REPUBLIC OF SENEGAL

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Un Peuple -Un But-Une Foi

Ministry of the Environment and Sustainable Development
Environment and Classified Installation Office (DEEC

CONTOURGLOBAL

Environmental and Social Impact Assessment for the ContourGlobal – Cap des Biches thermal power plant project

Final version – 12 March, 2015

2iEC ERM

The world's leading sustainability consultancy

ContourGlobal - Cap des Biches

Environmental and social impact assessment for the thermal power plant project

Final Version

Performed in collaboration with 2iEC Consultancy

ERM reference: GMS 0251196

For Environmental Resources Management

Approved by: Camille Maclet

Signature:

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LIST OF ACRONYMS

ANSD	:	National Agency of Statistics and Demography (*Agence Nationale de la Statistique et de la Démographie*)
AQS	:	Air Quality Standard
AT	:	Arrêt de Travail
BOD	:	Biochemical Oxygen Demand
BRGM	:	Geology and Mining Research Bureau (*Bureau de Recherches Géologiques et Minières - France*)
CAPEX	:	Capital expenditures
CE 50	:	Medium efficient concentration (50%)
CEP	:	Assumed environmental concentration
CL 0 or 100	:	Lethal concentration for 0% or 100% of mortality
COD	:	Chemical Oxygen Demand
CRODT	:	Oceanographic Research Center of Dakar-Thiaroye (*Centre de Recherches Océanographique de Dakar-Thiaroye*)
CT	:	Combustion Turbine (*Turbine à combustion)*
DEEC	:	Direction de l'Environnement et des Etablissements Classés (Environment and Classified Facilities Office)
DEFCCS	:	Direction des eaux, forêts, chasse et de la conservation des sols (Office for Water, Forests, Hunting and Soil Conservation)
DEIE	:	Division des Évaluations d'Impact sur l'Environnement (Environmental Impact Assessment Office)
DGID	:	Direction Générale des Impôts et des Domaines (General taxes and estate office)
DGPRE	:	Direction de Gestion et de la Planification des Ressources en Eau (Water resources management and planning office)
DIC	:	Division des Installation Classées (classified installations division)
DL 50	:	Dose létale médiane (50%) (Lethal dose 50%)
DPC	:	Direction de la Protection Civile (Civil protection office)
DPVE	:	Direction de la planification et de la veille environnementale (Environmental planning and supervision office)
DREEC	:	Direction Régionale de l'Environnement et des Etablissements Classés (Regional environment and classified installation offices)
ECOWAS	:	Economic Community Of West African States
EHS		Environnement, Santé et Sécurité (*Environment, Health and Safety*)
ERM	:	Environmental Resources Management
ESIA	:	Environment and Social Impact Assessment
ESMP		Environmental and Social Management Plan
GTDLI	:	Groupe de Travail sur les Dépôts de Liquides Inflammables (French working group on flamable deposits)
HIV	:	Human Immunodeficiency Virus
ICPE		Installation Classified for protection of Environment
IFC	:	International Finance Corporation
INERIS	:	Institut National de l'Environnement industriel et des Risques (French institute for industrial environment and risks)

IREF	:	Inspection Régionale des Eaux et Forêts (Regional water and forestry inspection office)
LAME	:	Laboratoire Africain de Métrologie et d'Essais (African laboratory for metrology and testing)
MSD	:	Musculo-Skeletal Disorders
NOEC	:	*No Observed Effect Concentration* – Concentration sans effets observés
OPEX	:	Operational expenditure
PC	:	Process contribution
PMD	:	Public Maritime Domain
PNAE	:	Plan National d'Action pour l'Environnement (National action plan for the environment)
PPI	:	Personal Protection Equipment
SAR	:	Société Africaine de Raffinage
SEI		Seuils des Effets Irréversibles (Irreversible effects threshold)
SEL		Seuils des Effets Létaux (Lethal effetcs threshold)
SENELEC	:	Société Nationale d'Electricité du Sénégal
SRTM	:	*Shuttle Radar Topography Mission*
ST	:	Steam Turbine (*Turbine à vapeur*)
TNI	:	Non-Immatriculated Title (*Titre Non-Immatriculé*)
ToR	:	Terms of Reference

NON-TECHNICAL SUMMARY

INTRODUCTION

This summary presents the Environmental and Social Impact Assessment (ESIA) for the project to modify the ContourGlobal - Cap des Biches power plant (formerly GTi Dakar) in Cap des Biches (hereafter "the Project").

This ESIA has been carried out to comply with Senegalese regulations, whilst also taking into account the 2012 performance standards of the International Finance Corporation (IFC – World Bank Group).

PROJECT DESCRIPTION

The Project, promoted by ContourGlobal - Cap des Biches, consists of the rehabilitation and modification of an existing 52MW thermal power plant (belonging to ContourGlobal - Cap des Biches) which was in operation between December 2000 and July 2013, and which is located in the Cap des Biches industrial area in the town of Rufisque, east of Dakar. The electricity will be sold independently for 20 years, within the framework of a purchase agreement signed with SENELEC.

The existing plant is located on 2.5ha of land, edged to the west by the SENELEC installation. This power plant (shut down) is a combined cycle thermal power plant of a maximum capacity of 52 MW. The proximity to the ocean, which causes a corrosive salty atmosphere, as well as certain delays in the maintenance of installations, have led to rapid deterioration of the latter.

The new power plant will be built on 2.99ha of land adjacent (to the east) to the initial site, which has been used for market gardening for several years. This plant will comprise three combustion engines (16.5MW each) running on heavy fuel oil associated with a combined cycle of 3.5MW representing a total power of 53MW. The electricity generated will be sent to the electricity unit at the existing power plant before being distributed using the electricity network already in place. Other equipment from the current plant (particularly the fuel storage tanks and the firefighting system) will also be used by the new layout for the plant, in order to optimise the land and budget associated with the new installations.

The provisional timetable for the Project plans for worksite operations to start at the beginning of 2015, with plant start-up during the first quarter 2016.

REASONS FOR THE PROJECT

Despite increased electricity generation supplying an increasing number of homes, the share of energy available for each home is decreasing due to the high demographic growth in Senegal. The deficit in electricity supply is resulting in a lack of stability that is affecting living conditions and the development of economic activity.

Development of the electricity plant is therefore essential for development in Senegal. The Project will have benefits both for ContourGlobal - Cap des Biches and for Senegal:

- For ContourGlobal - Cap des Biches, the project is part of a strategy to rehabilitate its energy generation assets and ensure its activities over the long term.

- At national level, the rehabilitation and modification of the ContourGlobal - Cap des Biches power plant will make Senegal's energy supply more reliable in response to increasing demand.

- At local level the Project will have direct benefits with the creation of jobs.

DESCRIPTION OF ENVIRONMENTAL AND SOCIAL BASELINE

Environmental baseline aims at characterise the Project's receptor environment and understand its sensitivity. Field data presented in the report was collected over the course of two field missions organised in June and October 2014, during which an analysis of the physical, biological and human environment was carried out. These missions also included public consultations processes and interviews were carried out with the various stakeholders in order to describe the administrative, demographic and economic context. These visits to the site were supplemented by bibliographical research.

The following topics were studied:

- Physical environment: geomorphology, geology, hydrogeology, hydrology, seismicity, weather conditions, air quality and ambient noise,
- Biological environment, natural habitats, flora, fauna, protected and/or threatened species, protected natural areas,
- Landscape,
- Human environment, administrative organisation, demographics, planning and land use context, agriculture, socio-cultural context and infrastructure, and
- Services rendered by the ecosystems.

For each of these topics a specific study area was defined based on the Project's potential zone of influence and according to the specific physical, biological or socioeconomic characteristics of each topic. In terms of the Project's zone and the close contact study area, land use is dominated by urbanised and industrial areas (Darou Salam Azur district to the east and SENELEC power plant and estate to the west).

Stakeholders in the Project were consulted at local, regional and national level, in accordance with current Senegalese regulations. The main conclusions and concerns put forward by stakeholders during the public consultation phase are also summarised in *Chapter 7*. It should also be noted that, in general, the Project was well received by the stakeholders consulted.

The process for acquisition of the land that will be occupied by the future power plant, managed by SENELEC in association with ContourGlobal - Cap des Biches, is also described in *Chapter 2*.

PROJECT ALTERNATIVES

Chapter 6 of the ESIA presents an analysis of the Project's alternatives. This analysis has taken into account the more important elements of the Project, such as the possibilities of total rehabilitation of the existing power plant, the location of the new power plant and the technological choices for electricity production. The "no project" option has been analysed separately.

This analysis has shown that the decision to install a thermal power plant run on heavy fuel oil associated with a combined cycle represents the best compromise according to social, environmental and economic criteria (cost-effectiveness and cost of energy production).

EVALUATION OF IMPACTS

Air quality

The operation of three engines running on heavy fuel oil will generate emissions of combustion gases (nitrogen oxides NOx, sulphur dioxide SO_2, carbon monoxide CO) and particles (PM). The impact of these emissions from the Project alone on air quality has been evaluated by means of modelling. The results of this modelling show that hourly concentrations of NO_2 could exceed Senegalese and international standards on air quality in inhabited areas in the short term (hourly limits exceeded) and for a very limited period (up to five episodes of one hour per year).

These potential excess levels (estimated by the modelling carried out) will represent only 0.06% of the annual operational time of the power plant. Moreover, for 98% of the time, hourly NO_2 concentrations modelled are 10% lower than Senegalese and international standards.

Air quality standards for SO_2 are not exceeded in the inhabited areas identified.

Total concentrations were then modelled (Project in operation + air quality under initial conditions) based on emissions from SENELEC thermal power plants. Modelling showed that total concentrations modelled over the long term are below applicable standards.

The importance of the impact linked to emissions from the engines is therefore considered to be **minor.**

Noise

During the building phase, noise emissions will be from site machinery and a temporary increase in road traffic (deliveries and employee transport). Noise from site machinery was evaluated in terms of the most sensitive receptors (houses in the SENELEC estate and the Diokoul district). According to this evaluation, the potential impacts associated with plant construction activities should be below the limits authorised by Senegalese regulations. This impact will therefore be minor to moderate and for a limited period only, such that no particular mitigation measure needs to be put in place.

During the operational phase, acoustic levels during the day time, assessed by taking account of the Project and of background noise, meet Senegalese noise limits for all receptors but show predicted noise levels above the IFC limit for the two receptors in the SENELEC housing estate. Current high background noise levels (pre-project) explain these excessive levels, whereas the contribution made by the project alone complies with noise limits. The contribution made by the project is therefore considered to be **negligible** compared to background noise.

- Noise levels obtained during the night exceed both Senegalese and IFC standards for all receptors analysed. However, the majority of sensitive receptors identified are schools, with no activity during the night. The increase in acoustic levels above the background noise generated at night by the operation of the new installations at the Project is, on the other hand, below IFC criteria (3 dB(A)) for all receptors and the impact generated can therefore be considered to be acceptable in terms of this criterion.

Finally, it can be noted that the project will not increase in any significant way the existing acoustic climate, which is mainly subject to noise emissions from existing SENELEC installations.

Availability and quality of water resources

Water requirements for building the Project are mainly linked to water consumption for domestic purposes at the site and to the use of water for construction works. The amount of water used during the building phase will be limited. Potential impacts on water resources will be negligible.

Impacts by the building phase on groundwater quality may be due to:

- run-off from the worksite loaded with matter in suspension, when it rains;
- discharge of used water from toilet facilities; and
- leaks or accidental spillage.

During the operational phase, the Project will be supplied by the *Sénégalaise des Eaux* distribution network. Requirements in terms of cooling water will be limited because the air cooling system will be designed with a closed loop. Unlike the former power plant, the new ContourGlobal - Cap des Biches power plant will in fact no longer use sea water for cooling. No local resource will therefore be used. Potential impacts on water resources linked to operation of the power plant should therefore be negligible.

All operational waste water that is likely to be contaminated, i.e. industrial water and potentially contaminated rain water, will be collected and treated by the effluent treatment plant to reduce its contaminant content. One of the main effects of the treatment carried out will be to separate water and hydrocarbons (which are the main pollutant likely to be discharged). Analyses will be regularly performed on the effluent prior to discharge in order to ensure that Senegalese standards on discharged water are met.

Discharge will be made into the marine environment via the SENELEC discharge canal located at the western limit of the existing ContourGlobal - Cap des Biches power plant. No heated discharge will be made by the power plant in operation. Any run-off of contaminated water will be avoided by means of the drainage and rain water separation system and waterproofing of the soils.

The Project's impact on water quality during normal operation should be minor. During abnormal functioning (due to a fault in the water treatment system), a moderate impact may occur; however, this would be a temporary impact since regular analyses of discharged water would rapidly identify any malfunction.

Biodiversity

The power plant building phase will begin with clearance of 2.99ha of land. In view of the small surface area concerned and the absence of any notable habitats in the area, the impact of this work is considered to be negligible. The presence of two isolated specimens of a partially protected plant species (*Faidherbia albida*) and a protected bird (the black kite – *Milvus migrans*) has been confirmed at the site but does not require the implementation of any specific measures prior to the start of operations (*Faidherbia albida* has been found commonly in the surroundings of the Project area and no trace of any nesting by the black kite has been observed in the construction area).

Landscape

The two main sources of visual and landscape impacts are the height and volume of the proposed structures. The main potential impacts resulting from the Project are the long term visual and landscape impacts due, on the Project's main site, to new buildings, and in particular the installation of a 40m high stack, which will be visible from the limit of the site, and the installation of tanks, the main steam turbines block and the two engines (about 16-18m high).

In view of the low sensitivity of the landscape and the intensity of the change, considered to be low, resulting impacts on the landscape are considered to be of negligible importance.

Land use and local infrastructures

Clearance of the land and the change of land use will lead to expropriation of a farmer who had been using the land concerned for market gardening and for fruit trees for several years. This farmer is not the owner of the land he was farming.

A land acquisition procedure was set up by SENELEC, in collaboration with ContourGlobal - Cap des Biches and a Senegalese surveyor who supervised operations. An agreement was signed with beneficiaries and planned compensation amounts were paid. There was no report of any dispute in the resolution of this issue.

No historic or archaeological site was identified within the Project area during investigations carried out within the context of the socioeconomic study. No cemetery or place of worship is located at the future power plant site and will not therefore be affected by development of the project.

Local socioeconomic context and living conditions

The Project's potential socioeconomic impacts are described in *Chapter 8*.

- Employment: During construction of the power plant, the recruitment of local workers will be preferred as much as possible. Workers will be employed for periods from several days to a few months. Numbers will therefore be variable throughout the building phase. Some construction tasks will require the intervention of qualified and specialist workers, who may be recruited from further afield if the necessary skills are not available locally. The construction work will therefore have a positive impact in terms of employment at local and regional level.

- Local economy and inflation: the local economy is already perfectly well integrated into the industrial and urban context of the study area, so that modifications induced by the arrival of workers in the area should be limited. Construction work at the plant will mean a dynamic for the local economy at different levels, depending on distance from the power plant area and the size of the communities affected. Workers working at the worksite and neighbouring communities will interact in various ways: food sales, sales of equipment and basic goods and various other services. These potential impacts can be seen as positive for the communities concerned.

- Immigration and pressure on existing local infrastructures: the development of infrastructure projects and associated building sites may also result in the phenomenon of opportunist immigration into the areas concerned by the projects, with the aim of finding a job. In the case of building this power plant, the probability of migrations towards the project area is highly improbable. In fact, the relatively limited size of the Project and the fact that the site is located not only close to the town of Rufisque but also to Dakar, will dilute the arrival of people looking for work at regional level. These effects are considered to be minor.

- Agriculture: in view of the low density of agricultural activities within the study area, the creation of local jobs at the plant building site will not have any real significant impact on agricultural production due to reduction in the labour force available for work on farm land and in orchards.

Finally, no specific impact on any vulnerable group has been identified.

Health and safety of local communities and employees

Activities carried out during clearance of the land involve cutting down trees, removing stumps, clearing grass, weeds, etc. across the installation area only (3ha). Risks associated with these activities will be relatively limited.

There is a risk that building of the thermal power plant could lead to an increase in health problems. Health risks are those that result from poor living and hygiene conditions, sexually transmitted diseases (HIV/ AIDS) and infections transmitted by vector. An influx of workers during building and operation of the plant is likely to increase the risk of propagation of diseases within local populations; these impacts should remain limited, however, on the one hand because the number of workers from outside the local community will be relatively small and, on the other, because no official accommodation will be provided for workers on the Project (which will avoid a concentration of workers).

Risk of accident and injury during the building phase will mainly affect workers employed at the site by the sub-contractor responsible for building the power plant. Measures to protect the health and safety of workers will be established within the context of a prevention plant, prior to the start of works, and implemented and following throughout the building phase.

During the building phase, traffic around the area where the future power plant will be located will increase significantly, in view of the fact that employees and equipment have to be transported by road to the site (mainly from Rufisque and Dakar). In view of the population density in certain areas, traffic risks could be increased. The impact caused by traffic is therefore considered to be medium.

During the operational phase, impacts on health and safety will be limited and will involve mainly the risks associated with running the power plant.

According to the modelling carried out during research into hazards (see below), no dwellings are located within the risk areas, such that this impact will be very limited. The other impact factors on health and safety (atmospheric emissions, noise issues, etc.) will be kept under control such that no major significant impact is expected (see above).

Services rendered by ecosystems

An evaluation of the impacts on services rendered by ecosystems has been carried out taking account of the value and sensitivity of receptors and the magnitude of impacts on ecosystems and natural resources. Impacts on ecosystems (food, traditional practices, etc.) during the various phases of the project have been evaluated as being of negligible to minor importance.

Solid waste products

During the building phase the types of waste products generated will be mainly excavated soils, domestic waste, packaging used for building materials and raw materials, materials resulting from the structural work as well as greasy waste, batteries, empty drums and other specific waste. Quantities of waste materials will be relatively low, meaning that the issue of their treatment is not considered to be problematic; the removal and management of waste materials will be dealt with by approved service providers.

During the operational phase, the main waste materials expected are domestic waste, sludge from the treatment stations, hazardous waste (lubricants and oils, filters, cloths, solvents) as well as waste from the maintenance workshop.

It is interesting to remember that ContourGlobal - Cap des Biches has the benefit of experience from the existing power plant, which is the object of rehabilitation and modification. The waste materials that were produced during operation of the existing power plant were managed by approved companies. ContourGlobal - Cap des Biches will use its knowledge and local experience in the choice of collection and treatment companies for this new power plant. The impact of waste production during the building phase has been evaluated as medium. Implementation of the mitigation and control measures described below will reduce this impact to an acceptable level.

Cumulative impacts

In the case of the development of the power plant Project, no other project currently being developed was identified during preparation of this study. Moreover, existing infrastructures within the study area were taken into account in the analysis of the baseline, in view of the fact that current conditions in the study area are already under the influence of activities associated with these infrastructures as well as their impacts.

With regard to the marine environment and associated industrial activities (carried out on the shore), no data relating to liquid discharge by activities within the Project area is available. Discharge into the sea from the future power plant will be limited, however, in view of the cooling technologies that will be used. The cumulative impacts of the various infrastructures in the study area on the marine environment will therefore be below those that existed through until July 2013, when the former ContourGlobal - Cap des Biches power plant (the operation of which required drawing up sea water and the output of heated discharge) was still in operation.

HAZARD STUDY

Hazard levels were studied based on the methodological guide published by DEEC [(1)], and with a view to compliance with current Senegalese regulations. Within the context of this study, hazards potentially presented by the installations were modelled and evaluated in terms of gravity and probability of occurrence. The scenarios were classified according to the criteria given in the Senegalese guide. Domino risks (risk of a chain of successive scenarios) were also analysed. No scenarios represents any intolerable risk.

The results of the hazard study indicate that the maximum area for irreversible effects is located 82 metres from the closest dwellings (housing used by SENELEC staff) and 270 metres from the Diokoul district, located to the east of the site. It is important to note that urban expansion will be very limited in terms of the Project area (the area is surrounded by fenced industrial projects, where no building is permitted), thus avoiding any new dwellings being built within the security distance.

Moreover, the implementation of prevention measures and measures to control any consequences, which are adapted to the potential hazards identified for the power plant, will make risks acceptable, in view of local conditions (in particular the location of the closest dwellings).

In addition to the hazard study, an analysis of professional risks was carried out, detailing potential risks for workers during the construction and operational phases and presenting measures by which to limit these risks, specifically by the use of personal protective equipment (PPE).

CLOSURE AND RESTORATION AFTER OPERATION

The contract signed between ContourGlobal - Cap des Biches and SENELEC provides for operations over 20 years. This period may be extended depending on local electricity production requirements and national production strategy. The power plant will be subject to a Closure Restoration and Aftercare Management Plan (CRAM). This measure will guarantee that ContourGlobal - Cap des Biches will not leave the site after operations in a deteriorated state compared to its state prior to occupation and that environmental or social impacts associated with site closure are controlled, in accordance with regulations and good practice.

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(1) Guide d'étude de danger, DEEC – Ministry for the environment and nature protection ; October 2005 version.

ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN

An Environmental and Social Management Plan (ESMP) was prepared after completion of the ESIA for the ContourGlobal - Cap des Biches project, with a view to complying with law N° 2001-01 of 15th January 2001 containing the environment code.

The aim of the ESMP is to provide an environmental and social management framework for the Project, by translating the mitigation measures specified in the ESIA into a plan for implementing the Project.

Thus, the ESMP proposes a reduction plan comprising mitigation measures to be implemented by the Project for each phase of its implementation, with the aim of complying with Senegalese regulations and with international standards and good practice. The plan also details ways in which measures are to be monitored and the costs and responsibilities involved.

The ESMP provides a framework for monitoring the Project's compliance with these standards and good practices. It makes specific reference to the roles and responsibilities for every aspect of the Project subject to mitigation measures and describes the organisation of environmental and social management responsible for mitigation and monitoring during the building and operational phases.

In addition to the reduction plan presented above, the report also provides essential principles in terms of the following environmental management procedures, which must be implemented within the context of development of the environmental and social management system:

- Water resources management procedure ;
- Waste management procedure ;
- Transport management procedure ;
- Procedure for intervention in case of spillage ; and
- Procedure for periodic audit and review of the ESMP.

These procedures will be designed to be adaptable to the various phases of the Project, in order to remain relevant to the issues specific to each phase.

The Chapter also includes a plan for supervising and monitoring the environment according to residual impacts revealed by the study. This plan is intended to ensure that the measures proposed are implemented and efficient, and details the responsibilities, deadlines and costs associated with internal and external monitoring (by the Senegalese authorities).

GENERAL CONCLUSION

Based on the assessments undertaken for the purpose of this ESIA and detailed in this report, the experts in charge of this study consider that the ContourGlobal - Cap des Biches Project follows the best international practices and is acceptable with regards to the social and environmental legislation in Senegal.

1 INTRODUCTION

1.1 AIM OF THE REPORT

This report presents the Environmental and Social Impact Assessment (ESIA) for the project to modify the ContourGlobal - Cap des Biches power plant in Cap des Biches (hereafter "the Project").

The Project, promoted by ContourGlobal - Cap des Biches, consists of the building of a new 53MW electricity generating power plant (belonging to ContourGlobal - Cap des Biches) to replace an existing 52 MW power plant which was in operation between December 2000 and July 2013, and which is located at Cap des Biches, Rufisque. This project has been defined in consultation with the National Electricity Company (hereafter SENELEC), based on projections for the demand and generation of electricity in Senegal in the medium and long term.

Planned modifications comprise:
- the replacement of main electricity generation equipment by other, more recent equipment and different technologies, and
- the rehabilitation of existing equipment.

In the long term, this will be a combined cycle thermal power plant comprising three 16.5MW diesel engines associated with a 3.5MW combined cycle. In total, the plant's generation capacity (as defined contractually between ContourGlobal - Cap des Biches and SENELEC) will be 53 MW with an availability rate of 91.5% per year, i.e. generation of 425 GWh/year.

1.2 PRESENTATION OF CONTOURGLOBAL - CAP DES BICHES

ContourGlobal - Cap des Biches is a private, independent producer which, in 1996, signed with SENELEC a contract for the exclusive supply of electricity for a period of fifteen years (initial contract was in the name of GTI-Dakar). A permit to operate the power plant was granted to ContourGlobal - Cap des Biches by ministerial order nº 006562/ MEPN/ MEMI/ DEEC dated 19th August 1998. In 2000, ContourGlobal - Cap des Biches obtained a power purchase agreement (PPA) for a 15 year period, and electricity generation at the ContourGlobal - Cap des Biches installation began in December 2000. The power plant was shut down in 2013 for technical reasons, investigations having revealed major deterioration of several of the turbine rotation components. ContourGlobal - Cap des Biches then decided not to re-start production but to update and renovate all the installations completely, in coordination with SENELEC.

In April, 2013, ContourGlobal - Cap des Biches was bought by ContourGlobal, an international energy production company. The aim of the project pursued by ContourGlobal is the building of a new 53MW power plant (to replace an existing 52 MW power plant. Renewal of the PPA contract between SENELEC and ContourGlobal was signed in August 2014. This contract is part of the Emerging Senegal Plan (PSE) and aims to improve SENELEC's production, at a reduced cost and to improve direct foreign investments, with an investment of one hundred million dollars. By the end of year 2014, GTI-Dakar changed his name to ContourGlobal – Cap des Biches.

1.3 PRESENTATION OF THE RESEARCH OFFICES RESPONSIBLE FOR THE ESIA

ContourGlobal - Cap des Biches has mandated Environmental Resources Management (ERM) to carry out this ESIA, working in partnership with the firm 2iEC. The list of the experts who have participated to this ESIA is detailed in *Annex 9*.

ERM (Environmental Resources Management)

ERM is one of the world's "leading" companies in environmental and social management consultancy, and has extensive experience in terms of environmental studies, throughout the complete life cycle of a project, from its conception through to cessation of activities and dismantling.

Inset 1.1 ERM's competencies

Project phase	Competencies
Identification, pre-feasibility	• Strategic studies, • Sustainable planning studies • Study of statutory, environmental and social constraints
Feasibility, engineering	• Environmental and social impact studies (ESIA) • Environmental and social management studies (ESMS) • Consultation with stakeholders, public enquiries • Plans for compensation and re-installation • Regulations files • Technical assistance for financial institutions
Implementation, operations	• Partnership in implementation of the ESMP • Environmental and social monitoring • Due diligence audit • Hygiene, safety, environment management systems (HSE) • Waste management
Cessation of activities	• Plans for the cessation of activities and dismantlement • Management of contaminated sites and soils • Site rehabilitation.

ERM employs almost 5000 people in 150 offices across the world, and has been working in Africa for several decades, from France, Spain, the UK and its three offices in South Africa.

ERM is certified for the performance of environmental impact studies under the terms of ministerial order n°002244/MEEDD/DEEC/DEIE/AG dated 10 September 2014.

2iEC

ERM has undertaken this ESIA and the consultations with stakeholders in partnership with 2iEC, a company researching and managing international projects based in Dakar and with offices in Togo and France. M. Oumar Karamoko Ndiaye, Director of 2iEC, is certified for the performance of environmental impact studies under the terms of ministerial order n°9470 MJEHP/DEEC dated 28th November 2001.

1.4 *ESIA OBJECTIVES AND METHODOLOGY*

1.4.1 *ESIA objectives*

The ESIA procedure is governed by Articles L-48 to L-54 of Chapter V of law N° 2001 - 01 dated 15th January 2001 covering the environment code.

Any new project, of any kind whatsoever, implies a modification to baseline conditions of the area in which it is installed. The main objective of an ESIA is to assess what impacts will be caused by the modifications linked to this project, and to define whether these impacts are acceptable from an environmental and social point of view.

The aim of the ESIA procedure is therefore to evaluate the potential impacts of a project likely to affect the biophysical, human and socioeconomic environment. Appropriate mitigation measures identified in the ESIA procedure are intended to remove, reduce or even compensate for the negative impacts of the project.

The drawing up of an ESIA must include the following elements:

- description of the receptor environment, characterisation of the environmental and social sensitivity of the area being researched;
- identification of any statutory obligations to be complied with during the various phases of the Project;
- identification of any classified installations planned for the preparation and operational phases of the Project ;
- description of any environmental issues linked to the layout /installations ;
- identification and evaluation of the project's potential impacts ;
- drawing up of an environmental and social management plan (ESMP) to remove, reduce or even compensate for the negative impacts discovered and to optimise the positive impacts, taking account of the opinions of any interested parties; and
- definition of the major outlines of environmental surveillance and of the environmental monitoring indicators to be implemented.

1.4.2 *ESIA methodology*

ESIA scope

The Project's characteristics, in its construction and operational phases, have been analysed in view of the environmental conditions in the installation area, based on the characteristics intrinsic to each interaction of the Project with the environment.

