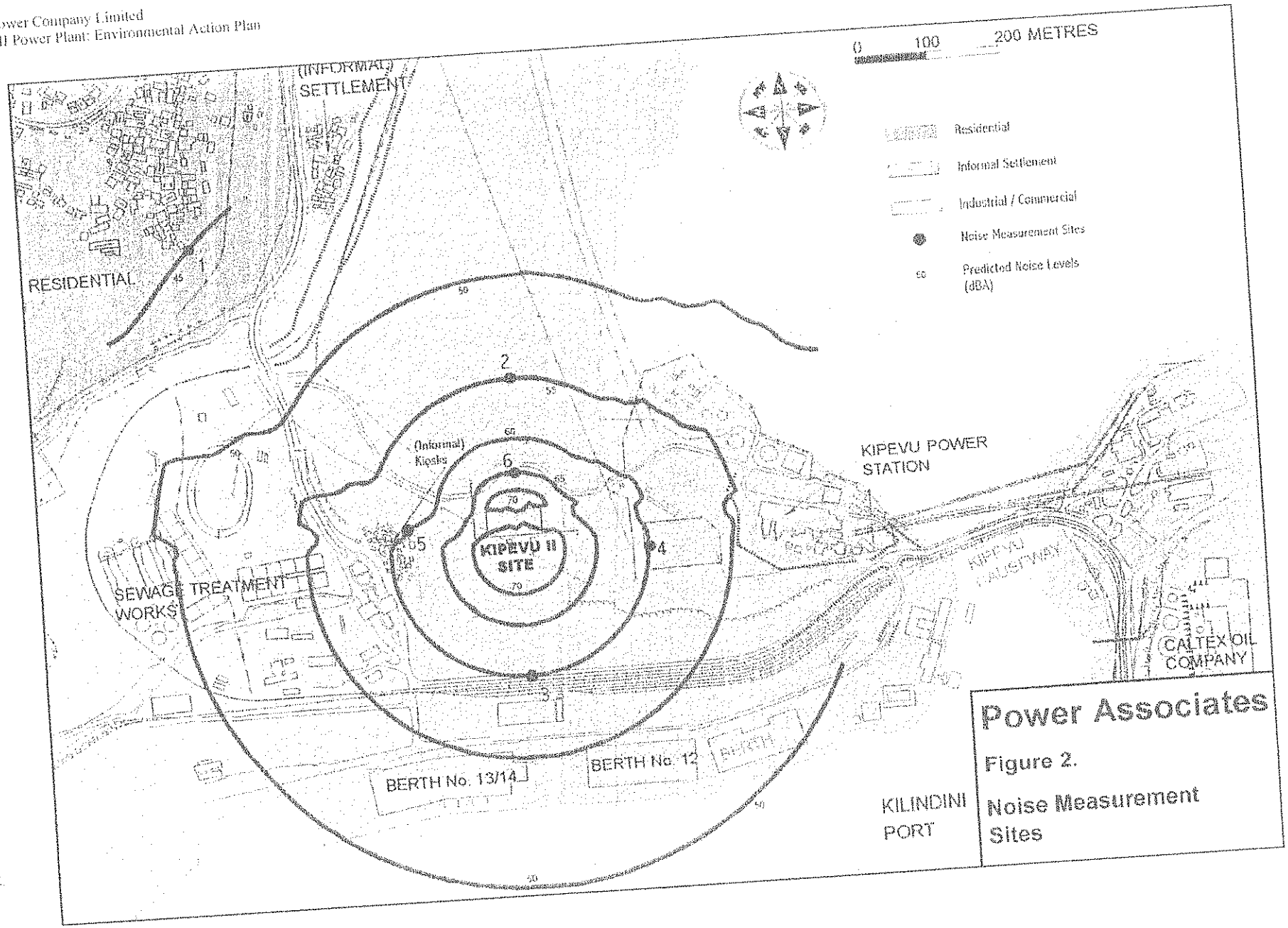

0 100 200 METRES
Residential
Informal Settlement
Industrial / Commercial
Noise Measurement Sites
Predicted Noise Levels (dBA)
(INFORMAL) SETTLEMENT
RESIDENTIAL
KIPEVU POWER STATION
(Informal) Kiosks
KIPEVU II SITE
SEWAGE TREATMENT WORKS
CALTEX OIL COMPANY
BERTH No. 13/14
BERTH No. 12
KILINDINI PORT
Power Associates
Figure 2.
Noise Measurement Sites

