

**CONTOURGLOBAL**



# **Environmental and Social Impact Assessment of a Dual Fuel 100 MW Power Plant in Lomé, Togo**

**Exhibit 6: Environmental Management Plan**

May 2009

## **Environmental and Social Impact Assessment of Proposed Installation of a Dual Fuel 100 MW Power Plant in Lomé, Togo**

### **Exhibit 6: Environmental Management Plan**

**May 2009**

Project Number: GMS 0050285

In the name of ERM

Approved by:

Position: \_\_\_\_\_

Date: \_\_\_\_\_

This report was prepared by ERM France with all reasonable skill, care and diligence, within the framework of the terms and conditions applicable to this project, and taking into account the resources dedicated to the project by the client.

We decline all responsibility toward the client and any third parties concerning questions that are not related to this study.

This report is confidential. We cannot accept responsibility of any form to third parties with whom the client or other parties may share the contents of this report in part or in whole. Any third parties drawing conclusions from this report do so at their own risk.

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## 7.1

## INTRODUCTION

This **Environmental Management Plan (EMP)** for the ContourGlobal dual fuel 100 MW power plant in Lomé provides the management framework needed for planning and implementation of activities during both the construction and operational phases in accordance with environmental commitments, in compliance with legal and regulatory requirements of Togo and the IFC Environmental, Health and Safety Guidelines. Issues addressed in the ESIA include:

- Air emissions
- Impacts on surface water and groundwater
- Impacts on terrestrial and marine flora and fauna and their habitat
- Land use
- Socioeconomic impacts

The **objective** of the EMP is to describe the measures and actions to be implemented during the design, construction and operation of the project to eliminate or reduce key identified biophysical, socioeconomic and health issues and impacts to acceptable levels. Adherence to the EMP will reduce the risk of adverse impact of construction on sensitive environmental receptors and minimise social impacts, especially with respect to disturbance of local residents. Project participants are committed to implementing this plan and to devoting to the implementation of the plan whatever resources may be required to achieve this objective.

The EMP addresses the need for environmental safeguards during the construction and operational phases of the project, and facilitates the adoption of environmentally sensitive workplace practices with respect to the above issues. The EMP further addresses:

- Management of hazardous materials during the construction and operational phases of the project
- Waste management requirements for both hazardous and non-hazardous wastes that will be generated during the construction and operational phases of the project
- Occupational health and safety (OHS)

The EMP concerns both general environmental requirements that are common to most construction projects, and specific environmental initiatives unique to this specific project.

The Environmental Action Plan (EAP) includes measures that shall be implemented during both the construction and operational phases of this project. They include:

- Investments in equipment and other infrastructure
- Development of required procedures
- Capacity strengthening

- Additional research or evaluation

The EMP forms part of the overall Project Management for this investment, and as such activities described are required to be integrated with other Quality, Sustainability and Health & Safety (H&S) management processes.

We note that OPIC requires an Occupational Health and Safety Plan (OHSP) that fully complies with the IFC General Guidelines, including but not limited to training, standard operating procedures to ensure safety, testing of fire alarms, the use of personal protective equipment and emergency response measures. We make reference to the following three documents:

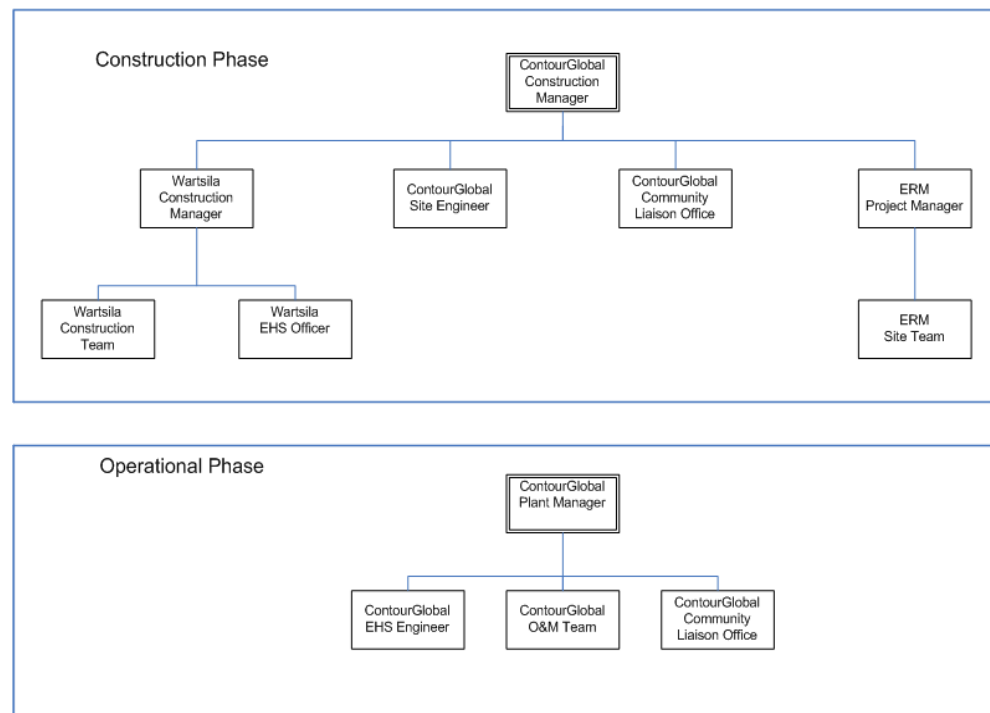
- The Wartsila “HSE Guidelines for Construction and Installation Work” concerning power plant construction;
- The ERM HSE guidelines for the soil remediation activities; and
- The ContourGlobal Health & Safety Policy.

The overall site OHSP shall be the responsibility of CG Togo, to which all contractors shall adhere when onsite.

## 7.2 ROLES AND RESPONSIBILITIES

Members of the Project Team will be assigned specific roles as shown in **Figure 7.1** and will be responsible for the correct application of the EMP.

Figure 7.1: Roles and Responsibilities



Specific roles of key team members are described below.

### 7.2.1 *ContourGlobal Construction Manager*

The ContourGlobal **Construction Manager** will have the responsibility for managing the project throughout the construction period and will ensure that appropriate resources are made available for application of the EMP, and environmental control and any agreed appropriate protection measures are implemented.

### 7.2.2 *Environmental, Health & Safety Responsibilities*

The **Environmental, Health & Safety responsibilities** during Construction will be managed on behalf of ContourGlobal's Construction Manager and during operation period by the appointed Environmental, Health & Safety Engineer for coordinating and managing all environmental activities during the construction and operation phases. The Environmental/Health & Safety responsibilities include:

- Ensure that the Contractor develops, and then reviews, the EMP and specialist procedures and method statements.
- Ensure delivery of environmental training to personnel within the project team.
- Review method statements for environmental aspects and advise of any suggested improvements prior to work starting.
- Monitor construction activities and performance to ensure that appropriate environmental control measures are being implemented and are effective and ensure compliance with the EMP.
- Liaison with Contractor's environment coordinator to ensure coordination of environmental mitigation and monitoring procedures.
- Dissemination of instructions to all relevant personnel on site to ensure "low ES&E impacts".
- Compliance with the instructions relative to the environment and the life space that the companies shall respect.
- Verification of the implementation of mitigating measures during the work site in collaboration with the public works contractors.
- The contacts between the owner and the associations, the public and the socio/professional groups, to resolve complaints and conflicts induced by the nuisance and bother caused by the different site works. An operational cell will be functional throughout the construction works.
- The organization and implementation of monitoring during the site works and the subsequent operation of the structures.

### 7.2.3 *ContourGlobal Community Liaison Officer*

The ContourGlobal **Community Liaison Officer** shall be responsible for:

- Implementing of the public consultation and disclosure process during the development and finalization of the ESIA/EMP;
- Overseeing development and implementation of the grievance mechanism;
- Liaising with ContourGlobal site staff regarding implementation of any measures arising from the grievance mechanism;

- Ensuring that the public is regularly informed with respect to site activities, including any events with possible negative social impacts.

#### 7.2.4 *Contractor's Environmental, Health & Safety Officer*

The **Wärtsilä Environmental, Health & Safety Officer** is responsible for coordinating and managing all the environmental activities during the construction phase, reporting to the ContourGlobal Construction Manager. The Contractor's Environmental Officer will provide a full time presence on site throughout the construction period. His/her responsibilities shall minimally include:

- Liaison with the Employer's Construction Manager.
- Follow the development of the EMP.
- Monitor construction activities and performance to ensure that appropriate environmental control measures are being implemented and are effective and ensure compliance with the EMP.
- Assistance in the development and delivery of environmental training for personnel of the Contractor and Sub-contractors.
- Management of the environmental monitoring programme, including noise, vibration and dust and review the routine reports.
- Dissemination of instructions to all relevant personnel on site to ensure "low ES&E impacts".
- Implementation, operation and monitoring of the project Site Waste Management Plan
- Environmental audit of Sub-contractors and suppliers.

#### 7.3 *REQUIRED RESOURCES*

Resources for implementing the EMP are largely related to employment of staff. Specific additional expenditures are reported in **Table 7.3**. The costs of public consultation and public relations will be determined once the EMP management staff has been appointed.

#### 7.4 *REPORTING*

Togolese law provides that the preparation of the EMP is the developer's responsibility. The developer is required to transmit periodic reports concerning the preparation of the environment management plan to the Environment Ministry. The frequency of the reports is presented in **Table 7.3** and will be confirmed by ministerial decree specifying the requirements for obtaining the environmental conformity certificate.

#### 7.5 *MITIGATION AND OFFSETTING MEASURES DURING THE CONSTRUCTION PHASE*

Possible environmental impacts due to construction activities (excavation, remediation activities, concrete pouring, road construction, enlargement and redevelopment of the site) that require offsetting measures are summarized in **Table 7.3**. ContourGlobal shall be responsible for implementing these measures.

Impacts due to construction are not specifically covered by the Environmental Code or by the standards or laws in force. They are dealt with in a general manner in various sections covering air and water pollution and noise annoyances.

#### 7.5.1 *Soil pollution – Proposed remediation works*

Certain areas of the site can be considered to be polluted, principally by hydrocarbons.

Although ContourGlobal is not the responsible party with respect to the highlighted soil and groundwater impacts (the origin of which predates ContourGlobal's activities), it proposes the implementation of the following management measures:

- Impacted soil identified during the ground investigations and requiring excavation for the construction of the structures of the power station will be separated from clean soil and stored in a containment cell.
- Installation of monitoring wells allowing regular groundwater monitoring (twice a year).

#### 7.5.2 *Site development*

The equipment will be installed on an undeveloped part of the CTL property. No relocation or permanent modification of the perimeter of the site is anticipated.