The study area for each component of the environment (physical, biological and human) has therefore been defined according to the Project's potential zone of influence. For example, weather conditions have been analysed within a sufficiently large perimeter to ensure that the various climatic events that may influence the dispersion of discharge into the atmosphere have been taken into account. Details of the definition of each study area are presented in *Chapter 4.*

Data used for the ESIA

The study has been based on field data collected during a mission to the site carried out from 24th to 27th June 2014. The mission resulted in collection of data related to the physical, biological and human environment (consultations with stakeholders and the identification of sensitive receptors located within the Project's zone of influence). A second phase of consultation with stakeholders was organised and several meetings were held from 6th to 22nd October 2014.

The study has also been based on existing documents, particularly statistics communicated by the local representatives of competent Senegalese ministries and reports and publications produced by international agencies and research centres.

Method for evaluating impacts

Evaluation of the Project's various potential impacts has been based on an evaluation grid that takes account of the type of impact (direct or indirect), and the intensity, extent, duration, frequency and probability of the occurrence of potential impacts. Finally, the various different characteristics of each impact were analysed in view of the sensitivity of the study area vis-à-vis each theme. This classification was based on professional judgements that comply with the directives and standards of impact studies.

The concerns of the various Offices linked to the Project (Office for the Environment and Classified Installations, Office for Water, Forests, Hunting and the Conservation of Soils, Regional Office for the Environment and Classified Establishments, etc.), the opinions of stakeholders and environmental and social regulations, as well as good practice in the sector have also been taken into account.

Depending on the scale of the Project's various potential impacts, measures to remove, reduce and compensate for them have been defined, such that residual impacts, after implementation of these various measures, are acceptable and comply with current Senegalese regulations and with international standards. These various measures are integrated into the Project's Environmental and Social Management Plan, provided in *Chapter 10* of this report.

1.5 TIMETABLE FOR THE ESIA

The ESIA procedure was initiated by ERM and 2iEC in June 2014 with the realisation of a scoping study as well as a mission to collect data in the field.

This study enabled the writing and deposition of the ESIA Terms of Reference with the Environment and Classified Installations Office (DEEC) at the end of September 2014.

These were validated on 30th October 2014, following a visit to the site by the DEEC on 3rd October 2014 (letter n°2720/MEED/DEEC dated 30/10/2014 is provided in *Annex 2*). The Terms of Reference were modified based on comments received; the finalised version is provided in *Annex 1*. The main modifications made to the Terms of Reference report following the integration of comments from the DEEC are shown in *Table 1.1*.

Table 1.1 Main modifications made to the Terms of Reference after integration of comments from the DEEC

Observations made by the DEEC		Additions/modifications made to the Terms of Reference
n°	Topic	
1	Project description	Addition of a section entitled "Content of the Project description chapter" in the ToR
2	Description of basic environmental conditions and definition of environmental incidents	Observations made by the DEEC included information already presented in the ToR; no modification was therefore made
3	Study of hazard levels	Observations made by the DEEC included information already presented in the ToR; no modification was therefore made
4	Environmental and Social management plan	These points have been specifically discussed by the DEEC (Environmental Impact Evaluation Division) and ERM; it has been agreed that all this information will be included in a chapter entitled "Environmental and Social Monitoring and Management Plan ". The ToR have been amended in accordance.
5	Environmental Surveillance and Monitoring Plan	
6	Institutional mechanism	
7	Increase in capacities	
8	Public participation	Observations made by the DEEC included information already presented in the ToR; no modification was therefore made.
9	Drafting of environmental clauses to be inserted into the DAO of contractors	The ToR have been amended in accordance.
10	Environmental report on the Project	The ToR have been amended in accordance.

Observations made by the DEEC		Additions/modifications made to the Terms of Reference
n°	**Topic**	
11	Structuring of the report	The structure of the report has been discussed specifically by the DEEC (Environmental Impact Evaluation Division) and ERM; it has been agreed that the "Environmental and social management plan" and "Monitoring and surveillance plan" chapters can be merged, as long as they contain all the information required by the DEEC.
-	NB	Relating to the plan for dismantling or securing the installations, it was specified in the ToR that existing installations not used for the Project will be recuperated by SENELEC as from December 2015. It is therefore up to SENELEC to define a dismantling plan or a plan to secure remaining installations. An "Existing installations not being re-used for the Project" section has been added to the ToR.

1.6 STRUCTURE OF THE ESIA REPORT

This ESIA report follows the organisation defined in Senegalese environmental and social legislation. The following sections and chapters are included in the report:

- non-technical summary ;
- introduction ;
- Project's justification ;
- description of the Project ;
- analysis of the site's baseline conditions and of its environment;
- public consultation ;
- regulatory and institutional framework of the study ;
- description and analysis of the possible alternatives of the Project ;
- identification and evaluation of probable impacts linked to the project mitigation measure and residual impacts;
- study of hazards and professional risks ; and
- environmental and social management plan.

2 PROJECT'S JUSTIFICATIONS

2.1 PROJECT'S JUSTIFICATION

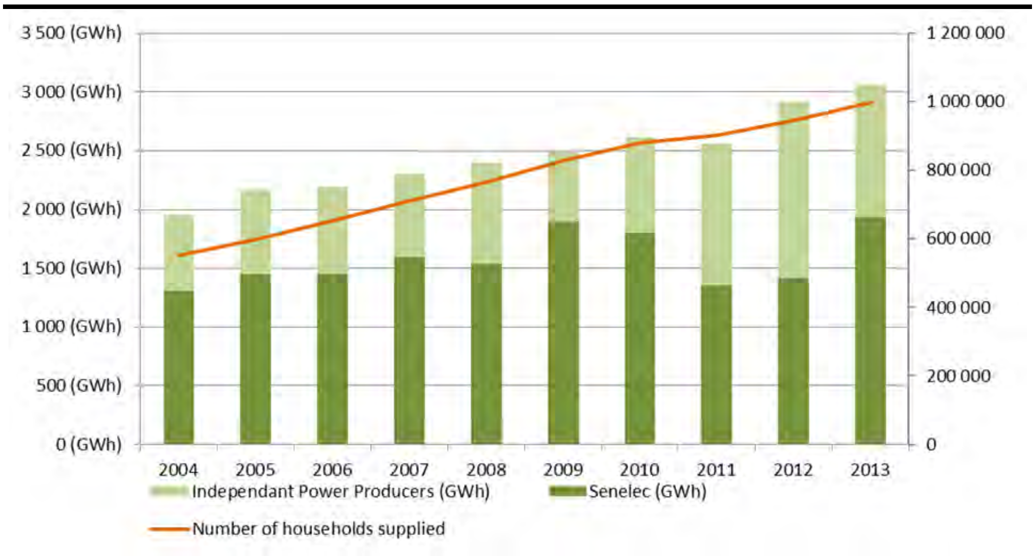
2.1.1 *Electricity production at national level*

In Senegal, regulation and control of the energy sector are dealt with by the State through the Energy Ministry (Commission for regulation of the energy sector). The production, transport, distribution and sale of electricity are delegated to the Société Nationale d'Electricité (SENELEC). Three private operators also operate in Senegal in public-private partnerships, including ContourGlobal - Cap des Biches, which became the leading independent energy producer in Senegal, when the Cap-des-Biches thermal power plant began production in December 2000, lasting through until July 2013.

In 2010, the total installed power of the Senegalese electricity generation plant was 686.5 MW (1), of which 493 MW generated by SENELEC and 192.5 MW by private producers. However, the relative state of dilapidation of certain installations limits electricity generation.

Figure 2.1 shows the developments in energy generation and the number of homes supplied between 2004 and 2013. Note the reduction in the share of energy generated by private producers in 2013, in part due to the shutdown of the ContourGlobal - Cap des Biches power plant.

Figure 2.1 ***Development in energy generation and the number of Senegalese homes supplied***

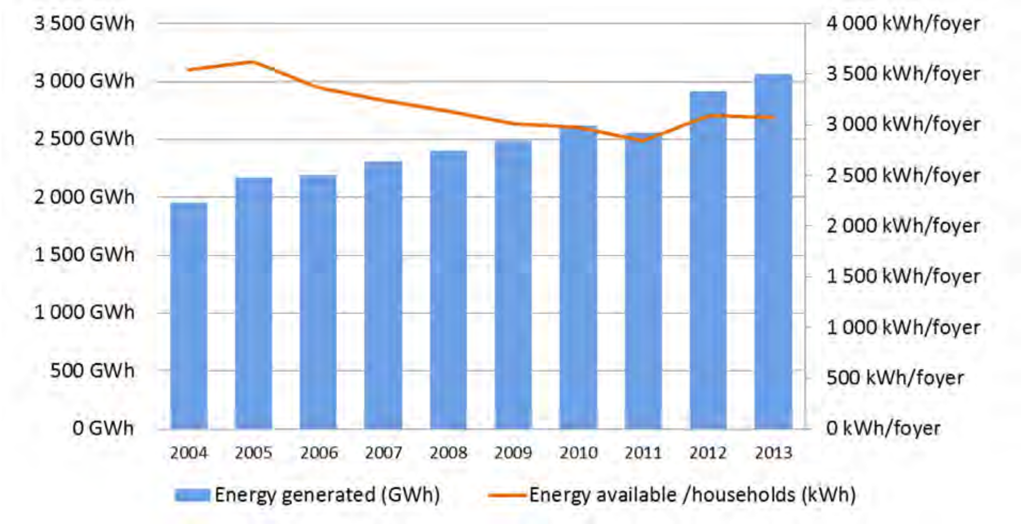


Source: *SENELEC, 2010* and *SENELEC, 2013*

(1) This figure includes generation at the Manantali dam (Mali), run by OMVS (Organisation pour la Mise en Valeur du fleuve Sénégal) 33% of the production of which goes to Senegal.

Despite increased electricity generation supplying an increasing number of homes, the share of energy available for each home is lessening due to the high demographic growth in Senegal, as shown in *Figure 2.2*. Despite an increase in 2012, the share of energy available per home remains below that in the years 2004-2005.

Figure 2.2 *Evolution of energy generation and energy available per home*



Source: *SENELEC, 2010* and *SENELEC, 2013*

This chronic deficit in the supply of electricity induces instability affecting living conditions and the development of economic activity. Development of the electricity plant is therefore essential to the development of Senegal.

2.1.2 Expected benefits

The Project will have benefits both for ContourGlobal - Cap des Biches and for Senegal:

- For ContourGlobal - Cap des Biches, the project is part of a strategy to rehabilitate its energy generation assets and ensure its activities over the long term.
- At national level, the rehabilitation and modification of the ContourGlobal - Cap des Biches power plant will make Senegal's energy supply more reliable in response to increasing demand.
- At local level, the Project will have direct benefits, with the creation of jobs.

2.1.3 Employment and local development

The building phase, (including start-up) which will last for about 14 months, will require the intervention of around 200 workers in total.

During the operational phase, ContourGlobal - Cap des Biches will employ around 45 permanent workers.

2.1.4 *Amount of the investment*

Capital expenditure (CAPEX) associated with the construction and start-up of the plant is estimated at 53.2 billion CFA francs. Later, monthly operational costs (OPEX), excluding fuel, will be of the order of 240 million CFA francs; the monthly cost for the purchase of fuel is evaluated at 2.57 billion CFA francs.

A royalty payment of around 50 million Francs CFA will be paid annually by ContourGlobal - Cap des Biches to the Senegalese State throughout the duration of operations at the plant. It is planned that this amount will be redistributed in part to the municipality of Rufisque Ouest by the General Taxes and Estates Office (DGID).

2.2 *REASONS FOR THE CHOICE OF LOCATION*

ContourGlobal - Cap des Biches's decision to rehabilitate and modify an existing plant rather than building a new one allows for optimisation of the use of space, restricting requirements in terms of land for new installations (cf. *Table 2.1*).

Table 2.1 Comparison of surfaces necessary for the implementation of a central

Surface	New power plant – data from ERM's feedback on similar projects	Project, reusing of some existing equipments
Power plant's boundaries	3 ha	1.5 ha
Construction site's boundaries	1.5 ha	1.5 ha

The choice of this location is also justified by the location of the electricity transport network, which is highly developed in the Cap des Biches area due to the historic SENELEC installation at the site. Neighbouring high voltage cables provides for sufficient capacity to transport the new electric power generated.

3 DESCRIPTION OF THE PROJECT

3.1 GENERAL DESCRIPTION OF THE PROJECT

3.1.1 Introduction

The Project, developed in collaboration with SENELEC, has been designed to produce between 425 GWh (contractual commitment) and 464 GWh (maximum production) per year. The electricity will be sold independently for 20 years, according to a purchase agreement signed with SENELEC.

The plant will comprise three engines and a combined cycle, representing nominal power of 53 MW. It will operate continuously.

The new plant will be located on a site adjacent to the existing plant; this proximity means that some of the existing equipment can be reused.

3.1.2 Location of the Project

The area in which the Project will be installed is located within the Cap des Biches industrial area, in the town of Rufisque, in the department of the same name (see *Figure 3.1*).

The existing plant is located on 2.5ha of land, edged to the west by the SENELEC installation (see *Section 5.7.5* relating to the industrial context). The new plant will be installed on 2.99ha of land, adjacent to the initial site and shown in *Figure 3.2*. This site comprises two parcels with different land registry statuses:

- A Non-Immatriculated Title (TNI) under the jurisdiction of the town of Rufisque (surface area: about 1.84ha); this land has been allocated to SENELEC (see Appendix 3) which will transfer it to ContourGlobal - Cap des Biches on a long lease, before the works phase.

- Land of around 1.14ha, which is part of the Public Maritime Domain (PMD); procedures to grant this land to SENELEC are on-going with the Economy and Finance Ministry.

Figure 3.1 Location of the Project area: overview

Source: *ERM, 2014* Satellite image: Bing, 2013.

Figure 3.2 Installation site for the new equipment

Red: site of existing installations / blue: new site
Source: *ERM, 2014*. Satellite image: *Bing, 2013*

3.1.3 *Description of existing ContourGlobal - Cap des Biches facilities*

Inscription on the special classified facilities register

ContourGlobal - Cap des Biches owns a thermal power plant of a capacity of 52 MW situated at Cap des Biches in the town of Rufisque. The permit to operate the plant was granted to ContourGlobal - Cap des Biches by ministerial order n°006562/MEPN/MEMI/DEEC dated 19th August 1998 (see *Annex 4*), and electricity production began in December 2000. This power plant was shut down in 2013.

The installation is listed under number 4221 in the special register of classified installations

Current facilities' operating principles (now shut down)

This is a combined cycle thermal power plant that can operated using diesel or naphthalene. It comprises a combustion turbine (CT) associated with a steam turbine (ST) that can operate either in single cycle (CT only) with a capacity of 35 MW, or in combined cycle (CT + ST) with a maximum capacity of 52 MW. The site covers a surface area of 2.5ha and includes the following installations:

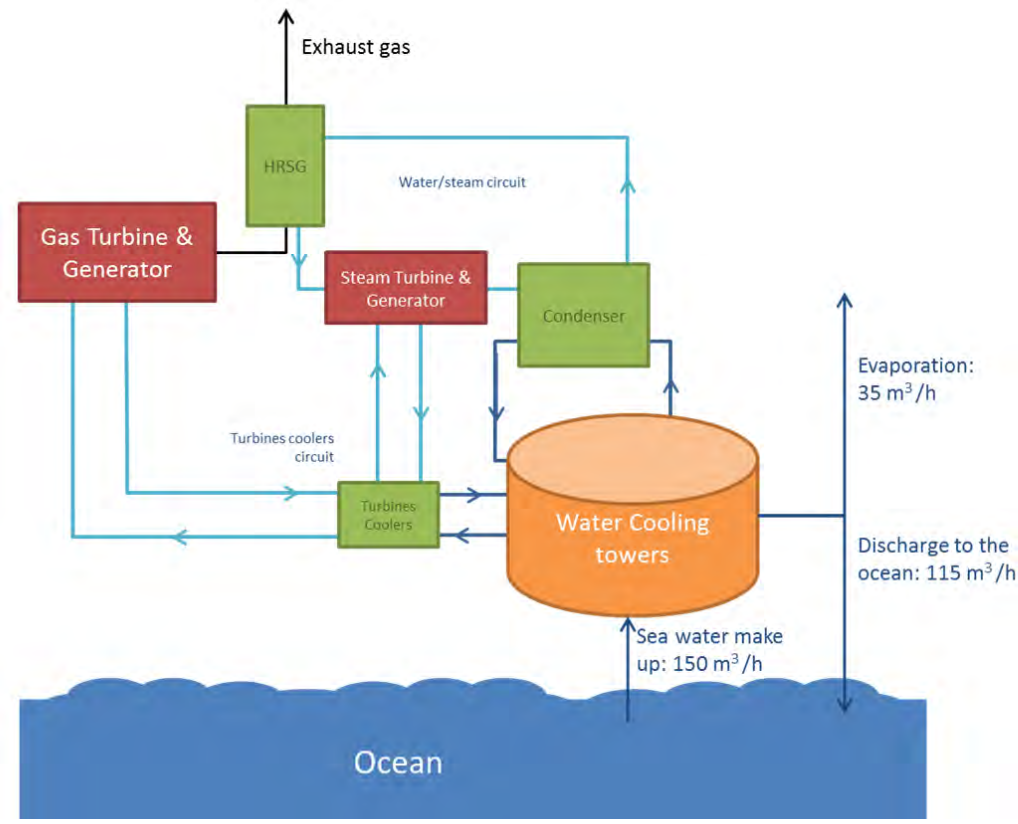
- Preparation installations: unloading and storage of fuel, raw water reservoir, and sea water pumping station.
- Production installations: combustion turbine (CT), connected to an alternator, steam turbine (ST), connected to an alternator, boiler collecting the heat from CT exhaust gases producing steam, ST cooling system using sea water, CT cooling system using air, combustion gases evacuation chimneys (one for operation in combined cycle and the other for single cycle operation).
- Auxiliary systems: water demineralisation and demineralised water storage unit, compressed air production unit, fire protection system, emergency electricity generator, water / oil separation system, prior to discharge into the sea.
- Post-production installations: 11/90 kV transformer and high voltage electricity station, for the evacuation of energy into the SENELEC network.
- Buildings comprising specifically: the control room, the electric auxiliaries' room, the protections room, operational offices, workshops, stores, chemicals warehouses.

During the operational phase, sea water required for cooling the ST was drawn from the canal bringing water to existing SENELEC plants and discharged through a discharge canal shared with the SENELEC plants. The location of these various facilities is shown in *Figure 3.3*; *Figure 3.4* shows the cooling principle used by the current plant during combined cycle operation phases.

Figure 3.3 Main facilities at the existing thermal power plant

Source: *ERM, 2014.* Fond cartographique: ©ArcGIS Online Basemap

Figure 3.4 Block diagram of the combined cycle cooling system – current plant now shut down



Source: *ERM, 2014*

Condition of current installations

The proximity to the ocean, which causes a corrosive salty atmosphere, as well as certain delays in the maintenance of installations, have led to rapid deterioration of the latter. Thus, the heat recovery boiler and the ST had to be shut down in March 2011 and the CT could only be maintained in operation with severe limitations.

In July 2013, the CT was completely shut down for safety reasons, investigations having shown major deterioration in several of the turbine rotations components. ContourGlobal - Cap des Biches then decided not to re-start production but to proceed with a complete update of the installations, in coordination with SENELEC.

3.1.4 Planned rehabilitation

The Project will reuse some of the equipment of the current plant, which will be rehabilitated so as to comply with current standards and good practice and to satisfy the Project's operational requirements. This equipment is as follows:

- The demineralised water production system
- Certain compressors for the production of compressed air
- Storage equipment: storage of fuel, storage of raw water, demineralised water and water for the firefighting system
- The transformer and connection to the electricity network
- The administrative buildings.

The other equipment required by the new plant will be installed on the adjacent site (see *Table 3.2*). The general map of existing facilities is presented in *Annex 5*; installations shown in grey correspond to existing equipment, whilst those shown in black will be installed for the Project; current equipment that will be reused is identified on the map.

3.1.5 Compliance of existing facilities with Senegalese regulations

An audit of compliance of existing facilities with Senegalese environmental regulations was undertaken by the Quartz Afrique office in March 2012, when the heat recovery boiler and the ST had already been shut down and the CT was operating intermittently in single cycle.

This compliance audit is provided in *Annex 6*. Considering the reduced activity of the power plant between March 2012 (completion date of the audit report) and July 2013 (date on which the plant was shut down), this audit is considered to be representative of the current condition of existing installations. This representativeness was checked by ERM during a preliminary visit to the site.

The 2012 audit comprised 2 levels of observation:

- observations of level A corresponding either to non-compliance in terms of Senegalese regulations, or to shortcomings that could lead to potential risks for workers, surrounding populations or, more generally, the environment (even if these shortcomings do not represent a non-compliance),

- level B recommendations, which are neither non-compliance in terms of Senegalese regulations, nor risks for workers, the public and the environment. In view of their non-regulatory nature, these level B observations have not been taken into account in this analysis.

As indicated in *Chapter 3.1.4*, only part of the equipment will be re-used for the Project. *Table 3.1* below presents a synthesis of non-compliances that came to light during the 2012 audit, which are linked to the equipment to be retained for the Project. The other observations are not applicable to this current Project, since they concern either installations that will not be rehabilitated or management practices that concerned the plant's former configuration.

Table 3.1 Non-compliance with regulations of equipment from the current power plant to be re-used for the Project

Issue	Non-compliance	Corrective action proposed in 2012
Waste water management	No buffer tank for the storage of waste water prior to discharge into the natural environment.	Creation of a buffer tank.
	Results of water quality analyses not transmitted to the DEEC.	Transmission of water quality analysis results to the DEEC.
Contamination of the soil and sub-soil	No monitoring of soil and sub-soil contamination in the at-risk areas (fuel storage areas).	Evaluation of possible contamination of the soil and sub-soil. Implementation of a groundwater monitoring system, in case of accidental contamination.
Firefighting resources	Firefighting resources not entirely efficient.	Improvement of firefighting resources (foams, cooling rings).
	Internal organisation plan not up to date.	Up-date of the Internal Organisation Plan

Source: ERM based on the compliance audit carried out by *Quartz Afrique, 2012*.

3.2 DESCRIPTION OF THE PLANNED NEW THERMAL POWER PLANT

3.2.1 *Energy production system*

The power plant will comprise a main building housing three combustion engines running on heavy fuel oil connected to an alternator and associated with a "Flexicycle" type combined cycle. The Flexicycle will recuperate the heat from the engines' exhaust gases. After gradual reheating and passage through an evaporator, the steam generated will activate a turbine connected to an alternator, before being condensed and going back to the start of the cycle. The electricity generated will be sent to the electricity station of the existing plant, before being distributed using the electricity network already installed.

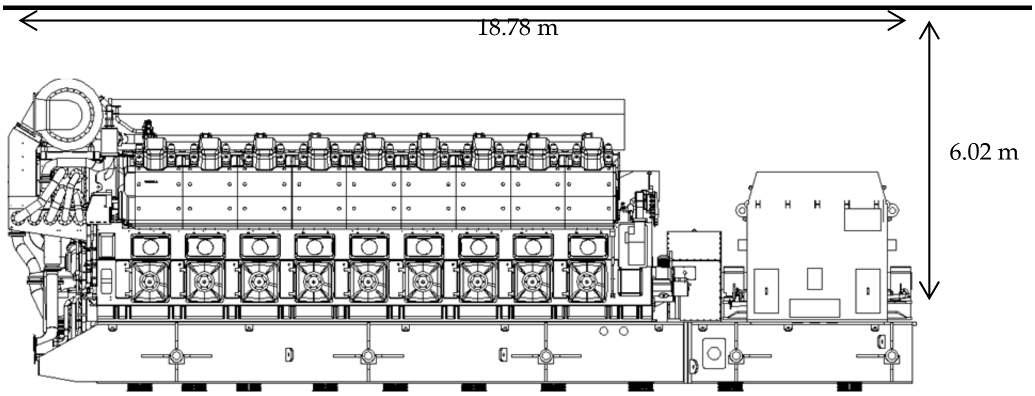
Main equipment

The main energy producing equipment at the ContourGlobal - Cap des Biches power plant will be:

- Wartsila 18V46 type, supercharged, four stroke, semi-fast diesel engines (see diagram in *Figure 3.5*). These engines enjoy a very high performance rate (46.9% excluding the combined cycle), thus guaranteeing the lowest possible fuel consumption, and they will deliver individual effective power of 16.5MW. They will be fitted with radiators to cool the engine, air filters, intake silencers and boilers to recycle heat before evacuation of combustion gases via the stack (Flexicycle – see below).

- A Flexicycle comprising a 3.5MW steam turbine, use of which results in a 50.2% energy performance rate. The Flexicycle comprises the following equipment :
  - A boiler including, amongst other things, a superheater, an evaporator and a tank for storing steam; the boiler can be used to recuperate the heat from the engines' exhaust gases and convert it into steam.
  - A steam turbine connected to an alternator, activated by the steam produced by the boiler, and
  - A condenser, used to transform water from the Flexicycle from steam to liquid, after passing through the turbine; the liquid water then returns in a closed cycle to the boiler.

Figure 3.5 Diagram of a Wartsila 18V46 type engine



Source: *Wartsila, 2014*

The main equipment at the power plant is presented in *Table 3.2*.

Table 3.2 Main equipment at the planned ContourGlobal - Cap des Biches thermal power plant

Description	Characteristics of the main components
Energy production system	3 engines of a unit power of 16.5 MW 1 3.5MW steam turbine
Storage in tanks	Heavy fuel oil • Two 1 480 m^3 storage tanks; these tanks are the ones from the existing power plant • One 3000 m^3 tank • One 55 m^3 intermediate tank • One 100 m^3 day tank Diesel: • One 120 m^3 tank; this is equipment from the existing power plant • One 100 m^3 tank Firefighting water: 700 m^3; this is equipment from the existing power plant Raw service water: 150 m^3 Demineralised water: 100 m^3; this is equipment from the existing power plant Water contaminated by hydrocarbons from the deoiler: 50 m^3 intermediate tank Water for cleaning the boilers: 5 m^3 Sludge: 80 m^3 storage tank New lubricant: 35 m^3 Used lubricant: 25 m^3 Maintenance lubricant: 16 m^3 Maintenance water (cooling system): 10 m^3
Water supply and treatment	Buried pipe, managed by the SDE(*) Water treatment system (demineralisation)
Combined cycle	3 boilers (one per engine), 1 steam turbine, 1 condenser.
SENELEC electricity station	Main transformer (existing): 11 kV / 90kV(*)
Other equipment	Loading / unloading area Unloading area Centrifuge (initial treatment of the heavy fuel oil) Firefighting system Administrative buildings Maintenance workshop Warehouse Canteen Laboratory Liquid effluent treatment system Cooling: closed circuit cooled by air

Source: *Wartsila, 2014*

The ContourGlobal - Cap des Biches power plant, whose water requirements are mainly linked to the diesel engine cooling system, to the Flexicycle "water / steam" circuit and to its cooling system, as well as to drinking water consumption, will be supplied with water from a buried piper with an output of 125 m^3/day. This pipe already exists and will not require any modification linked to the Project.

The layout of these various buildings within the area covered by the project is shown on the general layout map given in *Annex 5*.

In addition, a temporary area will be laid out during the construction phase in order to store the various materials and equipment necessary, as well as for the concrete plant. This area will be fenced around its entire perimeter and located within the area covered by the power plant.

Characteristics of the stacks

There will be three stacks with identical characteristics, located alongside each other (one stack per combustion engine). The characteristics of the stack as well as the emission parameters of the associated atmospheric emissions (temperature and speed) are show in *Table 3.3*. These characteristics have been defined with a concern to optimise correct dispersal into the atmosphere. The characteristics are reflected in the modelling of atmospheric emissions presented in *Chapter 8.5*.

Table 3.3 Main characteristics of the stack

Height of the stack	Stack diameter	Emission temperature	Emission speed
[m]	[m]	[C]	[m/s]
40	2.77	180	21.7

3.2.2 *Taking account of environmental issues and design optimisation*

The design of the ContourGlobal - Cap des Biches power plant has taken environmental topics into account, with the aim of achieving equilibrium between environmental performance, energy performance and the investment cost of the Project.

Integration of a combined cycle, associated with engines of recent design and with a high energy performance rate (around 47%) will thus optimise atmospheric emissions.

Moreover, the Wartsila combustion engines will be designed to be able to operate on natural gas (replacing the heavy fuel oil), as soon as this type of fuel is available in Senegal, thus permitting optimisation of costs and atmospheric emissions.