Table 7 Construction Impact Mitigation, Monitoring and Management Measures

Issue/Concern	Management Measures	Net Effects	Monitoring
Air Quality Exhaust emissions from haulage vehicles and generator sets and from fugitive dust in the immediate vicinity of the site or haul route.	Implement *good site practices*, including: • maintaining equipment in good running condition • protecting friable material with a barrier, vegetation, or windscreen • covering friable material during transportation • enforcing a 35 km/hr speed limit on dirt roads • suppressing dust on roads using water sprays	Insignificant, short-term, localised effects on air quality, primarily in relation to fugitive dust	Regular checks by TPC to ensure implementation of good site practices by contractors. Maintenance of a public complaints registry.
Noise Excessive noise/disturbance at closest residential or sensitive receptor.	Ensure that all vehicles and construction equipment have properly functioning silencers or mufflers.	Short-term increase in daytime noise in the vicinity of the site. Noise at the closest residential receptor is not expected to be excessive or to exceed World Bank guidelines	Regular checks by TPC to ensure implementation of noise management practices by contractors. Maintain liaison with the public including systematic recording of complaints
Human Sanitary Waste Potential for impairment of surface water quality and spread of disease vectors.	Provide appropriate numbers of toilets and hand-washing stations at the work site. Provide on site treatment of sanitary waste. Train construction employees on sanitation practices	Minimal risk of environmental or human health impacts – World Bank guidelines for effluent quality will be met	Regular checks by TPC to ensure implementation of sanitation requirements. Periodic inspection by TPC of operational status of on-site sewage treatment facilities.
Solid Waste Localised impairment of air quality during burning of solid waste, either on-site or at nearby Makupa waste disposal site. Incremental impacts on water quality and sediments at Makupa disposal site from erosion and leaching of waste.	Implementation of Good Site Practices consisting of: • systematic collection and protected-storage on site • a waste management program consisting of reduction, reuse and recycling of materials • burning of waste as a last resort and only when disposal impractical • only dry, clean-burning material (wood, cardboard, paper, dry vegetable material) to be burned	Minor incremental air quality impacts. Minor incremental impacts on soil, groundwater and surface water at municipal disposal site.	Regular checks by TPC to ensure implementation of waste management practices.
Potentially Contaminating Wastes Release of waste oily liquids and solvents into the environment.	Contractors to recover all liquid wastes (used oil, drained hydraulic fluid, spent solvents, etc.) in sound, labelled containers. Wastes to be stored in weather-protected areas having secondary containment for spills.	Minor risk of soil contamination on-site Minor emission of pollutants from on-site incinerator	Regular checks by TPC to ensure implementation of waste management practices. Regular checks by TPC of waste storage area.
Release of Contaminating Material Environmental contamination from spillage or disposal of fuels, lubricants, oils and solvents on the construction site.	Prohibition on dumping of any contaminating material into the environment, including waste oils Storage and routine handling of fuels, lubricants and other potentially contaminating substances in a weather-	Negligible risk of significant contamination.	Contractors report all spills greater than 5 litres to the TPC site supervisor. TPC will notify the appropriate Kenyan and City of Mombasa agencies of any reportable spills.