The remediation and construction work may however temporarily require significant areas for the storage of materials, the storage of soil... As a result, ContourGlobal may consider increasing the area of the site and to extend into public land located to the south and the west of the site. This would certainly be undertaken through dialogue with the authorities and the local population. Supporting measures for the market-gardeners would also be foreseen by ContourGlobal. In particular, communication as far in advance as possible will be designed to minimise the impact on the crops and the incomes of the market-gardeners.

The IFC EHS General Guidelines (2007), under Section 4 (Construction and Decommissioning), sub-section 4.1 (Environment) state: "Soil erosion may be caused by exposure of soil surfaces to rain and wind during site clearing, earth moving, and excavation activities. The mobilization and transport of soil particles may, in turn, result in sedimentation of surface drainage networks, which may result in impacts to the quality of natural water systems and ultimately the biological systems that use these waters." Various measures are cited for preventing soil erosion and consequent runoff:

- Reducing or preventing erosion through scheduling to avoid heavy rainfall periods (that is, during the dry season) to the extent practical, contouring and minimizing length and steepness of slopes, etc.;
- Reducing or preventing off-site sediment transport through use of settlement ponds, silt fences, and water treatment, and modifying or suspending activities during extreme rainfall and high winds to the extent practical;
- Segregating or diverting clean water runoff;
- Limiting access road gradients to reduce runoff-induced erosion and providing adequate road drainage based on road width, surface material, compaction, and maintenance;
- Limiting disturbance to water bodies; and



- Providing effective short term measures for slope stabilization, sediment control and subsidence control until long term measures for the operational phase can be implemented, as well as adequate drainage systems to minimize and control infiltration.

The project site (covering a little over 6 ha) is a few meters above sea level. The sea is about 700 m to the south. Currently rainwater drains naturally from north to south, with some diversion from east to west due to previous shaping and infrastructure at and around the site. May through June constitutes the beginning of the rainy season, with a brief respite in July, and heavy rains following through December, which is typically the beginning of the dry season. Recent years have seen some modification of the historic timing of the rainy seasons in Togo.

Construction activities in May and June will inevitably occur during some rain. However, according to Wärtsilä, only one-third of required excavation will be carried out prior to the dry season. Shaping of the land will occur in December 2009 and afterward, during the dry season. We understand from Wärtsilä that removed soil will be stored for no longer than one week, and then mixed with cement before being replaced. Contaminated soil will be placed into a covered temporary storage area to be constructed by Wärtsilä, prior to being integrated into the permanent containment cell to be constructed by ERM. Erosion and contaminated runoff are therefore expected to be minimal.

Nonetheless, the following measures specifically related to our understanding of the site, expected precipitation patterns and construction activities are proposed, in line with IFC EHS guidelines:

- Limit excavation during the dry season to shallow soil removal.
- Replace soil as quickly as possible.
- Cover soil mounds where possible and as required to limit erosion/runoff.
- Halt soil excavation activities during heavy rain.
- Maintain a low profile of removed soil with respect to rainfall.
- Identify any problematic parts of the site with respect to possible erosion that would be expedited by construction activities.
- Incorporate required measures into the construction contractor HS&E plan, and inform relevant workers of requirements.

### 7.5.3

#### *Air Quality*

This section presents the offsetting measures to be implemented to minimize the impacts of the construction on ambient air quality.

The agricultural areas are within a radius of 100 meters from the source of dust emissions. Therefore, good construction site practices shall be implemented to diminish these impacts:

- Tarpaulin trucks transporting loose/friable materials on and offsite site. Minimize the amount of materials lost during transportation.
- Limit speed to 30 kilometres per hour on unpaved roads.
- Maintain and store piles of loose/friable materials and soil (contaminated or not) in a manner that minimizes dust dispersion.
- Spray water on the site to allow suspended solid particles to settle. During periods of high winds, limit construction activities that generate a great deal

of dust in areas where sensitive receptors are located.

#### 7.5.4 *Protection of water resources*

Water will be used during construction for sanitary purposes, washing equipment and to spray the site down to reduce dust emissions.

In principle only city (municipal) water supply will be used (this will be the case during the operational phase as well). We understand that the site is already connected to the City of Lomé water supply system.

Expected water use during the construction phase is as follows:

- 45 m<sup>3</sup>/day during large concrete pours (for example for stack and engine foundations); and
- 20 to 25 m<sup>3</sup>/day average construction consumption (2 to 3 m<sup>3</sup>/day minimum construction consumption).

As noted earlier, groundwater at the site has been sampled, and analytical results indicate no elevated concentrations of the constituents analyzed, other than in localised areas. No large-scale use of groundwater has been identified in the site area. A few agricultural wells are located south and west of the site and used for small-scale irrigation. Given this and the permeable nature of the shallow sand deposits, it would be unlikely that the water supply requirements of the construction and operational phases would significantly deplete water resources in the site area. Nonetheless, should ContourGlobal find that the city water supply is inadequate for one or more uses (process water, potable water, etc.) either due to insufficient quality or volume, a more detailed study would need to be implemented concerning the sustainable extraction of site groundwater versus site needs, prior to any attempt to extract groundwater. Every means to conserve water shall be taken, regardless of the source.

To the extent that a backup water supply required, Wärtsilä will complete an impact analysis as required by OPIC with respect to the possible use of groundwater.

Water shall be treated before being discharged into the natural environment:

- Potentially polluted water shall be treated in the oily water treatment unit before being discharged into the natural environment,
- Sanitary water (showers, toilets) will be treated in septic tanks before being sent to the biological treatment unit then discharged into the natural environment,
- Rain water will be discharged into the natural environment; the risk zones (storage of products) will be equipped with secondary containment to prevent discharge of polluted water into the natural environment.

Chemical substances and the generators shall be equipped with secondary containment to avoid any risk of accidental spills. Waste, in particular waste oils, shall be disposed of by specialized companies. Any leaks of oils or fuels shall be cleaned (absorbents) and recovered.

The majority of the foundations will not reach 1.5m. Drainage of groundwater will be undertaken for the deeper foundations required for chimneys, (groundwater is present at 1.8m). Analyses of pumped water (hydrocarbons, metals and sulphates if

necessary) will be carried out before discharge to ensure that the natural environment is not polluted and to ensure that pollution is not transferred into an unpolluted zone.

During all stages of this project, as per clause 6.10(f) of the CTA, ContourGlobal shall ensure that all liquid effluents, including process wastewater, domestic sewage, and contaminated stormwater and runoff, shall meet the World Bank maximum limits before being discharged (see Section 7.7.4).

Monitoring of wastewater streams shall comply with Section 1.3 of the IFC General EHS Guidelines of 30 April 2007. The General EHS Guidelines do not specify frequency, but require that wastewater monitoring “take into consideration the discharge characteristics from the process over time.” As the discharges involved (other than stormwater) are not expected to vary considerably over time, we expect that occasional grab samples will be adequate. Composite samples would be more appropriate for stormwater and runoff, which are not expected to contain short-lived polluting parameters. Quarterly samples of process wastewater, wastewater treatment unit discharge (including process wastewater and domestic sewage) should be adequate. Composite stormwater and runoff samples would normally only be required during the rainy season, on a quarterly basis, depending on the level of precipitation.

As per the General EHS Guidelines, process discharge cannot be diluted prior to or after treatment. Sampling and analysis will be implemented by trained persons. Laboratories shall have international-level certification. Sampling and Analysis Quality Assurance/Quality Control (QA/QC) will be established and implemented.

Section 1.4 of the IFC General EHS Guidelines calls for implementation of water conservation programs “commensurate with the magnitude and cost of water use.” Water conservation measures may include:

- Water monitoring/management techniques;
- Process and cooling/heating water recycling, reuse and other techniques; and
- Sanitary water conservation techniques.

During the construction phase, ContourGlobal will ensure that water is used sparingly in accordance with international standards. This task will be coordinated with the soil erosion and runoff management described earlier. Further details on water conservation are provided in Section 7.7.4.

#### **7.5.5      *Reduction of noise pollution***

Noise levels from the construction site shall be verified at the property boundaries. If noise levels exceed the threshold of 70 dB(A), it is recommended that mitigation measures be implemented to reduce noise pollution to the minimum acceptable level.

Noise associated with construction can be reduced by placing effective silencers on the exhaust pipes of construction machinery, by ensuring that equipment is maintained in good condition, by using the quietest equipment possible, by placing equipment as far as possible from the most sensitive receptors and by using the buildings onsite as screens.

Work will be carried out during daylight hours, six days a week, excluding public holidays. To limit noise levels, daylight hours will also be prioritised for vehicle movements.

#### 7.5.6 *Waste management*

During the works, the subcontractor will be responsible for the following tasks:

- A site visit will be carried out by the subcontractor prior to commencing works,
- The subcontractor shall ensure that all (construction) wastes are recovered and treated in conformity with requirements of the World Bank and French regulations, and any complementary ContourGlobal requirements,
- The subcontractor shall ensure that wastes will be accepted by specialist companies,
- Burning of waste will be forbidden.

Furthermore, the recycling and the re-use of waste will be favoured, only inert waste (excavated soil) will be stored on site, no waste will be discharged into sewers.

#### 7.5.7 *Relations with the local population*

A grievance mechanism, tied in with a public information process, is essential for the success of this project. A well-functioning grievance mechanism:<sup>1</sup>

- Provides a predictable, transparent, and credible process to all parties, resulting in outcomes that are seen as fair, effective, and lasting;
- Builds trust as an integral component of broader community relations activities;
- Enables more systematic identification of emerging issues and trends, facilitating corrective action and pre-emptive engagement.

As per the IFC, the grievance mechanism will benefit the company, in that it:

- Serves as an early warning system for wider problems;
- Yields insights from individual grievances that spotlight changes that might be needed with respect to company operations or management systems; and
- Indicates possible systemic changes that might be needed to ensure that particular grievances do not recur.

The IFC view that stakeholders from the community and company shall be involved in the grievance mechanism design is supported.

The key features of the grievance programme will be as follows:

- Central point for coordination
- Well known multiple access points.
- Mechanism for reporting back to the community.
- Grievance log to monitor cases and improve the organization

(1) <sup>1</sup> The Office of the Compliance Advisor/Ombudsman, International Finance Corporation.

- Mechanism for evaluating and improving the system

As noted earlier, ContourGlobal will appoint a **Community Liaison Officer** (a part-time appointment) to oversee public consultation, including diffusion of project information and handling grievances (as required by IFC Performance Standards). This will be completed with the full cooperation of Wärtsilä.

The public will be advised of the Community Liaison Officer and contact information (primarily by telephone, letter and e-mail). Monthly meetings are to be held in the nearest residential area to the project site to discuss project progress, and hear any particular grievances that local residents may have. Grievances shall also be accepted from workers at the site.

ContourGlobal has already identified a Community liaison Officer (Raphael Dos Santos) with respect to the construction and operational stages of this project. ContourGlobal will identify promoters within the community. Once community promoters have been identified, the team will reach out to the community to design the communication and grievance mechanism. Team will be tasked with characterizing existing community systems for handling grievances and locate local dispute resolution capacity, and evaluating local factors that work for or against different types of grievance mechanisms, inside and outside the company.