Concerning noise levels, the engines have been designed by Wartsila to have low noise emissions. The following improvements have also been included right from the design of the power plant in order to reduce noise levels:

- Silencer on the exhaust output,

- Absorbent panels on the walls of the building, and
- Air inlet and output fitted with noise captors.

3.2.3 *Fire protection system*

The fire protection system at the site will comply with national requirements and international standards. It will comprise the following elements:

- Fire alarms and visual signals in noisy areas;
- Smoke detectors ;
- 700 m^3 extinction water storage tank ;
- Fire hydrants with an output of 1 500 L/min located all around the heavy fuel oil storage area;
- Sprinklers in the machine room;
- Various water outlets located across the site; and
- Portable extinguishers suitable for the type of fuel (CO_2, powder…).

The nearest fire station is located in Rufisque, less than 3km away; this proximity to the plant means that firefighters could be quickly on the scene. Relations between the Project and this fire station will be the object of a detailed analysis in order to draw up the intervention plan for the new ContourGlobal - Cap des Biches power plant.

3.3 *DESCRIPTION OF OTHER EQUIPMENT*

3.3.1 *Laboratory, workshops and storage areas*

The storage buildings and maintenance workshop are located between the energy production area and the SENELEC transformer station. They comprise the following:

- Domestic installations: separate male / female changing rooms, showers and toilets;
- Laboratory ;
- Storage areas for the machine tools and spare parts;,
- Work areas fitted with a welding unit and machines such as a lathe, mill, drill, press, … ;
- Electrical equipment maintenance workshop ; and
- Test room for fuel injectors.

3.3.2 *Administrative building*

The administrative building located between the tanks area and the transformer station comprises office areas, a kitchen and a canteen, as well as toilet facilities.

3.3.3 *Access road*

The access road to the existing power plant is asphalted. In view of the location of the new installations, in immediate proximity to the existing power plant, this access road will be reused for the new plant. No major road works will therefore be necessary for implementation of the Project.

3.3.4 *Unloading and settling area*

Option 1 - Supply by truck

The existing unloading area will be used for the new plant, particularly for diesel fuel. Roadways inside the plant will be 4m wide and will be designed to comply with the design procedure for road structures with low traffic levels, developed for AASHTO (*AASHTO Guide for Design of Pavement Structures*) and according to the results of geotechnical studies carried out at the site for the power plant extension.

The settling area will be fitted with separate pumps for heavy fuel oil, light fuel oil and maintenance oils (lubricants).

Option 2 - Supply by pipeline

It is possible that ContourGlobal contracts and agreement with the African Refining Company (*Société Africaine de Raffinage* - SAR) for the construction of a HFO pipeline. As part of this impact assessment study, the technical details of this new line are not yet finalized. However, it is noted that:

It will be a short length pipeline, leaving from the existing SAR pipeline passing along the eastern limit of the industrial area of Cap des Biches, to reach ContourGlobal's power plant.

This pipeline will not pass through residential areas or areas used by the local community; its construction will not induce resettlement.

The pipeline will be maintained to ensure its integrity and tightness.

As part of its in emergency response plan, ContourGlobal will develop procedures to respond to any incident involving the pipeline (hydrocarbon leak, fire, etc).

Fuel oil storage after delivery

Once unloaded, the heavy fuel oil will be stored in the 3000 m^3 tank, before being treated by centrifuge and then stored in one of the two 1 480 m^3 tanks. This mechanical treatment will fluidify the fuel by extracting some of the residue (sludge) present and thus make engine operation more reliable (see *Figure 3.7*).

3.3.5 *Electric installations*

The new facility will reuse some of the electrical equipment from the existing plant to export the electricity produced and also to import electricity to the site in case of stoppage. The existing electrical equipment that will be reused are the 11/90 kV transformer and the high voltage station for connection to the SENELEC network (see *Section 3.1.3*).

In addition, new electrical equipment to be installed in the new installation is as follows:

- Connections with the existing electrical system (11/90 kV transformer),
- A low voltage station (0.4 kV) for the plant auxiliary equipment, including a 500kW cold re-start up unit;
- An electrification system for the new installations (buildings, unloading area and storage area, etc.) and lighting;
- A fire detection system ; and
- A gas detection system.

3.3.6 *Compressed air*

Compressed air will be generated, distributed and stored at a pressure of 30 bars in order to be used on start-up of the diesel engines. Pressurised equipment will be designed, manufactured and tested according to the Directive on pressurised equipment.

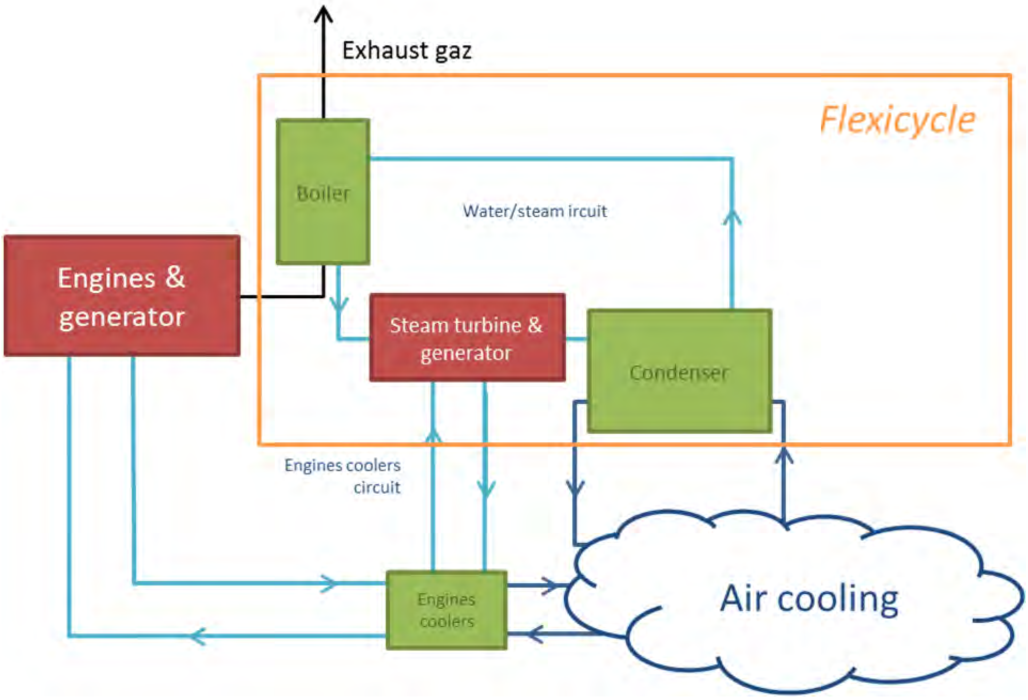
The system comprises:

- A double air compressor,
- A compressed air storage tank,
- A pneumatic start-up system for the engines, air treatment equipment and systems, and
- Piping and valves.

3.3.7 *Cooling system*

The new power plant will be equipped with two cooling systems: an air cooling system (radiators) for the Wartsila combustion engines and an air cooling system for the Flexicycle condenser. The principles of the cooling system to be used in the new power plant is summarized in *Figure 3.6* below.

Figure 3.6 Block diagram of the combined cycle cooling system - planned power plant



Source: *ERM, 2014*

Engine cooling

The system at the new power plant will comprise:

- One cooling radiator per engine,
- One tank of fresh water for maintenance (10 m3), and
- Piping and valves.

Condenser

The Flexicycle condenser will ensure that water from the combined cycle transits from steam (output from the turbine) to liquid , before passing again through the boiler (and again being turned to steam). This change of state in the condenser will take place by indirect contact (through a fine metallic wall) of the steam with colder ambient air. Air inlet temperature will be 27ºC and output temperature will be 38ºC.

3.3.8 Communication and surveillance system

The power plant will be equipped with a cutting edge communication and surveillance system comprising:

- A system for the control and surveillance of the entire power plant ; this system will be centralised in the control room and will comprise on the one hand an autonomous control system for the power plant and on the other a system for the surveillance and acquisition of data.

- Supervision systems using security cameras and internal and external communication systems.

3.3.9 *Compliance of existing facilities regarding the Senegalese regulation*

The equipment to be installed as part of the Project will comply with the Senegalese regulation. Existing facilities to be reused will be improved with an aim of complying with the regulation, as highlighted in the compliance audit study undertaken in 2012 (cf. *Chapter 3.1.5*). An analysis of the needs of modification is presented in the *Table 3.4* below (based on the 2012 audit).

Table 3.4 Compliance requirements of the existing equipment

Theme	Non-compliance	Corrective actions proposed in 2012	Planned corrective actions
Wastewater management	No buffer tank for storing wastewater before discharge into the natural environment	Creating a buffer tank	Buffer tank planned (cf. *Chapter 3.6.5*)
	Non-transmission of the results of water quality analysis to the DEEC	Transmitting the results to the DEEC	Results will be transmited as presented in the ESMP (cf. *Chapter 10.7*)
Surface and subsurface contamination	No monitoring of the potential surface and subsurface contamination within the fuel storage area	Assessment of the potential contamination. Setting up of a subsurface monitoring plan, in case of accidental leakage	Piezometers will be installed in order to monitor groundwater and to detect any potential contamination
Firefighting capabilities	Firefighting equipment not fully efficient	Improve the firefighting capabilities	Firefighting systems and equipment will be improved
	Internal Operation Plan (IOP) to be updated	Update of the IOP	A new IOP will be undertaken

3.4 PROJECT TIMETABLE

The Project's provisional timetable, developed by ContourGlobal - Cap des Biches in collaboration with SENELEC, is ambitious. It plans for site operations to start at the beginning of 2015 and an engine testing phase at the beginning of the first quarter 2016. Production will start immediately after the test period, at the end of the first quarter 2016.

The main deadlines in the construction phase are as follows:

- Construction phase: around 270 days, of which:
  - 270 days civil engineering
  - 170 days equipment assembly
  - 135 electric equipment assembly.
- Assembly and test phase: around 70 days, of which:
  - 30 days for the assembly and testing of each engine (operations on the three engines can take place in parallel)

- 50 days for assembly and testing of the Flexicycle.

3.5 CONSTRUCTION PHASE

3.5.1 *Equipment*

Origin of raw materials

Most of the raw materials (steel, cement, …) and other materials (anti-noise panels…) will be brought from Dakar by truck. Technical equipment such as the engines, boilers, auxiliary transformers and the steam turbine will be delivered via the port of Dakar by suppliers, mainly Wartsila, from Europe.

Hazardous materials

The main hazardous materials required during the construction phase will be the following:

- Inflammable paints, solvents and dilutants ;
- Pressurised gases ;
- Fuels containing oil derivatives ;
- Chemicals used to clean pipes ; and
- Other materials according to the waste products classification contained in current regulations.

The list of hazardous materials used at the site and the relevant Material Safety Datasheets (MSDS) will be available to employees at all times. The use of hazardous materials will be restricted to authorised staff who have received the necessary training and protective equipment.

Hazardous materials will be stored in the areas designated for this purpose and will be handled in compliance with the MSDS.

3.5.2 *Transport*

Deliveries of raw materials and equipment, as well as staff movements from and to the site will cause the traffic referred to in *Table 3.5* below. In all, 1 to 30 vehicles per day will run at the site during peak activity times.

Table 3.5 Traffic expected at the site during the construction phase

Deliveries	Approximate numbers of vehicles expected
Materials required to make concrete – cement, gravel, sand	2 deliveries per day on average for 7 months - 4 deliveries per day during peak activity times.
Steel and pipes	Up to 3 deliveries per day for 2 months (these should begin 3 to 4 months later than the concrete production activities)
Technical equipment	6 deliveries for the engines 3 deliveries for the boilers

Deliveries	Approximate numbers of vehicles expected
	1 delivery for the turbine 1 delivery for the transformers About 150 deliveries for tank construction and assembly materials
Various	1 to 10 deliveries per week
Staff transport	5 to 15 buses per day (workers) Up to 2 to 40 cars per day (managers, management staff and sub-contractors)

Source: ContourGlobal - Cap des Biches, 2014

Deliveries of equipment and materials will not take place during the night and will be planned as far as possible outside the times of day when traffic is at its highest level (between 7:30am and 9am and between 4pm and 6pm).

3.5.3 *Human and logistics resources*

Construction work will be carried out by a main sub-contractor in charge of project management. He will supervise several other sub-contractors performing the various other work.

Staff numbers and working days are described below:

- About 1600 workers in total will work on the construction site, depending on progress made with the work. On average, 84 workers will be on site every day, including about 20 expatriates.
- During peak activity times, up to 200 workers will be on site.
- The standard working day will start at 7am and end at about 6pm, to avoid staff journeys coinciding with school times (from 8am in the morning through until 12.30pm-1.30pm and even 4pm some days).
- The standard working day will last between 8 and 10 hours. The working day may occasionally exceed the times described above, when certain tasks have to be carried out without interruption (e.g.: pouring concrete…).
- A typical working week will last 6 days, from Monday to Saturday (with the exception of certain weeks during which some tasks cannot be interrupted).

The recruitment of local workers will be preferred insofar as the skills required are available within the Municipality of Rufisque Ouest. This local preference will be implemented by means of the application of a specific, adapted staff hiring policy.

The transport of staff and materials will mainly use Route Nationale 1 from Rufisque and Dakar as far as the installation site in Cap des Biches.

No employee accommodation is planned at the site. The construction site will be closed at night, for safety reasons. Employees living in neighbouring communities will continue to live at home and will travel to the site every day. Sub-contractors will organisers shuttle buses for their employees. This will reduce traffic on local roads as well as associated road travel risks.

The specialist employees who work at the site for short periods, as well as site management and managerial staff will be housed in Dakar; they will travel by car to the site every day.

Health and Safety of work force

The construction phase will be managed by Wartsila on behalf of ContourGlobal - Cap des Biches. A health / safety / environment management plan has been specifically developed for this Project.

3.5.4 *Water supply and consumption*

During the construction phase water will be used for the following:

- Domestic and sanitation use
- Concrete unit
- Sprinkling on the ground to avoid dust clouds from the construction work and when vehicles travel past.

The water will come from the existing SDE (Sénégalaise des Eaux) pipe in the existing power plant.

The amount of water required for the production of the 2500 m^3 of concrete required for the power plant is estimated at about 900 m^3. Amounts required for domestic purposes and the prevention of dust clouds have been estimated as follows, based on data from similar projects:

- 1000 m^3 water for sanitation purposes
- 100 m^3 water for washing equipment and preventing dust clouds.

In all, about 3600 m^3 water should be consumed during the construction phase.

3.5.5 *Management of emissions, effluent and waste products*

Atmospheric emissions

During the construction phase, atmospheric emissions will be mainly linked to the dust generated by the various activities such as clearance of the site, concrete mixing and the passage of vehicles on non-asphalted roads.

Vehicle engines and site machinery will also generate discharge into the atmosphere. Fuel consumption by the diesel engines of vehicles used cannot be quantified as yet and will evolve over the course of the construction phase. The atmospheric emissions of diesel engines will, however, be proportional to the emissions factors produced by the OGP (Oil and Gas Producers Association, formerly the Exploration and Production Forum) and presented in *Table 3.6*.

Table 3.6 Emission factors of a diesel engine

Pollutant	Emission factors (tons emitted / tons burned)
CO_2	3.2
CO	0.019
NOx	0.07
N_2O	0.00022
SO_2	0.008
CH_4	0.00014
COV	0.0019

Source: *Methods for estimating atmospheric emissions, E&P Forum, 1994*

More details on the project's atmospheric emissions during the construction phase are provided in *Chapter 8.5* (modelling of atmospheric emissions).

Noise

Noise emissions linked to the construction activities will issue mainly from site preparation works (land clearance, soil preparation and excavation), structural works and equipment installation.

Table 3.7 below shows noise levels for typical site equipment according to British standards (BS, *British Standard*) "*Noise and vibration control on construction and open sites, BS 5228* [(1)]".

Table 3.7 Acoustic performance of equipment – construction phase

Equipment	Level of acoustic pressure at 10m [dB(A)]
Site preparation	
Chain excavator	79
Bulldozer	81
Wheel loader	68
Roller	76
Steam roller (*road planer*)	82
Asphalt surfacer	84
Dump truck	87
Civil engineering and installation works	
Concrete mixer truck	80
Concrete pump	77

(1) British standard BS 5228: *Code of Practice for Noise and Vibration Control on Construction and Open Sites, Part 1: Noise. BSi, 2009*).

Equipment	Level of acoustic pressure at 10m [dB(A)]
Tower crane	77
Mobile crane	82
Fork lift truck	67
Motorised compressor	75
Generator	74
Worksite truck	87

Source: ERM based on standard BS 5228 *Code of good practice for basic information and procedures to control noise and vibration*.

More details on the estimated levels of noise generated during the project construction phase are provided in *Chapter 8.7* (Noise modelling).

Aqueous effluent

During construction, the various flows of aqueous discharge will be as follows:

- Waste sanitation water
- Water used for washing equipment (truck, concrete mixing unit)
- Rain water.

Discharge of used sanitation water from the temporary buildings (toilets, etc.) and from permanent installations (showers, canteen, toilets…) will be collected and stored in a temporary septic tank during the construction phase. This will then be replaced by a permanent septic tank to be used when the plant is in operation. It is estimated that about 230 m^3 of waste sanitation water will be generated every month during work at the site and gradual start-up of the engines. The septic tank will be emptied by an approved service provider.

Rain water will be separated from any possibly contaminated water by means of a drainage system that will be connected to the discharge canal used by the SENELEC power plants (adjacent to the installation). Discharges of water will comply with current regulations (notably standard NS 05061[(1)]). Rain water may potentially contain MES (matter in suspension) due to site activities or hydrocarbons should any accidental spillage occur.

Waste products

The main waste materials generated during the construction phase will be as follows:

- Excavated soils and materials excavated corresponding to the foundations of the main buildings
- Domestic waste

[1] NS 05-061.- Waste water – discharge standards.- 2001.-22p

- Packaging of construction materials and raw materials (cement bags, wooden chests, etc.)
- Materials resulting from structural works (excess concrete, …)
- Greasy waste, batteries, empty drums and other specific waste materials.

Concerning the excavated soils, volumes should be relatively small in view of the level topography and absence of any basements in the buildings (relatively small foundations). Some of the excavated soil can be used for levelling the land. The sub-contractor with responsibility for civil engineering will be contractually responsible for dealing with the soils and will contact the local authorities for details of places where the deposit of excavated materials is authorised.

Waste materials will be sorted according to their origin and treatment methods, this will avoid contact between incompatible waste materials and will permit inspections for the detection of leaks and spillages. The waste materials storage area will be waterproofed and covered to avoid the waste materials coming into contact with rain water. In addition, the area used for the storage of hazardous materials will be fenced and signs will be displayed to prevent access by authorised people and thus minimise any risk of accident.

According to feedback from similar projects, volumes of special / dangerous materials produced during the construction phase should be low, and most of the waste materials produced can be easily reprocessed via existing facilities. Moreover, about 200 m^3 of ordinary waste materials, (i.e. ten truck loads) will be generated every month.

In all cases, the collection of waste materials generated during the power plant construction phase will be managed by an approved service provider and will comply with current regulations. Special / hazardous waste materials will be evacuated to specialised facilities.

3.6 OPERATIONAL PHASE

3.6.1 Human and logistics resources

The plant will operate 24h/24 for most of the year, with employees working in shifts, 3 x 8h. ContourGlobal - Cap des Biches will employ 35 to 45 workers on a permanent basis. Unqualified or semi-qualified staff (cooks, security officers, cleaners…) will represent about 10% of all staff. Staff will be hired by ContourGlobal - Cap des Biches as far as possible from amongst inhabitants of the local communities.

Employees will be housed at their own expense in the surroundings and in the nearest towns. Employees will travel to the site every day, using their own resources.

Health and Safety of work force

ContourGlobal - Cap des Biches will develop for its own employees, a specific health and safety policy based on the H&S policy of Contour Global that is presented in *Annex 7*.

3.6.2 Traffic

Traffic caused by site operations will be mainly generated by staff and visitor travel to the site in light vehicles (between 20 and 30 per day, depending on the time of year) and the delivery of fuel oil by truck (see below).

3.6.3 Fuel oil supply and consumption

Supply

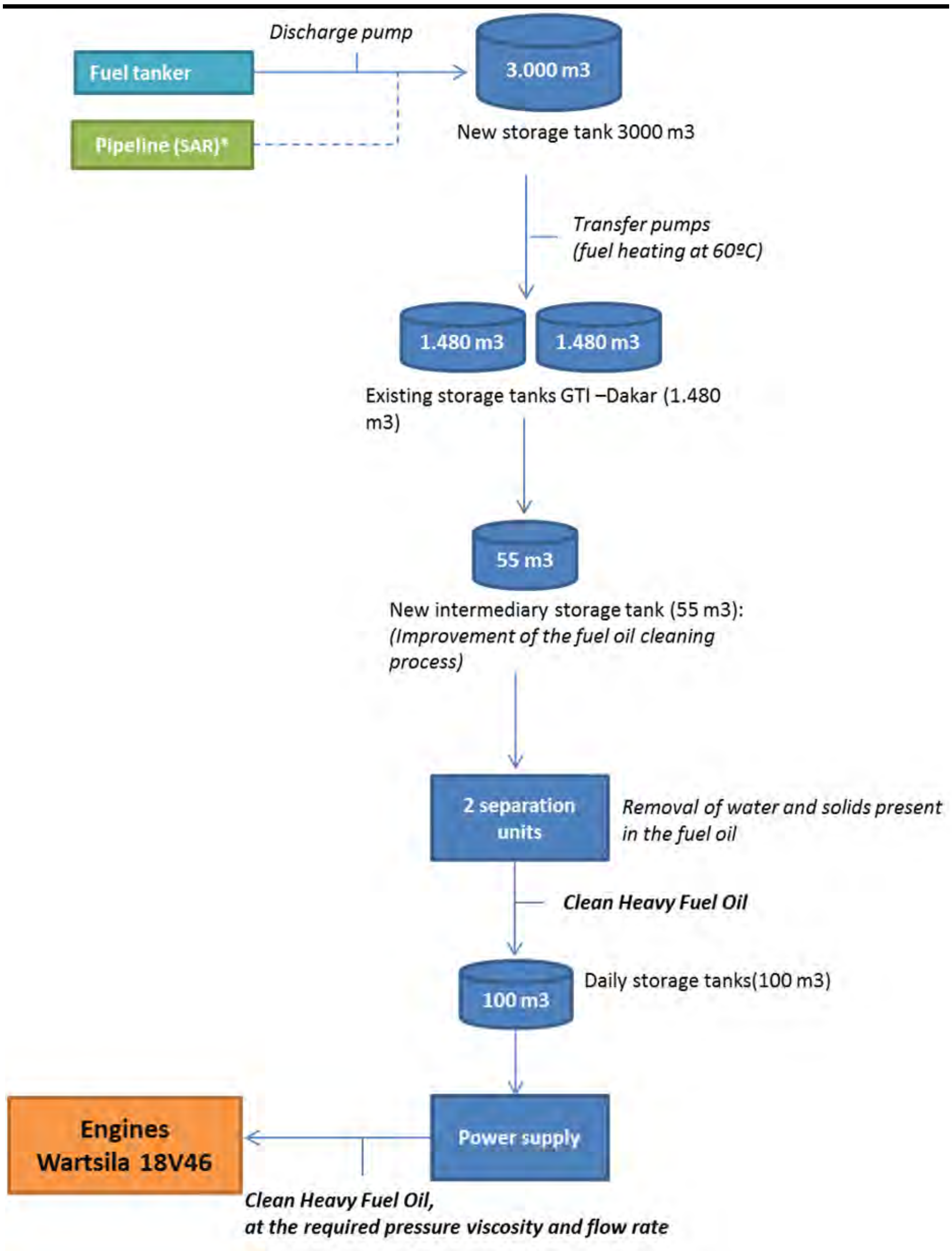
The heavy fuel oil supply contract has not yet been finalised, but the option adopted for HFO supply is the installation of a pipeline from the existing SAR's pipeline (*nota*: this option will be confirmed after validation of the supply agreements); an assessment of the technical issues associated with the pipeline may be undertaken after validation of the supply agreements. The unloading area will remain operational and will be used for LFO supply (used during the starting phases of the power plant). LFO supply will be very limited, and will be realized by trucks travelling from the refinery that is located a few kilometres away.

However, if this option is delayed or canceled, the impact assessment presented in Chapter 8 also considers HFO supply by trucks. This is a conservative assumption, given the risks typically associated with road transportation of hydrocarbons.

Volumes delivered every day will be about 260 m^3 under normal operation conditions, i.e. an average of 10 daily deliveries. The deliveries will take place seven days a week, during daytime hours only.

The transfer of heavy fuel oil from the trucks to the above-ground storage tank (3 000 m^3) will be carried out using a discharge pump. The transfer pumps and associated auxiliary equipment will be installed on a steel platform in the existing unloading area. Existing transfer pumps that are not suitable for unloading fuel oil will be removed and existing pipes clamped. *Figure 3.7* shows the main heavy fuel oil supply phases in the new power plant.

Figure 3.7 Heavy fuel oil supply diagram



Source: ERM based on *Wartsila, 2014*
*: Supply of heavy fuel oil from the Société Africaine de Raffinage, SAR pipeline. This project has been developed by SAR and therefore falls outside the context of this ESIA.

Unloading area

The unloading area is designed to allow for arrival of the truck at the discharge pump, unloading and exit to take place along a loop, without the need for the truck to carry out any particular movements. This limits the risks of accident.

The unloading area is fitted with safety equipment such as fire hydrants, level gauges, and a shelter over the various equipment and the truck and channels to direct rain water and any leaks towards a hydrocarbons separator.

Specifications relating to heavy fuel oil

The heavy fuel oil used will comply with current regulations. (Decree repealing and replacing decree n°2011-650 of 26th May 2011 setting out the specifications applicable to refined hydrocarbons). *Table 3.8* presents the properties of the fuel oil according to the design of the thermal power plant and the values specified by current regulations.

Table 3.8 Main properties of the fuel oil before treatment

Parameter	Limit	Value accepted by the engines	Value specified by current regulations*	Reference method
Density at 15°C	max.	950 to 1010 kg/m³	991 kg/m³	ISO 3675 or 12185
Viscosity at 50°C	max.	380 Cst	380 Cst	ISO 3104
Flash point	min.	60 °C	65°C	ISO 2719
Pour point	max.	30 °C	30°C	ISO 3016
Water	max.	0.5 % vol.	0.5 %	ISO 3733 or ASTM D6304-C
Sulphur	max.	4.5 % mass.	2%	ISO 8754 or 14596
Hydrogen sulphide	max.	2 mg/kg	-	IP 570
Acidity index	max.	2.5 mg KOH/g	-	ASTM D664
Ash	max.	0.15 % mass	0.140%	ISO 6245 or LP 1001
Vanadium	max.	450 mg/kg	350	ISO 14597 or IP 501, IP 470
Carbon residue	max.	20 % mass	18%	ISO 10370
Sodium	max.	100 mg/kg	100 mg/kg	IP 501 or IP 470 ISO 8218
Asphaltenes	max.	14 % mass	8%	ASTM D3279 T-60115
Total existing sediments of old fuel oil	max.	0.10 % mass	0.14 %	ISO 10307-2
Calcium	max.	30 mg/kg	30 mg/kg	IP 501 or 470 ISO 8220
Zinc	max.	15 mg/kg	15 mg/kg	IP 501 or 470 ISO 8221
Phosphorus	max.	15 mg/kg	-	IP 501 or 470
Aluminium and silicium	max.	60 mg/kg	60 mg/kg	ISO 10478 or IP 501, IP 470

* Decree repealing and replacing decree n°2011-650 of 26th May 2011 setting out the specifications applicable to refined hydrocarbons
Source: ERM, 2014 based on Wartsila, 2014 and the decree repealing and replacing decree n°2011-650.

The final composition of the fuel oil to be used has not yet been defined at this point in the project. Nevertheless the fuel oil used will have a maximum sulphur concentration of 2% in compliance with the new current Senegalese regulations and with international recommendations. It is interesting to point out that according to feedback on the current quality of heavy fuel oil in

Senegal, sulphur concentration in fuel oil can generally vary between 1% and 1.33%. However, using a prudent and conservative approach, sulphur concentration considered in this impact study is 2% (see *Chapter 8.5*).

Compliance with these quality standards will guarantee that atmospheric emissions from the power plant comply correctly with the builder's data, as taken into account in the analysis of impacts on air quality (see *Chapter 8.5*).

The heavy fuel oil will be treated by centrifuge before being stored in the day storage tanks (see *Figure 3.7*). This mechanical treatment will fluidify the fuel by extracting some of the residue (sludge) present.