Table 7 Construction Impact Mitigation, Monitoring and Management Measures

Issue/Concern	Management Measures	Net Effects	Monitoring
Environmental contamination from spillage of fuels, lubricants or solvents during transportation.	protected area having secondary containment for spills. Implement spill prevention procedures and a spill contingency plan. Have available on site all equipment and materials required to execute a clean-up. All wastes recovered during cleanup operations to be collected and stored in labelled and secure containers for subsequent disposal by on-site high incineration Implement safety program (signage, speed restrictions, lights on trucks, truck load restrictions, equipment inspections (i.e. brakes, horn, etc)) Establish spill response procedure to allow a quick and response to clean up any off-site spills	Negligible risk of significant environmental contamination.	Periodic inspection of vehicle safety equipment. TPC to investigate and report upon all spills associated with the project.
Traffic Community disturbance and potential hazard.	Provide safety training for truck drivers. Contractors to implement safety programme (signs, speed restrictions, lights on trucks, truck load restrictions, equipment inspections (brakes, horn, etc))	Accidents are expected to be infrequent, but cannot be precluded.	TPC to investigate all complaints about unsafe vehicle operation and any accidents.
Occupational Health and Safety Hazards Safety and well being of on-site personnel.	Implement TPC's Health and Safety Plan and require contractors and sub-contractors to comply with the plan and with Kenyan health and safety requirements.	Risks and hazards to workers minimised – World Bank general health and safety guidelines will be met.	Regular checks by TPC to ensure implementation of site safety procedures. TPC to review the monthly site safety reports.
Procurement of Local Labour, Goods and Services Economic benefits to the Mombasa Region.	Contractors will be encouraged to utilise local labour, goods and services. Whenever these are available at competitive quality and price, the contractor will be expected to follow a local procurement policy.	The construction phase of the project will create significant local direct and indirect economic benefits.	Contractors to provide estimates of actual amounts spent on local labour, goods and services.

Table 8 Operation Impact Mitigation, Management and Monitoring Measures

Issue/Concern	Management Measures	Net Effects	Monitoring[1]
Air Quality Increased ground level concentrations of NO_2, SO_2, and particulate matter.	Utilise Wärtsilä engines with advanced combustion control technology. Operate the Plant on 2.5% sulphur HFO rather than the 3.7% maximum sulphur content fuel currently specified by KPLC for its own facilities Promote the use of 2.5% sulphur fuel in all local (Mombasa) power plants by procuring fuel from the Kenya Petroleum Refinery.	Maximum 24-hr average ground level concentrations of NO_2 are predicted to be below the World Bank trigger value of 150 $\mu g/m^3$. Maximum annual average ground level concentrations are predicted to remain within World Bank guidelines. Kipevu II will not increase maximum 24-hour concentrations of SO_2 beyond the World Bank 24-hour trigger value in most of Mombasa. However, on Mombasa Island and in the immediate vicinity of the existing KPLC power station, ambient concentrations may already exceed the trigger value. Kipevu II will have only a minimal impact on air quality in these already polluted areas, on account of height of discharge and prevailing wind direction. Anticipated improvements in the operating economics of the Kenya Petroleum Refinery associated with increased output of HFO, and a planned US$ 100 million upgrade will enable the production of both heavy fuel oil and automotive fuel with lower sulphur contents, thus decreasing atmospheric sulphur loading in Kenya generally.	Monitoring of meteorological conditions and ground level concentrations of NO_2, SO_2 and PM for the lifetime of the project. Monitoring of plant stack emissions.
Noise Noise levels at nearby receptors.	Plant will be in an acoustically insulated powerhouse, and layout directs noise away from Changamwe area. Exhausts and air intakes will be equipped with silencers to reduce the noise level at source by about 35 dB(A).	Increase in sound level at nearest residential locations will be less than the 3 dB(A) indicated by World Bank guidelines	Measure noise levels at Commissioning and annually thereafter.
Site Aesthetics Visibility of the site	Colours and general shape of the plant will be designed to be consistent with the adjacent Kipevu I plant.	Kipevu II, although located on a prominent hill, is compatible with the general urban and industrial nature of the area.	Monitoring not applicable
Sanitary Waste Spread of disease vectors. Odours.	On-site treatment of sewage.	Little or no off-site impact – any sanitary effluent will met World Bank guidelines.	Periodic checks of facility by TPC to ensure continuing proper functioning.