The mechanism could include:

- Provision for communication of grievances to ContourGlobal via letters, internet, a logbook to be left at the site entrance, and/or periodic meetings where grievances can be raised.
- Provision for communicating to the public an update of project activities and actions taken in response to grievances, for example via the meetings cited above, as well as advertisements in local newspapers.

Specific measures to mitigate the negative socioeconomic impacts during the construction phase are set out in **Table 7.3**. ContourGlobal shall take preventive measures to ensure that the installation does not:

- Create disturbances for the farmers: dust emissions and noise from the construction site be reduced to minimize disturbing persons who work in the agricultural areas, the site will be sprayed down if necessary and noise measurements taken;
- Cause traffic jams: national highway RN 2 links the port and the industrial area and is suited for the transportation of goods by truck. However, traffic flow will be controlled to avoid creating traffic jams. Road safety will be taken into consideration (speed limits, choice of carriers, training of drivers, etc.).

This plan shall apply to both the construction and operational phases.

#### 7.5.8

##### *Influx of construction workers*

ContourGlobal, ERM and Wärtsilä will have limited numbers of Expatriates and other professional staff at the site during different periods of this project. ContourGlobal plans to recruit about 42 operating personnel at the site, at various skill levels. The ERM sub-contractor will have limited numbers of Togolese personnel at the site during remediation activities due to the specialist skills and training required for these works.

We understand that the Wärtsilä sub-contracted construction crew will result in the largest influx of workers to the site. Although at the beginning of construction Wärtsilä does not expect more than 10 to 40 workers at the site, peak construction activities will introduce 300 to 400 (or more) manual labourers at the site. Wärtsilä cannot say at present how these workers will arrive at the site, but a workers camp will not be established, and there is no accommodation in the surrounding area. Wärtsilä expects that most of the manual labourers have residence in Lomé, a city of over 800,000 people (with a significant labour force compared to project needs) that is only a few kilometres away from the project site.

As no local infrastructure exists nor will be established for accommodating these workers, most of whom we expect will have residence in or near Lomé, we do not believe additional measures are necessary, other than normal construction site sanitary facilities and assurance of adequate transportation to and from the site. The contractor will provide portable toilets, and will build shelters for dining, but will not provide a canteen. Wärtsilä has confirmed that the local practice is for the workers to buy their food from local vendors (“mamas”) or bring a lunch box. Adequate waste management will be implemented, including regular pickup of municipal solid waste. A subcontractor will be responsible for providing portable toilets, and for removing food, paper, plastics and other municipal-type waste, as well as construction waste.

We understand from Wärtsilä that the Wärtsilä sub-contractor does not expect to provide buses for transporting Togolese workers to the site. Workers will arrive by ‘moped’ taxis, minibuses and their own mopeds. The contractor will arrange some transportation with their own cars, as required. “Moped taxis” are the usual way of transportation on the region. Nevertheless, as the area surrounding the site is not a residential zone, we expect very little negative impact by transportation of workers to and from the site on local traffic patterns. ContourGlobal will ensure that transportation of workers to the site will be closely followed, and that any necessary measures for reducing any impacts of this transportation (mainly noise, increased probability of accidents with local residents, air emissions) will be acted upon right away.

## **7.6** *MITIGATION & OFFSETTING MEASURES DURING POWER PLANT OPERATION*

### **7.6.1** *Air quality*

#### *Operation*

During the combustion of heavy fuel (with 1% to 1.5% sulphur and 0.03% ash) or domestic fuel, the emissions from the future electricity plant will conform to limits provided by the World Bank, both for concentrations at the chimney discharge and concentrations at surface.

When gas is available, the power plant will run on natural gas, and its emissions will, therefore, be well below limits provided by the World Bank.

It is important to reiterate that the maximum concentrations per hour (or per 24 hour period) represent estimated concentrations during times of day when meteorological conditions (for dispersion) are the least favourable for the dispersion of the plume.

The principal offsetting measure applied to reduce sulphur concentrations are changes in the height of the chimneys (chimneys of 38m height are planned).

Whilst the proposed oil sludge incinerator falls beneath the 3MW threshold set out by the IFC/WB above which a separate assessment is required, ContourGlobal are obliged to ensure that emissions from the facility as a whole do not result in any air quality standards being exceeded. Dispersion modelling was, therefore, undertaken to assess the potential impacts on air quality arising from the operation of the oil sludge incinerator.

The assessment was undertaken for both the predicted impacts arising from the incinerator alone, and the predicted cumulative impacts to air quality arising from the operations of the facility including both the power plant and the incinerator.

It was necessary to make a number of assumptions throughout the assessment. Where made, in the main, these assumptions represent the worst case:

- The predicted cumulative impacts of the emissions from the plant were calculated based upon separate modelling of the incinerator and electricity generation plant. As a consequence of this methodology, it is possible that impacts have been overestimated as in reality the maximum impacts are likely to occur at different times due to differences in dispersion characteristics.
- The incinerator has been modelled on the basis of combusting 3 tonnes of oil sludge per day. However, during normal operations it is unlikely that more than 0.9 tonnes/day will be processed. This will have a major impact upon the predicted impacts of emissions from the incinerator, particularly in terms of annual mean concentrations which will be reduced by approximately 70%.
- The operation of the power plant on HFO is an interim operating scenario. During normal, planned operations, the electricity generating plant will operate on natural gas. In this case the incinerator will not be required as no oil sludge will be generated (sludge is only generated during periods when heavy fuel oil is utilised i.e. when gas delivery is disrupted). On this basis, the impacts, particularly when averaged annually, are overestimated as the incinerator will in reality only be operating for a small percentage of the year.
- There are a number of assumptions made when calculating the allowable fuel metal content, which include assuming that all metals are released to air rather than remain within residual ash, assuming that the centrifuge process does not concentrate metals in the sludge fraction, assuming that baseline levels of metals are negligible, and assuming that metals remain chemically unchanged during combustion.

The assessment identified that the cumulative impacts arising during the operation of the electricity generation plant and incinerator are unlikely to result in any air quality objectives being exceeded.

#### *Management and verification plan*

The air quality assessment will be updated based on the definitive engineering plans.

When construction is finished, samples of gas emissions will be collected in order to precisely study emission levels, exit velocity and temperature. This should provide indications regarding the validity of the assumptions made for this assessment and

will guarantee the site's ongoing compliance. Once a year, ContourGlobal shall measure the following emissions (NO<sub>x</sub>, SO<sub>2</sub>, CO, COV, TSP, heavy metals), as well as the parameters of the smoke plume (temperature, emission velocity, oxygen and humidity) to ensure combustion efficiency. Measurements of NO<sub>x</sub>, SO<sub>x</sub> and dust in the ambient air beyond the limits of property will also be carried out annually. These measurements will have to be carried out during periods of low wind speed (most penalising conditions) and at minimum points placed within agricultural zones to the south and the west, at northern limit of the site and within the district of Kagomé. However, this last point will be strongly influenced by industries around the site and non-compliance with legal limit values could not be attributed solely to the power station.

The annual verifications of NO<sub>x</sub>, SO<sub>x</sub> and CO emissions will be sent to the Environment Ministry.

#### *Ambient air quality monitoring*

The ambient air quality management plan will be undertaken based upon World Bank guidelines<sup>2, 3</sup>; these broadly specify the following, in line with which the following methodology has been developed:

- The monitored pollutants will have due consideration of the relevant emissions from the plant;
- Monitoring techniques shall be internationally recognized, and be compliant with ISO, European or USEPA standards; and
- Monitoring may be undertaken at the facility fence line or at off-site locations, but will be based upon the results of scientific methods (that is, dispersion modelling).

In addition, the monitoring methodology has been developed with due consideration of local circumstances, skills and cost effectiveness.

The monitoring will be undertaken using the following methodology.

#### *Analysis of NO<sub>2</sub> and SO<sub>2</sub> by diffusion tube*

The monitoring program will define determination of ambient levels of NO<sub>2</sub> (the monitoring will focus on NO<sub>2</sub> rather than total NO<sub>x</sub>, as the air quality standards refer to NO<sub>2</sub>), SO<sub>2</sub> and PM<sub>10</sub>, as these are the main pollutants of interest associated with the operation of the plant. Of these, NO<sub>2</sub> is the priority as this is the only pollutant that will be emitted in significant quantities when the plant is operating on all fuel types (ie SO<sub>2</sub> and PM<sub>10</sub> are only emitted when the plant operates on Light and Heavy Fuel Oil).

Ambient levels of NO<sub>2</sub> and SO<sub>2</sub> will be monitored at six locations in the vicinity of the plant on a monthly schedule, using diffusion tubes. The monitoring of NO<sub>2</sub> and SO<sub>2</sub> by

(1) <sup>2</sup> IFC (April 30<sup>th</sup> 2007) Environmental Health and Safety Guidelines, Air Emissions and Ambient Air Quality

(2) <sup>3</sup> IFC (December 19<sup>th</sup> 2008) Environmental Health and Safety Guidelines for Thermal Power Plants



diffusion tube is specified in the European Standard EN 13528 Parts 1-3 : 2002/3; typically the limit of detection achievable with NO<sub>2</sub> diffusion tubes is <1µg/m<sup>3</sup>, and for SO<sub>2</sub> the limit of detection is <4µg/m<sup>3</sup>. These limits of detection are well within the annual mean air quality standards for NO<sub>2</sub> of 100µg/m<sup>3</sup> and for SO<sub>2</sub> of 80µg/m<sup>3</sup>, respectively.

Diffusion tubes are an ideal technology for this situation, as they are low technology and do not require any specialist technical expertise which is potentially not available locally in Togo. The diffusion tubes would be changed on a monthly basis, following a schedule of four and five week periods. Supply and analysis of the tubes would be undertaken by a suitably accredited laboratory, either in Togo or abroad depending on the availability of local services.

#### *Monitoring of PM<sub>10</sub> and PM<sub>2.5</sub>*

IFC guidelines specify that the monitoring shall be capable of monitoring PM<sub>10</sub> and PM<sub>2.5</sub>. This methodology satisfies that requirement. PM<sub>10</sub> and PM<sub>2.5</sub> would be monitored on a continuous basis using a Topas optical device. The monitoring of PM<sub>10</sub> and PM<sub>2.5</sub> by optical methods is not directly specified in a European, USEPA or British Standard. However, the technology has been independently verified to be equivalent to the TEOM (Tapered Element Oscillating Microbalance), which complies with BS EN 12341:1999. Typically the limit of detection achievable with this type of monitor is 0.01µg/m<sup>3</sup> which is well within the annual mean air quality standard for PM<sub>10</sub> of 50µg/m<sup>3</sup>.

The monitoring of PM<sub>10</sub> and PM<sub>2.5</sub> would be undertaken on a continuous basis, with the monitoring being set up to allow comparison with both the annual and 24 hour air quality standards. Three-monthly servicing would be undertaken by site personnel, and annual calibration of the equipment would be undertaken by the equipment suppliers.