Use of light fuel oil (domestic fuel oil)

Similarly, light fuel oil will be used as start-up fuel. Delivery will also be made in 30 ton trucks from local refineries (about 6km away). The trucks will only use main roads and will not go through the town of Rufisque. The site will receive a delivery once a month or once every two months. Unloading will take place under the same conditions as those described above for heavy fuel oil.

The domestic fuel oil will be stored in an existing 120 m^3 above-ground tank and then sent to a new 100 m^3 day tank designed to operate for about 8 hours at full engine power.

The tanks for heavy and light fuel oil will be located in the same park. The tanks' park will be fitted with a retention that will be designed to contain 110% of the capacity of the largest tank, i.e. a capacity of 3 300 m^3.

Fuel consumption

Daily consumption of heavy fuel oil is estimated at 260 m^3/day.

Light fuel oil will only be used during the engine start-up phase after a stoppage. Consumption of light fuel oil will be very limited.

Fuel oil storage capacity

Total storage capacity for heavy fuel oil at the site will be 6 115 m^3, which corresponds to consumption over 20 to 25 days. The tanks will be full when the plant is started up and will then be continuously refilled by daily deliveries.

The total storage capacity for light fuel oil at the site will be 220 m^3.

Natural gas

As explained in *Section 3.2.1*, the new Wartsila engines can be easily converted to operate on natural gas, when this type of fuel is available in sufficient quantity and quality in Senegal. This will optimise costs and reduce atmospheric emissions.

This future alternative is outside the framework of this impact study. Conversion of the engines to natural gas will be the object of prior consultation with the Senegalese authorities, in compliance with applicable regulatory requirements.

3.6.4 *Water supply and consumption*

Water consumption

During the operational phase, water use will be as follows:

- Flexicycle steam turbine
- Fire protection system
- Domestic and sanitation usage (toilets, showers, cooking…)
- Cleaning of floors and equipment
- Cooling systems (maintenance water).

The steam turbine will represent about 60% of daily consumption. The remaining 40% will be divided between the other headings (including domestic consumption). Industrial requirements (mainly the turbine) are estimated at 3 m^3/hour on average. It should be noted that the cooling system planned for the new power plant greatly reduces the consumption and discharge of cooling water, in comparison with the cooling system used by the former power plant (pumping and direct discharge of sea water).

Other requirements should, for their part, be close to 50 m^3/day.

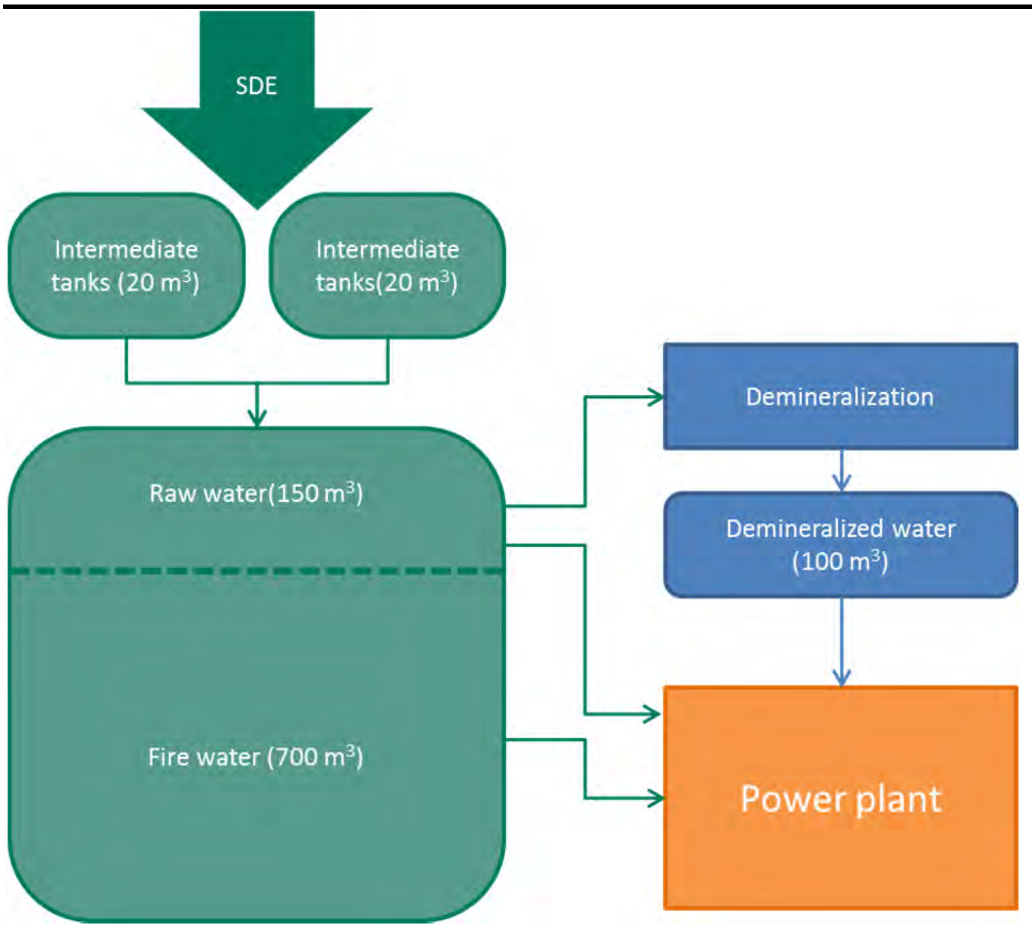
In total, daily consumption of the power plant in operation should not exceed 120 m^3.

Storage and supply

Raw water from the pipe in the SDE network, will be temporarily stored in two 20 m^3 buffer tanks intended to mitigate potential variations in pressure and output from the SDE network.

About 850 m^3 of raw water will be stored at the site, mainly for the fire protection system (700 m^3). A 100 m^3 tank will also be used for the storage of demineralised water, prior to use in the electricity production process. Distribution of water to the various different buildings and equipment will take place by means of buried pipes.
A diagram of this organisation is provided in *Figure 3.8*.

Figure 3.8 Principles of water supply and storage



Source: *ERM, 2014*

Demineralization process will use existing equipment, which will be improved and bring up to the Senegalese standards; the process will include the following equipment:

mechanical sand filters containing silicone dioxides;
activated carbon filters; and
- reverse osmosis equipment with ion exchange membranes

The demineralization system will consume hypochlorite (ClO), hydrochloric acid (HCl) and sodium hydroxide (NaOH).

3.6.5 *Management of emissions, effluent and waste materials*

Atmospheric emissions

Atmospheric emissions will be mainly those resulting from the combustion of fuel oil:

- particles (including the inhalable fractions PM10 and PM2.5 are taken into account in this ESIA under the generic term of PM)
- sulphur dioxide (SO2)

- nitrogen oxides (expressed in NOx and NO2) and
- carbon monoxide (CO).

Section 8.5 "Impact on air quality" provides a quantification of these emissions, as well as a study of their dispersal in the atmosphere after discharge.

Noise

Once started up the power plant will operate continuously, with the exception of production stoppages for maintenance reasons. The main sources of noise are:

- generating sets (18V46 engines, generators) ;
- transfer pumps
- the hydrocarbon separator
- the fuel oil discharge pump
- radiator ventilators
- the machine room
- air outputs and ventilation systems
- water condensers
- transformers

Section 8.7 "Impact on ambient noise" provides more detail on sources of noise linked to the project and a quantification of noise emissions, notably through the modelling of noise levels carried out based on technical documents relating to the design of the power plant obtained from ContourGlobal - Cap des Biches and Wartsila.

Aqueous effluent

After start-up, the various types of aqueous discharge will be as follows:

- Used sanitation water ;
- Rain water ; and
- Industrial water, mainly from purging the cooling system, the steam turbine and the hydrocarbons separator.

Used sanitation water will be collected in a septic tank. In view of the number of employees (about 45 people), monthly volumes of used sanitation water have been estimated at 30 m^3; the septic tank will therefore have to be emptied about twice a month and its contents will be eliminated by an approved service provider.

Rain water not likely to be contaminated will be collected by the drainage system. The drainage system is designed on the basis of rainfall intensity (50-100 mm/15 min), coherent with local rainfall data. The new drainage system will be connected to the existing drainage system and rain water collected will be discharged via the SENELEC discharge canal (western edge of existing installations).

Used water likely to be contaminated, i.e. industrial water and potentially contaminated rain water (e.g. rain water from the storage area), will be collected, directed and treated by the effluent treatment station by dissolved air floatation in two stages. During the first stage, the deoiler will separate the emulsified oil and the heaviest solid matter in suspension in the water. The oil will be transferred to a tank for recuperated oil, for elimination.

The separated part of the water will be pumped in a floatation device and treated in the physicochemical section in several stages:

- A floculation stage ;
- Addition of sodium hydroxide (NaOH); and
- Injection of coagulant.

The addition of hydroxides keeps the water within the right pH bracket and ensures an optimised coagulation process. The hydroxide also reacts with the coagulation iron. The iron hydroxides agglomerate the neutralised solids in suspension and the soluble hydrocarbons. Small flakes are then formed and, because their density is over 1kg/dm^3, they form sediment naturally.

The sludge that forms will then be transferred to the sludge reservoir (80 m^3) before being eliminated by an approved provider. The daily output of sludge will be about 0.77 m^3 (*Wartsila, 2014*).

Discharge of treated water (station output) will take place through the SENELEC discharge canal located at the edge of the land. According to the characteristics and size of the treatment unit provided by the builder (Wartsila), treated water will comply with the specific World Bank Group's specific environmental, health and safety directives, 2008. The water will be sampled on a regular basis for analysis purposes at the station output in order to check on compliance of the water discharged into the natural environment with Senegalese limit values (standard NS 05061[1]) and with World Bank Group values. In case of non-compliance, waste water will be treated again, passing again through the station's treatment process. *Table 3.9* below presents the values for discharged, treated water guaranteed by Wartsila. The block diagram for liquid effluent treatment is presented in *Figure 3.9*.

Table 3.9 Discharged treated water values guaranteed by the builder

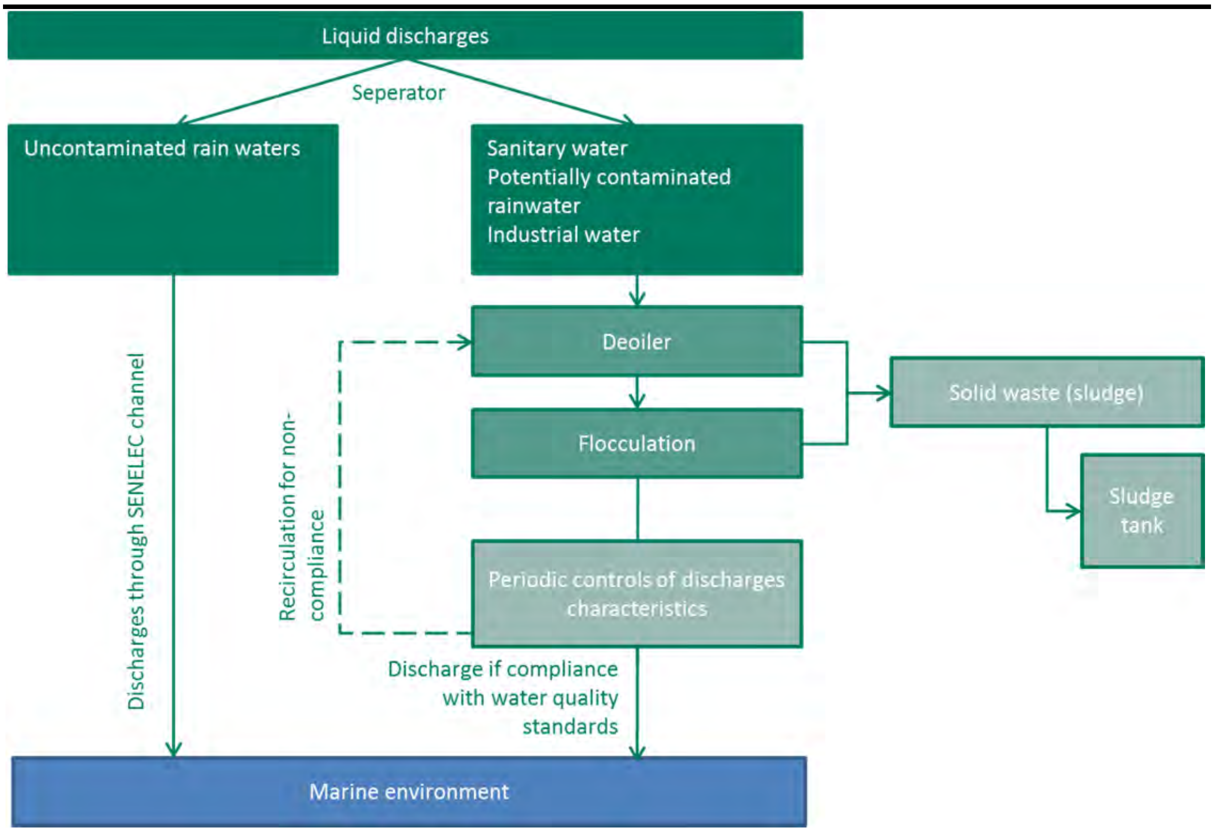
Parameter	Limit	Value accepted
pH	max.	6-9
Matter in suspension (MES)	max.	50 mg/1
Oils and greases	max.	10 mg/1

[1] NS 05-061.- Waste water : discharge standards.- 2001.-22p

Parameter	Limit	Value accepted
Total residual chlorine	max.	0.2 mg/l
Total chromium	max.	0.5 mg/l
Copper	max.	0.5 mg/l
Iron	max.	1.0 mg/l
Zinc	max.	1.0 mg/l
Lead	max.	0.5 mg/l
Cadmium	max.	0.1 mg/l
Mercury	max.	0.005 mg/l
Arsenic	max.	0.5 mg/l

Source: *Wartsila, 2014*

Figure 3.9 Block diagram of liquid effluent treatment



Source: *ERM, 2014*

In total, the power plant will generate an average of 158 l/h of oily water, i.e. about 4 m^3 per day, which will be processed through the treatment unit.

Liquid discharges from the demineralization unit will be punctual and only associated with the regeneration of resins.

They will include small amounts of acids and base (see *Section 3.6.4*) and the minerals trapped in the resin. The water used in the demineralization unit will come from the drinking water network, and will therefore be slightly charged in minerals. Acidic and basic discharges will neutralize each other and the pH of the final discharge will be almost neutral (and slightly acid). In all cases, the discharges will be treated within the liquid waste treatment plant (see above), whose process includes the addition of sodium hydroxide to stabilize the pH. Discharges from the demineralization unit will not represent a significant environmental issue.

Waste products

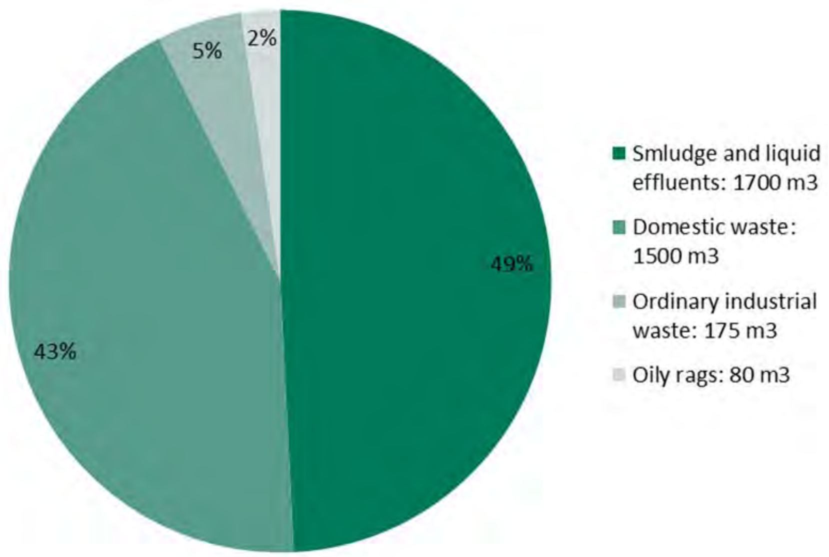
The main waste products expected after start-up of the site are as follows:

- Domestic waste
- Ordinary industrial waste
- Oily rags
- Sludge and oily effluent

Volumes of domestic waste have not been evaluated precisely, but it is estimated that about 4 m^3 will be generated daily (i.e. about 1 500 m^3 per year).

With regard to the other waste products, the annual amount of waste produced (excluding domestic waste) is estimated at less than 2 000m^3.

Figure 3.10 ***Estimate of the proportion of waste types produced during the operational phase***



Source: *ERM, 2014*

About 140 m^3 of sludge and other oily effluent will be generated every month, thus requiring between 8 and 10 trucks for collection and transport to a reprocessing centre. This collection, as well as the final processing of sludge, will be done by an approved company.

There are several processing companies in Senegal that specialise in the processing of the type of waste products that will be generated by the Project.

This are particularly service providers already involved in the processing of waste products from other thermal power plants, in particular SEPRES and ECOMAR.

ContourGlobal - Cap des Biches will evaluate recycling, reuse or disposal options for the waste products generated, depending on the waste product processing installations present in the site's environs. In step with its environmental policy, ContourGlobal - Cap des Biches will ensure that all waste flows are managed under the terms of a contract with a service provider who holds the necessary certifications.

4 *ANALYSIS OF THE REGULATORY AND INSTITUTIONAL FRAMEWORK OF THE STUDY*

4.1 *INSTITUTIONAL FRAMEWORK APPLICABLE TO THE PROJECT*

4.1.1 *The Constitution*

The country's institutional and regulatory framework is based on the Senegal Constitution established in 1959, the latest revision of which dates back to 2001 (the Constitution of 22nd January 2001, currently in force, is the fourth Senegalese Constitution following those of 1959, 1960 and 1963).

The Constitution of Senegal, defines the organisation and regulations of the following areas:

- Public and personal freedoms, economic and social rights, and collective rights
- The President of the Republic
- International treaties
- The Government
- The State and sovereignty
- The opposition
- The National Assembly
- The Economic, Social and Environmental Council
- Relations between executive power and legislative power
- Judicial power
- The High Court of Justice
- Local authorities
- Revision
- Transitory provisions.

In the First Heading, "of State and Sovereignty" of the Constitution of 22nd January 2001, Article 8 guarantees all Senegalese citizens the right to a healthy environment.

Moreover, Heading VII-1 of the Constitution of 22nd January 2001 is devoted to the Economic, Social and Environmental Council. It establishes that *"the Economic, Social and Environmental Council can be consulted by the President of the Republic, the National Assembly and the Government on any issue of an economic, social or environmental nature. Any programming plan or any draft law of an economic, social or environmental nature is submitted to it for an opinion"*. Also, *"it may also, on its own initiative, give an opinion on all matters of an economic, social or environmental nature involving the Nation's various sectors of activity"*.

The project objectives are fully in line with the guidelines of the State of Senegal, outlined in various policy documents and strategies for economic, social, environmental, institutional development of the country. The project is specifically in line for with the strategies, following economic and social policies and programs.

4.1.2 *Political framework applicable to the Project*

Senegal Emerging Plan (Plan Sénégal Émergent, PSE)

Senegal has decided to adopt a new development model to accelerate its progression towards emergence. This strategy, known as Senegal Emerging Plan (*Plan Sénégal Emergent, PSE*), is the referential of the economic and social policy in the medium and long term. The PSE aims at the economic emergence in 2035. The ambition of the State of Senegal to foster economic growth with high impact on human development is based on the implementation of a major investment program in sector with growth potential, able to stimulate a dynamic of strong and sustained growth. The energy sector plays an important role in the PSE, persistent disruptions in the supply of electricity could compromise the performance of the national economy, in addition to the negative impact on well-being.

National Strategy for Economic and Social Development 2013-2017 (Stratégie Nationale de Développement Economique et Sociale, SNDES)

The SNDES constitutes the reference framework for the development of policies, sectorial development plans and investment programs in Senegal. This strategy aims to ensure conditions for sustained and sustainable growth, significantly reduce poverty and achieve the Millenium Objectives for Development (*Objectifs du Millénaire pour le développement, OMD*).

The Strategic Document for Poverty Reduction (Document Stratégique de Réduction de la Pauvreté, DRSP).

The strategy of the DRSP is articulated around three axes: (i) Creation of economic opportunities and wealth for the promotion of productive employment and structural transformation of the economy; (ii) Acceleration of access to basic social services, social protection and sustainable development; (iii) Strengthening basic principles of good governance and promotion of human rights. In the energy sector, the fixed document a target of 66% (30% in rural areas) for household access rate to electricity service in 2015.

4.1.3 *Strategic framework for environmental planification*

The environmental sector policy

Environmental policy aims at sustainable economic and social development that is compatible with rational management/use of natural resources and the environment. The environmental policy seeks above all to develop the reflex of taking the environment into account in all activities generating goods and services.

The environmental sector policy is implemented by the Ministry for the Environment and Nature Protection, and has resulted in several national action plans, as listed below.

The national action plan for the environment (PNAE)

The PNAE is made up of study materials, concerted and decentralised reflections as well as proposals made by the various categories of stakeholders concerned by the questions of natural resources and environmental management. Activities carried out within the context of preparation of the PNAE have resulted in:

- An analysis of structuring economic activities and the evaluation of their effects on the environment
- In-depth study of a series of topics based around major environmental stakes and issues
- The drafting of Regional Action Plans for the Environment (PRAE) and their synthesis on an eco-geographic basis
- The synthesis of sectorial intervention strategies with a view to better knowledge of the various fields of expressions of natural resources and environmental management policies.

The national action programme for the combat against desertification (PAN/LCD)

Adopted in 1998, the PAN/LCD is, at national level, an instrument for implementation of the UN Convention to Combat Desertification(CCD, see *Section 4.2.8*) adopted in Paris on 17th June 1994, further to a wish expressed at the Conference on Environment and Development in Rio de Janeiro in 1992. It is a component of the PNAE the aim of which is to integrate the environmental dimension into the economic and social development process.

The strategy and action plan for conservation of biodiversity

The strategy and action plan for the conservation of biodiversity were adopted in 1998, within the context of implementation of the International Convention on the Conservation of Biodiversity (*Section 4.2.8)*. Senegal has drawn up a strategy and an action plan for the conservation of biodiversity, whose objective is to re-establish the essential equilibriums that will ensure sustainable development for the country.

The national strategy for adaptation to climate change (SMMO)

Establishment of the national strategy for adaptation to climate change (SNMO) is part of the programme of activities that Senegal has developed since the 1992 Rio conference 1992 (*Section 4.2.8)*. Indeed, in view of the commitments made in the UN Framework Convention on Climate Change (UNFCCC), the country has taken major initiatives with the aim of adapting to climate change. The SNMO thus acts as a reference framework to which all stakeholders and institutions must refer to ensure that their actions fit ever more into integrated adaptation strategies. The framework for action in the strategy for adaptation to climate change is defined in the national plan for adaptation to climate change (PANA) drawn up in 2006.

Among the strategic plans relating to environmental policy in Senegal, mention may be made of the following documents:

- Poverty reduction strategy, with a major section on education
- The national strategy for social cover and risk management (SNPS/GR), in which the "management of catastrophes and major risks" is part of the fourth section of strategies
- The national programme for the prevention and reduction of major risks and management of natural catastrophes; this programme is steered by the Civil Protection Division (DPC), and acts as an operational framework for interventions in the field of the management of risks and catastrophes
- The national integrated strategy for the protection and combat against coastal erosion, which corresponds to an integrated vision of the protection of the Senegalese coastline
- The master plan for liquid waste treatment for the Dakar region; this plan sets out the major guidelines in terms of waste treatment in the Dakar region, through until 2025, and defines the responsibilities of the National Waste Treatment Office (ONAS)
- The national plan for territorial planning which aims, in the medium and long terms, at optimal exploitation of resources and potential resources, decentralisation and the search for a better balance between the regions, in order to make achievements irreversible.

4.1.4 Policies and programs in the energy sector

The project also incorporates the objectives of the energy sector development policies and programs. The following programs are concerned.

The Development Policy for the Energy Sector (LPDSE)

In February 2008, the Government of Senegal adopted a Letter of Development Policy for the Energy Sector le (LPDSE), which aimed, amongst other things, to reach by 2012 average electrification rates of 75% at national level, 50% in rural communities and 95% in urban communities, as well as a rate of commercial energy independence of at least 20% by 2020 (compared with 4% in 2004) thanks to the contribution of biofuels, hydroelectricity and renewable energies.

Despite efforts made, it has not been possible to achieve these objectives completely (see *Section 2.1.1*).

Based on lessons learned, the Government in place after the presidential election on 25th March 2012 decided to implement a new energy policy, the fundamental orientations of which were defined by the President of the Republic during the Council of Minister held in DIOURBEL on 26th July 2012. This policy aims to see the emergence of the energy sector, characterised by perfect availability of energy at the lowest cost possible, with universal access to modern energy services whilst complying with social and environmental acceptability principles.

Heading II.2 details the positions and limitations of the Electricity sub-sector, and more particularly of SENELEC and rural electrification. The energy policy vision and strategic objectives are presented in the second section of the LPDSE.

Article 56 sets out Senegal's ambition for 2017: 50% electrification in rural communities, 95% in urban communities and 70% at national level.

Decision A/DEC.24/01/06 of 12/01/2006, on application of the objectives of the Economic Community of West African States (ECWAS)

Senegal subscribes to the general objective of the ECWAS of ensuring access by at least half (50%) of the rural and peri-urban population to modern energy services by 2015, in order to achieve the UN Millennium Development Objectives (MDOs). Specifically, 100% of peri-urban and urban populations and 36% of ECWAS countries should have access to an individual electricity service by 2015.

Strategic document on Poverty Reduction

The Strategic Document on Poverty Reduction (DRSP) thus sets at 66% (30% in rural communities) household access rate to the electricity service in 2015.

4.2 REGULATORY FRAMEWORK APPLICABLE TO THE PROJECT

Several national and international texts with the environmental, economic and social components are applicable to the project.

4.2.1 National environmental and social legislation

Environment code

The regulatory framework relating to the environment is defined by Law 2001-01 of 15th January 2001 covering the Environment Code, as well as by Decree 2001-282 of 12th April 2001 on application of the Environment Code. The Environment Code (2001) is implemented by the Environment Ministry and the Office for the Environment and Classified Installations is responsible for all questions relating to evaluation of the environmental impact when permits are granted (see *Section 4.2.3*).

Heading I (General provision) includes three chapters on the definitions, fundamental principles and instruments for environmental protection.

Heading II on "the Prevention and Combat of pollution and nuisance" (which comprises six chapters) concerns classified installations and the protection of the environment, human establishments, waste management, harmful and hazardous chemicals, impact study and the establishment of emergency plans. Classified installations are divided into two different classes: the first Class is subject to the authorisation regime and the second to declaration.

Heading III (Protection and valuing of receptor environments) comprises four chapters:
- Water pollution
- Air pollution and unpleasant odours
- The pollution and degradation of soils and sub-soils
- Noise pollution.

4.2.2 *Legislation relating to classified installations for environmental protection*

Legislative framework

According to the Environment Code, plants, factories, stores, warehouses depots, worksites and industrial, artisanal or commercial installations are subject to the regime on the declaration and authorisation of Classified Installation for Protection of the Environment (ICPE).

Chapter I of Heading II (Prevention and combat of pollution and nuisance) of the Environment Code deals with classified installations for environmental protection. The installations are classified in two categories (Article 9-11):

- Class I installations are defined as presenting the risk of "serious hazards or disturbance" with regard to "health, safety, public salubrity, agriculture, nature and the environment in general". They are subject to the authorisation regime. A study evaluating impacts on the environment is used to integrate environmental considerations into the economic and financial analysis of the project; this category requires an in-depth environmental evaluation.
- Class 2 installations are not considered to present any major threat of nuisance and are consequently subject to less strict controls. These installations are subject to the declaration regime; this category is the object of a summary environmental analysis.

A power plant such as the one that will be installed in the Project is a Class 1 installation in terms of the Senegalese nomenclature of ICPE. The first class includes installations whose operation can only be authorised on condition that measures are taken to prevent hazards or disruption linked to the environment, whilst the second class includes installations that are subject to more general instructions due to the apparent absence of any serious inconveniences.

Main classified facilities included in the Project and authorization scheme

According to the Senegalese ICPE nomenclature, the Project falls under the following headings:

- A1401 "Production and distribution of electricity [Process by steam and turbine generator]" – authorisation regime requiring the performance of an in-depth study on environmental impact, whatever the production capacity.
- A1402 "Production and distribution of electricity by combustion – thermal power plants, generators, etc." - authorisation regime requiring the performance of an in-depth study on environmental impact when the installed thermal power is over 2 MW.
- S702 "Storage of combustible liquids – Category D" - authorisation regime requiring the performance of an in-depth study on environmental impact when storage capacity is greater than 5000 m3.