Table 8 Operation Impact Mitigation, Management and Monitoring Measures

Issue/Concern	Management Measures	Net Effects	Monitoring
Solid Waste Air pollution (particulates, gases) from burning solid waste at nearby Makupa waste disposal site. Incremental impacts on water quality and sediments of Makupa Creek from erosion and leaching of waste.	Implementation of Good Site Practices consisting of: • Systematic collection and protected-storage on site • A waste management program consisting of reduction, reuse and recycling of materials.	Minor incremental air quality impacts. Minor incremental impacts on soil, groundwater and surface water at municipal disposal location.	Periodic checks by TPC environmental officer to ensure that on-site waste management procedures are followed.
Potentially Contaminating Wastes Release of sludge, waste oil, hydraulic fluid, paint, solvents, and similar materials into the environment.	Dumping or burial of any potentially contaminating waste product will be strictly prohibited. All oil-contaminated drainage from the power house floor pits; fuel unloading areas; and fuel, lubricating oil and waste oil storage tank areas will flow to a sump from which it will be pumped to an oily water settling tank. Oily-water separating from sludge in the sludge storage tanks will flow to the oily-water settling tank. Water separated from oil in the oily-water settling tank will be pumped to a sludge treatment unit, with the oil residue returned to the sludge tank. The sludge treatment unit will consist of two settling tanks where oil in water emulsions are broken down using a flocculent chemical and a pH adjuster, and two filter tanks where the separated water is passed through carbon. The water released to the environment from the carbon units will meet the World Bank criterion of 10 mg/l of oil and grease for discharge to the environment. De-watered sludge will be sent to an on-site, high-temperature incinerator. Ash will be land-filled at the Makupa landfill site. All other potentially contaminating wastes (used lube oil, drained hydraulic fluid, spent solvents, etc.) will be recovered in sound, properly labelled containers and disposed of by on-site incinerator or other approved manner. Economically viable options to incineration (e.g., re-refining of lubricating oil, solvent recovery), will be used if environmentally acceptable.	Minimal contamination of soil, groundwater and surface water is expected. Discharge water will meet World Bank guidelines	Ongoing program to ensure proper training of personnel who operate systems to treat hydrocarbon wastes. Periodic maintenance and inspection of environmental systems to ensure continuing proper operation. Monitoring of discharged treated water to verify compliance with guidelines.

Table 8 Operation Impact Mitigation, Management and Monitoring Measures

Issue/Concern	Management Measures	Net Effects	Monitoring
Accidental Spills Spills of fuel or other contaminating waste.	Storage areas will be constructed for complete containment of a worst-case spill. Areas where significant oil spillage could occur (e.g., couplings of fuel unloading systems) will be protected by a spill interception structure which drains back to a sump where the spillage can be recovered. TPC will develop a facility-specific "Spill Prevention, Control, and Contingency Plan", outlining plant environmental design features; spill prevention and control procedures; and an oil spill contingency plan. The format of the plan will conform to the generic "Spill Prevention, Control, and Contingency Plan" developed by Wärtsilä NSD for similar facilities world-wide. During mobilisation materials and equipment required to respond to the various types of potential spill incidents will be identified and procured as part of the process of developing the spill contingency plan.	Escape to hydrocarbons or other spilled contaminants into the larger environment is expected to be limited to levels well below those that could cause significant adverse environmental effects. Normal discharge water will meet World Bank guidelines for oils and greases.	Periodic monitoring of water discharged to surface drains to ensure that criteria are being met and that systems are operating as per specifications. Periodic testing and checks of spill response readiness, and emergency response equipment and material.
Traffic Community disturbance and potential hazard.	Provide safety training for truck drivers. Contractors to implement safety programme (signs, speed restrictions, lights on trucks, truck load restrictions, equipment inspections (brakes, horn, etc))	Accidents are expected to be infrequent, but cannot be precluded.	TPC to investigate all complaints about unsafe vehicle operation and any accidents.
Health and Safety Health and well-being of on-site personnel	Implement a comprehensive occupational health and safety program that addresses all aspects of worker health and safety relevant to the operation of a power plant. Develop a facility-specific safety manual based on internationally accepted 'best practice'. Implement medical examinations of all employees to establish the health baseline of new employees at the time of hiring. Regularly reassess each employee's health and physical conditions, including hearing acuity.	Employees who adhere to the occupational health and safety requirements outlined in the manual should be able to work in the power plant for an indefinite period of time without experiencing significant hearing impairment or chronic health problems from exposure to chemical substances. Risk of lost-time accidents minimised. World Bank health and safety guidelines will be met.	The safety officer and safety committee will monitor and report upon health and safety conditions within the plant on an ongoing basis. Ongoing monitoring of employee health and hearing acuity status.
Local Employment Approximately 60 mainly skilled and semi-skilled personnel will be hired to operate and maintain the power plant. Initially, the plant's top management will be expatriates.	Hire competent local persons for top management positions as soon as all routines are in place. Implement training programs to facilitate advancement.	Positive impact on local employment and skill upgrading.	Annual report on work force composition, training and new hires.