#### **7.6.2 Greenhouse gases**

##### ***Refrigeration equipment***

The current project no longer includes the use of refrigeration units.

##### ***Fuel used***

Over the last 100 years, the average temperatures at the earth's surface have increased by approximately 0.6°C, a phenomenon generally attributed to increases in the greenhouse effect<sup>(1)</sup>. The greenhouse effect is caused by the accumulation of greenhouse gases in the upper atmosphere, which increases the planet's insulation and therefore increases temperatures at the earth's surface. Although numerous other gases are involved, including nitrous oxides (NO<sub>x</sub>) and methane (CH<sub>4</sub>), the "key" gas in producing the greenhouse effect is carbon dioxide (CO<sub>2</sub>), which is generated, in particular, by burning fossil fuels.

The quantities of CO<sub>2</sub> emitted depend on the type of fossil fuel burned. The Lomé power plant will function initially with heavy fuel, then using natural gas when this is available.

When the installation is functioning using gas, CO<sub>2</sub> emissions per unit of energy produced will be much lower than for other fossil fuels (**Table 7.1**). Therefore, proportionately the facility will make a much lower contribution to the greenhouse effect.

Table 7.1 : CO<sub>2</sub> emissions factors for the burning of various types of fuel (based on net calorific value)<sup>(4)</sup>

Type of fuel	Emissions factor (kg CO <sub>2</sub> /GJ)
Wood peat	105.89
Brown coal	101.12
Anthracite	98.30
Sub-bituminous coal	96.00
Bituminous coal	94.53
Heavy fuel oil	77.30
Domestic fuel oil	74.01
Diesel fuel	74.01
Gasoline	69.25
<b>Natural gas</b>	<b>56.06</b>

The CO<sub>2</sub> emissions from the plant will be calculated on an annual basis, based upon the recorded use of each fuel type throughout the year, and using the factors provided in **Table 7.1**. Where required, the fuel use in kilograms can be translated into Giga-Joules for use with the above table.

### 7.6.3 Health risks: Legionnaires disease

The current project no longer includes the use of water cooling towers.

### 7.6.4 Protection of water resources

#### Operation

Connection to the public network is envisaged. Based on information currently available, water consumption shall not exceed 1 m<sup>3</sup>/h. In order to protect water resources, closed loop cooling circuits are planned. Only addition of water is necessary. Connection with the public network will be provided with a non-return device to prevent backflow of potentially polluted water towards the public network.

To maintain the quality of surface water and groundwater, all water shall be appropriately treated before any discharge into the natural environment. To summarise, the various waste water streams generated will be treated as follows:

- Water derived from the water treatment station, which, a priori, will not be polluted, will not undergo any treatment before discharge. ERM recommends undertaking analysis of this water to evaluate its pollution load and to ensure that discharge levels imposed by the World Bank are respected. This discharge has been evaluated at approximately 0.4 m<sup>3</sup>/h,
- The water collected from the potentially polluted zones will be treated at the oily water treatment unit, then at the biological treatment unit before being discharged. This discharge has been estimated at 0.29 m<sup>3</sup>/h.

(1) <sup>4</sup> "The Greenhouse Gas Protocol: a corporate accounting and reporting standard. WRI/WBCSD. 2001"

- Workshop “drips” will be stored in a pit before being treated as waste.
- Sanitary water will be treated in septic tanks, before being sent to the biological treatment unit and then discharged. The sanitary water discharge has been evaluated at 0.2 m<sup>3</sup>/h,
- Rain water will be discharged into the natural environment. Surface runoff within the risk zones (storage of products, engines...) will be recovered in order to prevent discharge of polluted water into the natural environment,
- Fire-fighting water. ERM recommends taking all necessary measures to collect fire-fighting water and to treat it, if necessary, if this water is polluted. Water could be recovered in the bunded areas of the storage tanks if of sufficient capacity.

The current project envisages the discharge of clean water into the public sewerage system. In the absence of an existing network in the industrial zone, all necessary measures shall be taken to facilitate the infiltration of clean water on the site (reeds filter, infiltration swales...). This infiltration will be carried out down hydraulic gradient of the polluted zones to avoid any transfer of pollution via discharged water.

The products on site (heavy fuel, domestic fuel, oils and chemicals) and the engines will be equipped with appropriate secondary containment in order to prevent any risk of pollution of the natural environment.

ContourGlobal is committed to setting up a rain water recovery system in car parking zones. This water will be treated at the oily water treatment unit or by an oil/water separator whose capacity shall be designed based on the rainfall typical in this area the area and the impermeable surface of the car park.

#### *Management and verification plan*

To verify the compliance of discharges from the site into the natural environment, water analyses will be carried out on commencement of operation of the power plant and then annually. **Table 7.2** outlines the discharge limits imposed by the World Bank in the document *General EHS Guidelines, 30 April 2007* (see also Section 6.10 (f) of the CTA).

Table 7.2 : World Bank limits for water discharges from natural gas power plants (April 2007)<sup>5</sup>

Pollutant	Discharge limits
pH	6-9
Suspended solids	50 mg/l
Hydrocarbons	10 mg/l
Biological Oxygen demand (BOD)	30 mg/l
Chemical Oxygen demand (COD)	125 mg/l
Total Ammonia	10 mg/l
Total Phosphorus	2 mg/l
Total Coliforms	400 mpn*/100 ml

\*most probable number

<sup>5</sup> We note that these standards are essentially the same as the standards stated in clause 6.10(f) of the CTA. Nevertheless, whereas the World Bank standards provide a limit for Total Ammonia, Section 6.10(f) cites Total nitrogen (both at 10 mg/l).

As stated earlier (cf. Section 7.6.4), we recommend quarterly samples for process wastewater, wastewater treatment unit discharge (including process wastewater and domestic sewage) should be adequate. Composite stormwater and runoff samples would normally only be required during the rainy season, on a quarterly basis, depending on the level of precipitation.

In the event of persistent non-conformity (not due to an accident), a remedial solution will be implemented and new verification measurements collected after this solution has been put in place in order to verify that quality objectives have been met.

As noted earlier, Section 1.4 of the IFC General EHS Guidelines require implementation of water conservation. Implementation of a water conservation programme requires identification, regular measurement and recording of principal flows, as well as definition of water consumption targets and regular review of performance. Comparison with international standards is essential.

Measures potentially applicable to this project include:

- Stormwater collection and use
- Process water pressure management
- Adequate spill and leakage control

ContourGlobal is committed to developing a water conservation programme that will apply conservation measures, as appropriate, to the various water uses at this plant. These include the following:

- The cooling water circulation system for the motors and other equipment is closed, so only make-up water will be required, thus reducing substantially process water needs.
- Leakage monitoring and control will be systematically implemented by the maintenance department.
- Equipment washing will be limited.
- Use of sanitary facilities will be equipped with water saving devices, and users will be required to follow water-saving practices.<sup>6</sup>

## 7.6.5

### *Waste management*

#### *Operation*

The following waste streams will be generated during site operations:

- Waste oils, recovery from secondary containment and discharges from hydrocarbon separators
- Residues derived from the centrifugation of heavy fuels
- Sludge from the oily water treatment unit
- Used ion exchange resins
- Used engine filters
- Used batteries

<sup>6</sup> These may include, by fitting a water efficient showerhead, and limitations on the length of showers (showers can use anywhere between 6 - 45 litres per minute), cistern displacement devices (usually more effective on larger cisterns, between 9 and 12 litres), toilet variable flush systems (with possible water use reduction of up to 50%), EuroTap or similar device (this is a retrofit tap device which only releases water when pressed and shuts off automatically when released; it eliminates the possibility of keeping the tap running unattended), and other flow control devices.

- Laboratory waste
- Maintenance waste
- Containers and drums contaminated with oil or chemical substances
- Septic tank sludge
- Office waste

Liquid waste shall be stored in secondary containment systems to prevent risk of any accidental spills and pollution of the natural environment.

Waste oil, ion exchange resins, filters and hazardous waste (laboratory waste, soiled rags, water used to wash the turbines) shall be turned over to a company that specializes in the recycling, regeneration or disposal of such materials.

Subsequent to the initial issue of the updated EIA report (November 2008), it was decided by ContourGlobal to include a waste oil incinerator, designed to combust waste oil residues, within the site infrastructure. Only oil derived from the bottom of oil storage tanks, residues from the fuel centrifugation process, and sludge from the oily water treatment unit will be burned in the incinerator. The sludge will be stored in a sludge tank (80m<sup>3</sup>), from where it is pumped to the incinerator unit.

The incinerator is designed to process a maximum of 3 tonnes of oil waste per day. In reality, it is predicted that an average of 1 tonne of oil waste will be incinerated per day.

Combustion of waste will generate approximately 1 tonne of ash per year. These wastes will be stored in a covered closed container, to avoid any contamination of runoff storm water.

Local disposal options have been identified in Lomé: a cement plant and a tile factory. ContourGlobal will perform analysis of the ash (notably heavy metal concentration) and provide the results to these potential disposal options. Ash will be accepted by local contractor depending on the results of the analysis and on the volume.

If the quality of ash is not acceptable for the local solutions, ContourGlobal will temporarily store the ash on site and find another solution for disposal, in the worst case by containerising it and sending it to Europe for disposal in an authorized landfill.

#### ***Management and verification plan***

Liquid waste, together with contaminated drums and containers, will be stored in area equipped with secondary containment in order to prevent any risk of contamination of the ground.

Transportation and waste disposal service providers shall be chosen on the basis of the quality of their services, including compliance with World Bank obligations regarding procedures for disposal of hazardous waste. Waste management will also compliant with the Basel and Bamako Conventions, both approved by the Togolese government.

All hazardous waste shall be traceable. Each shipment of hazardous waste shall be recorded on a hazardous waste monitoring form, which shall *inter alia*:

- State the origin and name of the waste, describe its packaging and give the quantity of waste;
- Identify the carrier;
- Identify the addressee and provide the acceptance certificate number.

This form shall be signed by each of the service providers each time it takes custody of the shipment and shall accompany the waste to its ultimate destination. The final service provider shall return a copy to the site so that it has proof of proper disposal of its hazardous waste.

In order to ensure compliance with applicable regulations and the ordering party's terms of reference, audits of the principal dangerous waste disposal contractors could be carried out.

#### 7.6.6

#### *Noise*

##### *Operation*

The following noise reduction measures shall be taken into account in the design of the power plant project:

- Avoid placing the buildings' doors and other openings on the side facing the nearest sensitive receptors.
- Use specific materials rated for their sonic insulation qualities in the construction of the offices facing the engines.
- Use the existing buildings on the site as screens and barriers to protect the nearest receptors from sources of noise.

The modelling provided by Wärtsilä shows that noise levels are expected to comply with World Bank standards.