The Project is therefore subject to prior authorisation with prior performance of an in-depth environmental impact study. Authorisation to commence operations must be granted to Project managers by the Ecology and Nature Protection Ministry prior to construction or start-up of the installation.

Other relevant ICPE requirements

According to article L 13 of the environment code, an ICPE must be 500m distant from "*dwellings, buildings habitually occupied by third parties, establishments open to the public and areas intended for use by housing, a water course, a lake, a communication link, a water catchment."*

According to chapter 1 of law N° 2001 - 01 dated 15th January 2001 covering the Environment Code and relating to the general provisions for ICPE, the Minister with responsibility for civil protection plays a consultative role for the Environment Minister. According to article R4 of this code, authorisations for the opening and operation or start-up of ICPE, as well as the classification of each of them, are determined by order of the Environment Minister, based on opinions from the Mines and Civil Protection Ministers.

Finally, in the "transfer or transformation of the rights to operate or extension or significant modification of those rights" (« *transfert ou mutation des droits d'exploitation ou extension ou modification notable* ») of a classified facility, it is required that the Minister for the Environment is informed before the realization of planned changes in order to decide how to proceed (Article R33 of Decree 2001-282 of 12 April 2001 on the implementation Code of the Environment).

This policy statement also applies when changing operator of an classified installation. The new operator has one month to inform the Minister for the Environment. It then issues a certificate of transfer of the operation rights of the relevant ICPE.

4.2.3 *Impact study*

Chapter V of Heading II of the Environment Code, as modified, concerns impact studies. It sets out generally that an impact study must be performed for "any development project or activity likely to affect the environment". The promoter is responsible for having the impact study carried out, which he must then communicate to the competent authorities.

The main texts regulating the performance process for impact studies in Senegal are as follows:

- Decree n° 2001-282, of 12th April 2001 which completes the environment code, defines the procedure for the evaluation and examination of the Impact study, its content and public consultation.
- Ministerial order n°9468, of 28th November 2001 setting out regulations for public participation in environmental impact studies
- Ministerial order n°9469, of 28th November 2001 setting out the organisation and functioning of the technical committee
- Ministerial order n°9470, of 28th November 2001 setting out the conditions for issue of Approval for the exercise of activities relating to environmental impact studies
- Ministerial order n°9471, of 28th November 2001 setting out the content of terms of references for Impact Studies
- Ministerial order n°9472, of 28th November 2001 setting out the content of the impact study report.

Decree n° 2001-282 of 12th April 2001 indicates in detail several of the Code's provisions. The Decree requires, notably, additional obligations for Class 1 and 2 installations. Heading II of the Decree sets out the obligation for an environmental impact study (EIE) for Class 1 and 2 installations, either with an in-depth environmental evaluation for ICPEs of Class 1, or through an initial environmental analysis for Class 2 installations. Decree n° 2001-282 also indicates that public consultations must be carried out prior to any administrative authorisation.

In both cases, it is necessary to carry out the EIS with regard to the following issues:

- Effects on the health and well-being of populations, environmental milieus, ecosystems (including flora and fauna)
- Effects on agriculture, fishing and habitats
- Effects on the climate and the atmosphere
- Effects on the use of natural resources (regenerative and mineral)
- Effects of the recycling and disposal of residues and waste
- The effects on the relocation of populations, archaeological sites, the landscape and monuments and social impacts and prior, post and transborder effects.

The impact study must be validated by a technical committee that supports the Ecology and Nature Protection Ministry, as specified in Order n° 9469 of 28th November 2001. This order defines the committee's members and responsibilities. The committee secretariat is assured by the Office for the Environment and Classified Installations.

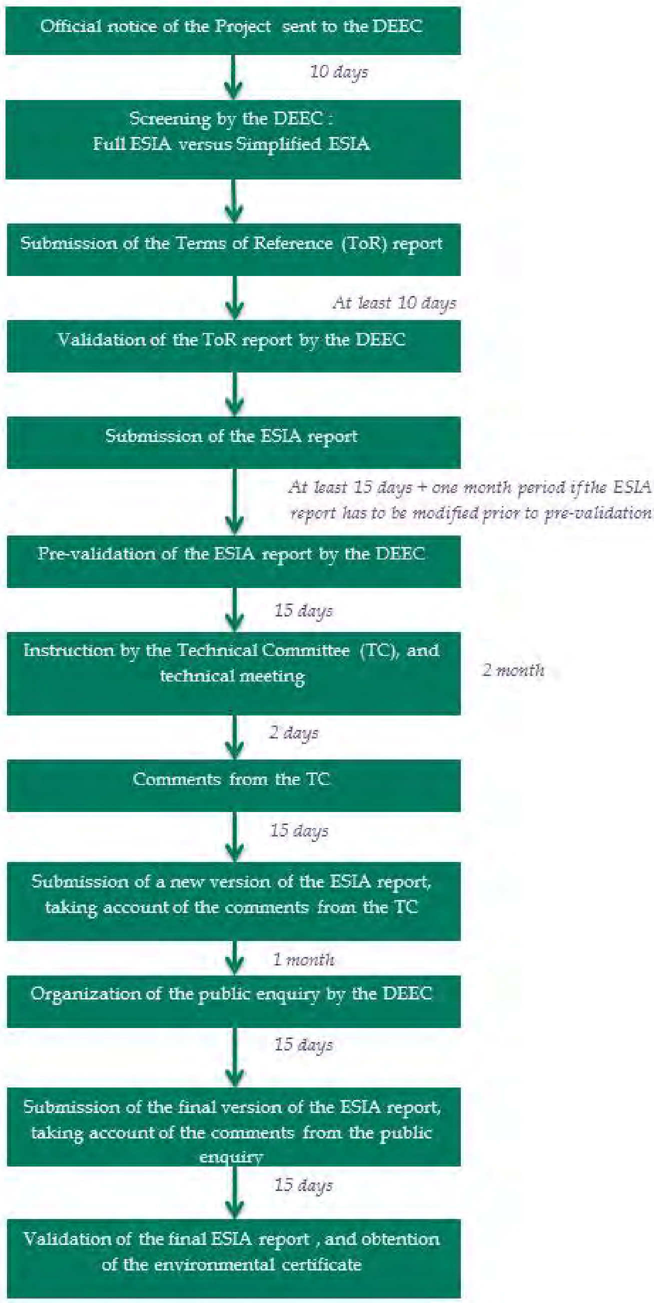
On the basis of the final study (containing all the comments received during public consultations), the technical committee has to present a decision to the Ministry with regard to the promoter's request. The Ministry must then make its decision known (positive or negative).

The two ministerial orders n° 9471 and 9472 dated 28th November 2001 define the content of the terms of reference for impact studies, as well as the content of the environment impact study report.

Process for performing and validating the ESIA

The procedure for requesting authorisation is summarised in *Figure 4.1*.

Figure 4.1 Procedure for requesting authorisation



Source: *ERM, 2014, based on current legislation in Senegal*

4.2.4 Legislation in terms of public consultation

Order n° 9468 sets out the conditions for public consultation within the context of the environmental impact study. The aim of the public hearing is "to present a summary of the EIS report and to collect opinions, observations and amendments from local stakeholders". The order on regulation of public participation in the environmental impact study underlines the following requirements:

- Announcement of the initiative by means of notices displayed at the town hall or local authority offices and/or communicated through the press
- Documents deposited at the town hall or local authority concerned
- Holding of an information meeting
- Collection of written and oral comments
- Negotiations, where necessary
- Drafting of the report.

Public hearings must be chaired by the Technical Ministry whose activities are being analysed. The Office for the Environment and Classified Installations deals with the secretariat. The project promoter submits the results of the public hearing to the technical committee.

4.2.5 Other environmental regulations

Heading III of the law covering the Environment Code concerns the Protection and Valuing of Receptor Milieus and deals with water pollution, air pollution and unpleasant odours, soil and sub-soil pollution and noise pollution. The provisions of the law are supplemented by those of Headings III to VI (water pollution, water policy, air pollution and noise pollution) of the Decree of application and by specific standards.

Water management

The Environment Code defines water as "*a public asset* » (Article L58 of the Law) and defines water pollution as *"any spillage, run-off or direct or indirect deposits of liquids or materials, and more generally any event likely to alter the quality of surface water, groundwater or sea water"* (Article R46 of the Decree).

The framework law governing the regulation of water management is Law 81-13 of 4th March 1981 covering the Water Code. It sets out the various provisions used to combat water pollution whilst reconciling requirements linked notably to the drinking water supply and public health, agriculture, the biological life of the receptor milieu and of fish life, health protection and water conservation.

The most essential principle is that water is in the public domain, which makes this resource an asset shared by all. It is on this basis that good resource planning rests, along with its correct management and fair distribution between the various usages and each according to his requirements within the strict framework of respect for the general interest.

Management of waste water

Law 2009-24 of 8th July 2009 covering the Water Treatment Code establishes a legal framework for the organisation of the public water and collective water treatment service. The parameters of application of the Water Treatment Code are described in Decree 2001-245 of 17th February 2011.

The first heading sets out the perimeter for treatment of liquids, waste water, excreta and rain water and the provisions relating to the elaboration, adoption and approval of waste water and rain water treatment master plans for municipalities and local hydraulic and treatment plans for rural communities, as well as their necessary interconnection with the planning master plan.

It also sets out provisions relating to direct or indirect spillages, run-off, deposit, disposal, burying and immersion of liquid waste or domestic, hospital and industrial origin, subject to the provisions of this law across the whole extent of the territorial, fluvial and coastal territory of Senegal.

Finally, the regime for the various effluents is defined, whether of domestic, rain water, industrial or hospital origin.

The second heading relates to specific provisions. It defines the General Conditions for the discharge of purified water into the natural environment, the re-use of purified water of domestic and industrial origin, the specific regime reserved for sludge, the protection of public treatment equipment against damage and the conditions for installing an autonomous treatment facility.

Water pollution

The Project's operational phase will lead to the generation of aqueous effluent such as waste sanitation water, rain water and industrial water. Management of this effluent is governed by Senegalese standard NS 05-061 of July 2001, laid down by interministerial order as the reference for the discharge of waste water into the receptor milieus defined within the territorial limits of Senegal.

Standard NS 05-061 is supplemented by several Appendices:

- Appendix 1 – Mechanisms for the sampling and measurement of standardised outputs: requirements in terms of the design of output mechanisms and the establishment of measurement points
- Appendix 2 – Limit values for the parameters of treated effluent, likely to be discharged into a receptor milieu; this Appendix presents, amongst other things, the limit values applicable to the Cap-des-Biches power plant
- Appendix 3 – Spreading
- Appendix 4 – Conditions for sample taking and conservation, definition of applicable standards in terms of analysis and testing.

Finally, Senegalese standard NS 05-061 of July 2001 establishes the limit values for the discharge of residual water and leaching, described in *Table 4.1*, below.

Table 4.1 Limit values for the discharge of residual water and leaching in Senegal

Component	Limits (mg/l)
Total matter in suspension (MEST)	50 mg/l

Component	Limits (mg/l)
BOD5* (on non-unloaded effluent)	80 mg/l if the maximum authorised daily flow does not exceed 30 kg/d; and 40 mg/l above that amount (30kg/d)
COD** (on non-unloaded effluent)	200 mg/l if the maximum authorised daily flow does not exceed 100 kg/d; and 100 mg/l above that amount (100kg/d).
Nitrogen (total nitrogen including organic nitrogen, ammoniacal nitrogen and oxidised nitrogen)	30 mg/l as average monthly concentration when the maximum daily flow is equal to or over 50 kg/day.
Phosphorous (total phosphorous)	10 mg/l as average monthly concentration when the maximum authorised daily flow is equal to or over 15 kg/day.

Source: *Senegalese standard NS 05-061*
Note: BOD 5 = Biological Oxygen Demand / Note**: COD = Chemical Oxygen Demand*

Air pollution

Article L76 of the Environment Code stipulates that the law and application regulations apply to air pollutions or odours that "*are unpleasant for populations, compromise public health or safety, are harmful to agricultural production, the conservation of buildings and monuments or to the character of natural sites and ecosystems.*"

Moreover, Heading V of the Decree 2001-282 covering application of the environment defines the general provisions on air pollution, with the main objective of regulating the emissions of gassy effluent in order to avoid any kind of pollution. Mainly, Decree 2001-282 describes the following provisions:

- It regulates pollutions caused by gas emissions
- It requires for all sources prior treatment of gassy pollutants prior to any discharge. Supervision and control are provided by certified officials from the Environment Ministry or by any other officer with jurisdiction in this field
- It sets out and specifies the terms of collecting the annual tax that has to be paid by industries that discharge gassy effluent. The tax is set by order. The money collected is paid into the Treasury and part of the money is used to carry out concrete actions that contribute to the combat against atmospheric pollutions and for the protection of environmental resources.

The combustion of the heavy fuel oil used for energy production will lead to atmospheric emissions that are regulated by Senegalese standard NS 05-062 of December 2004, established by interministerial order as a reference for the discharge of atmospheric emissions. The main instructions of this standard are as follows:

- declaration of emissions to the authorities on the basis of measurements taken at discharge points or a quantitative report on substances used
- discharge conditions: layout of installations so as to enable good diffusion and facilitate the measurement of pollutants

- supervision of discharge: the frequency of discharge measurements and the parameters to be analysed are set forth in the authorisation order
- Appendix 2 – emission limit values for special installations (including stationary combustion engines)
- Appendix 4 – method used for calculating the height of the stack
- Appendix 5 – conditions for sampling and measuring air pollution: definition of applicable standards for analyses and testing.

The limit values defined in the standard and applicable to the Cap-des-Biches power plant are presented in *Table 4.2* below; these values concern stack discharge and are not dependent on atmospheric dispersal. The pollutant concentration limit values in ambient air are also presented in *Table 4.3*; this standard concerns atmospheric emissions in the environment outside a power plant after discharge and dispersal into the air.

Table 4.2 Atmospheric emission limit values for stationery combustion engines running on heavy fuel oil

Parameter	Limit value
CO	650 mg/Nm^3
NO_X	2000 mg/Nm^3
SO_2	2 000 mg/Nm^3
Dust	100 mg/Nm^3

Source: *Standard NS 05-062 – Atmospheric pollution, discharge standards*

Table 4.3 Limit values for concentrations in ambient air

Parameter	Limit value
CO	30 mg/Nm^3 (Average over 24h, must not be exceeded more than once a year)
NO_2	200 µg/Nm^3 (Hourly average) 40 µg/Nm^3 (Annual average)
SO_2	50 µg/Nm^3 (Annual average) 125 µg/Nm^3 (Daily average)
Dust	80 µg/Nm^3 (Annual average) 260 µg/Nm^3 (Average over 24 h, must not be exceeded more than once a year)

Source: *Standard NS 05-062 – Atmospheric pollution, discharge standards*

Waste management

The construction and operational phases will lead to the production of several types of waste. These will be mainly domestic waste products and bulky refuse for the former, and hazardous waste and sludge from the effluent treatment plant for the second.

According to Article L 30 of the Environment, "*waste materials must be disposed of or recycled in a rational, ecological way in order to suppress or reduce their harmful* *effects on human health, natural resources, fauna and flora or the quality of the environment."* According to Article L 31 "*Anyone who produces or holds waste products must deal himself with disposal or recycling or ensure that it is disposed of or recycled by companies approved by the Environment Ministry. If not, he must pass these waste products on to the local authority or to any company approved by the State for waste management. This company, or the local authority itself, can sign contracts with waste producers or holders with a view to its disposal or recycling. Recycling must always take place in accordance with current standards in Senegal".* Moreover, this same code bans fly tipping and sets out the obligation of having waste products disposed of or recycled by a company with Ministerial approval. Similarly, the burying of waste materials cannot take place without first obtaining authorisation to do so from the Environment Minister who sets out the technical instructions and specific rules that must be observed.

Other regulatory texts relevant to waste management are as follows:

- Law n° 83-71 of 5th July covering the Hygiene Code which regulates hygiene. In particular, Law n° 83-71 regulates public or collective individual hygiene and the sanitation of the environment. The law defines, amongst other things, the hygiene rules applicable to dwellings, industrial installations, public highways and the packaging of waste materials.
- Law n° 96-06 of 22nd March 1996 covering the Local Authorities Code and law n° 96-07 of 22nd March 1996 covering the Transfer of environmental jurisdiction to local authorities, gives them full jurisdiction in terms of waste management
- Decree 74-338, relating to household waste: decree 74-338 o 10th April 1974 regulates the evacuation and deposit of waste products. This text focuses on the definition of waste, its collection and dumping. The decree does not address the question of transfer centres.

In terms of industrial waste, this is of several types, but regulatory provisions specify that it must be managed in situ by its producer by virtue of the polluter-payer principle. If suitable equipment is not available at the production site, regulations also provide for the possibility of using the services of approved organisations in order to carry out the required treatment.

Waste oil is also regulated, notably for organisation of its collection, storage, re-use and energy valorisation (interministerial order covering the management of waste oil dated 5th October 2007).

Specific instructions are defined for biomedical waste. The Hygiene Code states that this waste must be collected separately from household waste. Moreover, decree n°2008-1007 of 18th August 2008 deals specifically with this type of waste. Biomedical waste must be sorted right from production and then packed so as to avoid any kind of contamination. This waste must be disposed of by a facility approved by the Ministry.

Noise emissions

The main issues linked to noise emissions will take place during the operational phase. Noise emissions generated by installations such as radiator ventilators, water condensers or transformers, must be maintained at levels defined by Senegalese law.

According to article L84 of the Environment Code "*noise emissions likely to harm human health, create excessive disturbance to neighbours or have a negative effect on the environment are forbidden*".
Limit values with regard to human health (corresponding therefore to values measured at the closest dwellings) are defined in the regulatory section of the Environment Code:

- 55 dB(A) to 60 dB(A) by day

- 40 dB(A) by night

Currently no frequency of noise measurement is required.

Land law

In terms of land law, regulations are defined by the framework established in Law N°64-46 of 17th June 1964 relating to the national domain and Law N°76-66 of 2nd July 1976 covering the State domain code, which divided land into public and private domain areas. Law 64-46 reinforces the State's right to be guardian of all land and grants the State authority to intervene in governmental development projects in order to guarantee rational land usage and defend priorities in accordance with the nation's economic policies. It also permits the creation of four categories of land areas: the rural area, the classified area, the urban area and the pioneer area.

Moreover Decree N° 64-574 of 30th July 1964 covering application of article 3 of law 64-46 dated 17th June 1964, relates to the national domain and authorises, temporarily, registration of the name of occupants who have enhanced an area permanently. This legislation governs State public and private ownership and other public bodies.

Decree N°77-563 of 3rd July 1977 covering application of Law N°76-67 of 2nd July 1976 relating to expropriation for public usefulness and other land operations of public usefulness, defines the general provisions for obtaining certification and of certificates of land ownership rights.

Finally, the Decree of 26th July 1932 covering organisation of the land property regime in French West Africa defines the general provisions of private ownership.

The following regulatory texts are also potentially applicable to the Project:

- The Civil and Commercial Obligations Code
- Decree 91-748 of 29th February 1991, relating to reinstallation
- Decree n° 72-1288 of 27th October 1972 relating to the conditions for allocation and disaffection of land in the national domain that forms part of rural communities.

Law n° 2008-43 of 20th of August 2008 on the Urban Planning Code

This code defines building standards and urban plans, the distribution and organization of land in zones; the route of communicaton channels; spaces reserved in public servives, land-use condition etc. The Urban Planning Code sets forecasts and planning rules that are implemented by development and urban master plans (*schémas directeurs d'aménagement et d'urbanisme*), urban planning master plan (*plans directeurs d'urbanisme*), detailed urban planning (*plans d'urbanisme de détails*), subdivision plans (*plans de lotissement*).

The Code is supplemented by Decree No. 2009-1450 of 30 December 2009 on the regulatory part of the Town Planning Code.

Land clearance

The Forestry Code (Law n°98-03 of 8th January 1998, and its application decree, Decree n°98-164 of 20th February 1998) stipulates that any land clearance must obligatorily be authorised by the local authorities. Authorisation is granted only based on a file containing notably a report from the Water and Forestry Service, a milieu impact study and an evaluation of the cost of restoration of the area.

Protected species

Regulations on the protection of plant species are defined in the Forestry Code for flora (Law 98/03 of 8th January 1998 and Decree 98/164 of 20th February 1998).

Law 86-04 covers the Hunting and Fauna Protection Code and its decree of application (Decree n°86-844) regulating hunting activities and the protection of fauna. The provisions of Decree n°86-844 are divided into 3 headings, including Heading II on fauna protection, which includes provisions relating to the protection of certain species, national parks, dispensations to the hunting law, health protection and the protection of people and property.

In the case of a residual impact on protected or partially protected species, a request for a dispensation file must be made to the competent authorities.

4.2.6 *Legislation relating to the electricity sector*

The electricity sector in Senegal was previously governed by Law l n° 65-59 of 19th July 1965 relating to the production or catchment, transport and distribution of water and electricity and by Decree n° 84-1128 of 4th October

1984 covering regulations on the production, transport and distribution of electricity.

Under the terms of Decree n° 84-1128, it is the Société Nationale d'Electricité (SENELEC), in which the State own all the capital, which has the monopoly over transport and distribution.

The orientation Law n°98-29 of 14th April 1998 relating to the electricity sector creates a new institutional and regulatory framework intended to attract the necessary private investment for developing the electricity sector. It points out that the exercise of any activity in this sector is subject to first obtaining a licence or concession issued by the Minister with responsibility for Electricity.

Moreover, the conditions and terms for the issue and withdrawal of electricity production, distribution and sale concessions are set forth in Decree n°98-334.

Decree n°98-335, relating to the principles and procedures for defining and revising tariffs repeats and develops the tariff principles set forth in Law n° 98-29 relating to the electricity sector and sets out a procedure for revising tariff conditions.

The main institutional stakeholders (see *Section 4.3*) in the field of electricity regulation are:

- The Energy and Hydraulic Resources Ministry (ME) ;
- The Commission for the Regulation of the Electricity Sector (CRSE), established by Decree 98-333 covering the organisation and functioning of the Electricity Regulation Commission.

4.2.7 *Labour legislation*

Labour Code (Law 97-17 of 1st December 1997)

In its health provisions, Law No. 97-17 of December 1st, 1997 regarding the Labour Code sets working conditions: duration of labour (that must not exceed 40 hours per week), working at night, women and children work contracts, and weekly time off work that is mandatory. The text also deals with the Health and Safety at the workplace and identifies the measures that any activity must implement to ensure good health and safety condition that will guarantee healthy and safe working conditions. New Decrees were added to the system in place:

- Decree No. 2006-1249 of 15 November 2006 laying down minimum safety and health requirements for temporary or mobile construction sites;
- Decree No. 2006-1250 of 15 November 2006 on the movement of vehicles and machines inside the boundaries of a company's site;
- Decree No. 2006-1251 of 15 November 2006 on work equipment;
- Decree No. 2006-1252 of 15 November 2006 laying down minimum requirements for the prevention of certain environmental physical factors;

- Decree No. 2006-1253 of 15 November 2006 establishing a medical labor inspection and setting its role;
- Decree No. 2006-1254 of 15 November 2006 on the manual handling of heavy loads;
- Decree No. 2006-1256 of 15 November 2006 laying down the obligations of occupational safety for employers;
- Decree No. 2006-1257 of 15 November 2006 laying down minimum requirements for protection against chemical risks;
- Decree No. 2006-1258 of 15 November 2006 on the missions and rules of organization and operation of occupational medicine services;
- Decree No. 2006-1260 of 15 November 2006 on ventilation and sanitation conditions at the workplace;
- Decree No. 2006-1261 of 15 November 2006 laying down the general hygiene and safety in all types of institutions.

Heading XI of the Labour Code relates to health and safety in companies. It defines the following principles:

- The employer must ensure that workplaces, machines, equipment, substances and working methods do not present any kind of risk to worker health and safety. Prevention must be ensured by technical measures (design of machines, …) or organisational means (vocational medicine, …) (Article L 171).
- If these measures are not sufficient to guarantee workers' health and safety, individual protection measures must be implemented (Article L 172).
- The use of processes, substances, machines or equipment causing workers to be exposed to risks in the workplace must be communicated in writing to the Employment Inspector and Social Security (Article L 174).
- Workplaces must be subject to regular checks, notably with the aim or checking on compliance with safety standards and exposure limits (Article L 175).
- Workers' health must be regularly checked with a medical examination at the time of recruitment, followed by periodic medical examinations (Article L 176).
- Workers must be informed of any professional risks existing at their place of work and must be provided with adequate instructions to protect themselves against these risks (Article L 177).
- A periodic report on workers' state of health must be issued by the employer and a Health and Safety Committee (CHS) must be set up (Article L 178 and L 185).

Decree N°94-244 of 7th March 1994

This decree set out the terms for the organisation and functioning of health and safety at work committees. It defines the following principles:

- A health and safety committee must be organised by the employer and set up by employees in order to implement a health and safety at work programme (Article 1).

- The Committee carries out an inventory of all hazardous products, as well as an analysis and evaluation of real or potential risks (Article 11).
- A health, hygiene and safety register must be kept, in which will be entered minutes of the meetings, accident and professional illness statistics, the means of intervention and evacuation (Article 12).
- The establishment of an annual programme in terms of health and safety (Article 13).

The employer will also comply with articles that refer to legal obligations with regard to Work Inspection and Social Security, as defined in the Labour Code.

Hygiene Code (Law 83-71 of 5th July 1983)

The thermal power plant Project is subject to the Hygiene Code and notably section 6 relating to hygiene rules in industrial installations. The main instruction applicable to ContourGlobal Cap-des-Biches are as follows:

- Industrial premises and their surroundings must not be insalubrious
- Combustion fires, incinerators and incineration plants must not emit any dust, odour or nuisance fumes that may pollute the atmosphere
- Staff at factories and other industrial companies must undergo periodic medical examinations, in accordance with current regulations.

Chemicals

Operation of the power plant will require the use of chemicals, notably for the production of demineralised water. The use of chemicals is governed by decree n° 2006-1257 of 15th November 2006 which sets out minimum instructions for protection against chemical risks and defines conditions for the usage of chemicals in companies and the means of protecting workers against harm. The main instructions are as follows:

- Use labelled substances that come with a safety leaflet
- Limit the number of employee exposed to the chemical risk, notably by isolating workplaces where chemical products are used
- Based on safety leaflets, evaluate the chemical risks of substances and implement appropriate measures
- Implement collective and individual protection measures that are adapted to the risk involved
- Guarantee worker training and information, notably by means of notices on chemical risk prevention at every work station concerned, instructions displayed at premises, training in safety and emergency measures, etc. The employer must ensure that the various documents made available to exposed workers are correctly understood.

Workplace atmosphere

Decree n° 2006-1252 of 15th November 2006 setting out minimum prevention instructions for certain physical atmosphere factors defines the minimum instructions intended to protect workers against any kind of harm that could result from insufficient lighting, excessive or insufficient heat or a high noise level.

Lighting levels must be suitable for the work to be performed. The employer must also ensure that employees are not made uncomfortable by the heat radiating from light sources. Lighting apparatus and electricity carriers must also be firmly attached to avoid any electrical risk for employees. Safety lighting is required in work areas, to permit the evacuation of staff should the main lighting system fail.

Average equipment levels required are defined in the Appendix to the decree. Values applicable to the Cap-des-Biches power plant are summarised in *Table 4.4* below.

Table 4.4 ***Average lighting according to area of the site***

Site area	Average lighting
Traffic and storage areas	
Traffic areas	100 lux 150 lux if vehicles are moving
Stairs, unloading bays	150 lux
Storage warehouses	100 lux
Premises used by workers	
Changing rooms, toilets	100 lux
Canteen, refectory	200 lux
Sick bay	500 lux
Offices and administrative premises	
Archives	200 lux
Filing and reception areas	300 lux
Reading, writing areas, computer rooms, conference rooms	500 lux

In terms of heat, the temperature must be compatible with worker health and be controlled by thermometers installed across all work premises. As far as possible, the use of processes that do not exude heat is required or, failing which, processes that mitigate heat diffusion by insulating the equipment concerned or capturing and evacuating the heat. In case of excessive temperature, ventilation and air conditioning systems will be installed.

Similarly, noise levels must be limited to avoid affecting worker health. It is mainly required therefore to:

- Prefer the least noisy processes
- Reduce noise at source
- Insulate noisy equipment

- Distance employees from noisy areas.

The maximum noise level to which an employee can be exposed is 85 dB(A). If it is not possible to limit the noise level to this value, personal protective equipment must be used.

4.2.8 International conventions and treaties

Senegal has ratified several international conventions and treaties in the environmental and social fields, and has committed to develop and implement sustainable development policies and strategies in relation to these international treaties. A list of the main international conventions is provided in *Table 4.5* below.