Table 8 Operation Impact Mitigation, Management and Monitoring Measures

Issue/Concern	Management Measures	Net Effects	Monitoring[1]
Local Procurement of Goods and Services Participation of the local economy in the development of the power plant.	TPC will follow a policy of preferential local purchase of goods and services whenever they are available at an appropriate level of quality and at competitive prices.	The project by its nature will create positive benefits that will be enhanced by adopting a proactive procurement approach.	A list of local suppliers of goods and services required by the power plant will be developed and updated on an ongoing basis.
Kenya Power Supply Power supply to the national grid.	Maintain plant in good running order	Contribution of 74 MW of reliable power to KPLC.	
Local Benefits Benefits to the community hosting the power plant.	Establishment of an environmental and social projects fund of US$ 50,000 per year to provide monitory resources for issues of concern. Projects might include contributing resources toward initiatives such as schooling or air quality monitoring.	Projects undertaken using fund monies provide benefits to those persons potentially affected by the project	Maintain liaison with the local community leaders for allocation of the fund Provide annual report on allocation of the local benefits fund

Notes: 1. Details of the methodologies for monitoring are provided in Section 6.2 (Monitoring) of the Environmental Assessment Report

Table 9 Environmental, Health and Safety Monitoring Programme

Monitoring Issue	Monitoring Method	Measured Parameter	Frequency of Measurement
Air Emissions:			
SO_x	Stack Emissions	Calculated from sulphur content in Fuel using ISO/CD 8178-1, or principally similar method.	On Commissioning and annually thereafter.
	Fuel Quality	Analysis of sulphur content in Fuel provided by independent analysis under the Fuel Supply Agreement (FSA).	Testing of each fuel shipment received and at least 4 random samples per year
NO_x	Stack Measurements	Measured using EPA Method 7E – Determination of nitrogen oxides from stationary sources. Instrumental analyser method, or principally similar method.	On Commissioning and annually thereafter.
	Engine Operations	Engine fuel injection timing and charge air cooling water temperature.	Recorded continuously by Plant data-loggers.
PM	Stack Measurements	Measured using ISO 9096. Stationary source emissions – Determination of particulate material in gas-carrying ducts. Manual gravimetric method, or similar method.	On Commissioning and annually thereafter.
	Fuel Quality	Analysis of ash content in Fuel provided by independent analysis under the Fuel Supply Agreement (FSA).	Testing of each fuel shipment received and at least 4 random samples per year
Ambient Air Quality:			
SO_2 and NO_2	Continually analysed at agreed location	24 hour and annual averages	For life of project – transfer of monitoring programme to Ministry of Environment
PM	High Volume Sampler at agreed location	24 hr averages	For life of project – transfer of monitoring programme to Ministry of Environment
Climatic Conditions	Automatic meteorological recording station or obtained from Moi Airport	Wind speed and direction, temperature, humidity	For life of project – transfer of monitoring programme to Ministry of Environment
Other Issues:			
Plant Noise	Measuring Plant at 100% full load operation using an integrating noise analyser.	Time averaged measurements at receptors outside the Plant boundary	On Commissioning and annually thereafter.
Social Concerns	Nomination of a Community Liaison Officer for the Plant	Comments from community	As start of construction and as required thereafter.
Occupational Health and Safety	Reporting of accidents, incidents, and safety breaches.	Safety report and statistics	Monthly for life of project – including construction
Water Quality	Automatic continual analysis	• PH	On Commissioning and continually thereafter
	Grab samples of discharge from oily water treatment unit.	• Oil and grease	On Commissioning and quarterly thereafter
	Grab samples taken for laboratory analysis from oily water treatment unit.	• Total suspended solids • Total chromium, copper, iron and zinc	Quarterly for life of project

Table 10 Responsibilities and Duration of Monitoring and Mitigation Activities.