During operations, the noise generated by the power plant shall be verified using equipment that complies with international standards and is properly calibrated. Samples shall be collected during both day and night at property boundaries and in areas with regulated noise levels to ensure that the noise generated by the power plant complies with World Bank standards. These measurements shall be taken at least every three years and at the time of each significant modification to the site (modifications made to equipment, new equipment, new installations, etc.).

In the event of excessive noise levels, attenuation measures shall be implemented, such as an anti-noise wall, and further verification measurements carried out after the implementation of attenuation measures.

An evaluation of the proposed waste incinerator provided by Wärtsilä confirms that the noise emissions from the incinerator will not affect the overall level of noise from the site and will be compliant with IFC guidelines.

The IFC General EHS Guidelines require that noise monitoring be implemented "for the purposes of establishing the existing ambient noise levels in the area of the proposed or existing facility, or for verifying operational phase noise levels." Monitoring periods of 48 hours are suggested, on an annual basis.

As per CTA Section 6.10(h), “workers in the control room exposed to noise levels greater than 50 dB(A) shall be required to have a baseline hearing exam performed by a licensed or certified audiologist, otolaryngologist, or a physician or a technician who has demonstrated competence in administering audiometric examinations within six (6) months of employment.” ContourGlobal shall ensure such exams are repeated at least once a year.

#### 7.6.7 *Architecture and landscaping*

The negative visual impact of the future power plant is minimal since the site is located within an industrial zone. The new facilities will be visible only from the agricultural area to the west of the site and from national highway RN 2. Nevertheless, any negative impacts could be mitigated by taking the following measures:

- To the extent possible, design buildings with the lowest possible visual impact (colours, form and materials);
- Replacement of any trees cut down during construction with trees planted at the property boundary;
- Vegetation of the permanent containment cell for contaminated soils.

#### 7.6.8 *Relations with the local population*

ContourGlobal shall implement preventive measures to ensure that the facility:

- Regularly communicates with local communities;
- Implements a complaints procedure;
- Does not create fears concerning possible pollution risks (emissions of pollutants, hazardous substances, risks of explosion);
- Minimises noise nuisance and emissions of pollutants that disturb work in the agricultural areas;

ContourGlobal will respond to any complaints or concerns raised through the grievance mechanism within a week at most.

Details of the organisation of the ContourGlobal EMP implementation team is provided in Section 7.2.

#### 7.6.9 *Dismantling of the facility*

The concession has been signed for 25 years and the lifespan of a typical facility such as this is of more than 30 years if suitably maintained. A suspension of the activities on site is currently not envisaged. However, in the eventuality of a cessation of activities, ContourGlobal is committed, with the aim of ensuring the repairing of the site, to take the following actions:

- Elimination of all wastes and chemical products and associated containers;
- Dismantling of all production units and associated technical installations under conditions ensuring the prevention of pollution linked to the presence of fluids in the supply circuits;
- Cleaning of zones where necessary, emptying and rendering inert tanks, cleaning chemical product networks...

In general, the measures proposed during construction will be applied during dismantling, notably concerning:

- Noise limitation,
- Limiting dust emission,
- Waste management,
- Management of health and safety issues on site.

#### **7.7 RISK PROTECTION MEASURES**

The means of protection against risks will be presented in the updated risk study, which will be transmitted to the authorities before December 31, 2008.

#### **7.8 HEALTH AND SAFETY RECOMMENDATIONS**

##### **7.8.1 Health and safety committee**

A Health and Safety Committee will be created for the new site. These committees are normally made up of staff members in charge of operations. The members of the Committee shall be replaced and rotated regularly. The Committee shall be responsible for inspecting the facilities, making recommendations for improvements with regard to health and safety, analyzing the causes of accidents and making recommendations concerning necessary changes.

Collaboration with the local fire brigade will be implemented. An inspection of fire protection measures will be carried out by the fire brigade during the construction phase and during site operation. This inspection will allow verification of the compliance of materials and equipment and enable fire risk training of the employees to be undertaken.

##### **7.8.2 Hazard Study**

The Hazard Study prepared by ERM identified several recommendations to mitigate potential hazards; these recommendations have been addressed by ContourGlobal and Wärtsilä and are to be implemented as part of construction works. These mitigating measures are as follows:

1. Plan a safety zone in the immediate surroundings of the site (of at least 20m width), inside which any human activity external to the site shall be limited as much as possible, and preferably prohibited.

Mitigating measure:

Wärtsilä will erect warning signs on the west and south facing boundary fences indicating the potential hazard and requirement to evacuate in the event of an alarm. In addition, ContourGlobal will discuss local requirements with the fire department and as necessary provide instruction to local market gardeners.

2. Equip the base of the bunded area surrounding the hydrocarbon tanks with a network of automatic hydrocarbon detection cables or UV system; this would



be in order to quickly identify any leaks and to evacuate the adjacent farming zones before a possible ignition.

Mitigating measure:

Wärtsilä will provide adequate detection linked into the alarm system within the fuel tank banded areas to provide the power station team with advance warning.

3. Install protection equipment ensuring effective cooling of all the hydrocarbon storage tanks. Assess, for example, the installation of mixed Water/Foam crowns and foam discharge points outfalls on the oil and residual sludge storage tanks.

Mitigating measure:

Wärtsilä has included active fire protection systems for cooling of storage tanks and foam pouring into the tanks. A description of "Lome Fire Protection" document No DBAA310222 is included in Exhibit 1.

4. In order to protect personnel in the event of accident, working areas requiring a continuous employee presence shall be isolated from the potential sources of accidents by firewalls and water curtains.

Mitigating measure:

In discussion with ERM Risk team it was agreed that the buildings provided by Wärtsilä provide sufficient protection (up to 1 hour) for employees to evacuate in the event of a fire to a safer location. In addition, for each building exit doors will be located on the opposite side to the tank storage, where heat radiation will be lowest.

5. Prepare an emergency plan allowing the implementation of all adequate actions if such a fire occurred, in particular the organization of emergency responses and the evacuation of the public around the site.

Mitigating measure:

As part of the operational OHSP, emergency plans including evacuation of employees and where applicable general public around the site boundaries will be completed prior to the commencement of power station operations.

6. Increasing awareness and training of staff on the consequences of an explosion; an emergency plan document will be prepared and will describe all measures to be implemented in the event of detection of a gas leak on the site in order to reduce the probability of an accident and its human consequences.

Mitigating measure:

Power station employees will be provided with training during construction in preparation for taking over the site on completion of construction. Ongoing training will be provided as part of the operational OHSP. The major

flammable gas leak scenario will be included in the emergency response plan to be prepared.

7. Assess the installation of passive protection measures such as a firewall or 2m high earth bund surrounding the gas supply point, in order to decrease the impact on adjacent buildings and beyond the property limits of heat fluxes generated by a fire.

Mitigating measure:

These recommendations are no more necessary since Wärtsilä construction works will ensure the gas pipe line (from the tie in point to the engine hall) is buried beneath ground level and provided with adequate emergency shut off and manual isolation valves.

8. Modification of the location of the installations in order to provide sufficient safe distances to reduce domino effects between the installations of the site as well as the fire protection systems.

Mitigating measure:

This primarily refers to the location of the fire protection pumping equipment container and fire water tank. It is agreed (between CG, Wärtsilä and ERM) to relocate the fire water tank and container to the north east section of the plant, adjacent to the existing CTL workshop, where it will not be impacted by the heat radiation from a fire on site. Additional measures will also be implemented concerning the foam house where foam concentrate tanks and foam protection systems for the Fuel Oil Storage tanks are located. This is to ensure that this equipment will not be damaged by heat radiation from the flames and also that activation means of the foam systems could be reached by fire-fighters (equipped with suitable protection clothes and helmets). Therefore, this foam house has been relocated to provide sufficient safety distance from the bund.

A revised "preliminary layout" drawing is included in Exhibit 2, drawing No DBAA294819, it will be finalised after detailed design has been considered.

9. The gas supply pipeline will be buried until arrival inside the gas pressure regulation station and reinforcement of the structure of this unit (fire resistant walls) to confine fire in the event of a leak; installation of safety devices on natural gas supply pipe work against external sabotage (for example passive isolation beneath a concrete slab);

Mitigating measure:

As stated in item 7, the gas pipe line will be buried beneath the ground, gas and general fire alarms and protection will also be provided inside the gas regulating unit. Typical protection means will be provided above the gas pipe in the areas where civil works may occur.

10. Installation of a safety valve upstream of this pipeline (at the tie-in to the site supply) allowing quick isolation of any leak and to stop a fire (before causing

a domino effect) or to isolate a gas leak (before its ignition). A P&ID of the Fuel Gas System No DBAA565942b is included in Exhibit 3.

Mitigating measure:

As stated in item 9, emergency shut down valves are included in the design. This includes the installation of an automatic emergency shut-down isolation valve located upstream of the gas regulating unit adjacent to the tie-in point to the plant feed as pipeline.

11. Installation of flammable gas detection system sat (potential) gas leak sources located on the above ground part of the gas fuel pipelines, within the gas pressure regulation station and the generator building. The gas detection system will raise an alarm at the site control room and will also be able to automatically isolate the gas fuel supply by closing the safety valve mentioned above.

Mitigating measure:

Wärtsilä has incorporated gas detection units within the gas regulation unit housing and in the engine hall around each of the engines. The pipe line will be buried beneath ground level. The gas detection will initiate an indication (alarm) of a release in the central control room at low level gas detection (e.g. 10% LFL) and automatic isolation of gas fuel feed at high level gas detection (e.g. 40% LFL). These systems will be adequate to cope with small gas leaks.

12. Concerning the generator building, the installation of “anti explosion” panels on the walls of the building or installation of a water spraying system protecting the interior of the building would also limit the effects of a confined gas explosion (reduction of the severity of the explosion). Another possibility would be to have an open building (only the roof of the building would be preserved) if that is technically feasible (required to protect the turbines).

Mitigating measure:

The engine hall and gas regulating unit housing will be provided with “anti explosion” panels to mitigate the impact of a potential confined gas explosion. Wärtsilä will design panels in the wall to be constructed in such a way that an increase in building pressure will result in panel “blowing” out, which will stop the over pressure rise inside the building and mitigate the severity of the blast (such panels will be restrained by tie wires or netting, this detail has still to be decided as part of detailed design). These systems will be adequate to mitigate an explosion associated with a major gas leak inside of these buildings.

### 7.8.3 *Prevention of industrial accidents*

#### *General prevention principals*

In general, ContourGlobal will adopt the following principles:

1. Avoid risks in the workplace;

2. Assess risks that are unavoidable;
3. Implement protective measures, placing the emphasis on collective measures if possible;
4. Train employees;
5. Establish a first aid station.

Whenever necessary, appropriate personal protective equipment shall be made available to workers. Such equipment shall be verified regularly.