Table 4.5 International conventions and treaties

Convention title	Date of signature	Date of ratification	General aim
Protection of the ozone layer and climate change			
Vienna Convention for the protection of the ozone layer	22/03/1985	19/03/1993	To protect human health against the harmful effects of modifications to the ozone layer
Montreal Protocol (and its associated amendments) relating to substances that deplete the ozone layer and its amendments	29/05/1990	06/05/1993	To protect the ozone layer by taking measures to regulate world emissions of substances that deplete it
Kyoto Protocol to the UN framework convention on climate change	11/12/1997	20/07/2001	To reduce greenhouse gas emissions
Rational waste management			
Basel Convention on the control of transboundary movements of hazardous wastes and their disposal (Basel, 1989)	22/03/1989	10/11/1992	To ensure application of provisions governing movements
Protocol on liability and compensation for damage resulting from transboundary movements and the disposal of hazardous wastes (Basel, 1999)	22/03/1989	10/11/1992	To establish a complete system for liability and rapid adequate compensation in case of damage resulting from a transboundary movement and the disposal of hazardous waste, including the unlawful trafficking of this waste.
African Convention on the ban on the Import into Africa and the Control of Transboundary Movement and Management of	30/01/1991	16/02/1994	To regulate transboundary movements of toxic waste. To unite African countries against the import into the continent of hazardous waste.

Convention title	Date of signature	Date of ratification	General aim
Hazardous Wastes within Africa (Bamako, 1991)			
Management of chemicals			
The Rotterdam Convention on the prior informed consent procedure for certain hazardous chemicals and pesticides in international trade	11/09/1998	20/07/2001	To protect human health and the environment against potential risks from international trade in chemicals, to facilitate the exchange of information on pesticides and prevent illegal trade.
Stockholm Convention de on Persistent Organic Pollutants	23/05/2001	08/10/2003	To protect human health and the environment against persistent organic pollutants.
Management of natural resources and fauna			
UN framework convention to combat against desertification (Paris, 1994)	14/10/1994	26/06/1995	To combat the deterioration of soils
African Convention on the conservation of nature and natural resources (Alger, 1968)	15/09/1968	03/02/1972	To protect nature and natural resources in Africa
Rio Convention on biological diversity (Rio de Janeiro), 1992	13/06/1992	17/09/1994	To conserve the diversity of species and genetic diversity within the same species and the diversity of ecosystems
Bonn Convention on Migratory Species (CMS) (Bonn, 1979)		01/03/1988	To conserve migratory species at world level. Wild animals are the object of particular mesological, ecologic, genetic, scientific, recreational, cultural, educational, social and economic importance.
Convention on the international trade in endangered species (CITES)	05/08/1977	03/11/0977	Convention on the international trade in endangered species of wild fauna and flora (CITES) is an international agreement between states. Its aim is to ensure that the international trade in specimens of wild animals does not threaten the survival of the species to which they belong.

Convention title	Date of signature	Date of ratification	General aim
Ramsar Convention	-	11/11/1977	The convention of wetlands, known as the Ramsar Convention, is an inter-governmental treaty which acts as a reference framework for national action and international cooperation for the conservation and rational usage of wetlands and their resources. Five Ramsar sites are registered in Senegalese territory.
Convention for the creation of the UN World Organisation for Food and Agriculture	16/10/1945	16/10/1945	The creation of the Organisation has the aim of combatting poverty and hunger in the world and working to raise the level of nutrition and production yields, to distribute foodstuffs more efficiently and to improve living conditions in general; to promote mainly agriculture and sustainable rural development.
International Plant Protection Convention, revised at the 29th session of the FAO Conference, November 1997	07/11/1997	02/10/2005	To ensure efficient joint action to prevent the dissemination and introduction of organisms that are harmful to plants and plant products and to promote measures to control them and to provide a framework for international cooperation, harmonisation and technical exchanges in collaboration with regional and national protection organisations.
Cultural heritage			
Convention for Safeguarding of Intangible Cultural Heritage, adopted in Paris (UNESCO)	17/10/2003	03/08/2005	This recent convention insists on the need to preserve the cultural heritage of certain peoples.
Labour regulations			
International Labour Organisation Conventions (ILO)	-	-	Senegal is a member of the international labour organisation and a signatory to several international conventions associated with that organisation. Note, for example, the ILO Convention on child labour, ratified by Senegal on 26th December 1999.

4.2.9 *Requirements in terms of environmental and social compliance: IFC performance standards*

In April 2006, the International Finance Corporation (IFC) published a series of eight Performance Standards (PS) which have become an international benchmark for the social and environmental evaluation process in which IFC and other international fund providers are involved. These standards have recently been revised and the new version came into force in January 2012. *Table 4.6* recapitulates these performance standards.

Table 4.6 *IFC performance standards*

N°	Title	Field of application
1	Assessment and management of environmental and social risks and impacts	Defines the provisions for instituting an adapted environmental and social management policy, including requirements in terms of the Environmental and Social Impact Study.
2	Labour and working conditions	Defines the provisions for establishing and applying fair staff recruitment and management policies
3	Resource efficiency and pollution prevention	Defines an approach for the rational use of resources and prevention and the combat against pollution at project level, in compliance with technologies and practices used at international level.
4	Community health, safety and security	Defines the provisions to ensure that the Project's negative impacts on the host community are properly managed and controlled.
5	Land acquisition and involuntary resettlement	Defines the provisions for management of land ownership and the relocation of communities within the context of project development.
6	Biodiversity conservation and sustainable management of living natural resources	Defines the provisions for ensuring that the Project's impacts on nature, ecosystems, habitats and biodiversity are properly managed.
7	Indigenous people	Defines provisions to ensure that the rights of native minorities are respected and that native populations benefit from the Project
8	Cultural heritage	Defines the provisions for managing the project's impacts on the tangible and intangible heritage.

Source: *IFC, 2012*

The IFC's first performance standard establishes the importance of managing social and environmental performance throughout a project's lifecycle. It encourages the implementation of a permanent efficient social and environmental management system and real community participation thanks to a good policy of communication and consultation with local populations. It also encourages the integrated evaluation of impacts, risks and opportunities associated with the project right from its initial development phases, thus providing a hierarchy and coherence for the continuous mitigation and management of risks.

On the basis of the information that was collected during the framework report and visit to the site, it would appear that the IFC[1] performance standards applicable to the power plant project are as follows:

(1) http://www.ifc.org/wps/wcm/connect/38fb14804a58c83480548f8969adcc27/PS_French_2012_Full-Document.pdf?MOD=AJPERES
(2) The study was carried out on line with the new IFC performance criteria published in January 2012

- Performance Standard n°1: Assessment and management of social and environmental and social risks and impacts
- Performance Standard n°2: Labour and working conditions
- Performance Standard n°3: Resource efficiency and pollution prevention
- Performance Standard n°4: Community health, safety and security
- Performance Standard n°6: Biodiversity conservation and sustainable management of living natural resources

As specified in *Chapter 3* on description of the Project, the land on which the Cap-des-Biches power plant will be installed is part of the land allocated to SENELEC. Performance Standard n°5 (Acquisition of land and involuntary relocation) is not therefore directly applicable to the Project. This issue of land acquisition and local socio-economic consequences will however be addressed in this ESIA.

IFC directive on the Environment, Health and Safety

The World Bank Group has also published a series of Directives for the management of the environment, health and safety (EHS Directives). These directives are technical reference documents which present examples of international good practice of general scope or concern a specific branch of activity. They present environmental, health and safety guidelines.

Within the context of Project development, the main directives to take into account (that can be consulted on the IFC website) are:

- The general EHS Directive (2007), which presents the environmental, health and safety guidelines applicable in all areas
- The EHS Directive for thermal power plants (2008), which presents good practice to be applied in terms of the various types of power plants and according to the issues identified (particularly emission values to be complied with)
- The IFC EHS Directive on atmospheric emissions and ambient air quality published in 2007, which refer to WHO recommendations for air quality (1).

These Directives present, amongst other things, international recommendations and standards with regard to the main emissions, particularly noise emissions (see *Inset 4.1*), atmospheric emissions (see *Table 4.7*) and ambient air quality standards (see *Table 4.8*).

(3) The IFC performance criteria 7 on native populations does not apply because no native population (as defined in the CP 7) was identified in the project area.
[1] WHO's guidelines on air quality are available on http://www.who.int/fr/

Inset 4.1 IFC standards on noise emissions

The IFC general EHS directives (2007) that implement the "Ambient Noise Directives" established by the World Health Organisation (WHO) in 1999, set forth absolute noise levels for day and night time, with two possible levels of sensitivity.
- industrial and commercial area
- residential, institutional and educational area.

In residential areas, ambient noise levels considered are 55 dB(A) by day and 45 dB(A) by night. These values are commonly used as design standards for industrial installations.

Measurements must be taken in the receptor areas located outside the limit of the project's property. In areas where ambient noise already exceed (prior to implementation of the project) 55 dB(A) by day and/or 45 dB(A) by night, the IFC requires that the Project's noise emissions should not increase the ambient noise level by 3 dB(A) or more in a residential area (during the noisiest time over a 24 hour period).

Table 4.7 IFC limit values for atmospheric emissions

Limit in standards		NO_x [mg/Nm³]	SO_x [mg/Nm³]	Dust [mg/Nm³]	CO [mg/Nm³]
IFC directives	BND(a)	1850	1170(c)	50	n/a
	BD(b)	400	0.2% S	30	n/a

a) Non-deteriorated basin
b) Deteriorated basin
c) Or use of 2% or less of S fuel

Table 4.8 IFC air quality standards

Pollutant	Average period	IFC standards [µg/m³]
SO_2	Calendar year	-
	24 h	125 (Intermediate target 1)
		50 (Intermediate target 2)
		20 (Guideline)
NO_2	Calendar year	40
	1 h	200
PM10	Calendar year	70 (Intermediate target 1)
		50 (Intermediate target 2)
		30 (Intermediate target 3)
		20 (Guideline)
	24 h	150 (Intermediate target 1)
		100 (Intermediate target 2)
		75 (Intermediate target 3)
		50 (Guideline)
CO	24 h	-

4.3 INSTITUTIONAL FRAMEWORK

This Chapter presents the various institutional units involved in validation and supervision of the Project. A recap of these various entities is presented in *Table 4.9*.

4.3.1 *At central level*

Economic, Social and Environment Council

The Economic, Social and Environmental council is made up of 80 councillors and 40 associate members, all of diverse and varied profiles. This diversity of members ensure the wealth of the Institution. Representatives include people from:

- Economic life and social dialogue
- Social and territorial cohesion and associations
- Nature and environmental protection.

The Economic, Social and Environmental council is Senegal's second constitutional Assembly. It acts for the public authorities as a consultative assembly that can be referred to by the President of the Republic, the National Assembly or the Prime Minister in the name of the Government, with requests for opinions or studies.

Made up of the Nation's lifeblood, the Economic, Social and Environmental council is a place for collaboration and participation by socioprofessional categories in the economic, social and environmental policy of the nation. It looks economic, social and environmental developments and suggests the necessary adaptations. It promotes a policy of dialogue and cooperation with local authorities and similar foreign organisations.

It can deal with the examination of economic, social and financial issues, undertake the necessary studies and enquiries and, in conclusion, issue opinions and suggestions for reform that it believes will encourage the nation's economic, social and environmental development.

It is referred to, for an opinion, by the President of the Republic:

- Compulsory for planned laws on programmes and plans of an economic, social or environmental nature, and
- Optionally for draft laws on programming to define multi-annual orientations for public finances, draft laws, orders or decrees and proposals for laws that fall within its area of jurisdiction.

The Environment and Sustainable Development Ministry

The Environment and Sustainable Development Ministry (MEDD) has the task of drawing up and applying environmental policy, the management of which involves several other participants, notably local authorities. In its task it is supported by several technical offices, notably:

- The Environment and Classified Installations Office (DEEC) ;
- The Environmental Planning and Supervision Office (DPVE) ;
- The Office for Water, Forests, Hunting and Soil Conservation (DEFCCS)
- The National Parks Office (DPN)
- The Ecological Monitoring Centre (CSE) ;

In the performance and tracking of ESIA procedures, the MEDD is supported by the Environment and Classified Installations Office (DEEC) and the Technical Committee.

The Environment and Classified Installations Office (DEEC)

In the field of environmental impact studies, this office, through the pollution and nuisance prevention and control division and the office for environmental impact studies, has the task of ensuring application of the provisions relating to environmental and social impacts studies.

It prepares, for the Environment Minister, opinions and decisions relating to environmental and social impacts studies.

The DEEC has an environmental impact studies division which includes specialists competent to ensure scientific and technical supervision as was as checks on compliance and legality.

The Environment and Classified Installations Office is represented at regional level by the Regional Environment and Classified Installations Offices (DREEC).

The technical committee for the validation of environmental impact studies

This was instituted by ministerial order n°00949 of 28th November 2001 and supports the MEDD in the validation of impact studies. Its secretariat is performed by the Environment and Classified Installations Office. The environmental impact study procedure focuses particularly on the holding of a public hearing with a view to validation by the people of the impact study. At this level, note the emergence of a civil society association called Association sénégalaise pour l'évaluation environnementale (ASEE) *(the Senegalese Association for Environmental Evaluation)*, created in 1994.

The Civil Protection Office (DPC)

The Civil Protection Office is responsible for ensuring the protection of people as well as the conservation of public and private installations, resources and property.

The DPC has the following tasks:

- In the field of prevention:
  - To draw up draft law on civil protection
  - To organise, with Regional and Auxiliary Civil Protection Commissions, and with interministerial technical committees, preventive visits to establishments that are open to the public, classified installations, high rise buildings and any other establishment that could present a hazard
  - To follow-up on reports issued after prevention visits
  - To issue opinions, in the form of safety studies, on construction project files for establishments open to the public, classified installations and high rise buildings. These opinions are issued prior to the granting of an authorisation to build
  - Train, inform and create public awareness of risk prevention.

- In the field of disaster management: to issue an opinion on Specific Intervention Plans (P.P.I.) and Internal Operations Plans (P.O.I.).

Thus, the Civil Protection Office draws up specific plans for the management of certain risks: rehabilitation and installation of fire hydrants, installation of lightning rods, etc.

It is thus clear that the DPC has both the resources and the competence necessary for performance of its mandate.

The Labour and Social Security General Office

This office is responsible for implementing the national policy on safety at work and for preparing the texts, orders and application decrees for the labour code. In this respect, it has the task of checking on performance by third parties, notably companies, of the professional risk prevention measures contained in current regulations.

It also works on the reinforcement of capacities in order to take better charge of this issue. In the exercise of its tasks it is supported by the Social Security Office, which also has human resources with competencies in this field.

The Ministry for Mines, Energy and Hydraulic Resources (ME)

The Ministry for Mines, Energy and Hydraulic Resources is responsible for setting out the sector policy and for defining applicable standards. It is solely authorised to grant the licences and concessions that give operators the right to produce, distribute or sell electricity on national territory. On proposal by the Electricity Sector Regulation Commission, the Minister also decides on the tariff conditions applicable to each concession.

The Electricity Sector Regulation Commission (CRSE)

The CRSE is responsible for the regulation of activities in production, transport, distribution and sale of electricity in Senegal. It is the CRSE that considers all requests for licences or concessions, and gives its opinion, with justification, to the Energy Minister for a decision and allocation.

Energy Office, under supervision of the Energy Ministry

The institutional framework of the energy sector was renewed in September 2013, with the establishment of a ministerial department dedicated solely to the sector and a redefinition of the roles of those involved. The Energy Office takes over from the Energy Ministry in terms of energy supply policy in Senegal and as such oversees companies in the para-public sector whose activity is in the import, export or sale of hydrocarbons.

The Energy Office's tasks include:

- The preparation and performance monitoring of development plans and energy based programmes
- Establishment of energy statistics and reports
- Ensuring the tracking of supplies to the domestic market of oil products
- Keeping track of companies and other autonomous administrations working in the energy sector (SENELEC, ASER, CNH, etc…).

The energy authorities in Senegal (excluding the Ministry and the Energy Office presented above) are as follows:

- The Energy Sector Regulation Commission (CRSE), created by Law n°98-29 of 14th April 1998, it is responsible for the regulation of electricity production, transport, distribution and sale in Senegal, and in particular for setting tariffs.
- SENELEC a limited company with majority public capital which has the monopoly over the distribution and sale of electricity within its perimeter of concession
- The Senegalese Agency for Rural Electrification (ASER) which promotes rural electrification
- The Agency for Energy Savings and Control (AEME), whose task is to promote the rational use of energy in every sector of activity
- The National Agency for Renewable Energies (ANER), which promotes the use of renewable energies in every sector of activity.

The following agencies also work in the energy sector, overseen by the Energy Ministry:

- The National Hydrocarbons Committee (CNH)
- The African refinery Company (SAR)
- The Senegalese Oils Company (PETROSEN).

Institutions concerned by the project

The main institutions potentially concerned by the Project are the following:

- The National Hygiene Office

- The National Hygiene Service
- The Water Resources Management and Planning Office (DGPRE)
- The Planning and Architecture Office
- The Land Planning Office
- The Local Authorities Office
- The Senegal National Office for Sanitation (ONAS)
- The Municipal Development Agency (ADM)
- Research Centres and Institutes

4.3.2 *At regional and local levels*

The Law 96-06 of 22nd March 1996 covering the local authorities' code defines the region, municipality and rural community in compliance with national unity and territorial integrity. It was modified in 2013 by a major reform of the territorial organisation of the State of Senegal, with a new decentralisation law. Law n° 2013-10 of 28th December 2013 covering the General Local Authorities Code – Act III of decentralisation sets out the framework.

Act 3 of decentralisation has the aim of achieving universal communalisation of local authorities whose economic powers will be increased, to improve local governance, to improve the land and local planning policy, to give local representatives a new status, to increase deconcentration and to define new types of relations between deconcentration and decentralisation, etc.

The current decentralisation context offers local authorities responsibilities in terms of the transfer of competencies, notably with regard to the management of natural resources. More specifically, they hold the prerogative for this management in the field of non-classified land, where they are the main players and even the beneficiaries, even if they very often do not have any proven competency in these areas.

Regional committees

Regional committees for the environmental and social monitoring of development projects (CRSE) have been set up in the regions by Governor order. CRSE meetings are called and chaired by Governors; the DREEC deal with the secretariat. These committees are made up of the technical services involved in the environmental and social management of projects. Amongst the competencies attributed to them, committees can:

- Support the environmental and social evaluation of local development projects
- Carry out a review of any studies that have been undertaken
- Track the application of mitigation/accompaniment measures
- Track the implementation of any project management and monitoring plans
- Contribute to strengthening the capacities of those involved.

Local authorities

Environmental protection also involves other administrative structure: at local authority level Law n° 96-07 of 22nd March 1996, which supplements the Local Authority Code, transferred competencies in nine areas, including the environment and the natural resource management.

Decree n° 96-1134 of 27th December specified the terms of application of the transfer of environmental and natural resource competencies. Thus local authorities (Region, Municipality and Rural Community) ensure the protection and management of natural resources and the environment.

NGOs and community associations

- Implementation of the active programmes drawn up after consultation with populations and civil society is based in great part on the mobilisation and involvement of non-government stakeholders, amongst which can be distinguished individuals, associations/groupings (civil society) and national NGOs. These proximity structures can play an important role in monitoring the implementation of development projects.

4.3.3 *Summary*

Table 4.9 Main institutions / administrative entities involved in the environmental management related to the Project

Entities	Sub-entities	Fields of involvement / mandates
National administration		
Economic, Social and Environmental Council		Senegal's second constitutional assembly. Public and consultative powers.
Ministries		
Environment and Sustainable Development Ministry	Environment and Classified Installations Office (DEEC) Represented at regional level by the Regional Offices for the Environment and Classified Installations (DREEC)	Ensures the project's compliance with environmental policy and the texts of environmental laws and standards
	Technical Committee for the validation of environmental impact studies	Validation of impact study reports
Ministry of Mines, Energy and Hydraulic Resources	Energy Office	Energy supply policy and the supervision of para public sector companies
	Electricity Sector Regulation Commission (CRSE)	Regulation of production, transport, distribution and selling activities
	SENELEC	distribution and sale of electricity
	The Senegalese Agency for Rural Electrification (ASER)	promotion of rural electrification
	Agency for Energy Saving and	Promotes the rational use of

Entities	Sub-entities	Fields of involvement / mandates
	Control (AEME)	energy
	The National Agency for Renewable Energies (ANER)	Promotion of the use of renewable energies
Ministry of Trade, Industry and the Informal Sector	Industry Office	Management of industrial establishments
Ministry of Health and Social Action	Health Office	Professional illnesses
	Medical Prevention Office	Other illnesses and the Propagation of STD / Aids
Interior and Public Safety Ministry	Civil Protection Office	Probability of catastrophe and technological risks
Ministry of Land Planning and Local Authorities		
	Local Authorities Office	Interface between State and authorities for local development
Public Service, Labour and Institutional Relations Ministry	Employment Office	Job creating project
	Inspection of Work	Declaration of worksite opening. Professional illnesses according to the provisions of a recent decree
Regional administration		
Dakar region	Management of the regional environment	
Management of the regional environment	Management of the regional environment	
Local authorities		
Town of Rufisque	Management of the local environment and living conditions	
Rural Community of West Rufisque	Management of the local environment and living conditions	
Delegates / elders in the neighbouring district of Darou Salam Azur	Management of the local environment and living conditions	
Associations and Non-Governmental Organisation		
Women's groups	Public consultation	
Fishermen's groups	Public consultation	
The Environment Commission APROPRE	Public consultation	
Gatherers/users of shells	Public consultation	

4.4 *ADMINISTRATIVE PROCEDURES REQUIRED*

This ESIA report is part of a wider administrative context; ContourGlobal - Cap des Biches must obtain the following authorisations and permits to enable the Project to succeed:

- Environmental permit (after validation of the ESIA);
- ICPE classification of facilities (subject to a request for authorization to operate for a classified installation);
- Building permit issued by the Urbanisation and Land Planning Ministry
- Project approval order under the Investments Code, by the Finance Ministry;

- Letter from the Finance Ministry relating to the authorisation to repatriate capital and the convertibility of CFA francs/euros or dollars;
- Letter from the Finance Ministry relating to agreement to the depreciation model for assets at the power plant ;
- Exemption from land tax on land on which buildings are constructed for the power plant ;
- Importer – exporter card ;
- Residence permits and visas from the Labour Ministry for expatriates ;
- Authorisation for foreign investment in Senegal granted by the Finance Ministry ;
- Private electricity producer licence and licence for the sale of energy issued by the Energy Ministry ;
- Agreement from the Finance Ministry on the terms for invoicing value added tax (VAT) by the company.

5 ANALYSIS OF THE SITE BASELINE AND ITS ENVIRONMENT

5.1 INTRODUCTION

5.1.1 Aim and plan of this chapter

This chapter presents a description of the environmental baseline:

- A summary of basic environmental conditions using documentary research, the results of inspections carried out in the field and public consultations;
- An identification of the main environmental sensitivities that may be affected by the project.

It includes a description:

- Of the physical environment ;
- Of the biological environment, of protected areas and habitats;
- Of the human environment (general review of socioeconomic conditions and the social context).

This description is completed by an analysis of ecosystemic services in the Project's area. Services rendered by ecosystems represent interactions between the natural environment and the human environment, and their study is based on an analysis of the main sensitivities identified.

5.1.2 Sources of information

The topics developed in this analysis of the baseline are based firstly on national, regional and local information. The analysis of environmental and social issues also takes account of the local context in the area in which the power plant is located, by means of a description of the baseline of the Project area. To this end, a desktop study covering the various topics at national and regional level (based on available bibliographic data) and a detailed field study of the installation site have been carried out, in order to have available reliable, up to date information as to the environmental and social components inherent to the Project.

The field study was undertaken from 24th to 27th June 2014 and resulted in a qualitative and quantitative analysis of the biological environment and of ecosystems, as well as initial public consultations. A second mission, undertaken from 6th to 10th October 2014 finalised the public consultations process with interviews with the various stakeholders, in order to describe the administrative, demographic and economic context. A visit was also made to places playing an important role in the social life of the communities concerned (religious buildings, holy places, schools, …) in order to collect secondary data.

5.2 *STUDY AREA*

Definition of the study area is based on the various components linked to future activities, on their presumed interactions with the environment and surrounding populations, and on the local context and topics studied, with the aim of marking out the apparent potential zone of influence of the project in order to describe the various environmental and social components that may be influenced by implementation of the project.

Feedback from operation of the power plant in its initial configuration enabled the definition of two types of zones of influence: terrestrial and marine. The potential marine and terrestrial zones of influence are detailed below.

In addition to the Project's zone of influence, a remote study area was also taken into consideration for certain topics:

- Physical environment ➔ the study zone is defined according to the specific characteristics of each parameter studied. Thus, hydrography, climate and geology are presented in large scale, covering the normal variations of each parameter, according to the data available from as close as possible to the Project area.
- Human environment ➔ scale of the sub-prefecture or even the prefecture, depending on the topics addressed. Public consultations also follow this method. Interviews were also organised with representatives of the central administration in order to integrate certain more general topics (see Chapter 5.9 on the public consultations).

The potential marine and terrestrial zones of influence are shown in *Figure 5.1*.

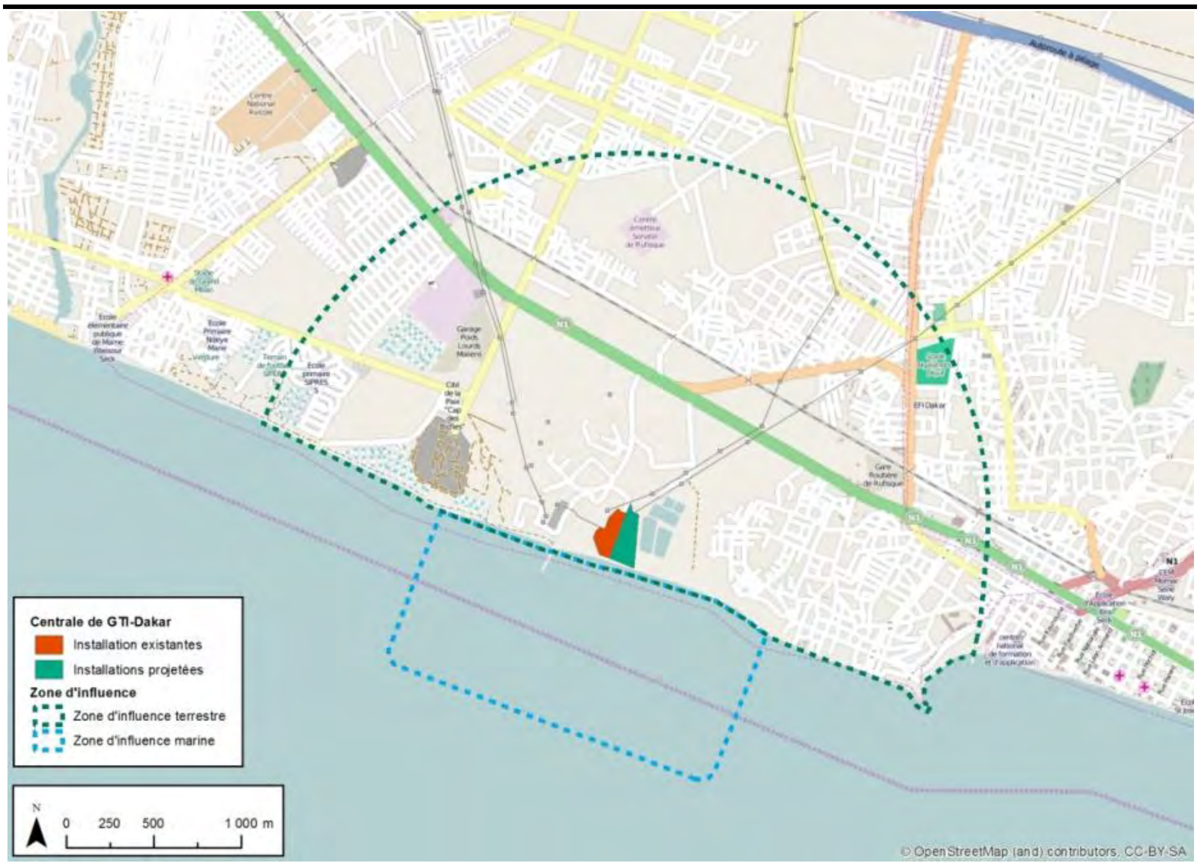
Marine zone of influence

The Project's potential influence on the marine environment is mainly linked to the discharge of water into the coastal area. As detailed in the ToR report (*Annex 1*), a coastal area of 1km on either side of the Project area, up to a distance of 1km out to sea, has been taken into account. This marine environment study area is considered to cover the Project's zone of influence.