Activity	Estimated Duration and Timing	Monitoring	Mitigation
1. SO_x, NO_x, and PM Emissions	• On commissioning and continually thereafter	EPC Contractor during Commissioning and O&M Operator thereafter	EPC Contractor during Commissioning and O&M Operator thereafter
2. Ambient Air Quality	• For six months prior to start-up, on commissioning, and continuously thereafter	Tsavo Power Company	Tsavo Power Company
3. Noise Emissions	• Prior to start-up, on commissioning and annually thereafter	EPC Contractor during Commissioning and O&M Operator thereafter	EPC Contractor during Commissioning and O&M Operator thereafter
4. Waste Water Emissions	• On commissioning and continually thereafter	EPC Contractor during Commissioning and O&M Operator thereafter	EPC Contractor during Commissioning and O&M Operator thereafter
5. Adoption of Environmental Policy	• At commencement of construction and ongoing thereafter	Tsavo Power Company with EPC Contractor up to Commissioning and with O&M Operator thereafter	N/A
6. Employee Environmental Training	• As part of EPC and O&M mobilisation and as needed thereafter	EPC Contractor and O&M Operator	N/A
7. Assignment of Community Relations Officer	• At start of construction and as needed thereafter.	Tsavo Power Company	N/A
8. Maintenance of Operations Manuals	• As part of O&M mobilisation and as needed thereafter.	O&M Operator	N/A
9. Occupational Health and Safety Monitoring	• At start of construction and ongoing thereafter.	Tsavo Power Company with EPC Contractor up to Commissioning and with O&M Operator thereafter	N/A

Table 11 Predicted Costs and Implementation Schedule for Mitigation and Monitoring.

Activity	Estimated Duration and Timing	Approximate Cost (US$)
1. Assignment of a senior manager responsible for environmental management	• At start of construction, and ongoing for the life of the project.	Included as part of project development and operations costs
2. Preparation of TPC Health and Safety Plan	• Already issued to EPC and O&M contractors and included in contract documents. To be updated as necessary for the life of the project.	Included as part of project development and operations costs
3. Preparation and Implementation of TPC Spill Prevention, Control and Contingency Plan	• At start of O&M mobilisation, and up-dated as necessary for the life of the project.	Included as part of project development and operations costs
4. Preparation and Implementation of TPC Safety Manual	• At start of O&M mobilisation, and up-dated as necessary for the life of the project.	Included as part of project development and operations costs
5. Establishment of Environmental and Social Projects Fund of US$ 50,000 per year.	• At start of O&M mobilisation, and on-going for the life of the project.	$50,000 per year
6. SO_x, NO_x, and PM Emissions Monitoring	• Direct exhaust gas analysis for NOx and PM on commissioning and annually thereafter • Sulphur emission measurements using ISO/CD8178-1 on commissioning and annually thereafter • Fuel quality testing quarterly and for each new batch • Continuous engine efficiency monitoring	$20,000 per year
7. Ambient Air Quality Monitoring	• For a period of six months prior to start-up, on commissioning and then ongoing for the life of the project	$75,000 start up $50,000 per year
8. Noise Monitoring	• Prior to plant start-up, on commissioning and annually thereafter for the life of the project	$15,000 start up $5,000 per year
9. Waste Water Monitoring	• At plant start-up and ongoing thereafter for the life of the project	$5,000 per year
10. Adoption of Environmental Policy	• At start of construction and then ongoing for the life of the project	Included as part of project development and operations costs
11. Employee Environmental Training	• As part of O&M mobilisation and ongoing as needed	Included as part of training costs
12. Assignment of Community Relations Officer	• At start of construction, as part of O&M mobilisation, and ongoing as needed	Included as part of project development and operations costs

13. Modification of Operations Manual	• As part of O&M mobilisation and as necessary thereafter	Included in O&M contract costs
14. Occupational Health and Safety Monitoring	• On start of construction and ongoing thereafter for the life of the project	Included as part of construction and operations contracts
Total Estimated Costs		**$90,000 start-up** **$80,000 per year**