### *Training*

Workers will receive training as necessary, notably:

- Training in the use of fire fighting equipment, renewable annually,
- General safety training (dangerous areas onsite, evacuation procedures, actions to take in the event of an emergency, etc.), renewable every 2 years
- Training in workplace safety, renewable every 2 years
- Development of an Emergency Plan for the site
- Training where necessary for locals persons engaged in activities within the 20m safety zone described in the Hazard Study
- First aid training, renewable every 2 years
- Certification to work on electrical installations, renewable every 3 years
- Training regarding chemical hazards in the event of exposure to hazardous substances, including highly toxic, toxic, carcinogenic, mutagenic or teratogenic substances, renewable every 3 years
- Certification to operate forklifts if applicable, renewable every 3 years
- Training regarding manual handling of heavy loads, if applicable, renewable every 3 years.

This training shall be provided on commencement of employment and repeated periodically (respecting the frequencies outlined above), in particular whenever there is a change in position, a change in working methods or a change in equipment.

### *Subcontractors and external companies*

Work by subcontractors or external companies shall be coordinated by ContourGlobal, which shall coordinate all outside companies performing work on the site and their subcontractors, both before and during the performance of the work, by specifically monitoring compliance with procedures fixed during preliminary coordination meetings or procedures rendered necessary by the progression of work.

The future construction site will be visited jointly by representatives of ContourGlobal and the subcontractor. An OHSP will be provided to the subcontractor and signed by the subcontractor and the Contour Global representative. This plan shall include the following:

1. Definition of dangerous phases of work and the specific associated prevention measures applicable;
2. The adaptation of materials, installations and equipment to the operations to be carried out as well as the definition of their maintenance program;
3. Instructions to be given to employees;
4. Instructions necessary for accident prevention, including:

- Instructions in effect on the site, which shall be communicated by the site's representative during the joint site visit prior to the start of work;
  - Instructions that the management of the contractor's company will give to its employees who will be performing work on the site, prior to the start of work.
5. The system set up to provide first aid in the event of an emergency;
  6. The requirements to be met by employees of a company who will participate in work performed by another company in order to ensure the necessary coordination between different parties to maintain safety.

### ***Traffic circulation***

The site shall develop a traffic plan, taking the following parameters into account:

- Separation of traffic zones in order to limit the risk of collisions (vehicles, pedestrians, forklifts);
- Marking traffic circulation zones on the surface: painted arrows to indicate the direction of traffic, painted speed limits, one-way traffic signs;
- Suitability of all traffic routes for the operation of the facility;
- Delimitation of areas for parking, loading and unloading vehicles;
- Easy access to all areas by external emergency services;
- Incorporate a safety area.

Operating of vehicles on and offsite will be carried out in accordance with the requirements of ContourGlobal (section 4), Wärtsilä (section 4) and ERM (section 25) health and safety documents.

### ***Dangerous activities***

The operator shall identify the list of dangerous activities that will be performed onsite. At minimum, such activities shall include:

- Work on electrical equipment
- Inspection of tanks, basins and reservoirs
- Work at height
- Use of lifting equipment
- Work that exposes personnel to hazardous substances
- Trench digging (digging permit)
- Work in confined spaces
- Work in ATEX zones

Adequate preventive measures shall be implemented (personal protective equipment, work supervisors, etc.).

## **7.8.4**

### ***Regulatory provisions for occupational health***

#### ***Ventilation***

Workshops shall be installed in well ventilated buildings.

### *Lighting*

Workshops and offices shall be appropriately illuminated. Emergency lighting to indicate emergency exits shall be powered by an emergency generator or by autonomous battery packs.

At night, lampposts will illuminate walkways outside the site.

### *Cleaning*

All workshops, offices and company premises shall be regularly cleaned by site personnel.

### *Sanitary facilities*

A number of restrooms appropriate for the size of the workforce shall be provided. The rest rooms shall be located near the work areas.

### *Noise*

Equipment that generates the highest levels of noise shall be clearly indicated. When such equipment is installed, noise measurements shall be taken in the working areas. If the values exceed the regulatory threshold (85 dBA) appropriate signs will be provided identifying high noise areas. Employees shall be provided with hearing protection for use in such areas.

### *Work in explosive atmospheres*

The use of natural gas as a fuel creates the risk of creating explosive atmospheres, known as ATEX. Therefore, the areas in which there is a risk of explosive atmospheres shall be defined. These zones fall into three categories:

- Zone 0: an area where an explosive atmosphere is present continuously or for a period exceeding 1,000 hours/year.
- Zone 1: an area where an explosive atmosphere is present during a particular process or for a period between 100 and 1,000 hours/year.
- Zone 2: an area where an explosive atmosphere is present occasionally or for a period of less than 100 hours/year.

This classification shall be established for all workshops or installations where flammable gases or liquids are used. All locations classified as an ATEX zone shall be indicated by a sign in compliance with regulatory requirements, such as:



Maintenance of this type of equipment requires that maintenance staff have specific training. Accordingly, staff members who perform work on ATEX rated equipment will be given specific training in order to maintain the required level of protection.

In addition, work in a location classified as an ATEX zone requires the use of anti-spark tools. Strict procedures shall be implemented forbidding all work in ATEX zones with equipment and tools that are not approved for ATEX zones.

#### 7.8.5 *Relevant health and safety documents*

ContourGlobal will develop an overall site Health and Safety document in accordance with IFC guidelines. Additionally, Wärtsilä will develop their own health and safety documents for their activities in accordance with IFC guidelines. ERM has already developed a site H& S plan.

Contour Global will maintain the following records onsite:

- The register of industrial accidents
- Health and safety verification and control reports (work equipment, electrical installations, high-pressure equipment, etc.)
- Inspection reports on the quality of work environments (lighting, exposure to noise, exposure to chemical substances, etc.)
- The list of subcontractors and external companies performing work and safety instructions provided to them
- The register documenting periodic fire fighting exercises and tests of fire fighting equipment
- The occupational health register
- The employee register

#### 7.9 *CONTRIBUTION TO SOCIOECONOMIC DEVELOPMENT*

The project will enable Togo to reduce its energy dependency. It will provide the country with the power it requires to develop productive activities necessary for the country's economic development. The project will generate few negative socioeconomic impacts since it is located in an industrial area. Nevertheless, adequate information will be provided to the workers in the free trade zone and to the residents of the residential area to the north of the site.

During the construction phase, it would be advisable for the developer to appoint an in-house contact person charged with:

- 1/ Informing the population regarding the project (start of work, etc.);
- 2/ Settling disputes that may arise with neighbours.

#### 7.10 *ENVIRONMENTAL & SOCIAL MANAGEMENT PLAN: ACTION PLAN*

The Action Plan is presented in **Table 7.3**.

Table 7.3 : Environmental and social management plan

Project phase	Activity	Problems – Impacts	Attenuation / mitigation measures	Implementation period	Implementation authority	Verification authority	Measurable	Verification measures	Implementation cost
<b>Construction phase</b>									
Construction	Remediation, construction work	Site establishment	Public support measures in the event of need for extension of the influence of the site (remediation, building work...).	Prior to construction	ContourGlobal	Togolese authorities			To be confirmed
Construction	Construction work	Health and Safety	<p>Working conditions to follow best construction site practice. These will be detailed in an Occupational Health &amp; Safety Plan that fully complies with the IFC General Guidelines, including but not limited to training, standard operating procedures to ensure safety, testing of fire alarms, the use of personal protective equipment and emergency response measures. Reference to the following three documents:</p> <ul style="list-style-type: none"> <li>• The Wartsila “HSE Guidelines for Construction and Installation Work” concerning power plant construction;</li> <li>• The ERM HSE guidelines for the soil remediation activities; and</li> <li>• The ContourGlobal Health &amp; Safety Policy.</li> </ul>	During construction	Wärtsilä, ERM, Contour Global	ContourGlobal	Respect subcontractors terms of reference	Subcontractors terms of reference	Management time



Project phase	Activity	Problems – Impacts	Attenuation / mitigation measures	Implementation period	Implementation authority	Verification authority	Measurable	Verification measures	Implementation cost
Construction	Construction activities	General emergency procedures	<ul style="list-style-type: none"> <li>Plan a safety zone in the immediate surroundings of the site (of at least 20m width</li> <li>In order to protect personnel in the event of accident, working areas requiring a continuous employee presence shall be isolated from the potential sources of accidents by firewalls and water curtains.</li> <li>Increase awareness and training of staff on the consequences of an explosion; an emergency plan document shall be prepared and will describe all measures to be implemented in the event of detection of a gas leak.</li> <li>Development of a construction phase Emergency Plan for the site</li> </ul>	During construction	Wärtsilä	ContourGlobal	Periodic safety awareness tests	Test scores	Management time
Construction	Negative ESH impacts on residents	Any perceived impacts due to construction activities	A grievance mechanism will be established, and information on construction activities will be periodically disseminated to the concerned public.	During construction	ContourGlobal	Local citizens organisations, Competent Authority	Quick and adequate response to perceived negative impacts	Grievance reports	To be confirmed

Project phase	Activity	Problems – Impacts	Attenuation / mitigation measures	Implementation period	Implementation authority	Verification authority	Measurable	Verification measures	Implementation cost
Construction	Remediation, transport of materials, construction, traffic	Dust emissions	<p>Implementation of best construction site practices:</p> <ul style="list-style-type: none"> <li>Tarp trucks transporting loose/friable materials on and off site. Minimize the amount of materials lost during transportation</li> <li>Limit speed to 30 km per hour on unpaved roads,</li> <li>Maintain and store piles of loose/friable materials and soil (contaminated or not) in a suitable manner in order to minimize dust dispersion (for example: balance cutting and filling operations),</li> <li>Spray water on the site to allow suspended solid particles to settle (however, particular attention shall be paid to contaminated soil).</li> </ul>	Construction phase	Subcontractor	ContourGlobal		Subcontractor inspections Periodic meetings with subcontractors	Management time
Construction	Historic activities	Soil and groundwater contamination	<ul style="list-style-type: none"> <li>Storage of polluted soil excavated during construction in a holding cell on site.</li> <li>Install two piezometers downstream from the permanent containment cell for contaminated soil and monitor the hydrocarbon content of the water table twice a year</li> </ul>	<p>Works before and during construction</p> <p>Construction phase and operation</p>	ERM / Wärtsilä /ContourGlobal	ContourGlobal	Analysis results	Sampling and analysis for hydrocarbons twice per year	<p>Implementation of works : Dependent upon final volume excavated</p> <p>Monitoring : 5000 € per year</p>

Project phase	Activity	Problems – Impacts	Attenuation / mitigation measures	Implementation period	Implementation authority	Verification authority	Measurable	Verification measures	Implementation cost
<i>Construction</i>	<i>Foundations</i>	Soil and groundwater contamination	The majority of the foundations will not reach 1.5m. Drainage of groundwater will be undertaken for the deeper foundations required for chimneys. Analyses of pumped water shall be carried out before discharge to ensure no transfer of pollution.	During construction	Wärtsilä	ContourGlobal	Hydrocarbon, metals and sulphate levels if necessary	Analysis of pumped water before discharge into natural environment	Monitoring: 1 000 euros