Terrestrial zone of influence

The Project's potential terrestrial zone of influence is mainly linked to the discharge of gases. Detailed in the ToR report (*Annex 1*), an area of a radius of 2km around the power plant has been taken into account.

Figure 5.1 Project's potential zones of influence (preliminary evaluation)



5.3 PHYSICAL ENVIRONMENT

The study of the physical environment of the areas in which the Project will be installed was carried out based on local bibliographic data, supplemented by more global information from generic data. In parallel, a field mission was carried out for:

- Geographic reconnaissance with identification of the project site's GPS coordinates;
- Reconnaissance of the Project's zones of influence

5.3.1 *Geomorphology*

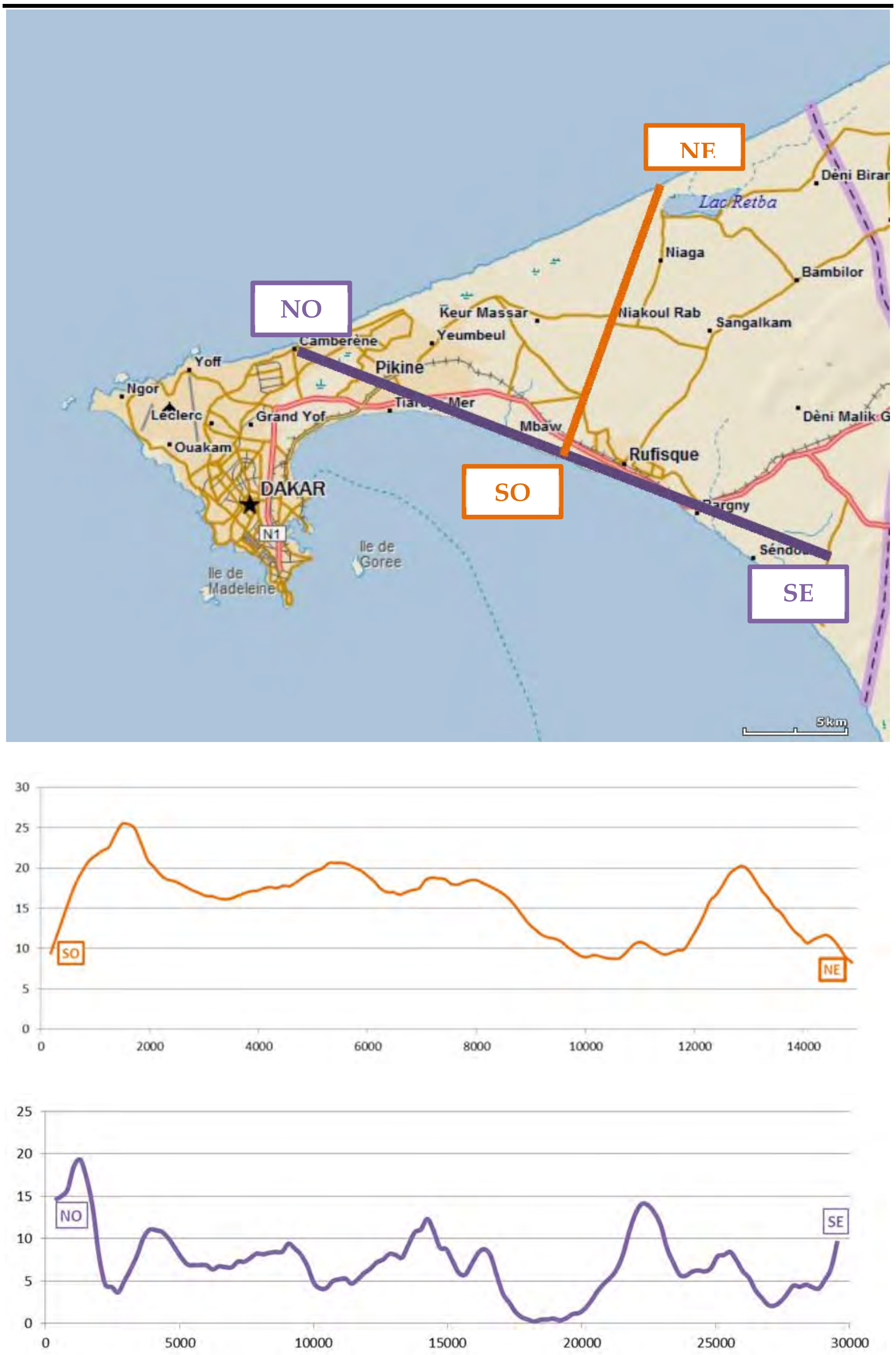
The new power plant will be installed on 2.99ha of flat land of homogenous geomorphology. Altitude at the installation site is 6 m and the same altitude is found across all parcels. The site is edged to the east by the Rufisque waste water treatment plant, whose waste water storage lagoons are surrounded with berms about 5m high.

Figure 5.2 ***Berms around the waste water storage lagoons at the Rufisque WWTP***

At regional level (15km radius), relief in the coastal area remains homogenous, with altitudes of between 0 and 20m (average of about 7m). This increases slightly inland, with an altitude of between 6 and 25m (average of around 16m).

Figure 5.3 shows the altitude profiles over a 15km radius, in south-west / north-east and north-west / south-east directions.

Figure 5.3 Morphology of the Project area – regional scale



Source: *ERM based on altitude data from SRTM 90m (Shuttle Radar Topography Mission)*

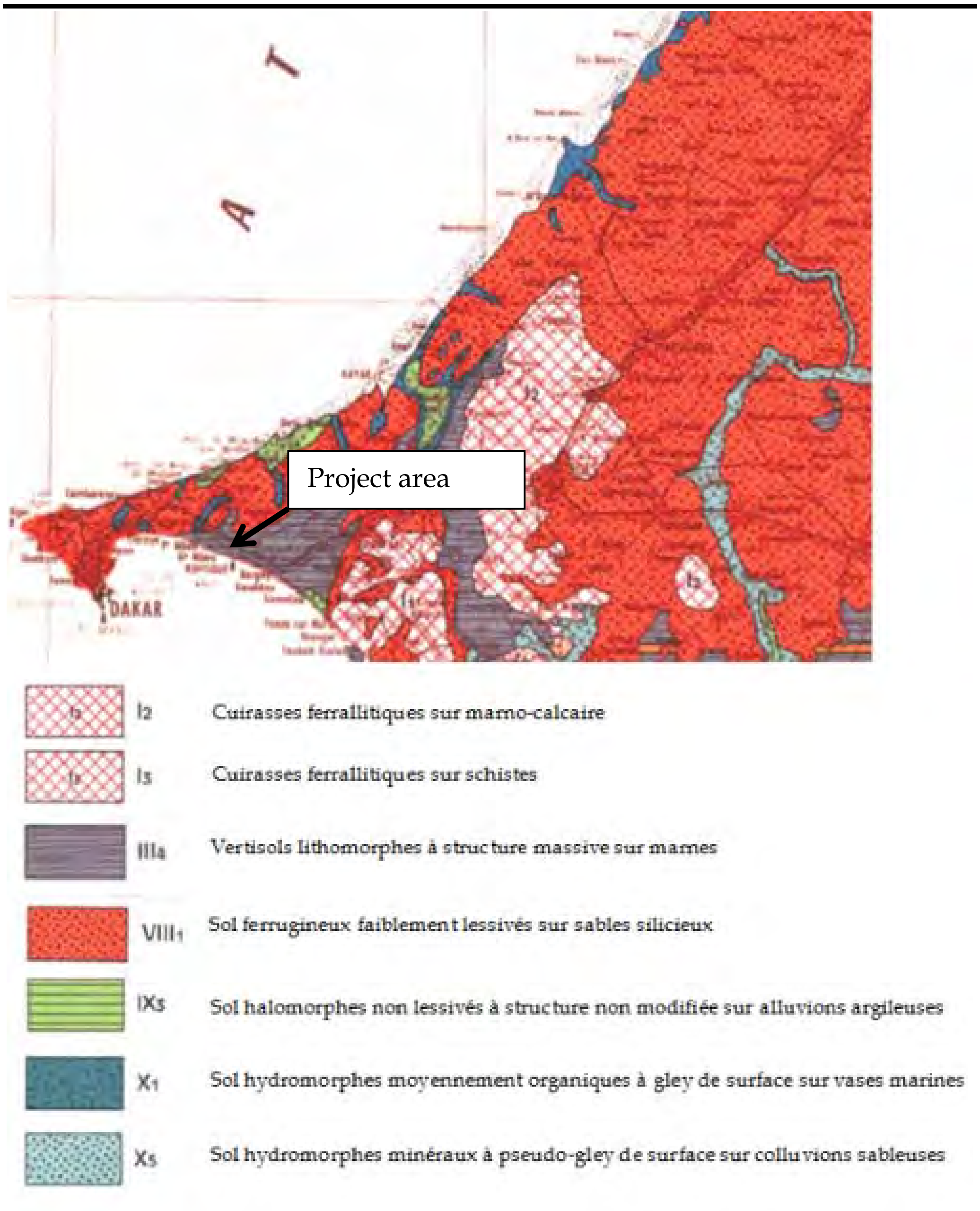
5.3.2 *Pedology*

An extract taken from the pedological map of Senegal (*Figure 5.4*) situates the project area in marlstone formations.

This bibliographic data is confirmed by a geotechnical report dated 16th July 2014 carried out by *Senelabo.btp* and describing the results of sampling taken from the parcel on which the power plant extension will be located. These samples characterised the soils at the site, as follows:

- At depths of 0 to 4m on average (max. 7.5m): clay formations containing high plasticity clays
- At depths of 3.5 to 6m : sandy formation containing clay sands with shell concretions
- At depths of 6 to 30m : limestone-marl formation

Figure 5.4 *Extract from the pedological map of Senegal*



Source: *Pedological map of Senegal, scale 1/1.000.000 – ORSTOM*

5.3.3 *Geology*

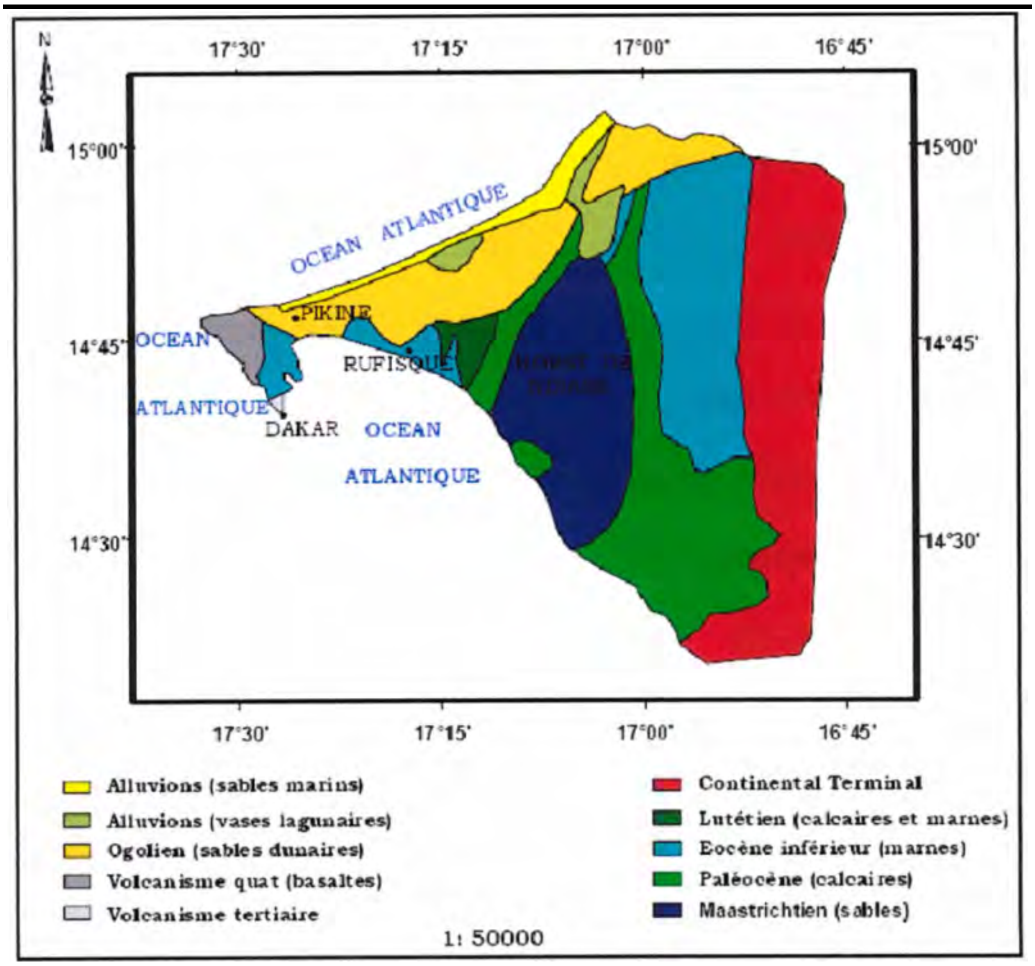
The Project site lies on a basalt substratum from the earliest quaternary. The site's geology is characterised by the presence of:

- Volcanic products (deposit of pyroclastic products and flows of doleritic basanite dating from the lower Pleistocene and the middle Pleistocene which touch the north-west of the peninsula (Figure 5.5), forming coastal cliffs.

- Infra-basalt sands, corresponding to the oldest known quaternary deposits. They comprise a group of sands and clays with sea shells as well as clay and dune sands, with a maximum known thickness of 74 m.

- Geology of the Dakar region is shown in Figure 5.5.

Figure 5.5 Geological outline of the Dakar region



Source: *P. Edouard, 1980*

5.3.4 *Hydrogeology*

According to the geotechnical report drawn up for the Project area (*Senelabo.btp, 2014*), piezometric levels are between 2m and 6m.

These variations can be explained by the proximity of the coast, which could lead to fluctuations in terms of the aquifer depending on the height of tides.

5.3.5 Hydrology

No water course is located in the area in which the Project will be installed. The sandy nature of the soils *Section 5.3.2*) encourages water flow in the soils, which is naturally drained towards the ocean. During the visit to the site, traces of run-off from the Rufisque WWTP adjacent to the site were observed.

To the south-east, at about 1 400m from the Project area, an outlet flows into the ocean. This is a temporary, channelled water course, which is also used to collect waste water from part of the town of Rufisque.

5.3.6 Seismicity

General

The substratum of Senegalese territory is made up of two major geological units: the sedimentary basin which occupies over ¾ of the territory and the Precambrian basement in the south-east of the country.

The Senegalese sedimentary basin dates from the Secondary and the Tertiary. It represents the central section of the north-west African coastal basin which runs from the Réguibat dorsal in the north (in Mauritania) to the Guinean fault in the south.

The most important tectonic accidents and movements are observed in the western section of the basin, in the Cap Vert Peninsula region and its surrounding areas, which have been unstable since the Cretaceous. Excluding this period of "relating instability" with intense tectonic activity in the Cretaceous (Secondary) and volcanism in the Cap Vert peninsula in the Tertiary, no major geological incident or seismic activity has ever been noted in Senegal.

The Senegalese basin is a typical, stable passive margin which opens towards the Atlantic Ocean. The study area is part of this geological context and therefore presents similar seismic conditions.

Seismicity in the Project area

The site is in a 0-1 seismicity area. This means that seismicity in the area is negligible but not zero to weak. The definitions are as follows:

- zone 0 of "negligible but not zero seismicity": there is no particular para-seismic instruction, no earthquake of over VII has been observed historically.
- zone I of "weal seismicity":

- no earthquake of an intensity higher than or equal to VIII has been observed historically, or
- the period for the return of an earthquake of intensity of over VIII exceeds 250 years
- the period for the return of an earthquake of intensity of over VII exceeds 75 years

5.3.7 Climate

Regional context

The area in which the Project will be installed is located between parallels 15° and 16° of north latitude. It is therefore part of the semi-arid intertropical area and part of the "Sahelo-Sudanian region" where the transition sub-desert regime is characterised by a three month rainy season (July to September) and a long dry season lasting almost nine months.

This seasonal cycle is caused by the antagonism of the flow of the Alizé trade wind or Harmattan wind (Sahel continental air) and the flow of the monsoon (damp equatorial air originating over the ocean). The area of convergence between these masses of air constitutes the intertropical convergence zone (ITCZ). These air currents are of different origins and directions. They are separated by the intertropical front which represents the northern limit of extension of the damp equatorial air. The position and movement of the ITCZ, mainly linked to surface temperatures, condition the regular alternation of the two seasons (*A. Martin 1970; Serigne FAYE, 1995*).

The Dakar region, which juts out into the Atlantic, is characterised by a coastal type microclimate, strongly influenced by maritime Alizé trade winds and the monsoon.

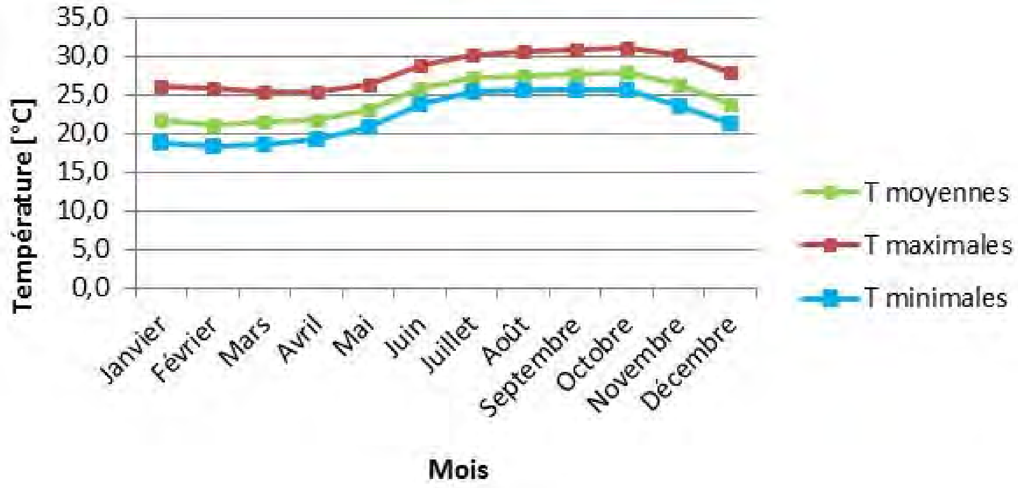
The closest weather station to the Project area is located at Dakar airport, about 20km to the west. This station is used as a reference for the description of the weather conditions presented below, for the period from 1973 to 2013.

Temperatures

The closest weather station to the study area offering regular temperature recordings is the one at Dakar airport, located about 21km from the Project area. The average temperature measured over the last twenty years (1993-2013) is 24.7°C. The Dakar region, where the study area is located, is characterised by a major Atlantic influence, leading to a smaller seasonal difference than in the rest of the country.

The climate is marked by a hot period, lasting from May to November, and a cool period, from December to April. The months July to October are the hottest on average (27.5ºC-27.9ºC) and the months of February and March are the coolest, on average (21.2 °C -21.5 °C). *Figure 5.6* and *Table 5.1* below present the average monthly temperatures recorded at Dakar airport.

Figure 5.6 ***Evolution in average monthly temperatures in Dakar, period: 1993 to 2013 (°C)***



Source: *ERM, 2014 based on data from Dakar airport (January 1993 to December 2013)*

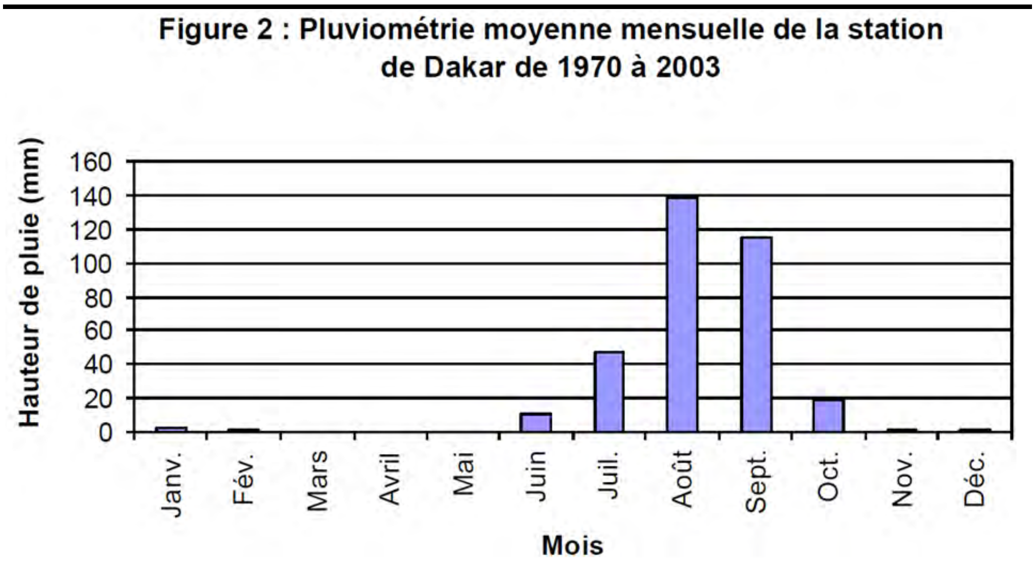
Table 5.1 ***Average monthly temperatures in Dakar, period: 1993 to 2013 (°C)***

Month	Average	Maximum average	Minimum average
January	21.8	26.0	18.9
February	21.2	25.8	18.3
March	21.5	25.4	18.6
April	21.7	25.3	19.2
May	23.2	26.4	20.8
June	25.8	29.0	23.7
July	27.3	30.2	25.5
August	27.5	30.6	25.7
September	27.7	30.9	25.6
October	27.9	31.2	25.7
November	26.3	30.2	23.7
December	23.9	28.0	21.3

Rainfall and cloud

Annual rainfall in the Dakar region is between 300 and 400mm (1970 to 2003 – see *Figure 5.7*). The frequencies of average daily rainfall shows that almost all rainfall is between 0.1 and 50mm. The heart of the rainy season is in the months of August and September, with maximum rainfall that can reach respectively 138mm and 115mm. The dry season runs between October and June.

Figure 5.7 Average monthly rainfall in Dakar, period: 1970 to 2003 (mm)



Source: *UNEP/UNESCO Décembre 2004 « Aquifère superficiel et pollution urbaine en Afrique. Rapport Final du Sénégal »*

Winds system

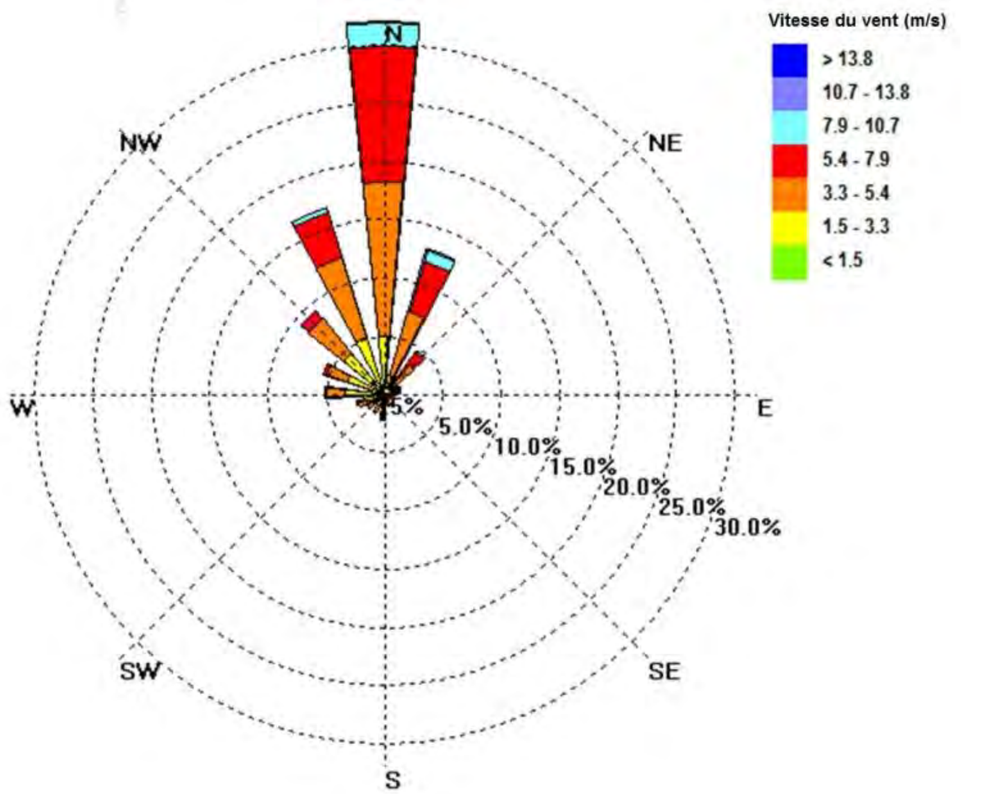
The winds system is characterised by a seasonal variation in prevailing wind directions:

- A season from October to May, with north and north-eastern winds, and
- A second season from June to September, where southern to western sector wind dominate very clearly in terms of frequency.

The wind direction compass in *Figure 5.8* shows that the winds system in the Project area presents a prevailing N and NW wind direction. Mild winds (<0.5 m / s) represent 0.49% of the average wind speed value of 4 m/s. The maximum speed recorded over the period under consideration (1993-2013) is 62 m/s, recorded in October 2007. Also, the maximum wind speed recorded over last year (2013) is 9 m/s.

This wind direction compass shows that, for most of the year, atmospheric emissions from the Project will be blown southwards towards the sea, which should help to minimise concentrations at ground level in the Project area and beyond.

Figure 5.8 *Wind direction at the Dakar airport weather station in 2012*



Source: ERM, 2014 based on data from Dakar airport *(1993-2013).*

Modelling of atmospheric dispersal conditions

Modelling of atmospheric dispersal conditions was undertaken for this ESIA in order to study closely the impact of atmospheric emissions from the Project. This modelling was based on an extrapolation of one-off measurements of weather conditions in the study area. The data was extrapolated using CALMET software in order to take account of annual climatic variations at the Project area, and therefore is a reliable description of actual atmospheric dispersal conditions in the area where the future power plant will be installed. This is input data which was then used to model the dispersal of gaseous discharge (presented in section *8.5* of this study).

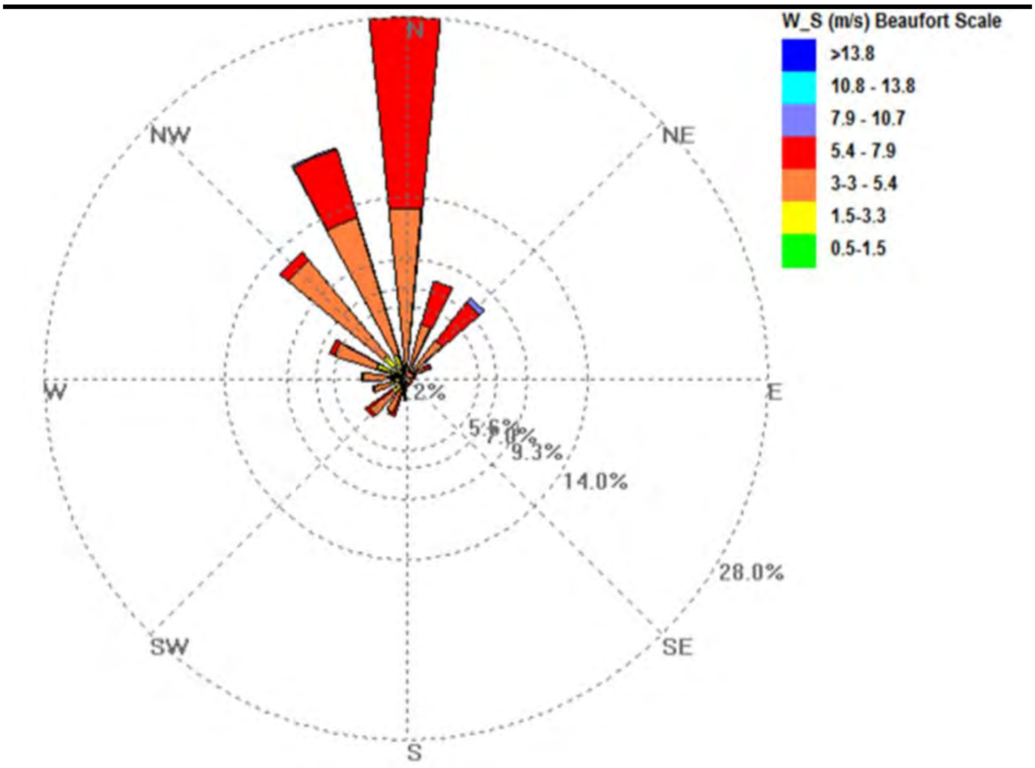
CALMET software can be used to generate data in three dimensions for the main meteorological variables. The wind direction compass is created using orography (1), land use and a geographic and altitudinal extrapolation of meteorological data, according to an hourly base and weather data for 2013.