Project phase	Activity	Problems – Impacts	Attenuation / mitigation measures	Implementation period	Implementation authority	Verification authority	Measurable	Verification measures	Implementation cost
Construction	Use and discharge of water	Soil, surface water and groundwater contamination	<ul style="list-style-type: none"> <li>Water will be used during construction for sanitary purposes, washing equipment and to spray the site down to reduce dust emissions. All possible conservation measures will be taken, including recycling, reuse and the use of water conservation devices (for example flow restriction devices).</li> <li>Potentially polluted water to be treated before being discharged into the natural environment: Implementation as soon as possible of treatment unit (oily water treatment, septic tanks...)</li> <li>To the extent that a backup water supply required, Wärtsilä will complete an impact analysis as required by OPIC with respect to the possible use of groundwater.</li> </ul>	During construction	Wärtsilä	ContourGlobal	Implementation of treatment measures	Inspection of works	Included in construction costs

Project phase	Activity	Problems – Impacts	Attenuation / mitigation measures	Implementation period	Implementation authority	Verification authority	Measurable	Verification measures	Implementation cost
Construction	Construction work	Soil, surface water and groundwater contamination	<p>Other attenuation measures will be implemented as follows:</p> <ul style="list-style-type: none"> <li>Chemical substances, liquid waste and the turbines shall be equipped with secondary containment to avoid any risk of accidental spills</li> <li>Any leaks of oils or fuels will be cleaned (absorbents) and recovered.</li> </ul>	During construction	Wärtsilä	ContourGlobal	Wastes properly stored	Regular inspections	Included in construction costs

Project phase	Activity	Problems – Impacts	Attenuation / mitigation measures	Implementation period	Implementation authority	Verification authority	Measurable	Verification measures	Implementation cost
Construction	Excavation and other ground preparation	Soil erosion and surface runoff	<ul style="list-style-type: none"> <li>Limit excavation during the dry season to shallow soil removal.</li> <li>Replace soil as quickly as possible.</li> <li>Cover soil mounds where possible and as required to limit erosion/runoff.</li> <li>Halt soil excavation activities during heavy rain.</li> <li>Maintain a low profile of removed soil with respect to rainfall.</li> <li>Identify any problematic parts of the site with respect to possible erosion that would be expedited by construction activities.</li> <li>Incorporate required measures into the construction contractor HS&amp;E plan, and inform relevant workers of requirements.</li> </ul>	During construction	Wärtsilä	ContourGlobal	No erosion or runoff due to excavation activities	Visual inspection	Standard operating procedures
Construction	Construction work	Waste	<ul style="list-style-type: none"> <li>Prioritise recycling and return to supplier.</li> <li>Disposal of municipal and construction waste by specialist companies.</li> <li>Provision of sanitary facilities and removal of waste</li> <li>Liquid waste storage equipped with secondary containment.</li> </ul>	During construction	Wärtsilä / ContourGlobal	ContourGlobal	Maximise waste recycling	Regular inspections	Management time

Project phase	Activity	Problems – Impacts	Attenuation / mitigation measures	Implementation period	Implementation authority	Verification authority	Measurable	Verification measures	Implementation cost
Construction	Construction work	Noise	<ul style="list-style-type: none"> <li>Prohibit night-time work during construction</li> <li>Implement measurements at property limits to verify conformity of noise emissions</li> <li>PPE will be worn by all employees and visitors to site, also Wartsila and ERM and other sub contractors will be required to wear PPE (this will include appropriate ear protection devices).</li> <li>Signs will be placed at appropriate locations at site to remind staff of possible dangers and safety measures to be taken.</li> </ul>	During construction	Wärtsilä  ContourGlobal  Wärtsilä  Wärtsilä	ContourGlobal  ContourGlobal  ContourGlobal	Working hours  Noise emissions < 70 dBA  Proper equipment to be worn at appropriate places  Appropriate signs placed at appropriate places	Periodic inspection of subcontractors  Noise measurements at property limits  Shift supervisors  Confirmed by site management	Management time  Measurements : 3 000 €  Management time  Management time
Construction	Traffic circulation	Noise and traffic	Strictly limit speed and hours of traffic movements	During construction	Wärtsilä	ContourGlobal	Traffic circulation hours	Periodic meetings with subcontractors	Management time

Project phase	Activity	Problems – Impacts	Attenuation / mitigation measures	Implementation period	Implementation authority	Verification authority	Measurable	Verification measures	Implementation cost
Construction	Vehicle movements	Dangers associated with vehicle movements	<ul style="list-style-type: none"> <li>Implementation of a traffic plan (identify traffic, parking and pedestrian zones)</li> <li>Limit traffic speed.</li> </ul> <p>Heavy lifts (onsite and offsite) will be coordinated between the construction manager and public relations officer, who will also assist with coordination with local authorities</p>	During construction	Wärtsilä	ContourGlobal	Implementation of a traffic plan. Number of accidents linked to traffic	Visits and meetings with subcontractors	Management time
Construction	Construction work	Discovery of archaeological or cultural material within the site boundary.	<ul style="list-style-type: none"> <li>Interrupt construction works and notify the local authority for cultural heritage.</li> <li>Assure that procedures for the potential discoveries are included in the contract signed with the developer.</li> </ul>	During construction	Wärtsilä  ContourGlobal	ContourGlobal	Description of discoveries	Describe all potential discoveries in the subcontractor reports issued to ContourGlobal	Management time
Construction	Construction work	Influx of workers into Lomé industrial zone	<ul style="list-style-type: none"> <li>Identify an authority responsible for external relations</li> <li>Ensure adequate transportation for workers to and from site that does not significantly disturb local traffic patterns or create unacceptable levels of noise, air emissions or risk to pedestrians</li> <li>Ensure availability of potable water and proper sanitary facilities</li> </ul>	During construction	ContourGlobal	Ministry	Authority identified	Management of potential problems during works	Management time



Project phase	Activity	Problems – Impacts	Attenuation / mitigation measures	Implementation period	Implementation authority	Verification authority	Measurable	Verification measures	Implementation cost
Construction	Construction work	Socioeconomic impacts: Creation of employment opportunities and small commercial activities surrounding construction site	In accordance with Togolese legislation priority shall be given to hiring Togolese workers.	During construction	ContourGlobal	Togolese authorities	Number of Togolese employees /Total n° of employees	Work contracts and site labour statistics	Management time
Construction	Construction work	Health and safety of workers (including protection against workplace accidents)	Ensure that subcontractors have passed H&S training of their staff	During construction	Wärtsilä	ContourGlobal	Respect H&S rules during work. Number of accidents.	Include this clause in subcontractors contracts	Management time
Construction	Construction activities	Health, safety and minimal impact on livelihood and daily activities of residents	Install a grievance mechanism: <ul style="list-style-type: none"> <li>• Appoint Community Relations Officer (CRO)</li> <li>• Appoint stakeholder counterparts</li> <li>• Develop grievance mechanism</li> <li>• Implement grievance mechanism system (including periodic meetings with selected stakeholders)</li> </ul>	During construction, operational and decommissioning periods	ContourGlobal	ContourGlobal	Development of grievance mechanism report; periodic reports from CRO	Written grievance mechanism, periodic reports and minutes of stakeholder meetings.	Management time

Project phase	Activity	Problems – Impacts	Attenuation / mitigation measures	Implementation period	Implementation authority	Verification authority	Measurable	Verification measures	Implementation cost
Construction	Tanks	Hazard prevention	<ul style="list-style-type: none"> <li>Equip the base of the bunded area surrounding the hydrocarbon tanks with a network of automatic hydrocarbon detection cables or UV system for leak detection</li> <li>Install protection equipment ensuring effective cooling of all the hydrocarbon storage tanks.</li> </ul>	During construction	Wärtsila	ContourGlobal	Prescribed measures implemented	Technical field reports	Included in equipment cost
Construction	Gas manifold and distribution system	Hazard prevention	<ul style="list-style-type: none"> <li>Assess the installation of passive protection measures such as a firewall or 2m high earth bund surrounding the gas supply point</li> <li>Installation of flammable gas detection systems</li> <li>Concerning the generator building, the installation of “anti explosion” panels</li> <li>Installation of a safety valve upstream of gas pipeline</li> </ul>	During construction	Wärtsila	ContourGlobal	Prescribed measures implemented	Technical field reports	Included in equipment cost

Project phase	Activity	Problems – Impacts	Attenuation / mitigation measures	Implementation period	Implementation authority	Verification authority	Measurable	Verification measures	Implementation cost
<b>Operation phase</b>									
<i>Operation (see also Construction)</i>	<i>Negative ESH impacts on residents</i>	Any perceived impacts due to construction activities	A public consultation process and grievance mechanism will be established. The public consultation process will include periodic dissemination of information regarding plant operations and procedures to the concerned public.	During construction, adapted to operational period	ContourGlobal	Local citizens organisations, Competent Authority	Quick and adequate response to perceived negative impacts	Grievance reports	To be confirmed

Project phase	Activity	Problems – Impacts	Attenuation / mitigation measures	Implementation period	Implementation authority	Verification authority	Measurable	Verification measures	Implementation cost
Operation (see also Construction)	Plant operations	General emergency procedures	<ul style="list-style-type: none"> <li>Plan a safety zone in the immediate surroundings of the site (of at least 20m width</li> <li>In order to protect personnel in the event of accident, working areas requiring a continuous employee presence shall be isolated from the potential sources of accidents by firewalls and water curtains.</li> <li>Increase awareness and training of staff on the consequences of an explosion; an emergency plan document shall be prepared and will describe all measures to be implemented in the event of detection of a gas leak.</li> <li>Development of an Emergency Plan for the site</li> <li>Training where necessary for locals persons engaged in activities within the 20m safety zone described in the Hazard Study</li> </ul>	During operations	ContourGlobal	ContourGlobal	Periodic safety awareness tests	Test scores	Incorporated into plant management costs

Project phase	Activity	Problems – Impacts	Attenuation / mitigation measures	Implementation period	Implementation authority	Verification authority	Measurable	Verification measures	Implementation cost
Operation	Operation of the plant	Atmospheric pollution	<p>The attenuation measures proposed in the ESIA include:</p> <ul style="list-style-type: none"> <li>Stacks of <b>38m</b> height</li> <li><b>Heavy fuel</b> with 1% sulphur and domestic fuel with 1.5% sulphur (the possibility of using heavy fuel with 1.5% sulphur will also be studied)</li> </ul>	<p>Construction phase</p> <p>Operation phase</p>	ContourGlobal	Togolese authorities	<p>Compliance with WB limits for stack emissions for les NOx, SO<sub>2</sub>, CO, heavy metals and dust.</p> <p>Verification of parameters of smoke plume (T°, emission speed, Oxygen and humidity)</p> <p>Compliance with WB limits for <b>NOx, SOx and dust in ambient air outside property limits</b></p>	<p>Monthly atmospheric emission measurements (stack)</p> <p>Use of yield parameters (combustion parameters) to guarantee permanent site conformity</p> <p>Annual atmospheric emission measurements (property limits – north, south, west and Kagomé area).</p>	Atmospheric emission measurements : 3-4000 euros
Operation	Air quality monitoring	Non-compliance with IFC and Togolese air quality standards	<ul style="list-style-type: none"> <li>Monthly Analysis of NO<sub>2</sub> and SO<sub>2</sub> by diffusion tube at six locations around the site</li> <li>Continuous monitoring of PM10 and PM2.5 by Topas</li> <li>Calculation of CO<sub>2</sub> emissions from the plant on an annual basis, based upon the recorded use of each fuel type throughout the year</li> </ul>	Operation	ContourGlobal	Competent Authority	Analytical results	Review of analytical results by Competent Authority	<p>6 175 € for Topas equipment (including shipping and service)</p> <p>1 600 € annual cost for diffusion tubes</p>

Project phase	Activity	Problems – Impacts	Attenuation / mitigation measures	Implementation period	Implementation authority	Verification authority	Measurable	Verification measures	Implementation cost
Operation	Operational water consumption	Water resources	ContourGlobal will develop a site water conservation plan. This will include the following elements:	Installation of equipment	Wärtsilä	ContourGlobal			
			<ul style="list-style-type: none"> <li>Provision for closed circuit cooling system</li> <li>Regular monitoring of water consumption (locate zones of highest consumption and possible leaks).</li> <li>Installation of meters at water supply points and at locations identified as of highest consumption.</li> <li>Connection with network equipped with non-return system.</li> <li>Equipment washing will be limited.</li> <li>Use of sanitary facilities will be equipped with water saving devices, and users will be required to follow water-saving practices</li> </ul>	Operation phase	ContourGlobal	ContourGlobal	Consumption conforms to consumption presented in study	Monitoring of consumption	Management time for monitoring 2 to 6 000 euros per meter
				Construction phase	Wärtsilä	ContourGlobal	Equipment installed		Non-return system : 5 000 euros

Project phase	Activity	Problems – Impacts	Attenuation / mitigation measures	Implementation period	Implementation authority	Verification authority	Measurable	Verification measures	Implementation cost
Operation	Water discharge	Soil, surface water and groundwater contamination	<p>Appropriate treatment will be implemented prior to any discharge into the natural environment:</p> <ul style="list-style-type: none"> <li>Sanitary will be treated in septic tanks before being sent to the biological treatment unit then discharged into the natural environment,</li> <li>Potentially polluted water shall be treated in the oily water treatment unit before being discharged into the natural environment,</li> <li>Rainwater discharges from parking areas will be linked to an oil / water separator or the oily-water treatment unit.</li> </ul>	Treatment to be implemented during construction phase and to be maintained in good condition throughout operation	Wärtsilä	ContourGlobal	Compliance of discharges with WB limits for the following parameters: pH, TSS, Hydrocarbons, BOD, COD, Nitrogen, Phosphorus, Coliform	<p>Verification of the condition of the water recovery equipment and operation of treatment units</p> <p>Implement sampling and analysis of discharges at minimum annually following commencement of operations</p>	<p>Operational costs</p> <p>1 to 2 000 euros per analysis</p>
Operation	Wastewater discharge	Soil, surface water and groundwater contamination	Link rain water from parking zones to the oily water treatment unit or to an oil/water separator	During construction	Wärtsilä	ContourGlobal	Equipment installed		2 to 5 000 euros





Project phase	Activity	Problems – Impacts	Attenuation / mitigation measures	Implementation period	Implementation authority	Verification authority	Measurable	Verification measures	Implementation cost
Operation	Waste generation - storage	Good waste management	<ul style="list-style-type: none"> <li>Liquid waste will be stored with secondary containment to prevent risk of accidental spillage of pollution of the natural environment.</li> </ul>	Operation	ContourGlobal	ContourGlobal	Liquid waste with secondary containment	Regular inspections	300 to 1 000 € per area of secondary containment
Operation	Waste generation - treatment	Good waste management	<ul style="list-style-type: none"> <li>Waste will be sorted and recycled or reused as far as possible. This assumes employee training.</li> <li>Waste oils, residues from centrifugation of heavy oil, ion exchange resins, filters, dangerous waste (laboratory waste, soiled rags, water used to wash turbines) will be passed to a company specialized in recycling, regeneration or disposal of these materials.</li> </ul>	Operation	ContourGlobal  ContourGlobal		Recycling rate  Shipment to specialist companies. Recycling rate  N° of waste elimination documents received	Implementation of audits of the principal dangerous waste disposal contractors  Issue of a waste transfer note of all dangerous waste and recovery of notes after treatment	Management time)  Management time)  Management time

Project phase	Activity	Problems – Impacts	Attenuation / mitigation measures	Implementation period	Implementation authority	Verification authority	Measurable	Verification measures	Implementation cost
Operation	Waste generation - treatment	Good waste management	<p>Oily wastes and sludges will be sent to a steel mill close to the site or treated on site using an incinerator.</p> <p>The installation of an incinerator would require an environmental impact assessment and risk study prior to implementation.</p>	Operation	ERM / ContourGlobal	Togolese authorities	No significant additional impact	Implementation of the impact study	Incinerator 250 000€
Operation	Noise emissions from equipment	Problems for population outside site	<p>The turbines will be installed within a building and all measures taken to limit noise emissions.</p> <p>In addition, with regard to construction:</p> <ul style="list-style-type: none"> <li>• Avoid placing the buildings' openings facing the nearest sensitive receptors,</li> <li>• Use specific materials rated for their sonic insulation qualities in the construction of the offices facing the turbines.</li> <li>• Use the existing buildings on the site as screens and barriers to protect the nearest receptors from noise sources.</li> </ul>	Construction phase	Wärtsilä	ContourGlobal	Respect of WB limits	Verification of noise emissions on commencement of operations, then every 3 years	Measurements : 3 000 €

Project phase	Activity	Problems – Impacts	Attenuation / mitigation measures	Implementation period	Implementation authority	Verification authority	Measurable	Verification measures	Implementation cost
Operation	Noise emissions from equipment	Worker exposure to high levels of noise	<ul style="list-style-type: none"> <li>PPE will be worn by all employees and visitors to site, also Wartsila and ERM and other sub contractors will be required to wear PPE (this will include appropriate ear protection devices). to be used in the areas of the site (close to the engines) with high noise levels</li> <li>Signs will be placed at appropriate locations at site to remind staff of possible dangers and safety measures to be taken.</li> <li>Control Room personnel (and other personnel as required) exposed to noise levels greater than 50 dB(A) shall be required to have a baseline hearing exam annually.</li> </ul>	Operation	ContourGlobal	ContourGlobal	Compliance with WB limit (85 dBA)	Verification of noise emissions at work station every 3 years.  Results of annual hearing exam for exposed personnel	Measurements : 3 000 €
Operation	Building construction	Architecture and landscape	If trees must be cut down during construction, new trees will be planted at the site	Construction phase	Wärtsilä	ContourGlobal	Vegetated surface on site	Environmental performance report	Management costs
Operation	Storage and use of fuels	Management of fire and explosion risks	Update of Risk Assessment	Before December 2008	ERM	ContourGlobal		Report issue	Based on results

Project phase	Activity	Problems – Impacts	Attenuation / mitigation measures	Implementation period	Implementation authority	Verification authority	Measurable	Verification measures	Implementation cost
<i>Operation</i>	<i>Operation</i>	Workplace accidents, health and safety of personnel	Implementation of a system for the management of on site health and safety issues: <ul style="list-style-type: none"> <li>• creation of an H&amp;S committee</li> <li>• safety training for employees,</li> <li>• management of external companies using H&amp;S plans,</li> <li>• implementation of a traffic plan,</li> <li>• identification of explosion risk zones</li> </ul>	Operation	ContourGlobal	H&S committee + Togolese authorities	Existence of H&S committee  N° of safety trainings  N° of H&S plans	Verification of H&S knowledge of employees  Review of H&S plans	Management time
<i>Operation</i>	Use of chemical products	Chemical risks	Hazardous substances shall be stored with secondary containment. Near and outside areas where acid is stored and handled, safety equipment shall be provided, e.g., autonomous breathing protection equipment, extinguishers, a water station with abundant flow, safety showers and eye-wash fountains.  Employees shall be trained regarding chemical hazards.	Operation	ContourGlobal	H&S committee	Equipment available	Regular verification of systems by staff	Operational costs
					ContourGlobal	H&S committee		Regular training	Management time

Project phase	Activity	Problems – Impacts	Attenuation / mitigation measures	Implementation period	Implementation authority	Verification authority	Measurable	Verification measures	Implementation cost
<i>Operation</i>	Air quality monitoring	Non-compliance with IFC and Togolese air quality standards	<ul style="list-style-type: none"> <li>Monthly Analysis of NO<sub>2</sub> and SO<sub>2</sub> by diffusion tube at six locations around the site</li> <li>Continuous monitoring of PM10 and PM2.5 by Topas</li> </ul>	Operation	ContourGlobal	Competent Authority	Analytical results	Review of analytical results by Competent Authority	6 175 € for Topas equipment (including shipping and service)  1 600 € annual cost for diffusion tubes
Dismantling phase									
<i>Dismantling</i>	<b><i>Dismantling work</i></b>	Returning site to initial condition	The following measures will be implemented in the event of site dismantling: <ul style="list-style-type: none"> <li>Elimination of wastes and chemical products ;</li> <li>Dismantling of all production units and associated technical installations;</li> <li>Cleaning of zones where necessary, emptying and rendering inert tanks, cleaning chemical product networks.</li> </ul>	Dismantling period	Dismantling company	ContourGlobal	Verification during and after works	Meeting with subcontractors  Inspections	
<i>Dismantling</i>	<b><i>Dismantling work</i></b>	Nuisances due to works	Implementation of necessary measures described for the construction phase to: <ul style="list-style-type: none"> <li>Noise limitation,</li> <li>Limiting dust emission,</li> <li>Waste management,</li> <li>Management of health and safety issues in site</li> </ul>	Dismantling period	Dismantling company	ContourGlobal	Good site operational practices	Site visits  To be included in subcontractor contracts	Management time

**Table 7.4** summarises the deadlines and timetable for transmission of reports to the Environmental authorities.

*Table 7.4: Timetable of environmental report transmission during operation phase*

Theme	Report	Transmission timetable
Air	Atmospheric emissions measurements (NO <sub>x</sub> , SO <sub>2</sub> , CO, metals, dust) - stack effluent and ambient air	Annual
Water	Analysis of aqueous discharges (pH, TSS, Hydrocarbons, BOD, COD, Nitrogen, Phosphorus, Coliform)	Annual
Waste	Summary of waste management (quantity, transport, disposal)	Annual
Noise	Noise measurements at property limit	3 Years