Climatic data is obtained from radiosondes (2) representative of the project area, and is similar to that measured at Dakar airport and presented above. It was transmitted by *Lakes Environmental™*, an international supplier of environmental data (topographic and meteorological).

(1) Data describing the topography of an area.
(2) Meteorological device carried by a sensor-balloon and measuring the characteristics of the atmosphere from ground level up to an altitude that can exceed 35 000 metres.

The wind direction compass below (*Figure 5.9*) was created using these simulations. It is characterised by prevailing north-north-west sector winds which represent over 55% of the winds. The prevailing winds are of moderate speeds (between 3.5 and 5.4 m/s). The strongest winds (up to 7.9 m/s) are more common from the north sector.

Figure 5.9 ***Compass of wind directions in the Project area (modelling)***



Source: *Lakes Environment, 2013*

5.3.8 *Air quality*

Methodology – baseline modelling

Regarding the absence of existing ambient air quality data and the short delay to undertake the ESIA, it has been decided to assess the air quality within the Projet area by modelling the main sources of atmospheric emissions within Cap des Biches industrial zone (direct measurements during the rainy season would have occurred underestimations of airshed quality, as a leaching phenomenon can occur during this season).

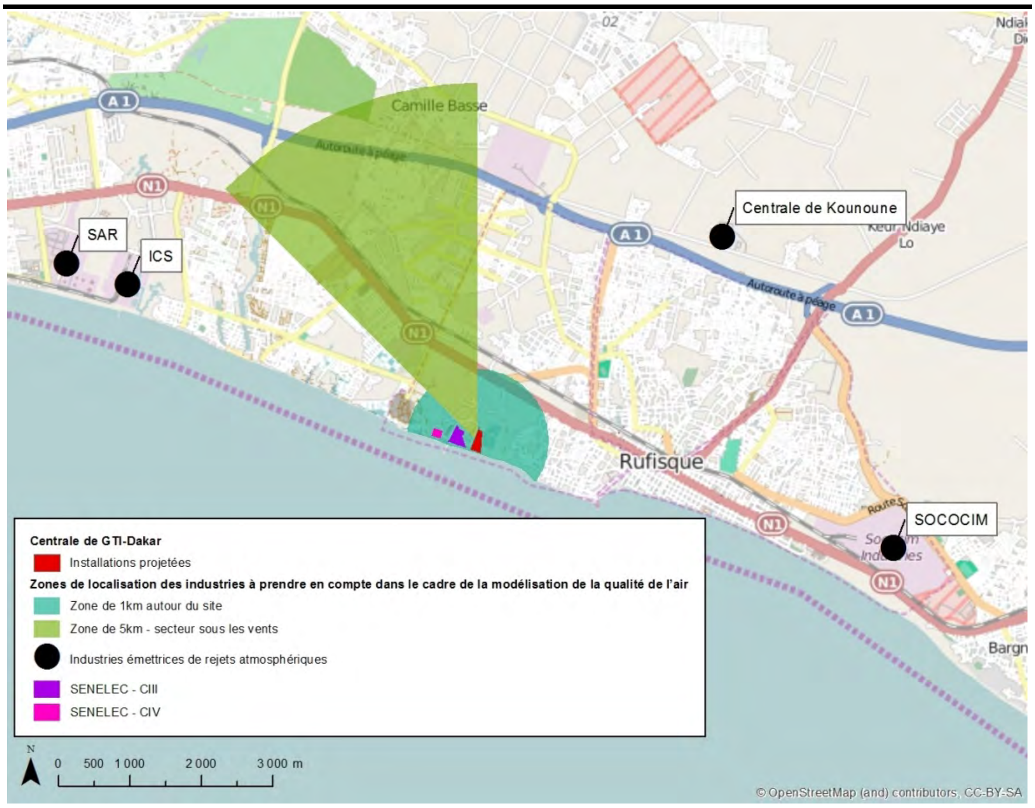
The criteria considered to define the industries to consider for the modelling were the following:
Industries emitting the same kinds of atmospheric pollutant than the Project: Projet (NOx/NO2 ; SO2, PM10 & PM2.5 ; CO).
Industries located:
Within a 1km buffer around the Project site; or
Within a 5km buffer and under the main winds (north to north-west – cf. *Section 5.3.7*)

Figure 5.10 below presents the location of the industries that have been considered as part of the modelling activities. Among the ones identifies within the Project area (cf. *Chapter 5.7.5*), SENELEC power plants are the only ones emitting important amount of atmospheric pollutant similar to the Project's ones.

At a larger scale (about 5 km), the following industries are present: SAR, ICS, SOCOCIM and Kounoune power plant.

These facilities have been reported in *Figure 5.10* below; accordingly to the criteria presented here-above, SENELEC power plants are the only sources that have been taken into account in the air quality modelling.

Figure 5.10 Facilities to be considered as part of the air quality modelling activities



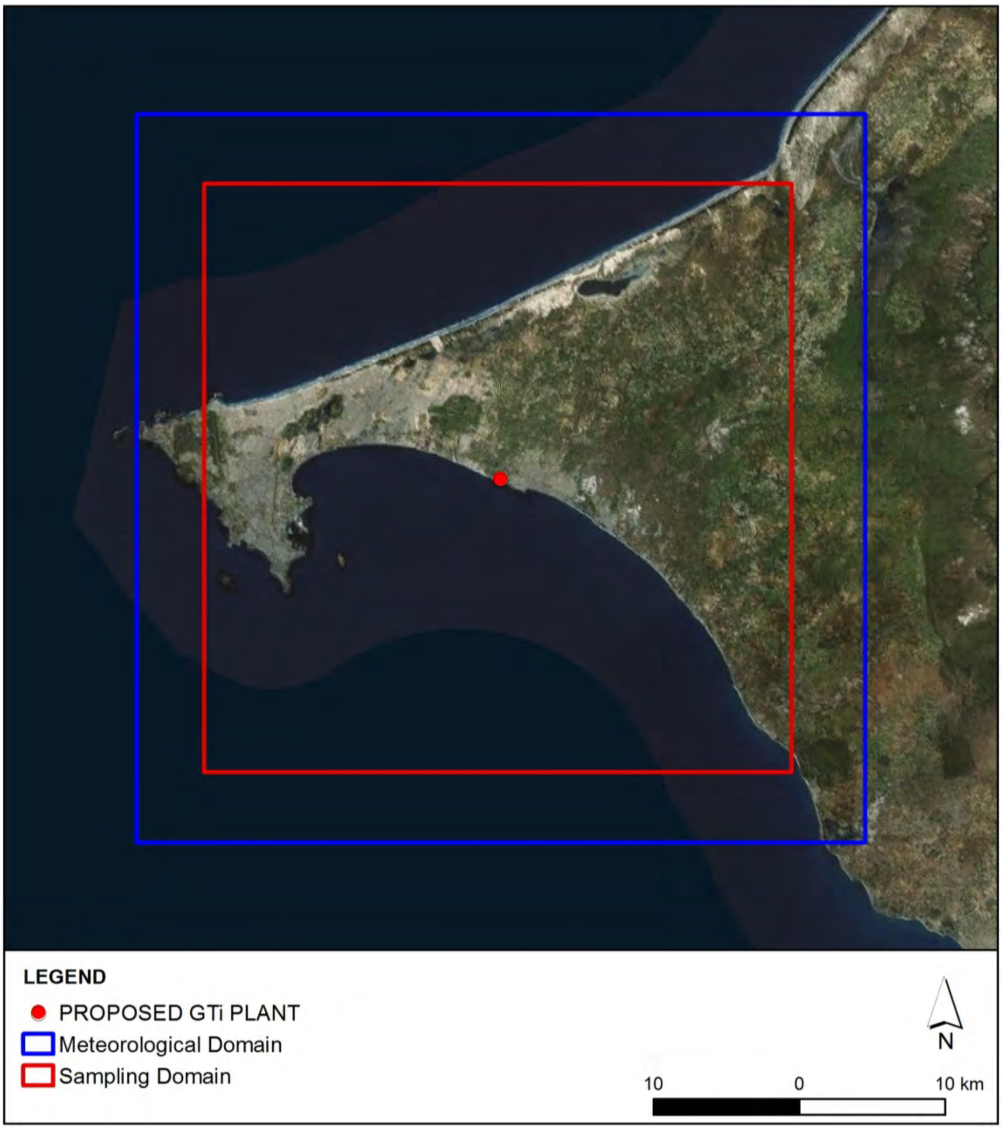
Source: *ERM, 2014*

Air quality in the Project area was simulated using the CALMET – CALPUFF system modelling method. Detailed information related to the CALMET – CALPUFF modelling system is given at the end of this section.

The CALMET meteorological simulation perimeter used in the modelling study undertaken is an area of 50 x 50 km, characterised by resolution of 250 m. The surface area of the perimeter (2 500 km^2) was fixed according to the characteristics of the emissive source and dispersal capacity.

Figure 5.11 below presents both the meteorological and sampling perimeters used for the modelling study, highlighting the location of the Project site.

Figure 5.11 Perimeters for the calculation of meteorological and atmospheric dispersal data



Main sources of emissions

The Project site is part of a major existing energy production installation that comprises two units (CIII and CIV) located to the west of the Project site, and which are currently operated by SENELEC. *Figure 5.12* below shows the geographic location of the proposed ContourGlobal – Cap des Biches plant and of the exiting SENELEC CIII and CIV units.

Figure 5.12 Project and existing installations site

Source: *ERM, 2014*

Data and emissions taken into account for both installations are based on the ESIA carried out for ContourGlobal - Cap des Biches in 1998. It should be noted that the emissions data taken into account in the characterisation of the state is based on the atmospheric emission limits of SENELEC plants and is therefore over-estimated in terms of actual emissions. The modelling study presumes that the SENELEC installations are operating at their maximum capacity, whereas these plants are sometimes not in operation.

Currently, in addition to the SENELEC CIII and CIV units, two 50 MW and 40 MW generators are in operation, located to the north of the ContourGlobal - Cap des Biches installations and to the south of the CIII and CIV units respectively. These units will be shut down in 2015 and have not therefore been taken into account in modelling of the baseline conditions.

The modelling study considered SENELEC emission sources and atmospheric emissions of NOx and SO_2. Fine particles (PM) were not taken into account in the evaluation of local atmospheric quality because data on fine particle emissions was not available for the CIII and CIV plants.

Air emissions characteristics considered for modelling the emissions of power plants CIII and CIV are summarized at the end of this section.

Results

Table 5.2 below presents a summary of the results of the modelling study carried out for the initial state scenario and indicates maximum concentration values over the long term, obtained within the perimeter of the study area.

Table 5.2 Maximum concentration predicted over the long term for atmospheric pollutants in ambient air (baseline conditions, without the Project)

Pollutant	Parameter	Maximum ambient concentrations modelled [µg/m³]
NO_2	Calendar year	11.04
SO_2	Calendar year	34.37

For a more in-depth interpretation of the results, estimated maximum concentrations were analysed at seven sensitive receptors located in proximity to the Project; these are presented in *Figure 5.13* below. *Table 5.3* below indicates the maximum concentrations estimated for each of the sensitive receptors identified, over the long term.

Figure 5.13 Air quality at sensitive receptors

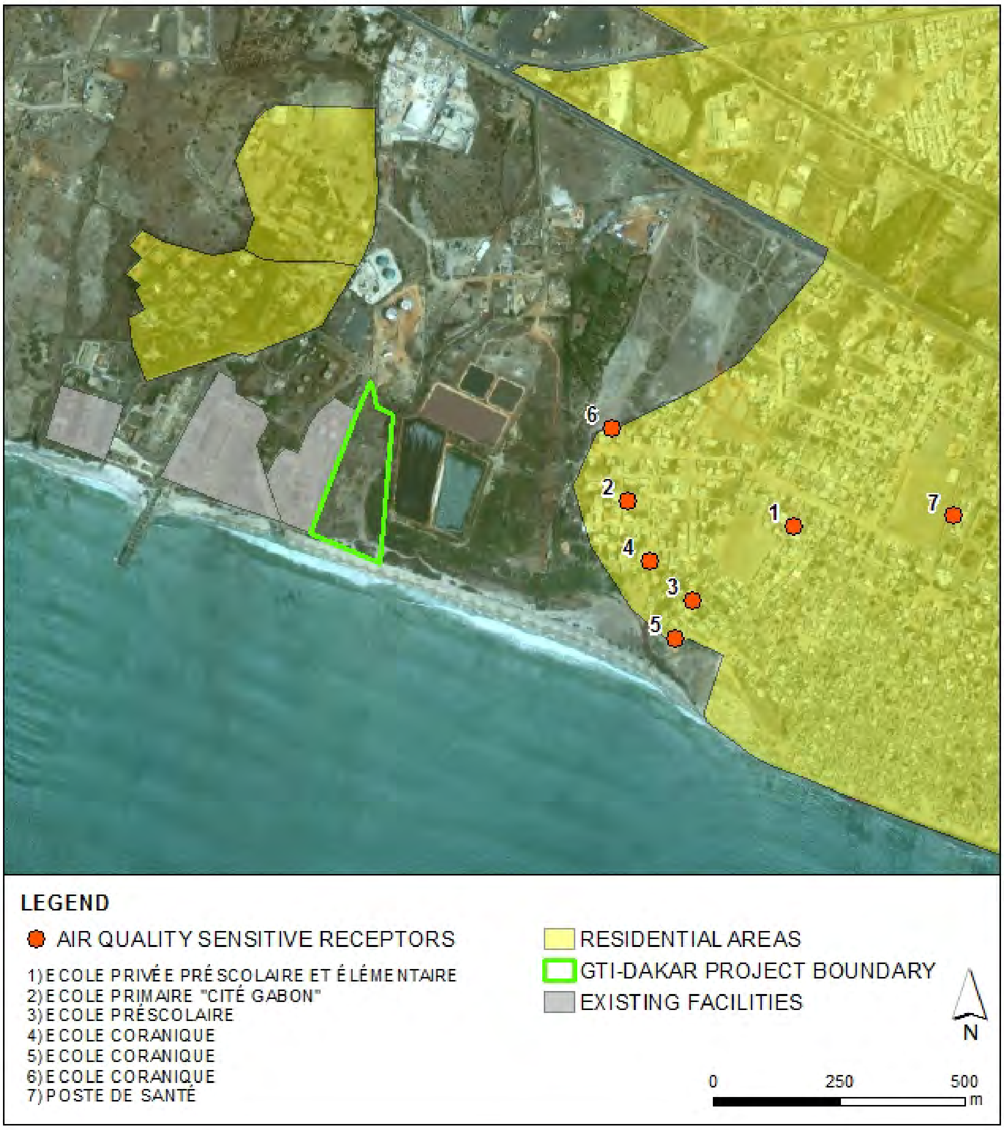


Table 5.3 Modelling of the baseline: maximum concentration predicted at sensitive receptors (baseline, without Project).

Receptors		Concentrations modelled [µg/m³] NO₂ Annual average	Concentrations modelled [µg/m³] SO₂ Annual average
ID	*Name*		
1	Private nursery and elementary school	2.92	4.02
2	"Cité Gabon" primary school	2.95	4.09
3	Nursery school	2.85	3.95
4	Koranic school	2.88	3.99
5	Koranic school	2.74	3.83
6	Koranic school	3.17	4.40
7	Health station	2.93	4.01

Concentration maps have been produced for long term concentrations of NO_2 and SO_2. The concentration maps are used to locate maximum concentrations spatially.

Figure 5.14 ***Modelling of the baseline: Annual concentrations of NO_2 (baseline, without Project)***

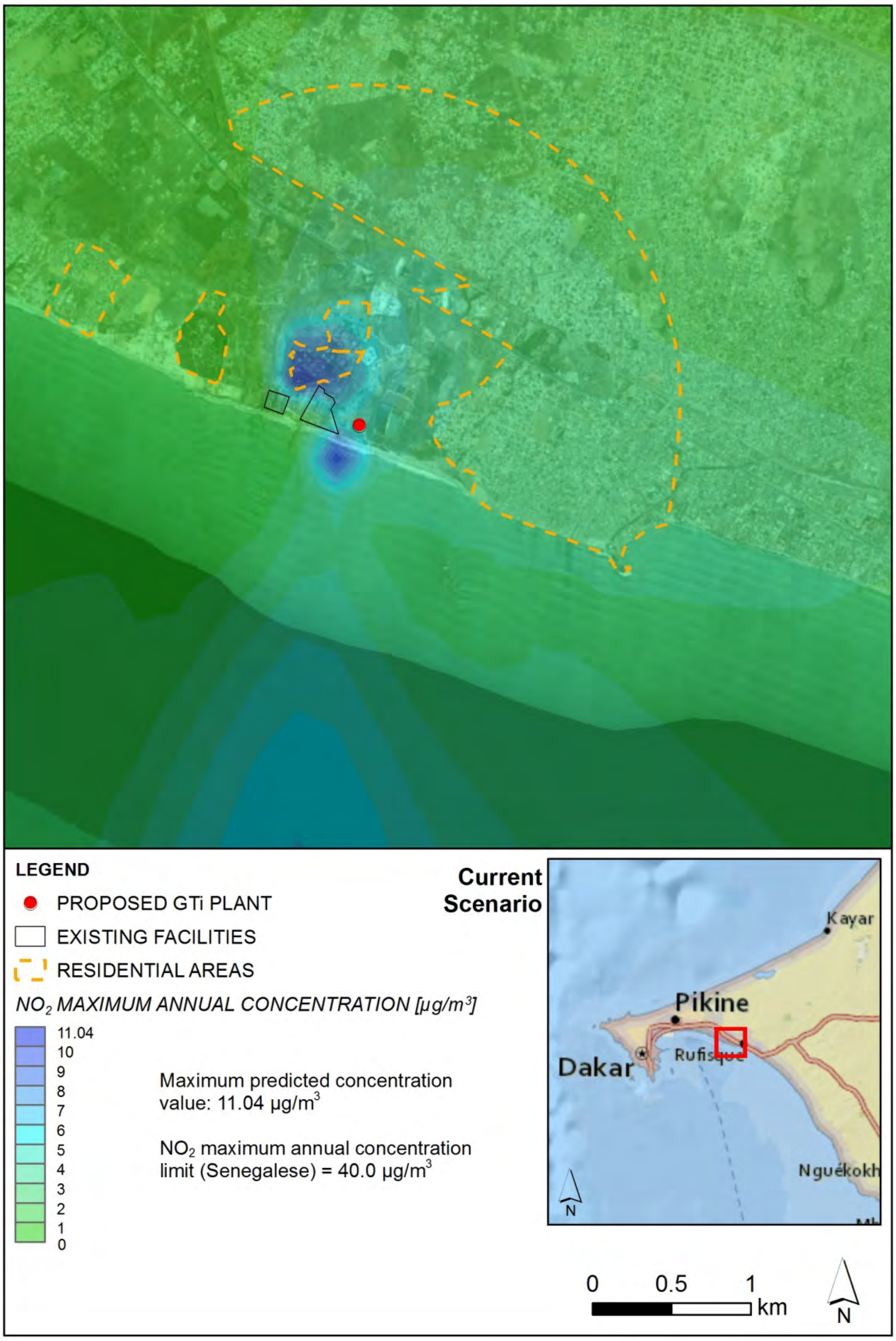
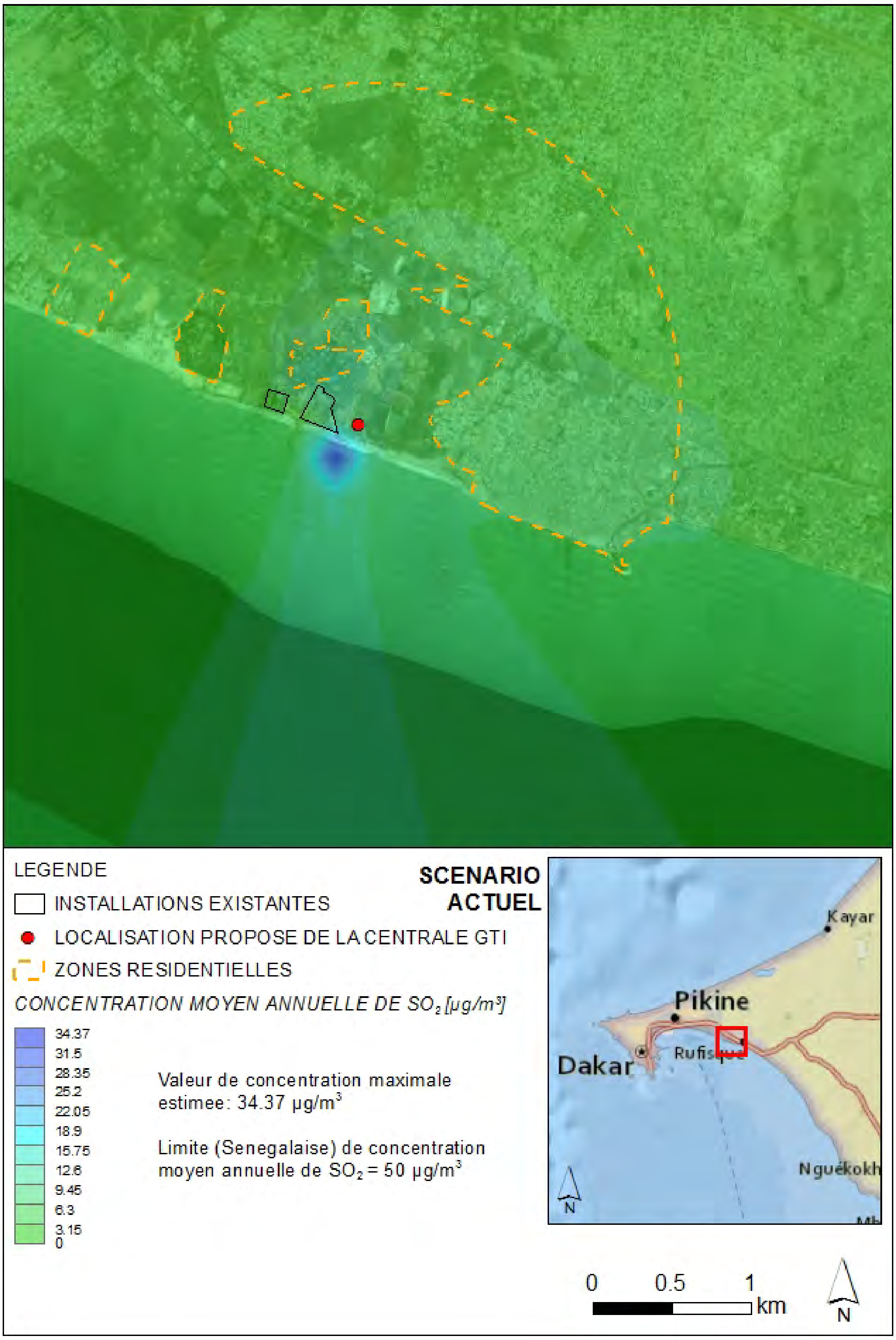


Figure 5.15 Modelling of the baseline: Annual concentrations of SO_2 (baseline, without Project)



The concentration maps underline the fact that the area affected by the highest estimated concentration is located in the environs of the SENELEC source of emission. In particular for annual concentrations of SO_2 the highest concentration values occur out at sea.

System CALPUFF

The CALPUFF modelling system consists of three main components, including a pre-processor and post-processor.

- The meteorological pre-processor CALMET produces the three-dimensional fields for the main meteorological variables, temperature, wind speed and direction, over the simulation domain.
- The processor CALPUFF is a non-steady-state Lagrangian Gaussian puff model containing modules for complex terrain effects, overwater transport, coastal interaction effects, building downwash, wet and dry removal, and simple chemical transformation[1].
- The post-processor CALPOST statistically analyses CALPUFF output data and produces datasets suitable for further analysis. Post-processed CALPUFF outputs consist of matrices of concentration values. Receptors in the simulation domain can be discrete or gridded. The values calculated at each receptor could be referred to one or more sources.

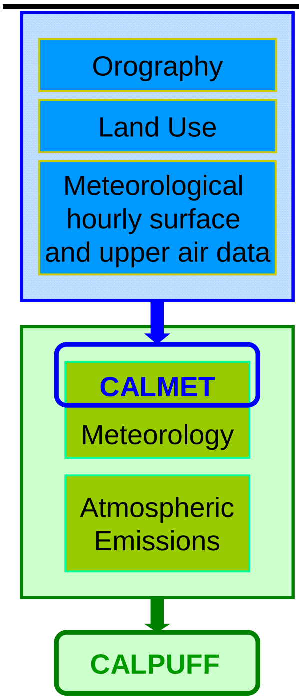
The results can be processed by any GIS software, creating iso-concentration maps. The CALPUFF modelling system requires the following input data:

- meteorological variables' surface data and height profile, to build the three-dimensional wind field, with the meteorological pre-processor CALMET;
- source characteristics and emission data, to simulate the pollutants atmospheric dispersion, with CALPUFF.

The following *Figure 5.16* presents a flow chart of the CALPUFF modelling system inputs, while the *Box 5.1* gives a summary of the CALMET CALPUFF and CALPOST characteristics.

[1] A User's Guide for the CALPUFF Dispersion Model (Version 5), Scire, Strimaitis, Yamartino 2000

Figure 5.16 CALPUFF Modelling System inputs



Source: *ERM, 2014*

Box 5.1 Features of the Pre-Processor CALMET, CALPUFF and Post-Processor CALPOST

CALMET is a diagnostic meteorological pre-processor able to reproduce three-dimensional fields of temperature, wind speed and direction along with two-dimensional fields of other parameters representative of atmospheric turbulence. CALMET is able to simulate wind fields in complex orography domains characterized by different types of land use. The final wind field is obtained through consecutive steps, starting from an initial wind field often derived from geostrophic wind. The wind field is linked to the orography, since the model interpolates the monitoring station values and applies specific algorithms to simulate the interaction between ground and flow lines. The module contains a micro-meteorological module determining thermal and mechanical structures (turbulence) of lower atmospheric layers.
CALPUFF is a hybrid dispersion model (commonly defined 'puff model'). It is a multi-layer and non-steady-state model. It simulates transport, dispersion, transformation and deposition of pollutants, in meteorological conditions varying in space and time. CALPUFF uses the meteorological fields produced by CALMET, but for simple simulations an external steady wind field, with constant values of wind speed and direction over the simulation domain, can be used as input. The module contains different algorithms to simulate different processes, such as: • buildings downwash and stack-tip downwash; • wind vertical shear; • dry and wet deposition; • atmospheric chemical transformations; • complex orography and seaboard.(In marine coastal areas, CALPUFF considers breeze phenomena in order to model efficiently the Thermal Internal Boundary Layer (TIBL) as in case of coastal sources, the TIBL causes a quick fall of pollutants to the ground.) Besides, CALPUFF allows the selection of the source geometry (point, linear or areal), improving in this way the accuracy of the emission input. Point sources simulate emissions coming from a small area while areal sources describe a diffuse emission coming from a wider area; emissions from linear sources are distributed along a main direction (i.e. roads).
CALPOST processes CALPUFF outputs producing an outputs' format suitable for further analysis. CALPOST output files can be fed into graphic software to create concentration or deposition maps

Characteristics of the project and data considered for modelling

Land cover data has been taken from the Global Land Cover Network (GLCN) database launched by the Food and Agriculture Organisation of the United Nations (FAO) and the United Nations Environment Programme (UNEP), with the objective of improving the availability of global information on land cover and its dynamics, harmonising land cover mapping and monitoring at national, regional and global levels.

Site-specific information on regional orography has been reproduced using the Shuttle Radar Topography Mission (SRTM) DEM, developed by NASA, and GTOPO30, developed by the USGS.

The resolution of the DEM and Land Cover used in the performed modelling study is of 30 m and 1000 m respectively.

CALMET input meteorological data for surface and upper air data have been taken from MM5 meteorological model. MM5 is a widely-used three-dimensional numerical meteorological model which contains non-hydrostatic dynamics, a variety of physics options for parameterising cumulus clouds, microphysics, the planetary boundary layer and atmospheric radiation. MM5 is developed by Pennsylvania State University and the U.S. National Centre for Atmospheric Research (NCAR) and raw MM5 output can be converted into a format recognized by CALMET. All the MM5 meteorological data acquired as input for this study have been provided by Lakes Environmental™ , a worldwide provider of environmental data (terrain and meteorology).

The vertical resolution adopted in the modelling study consists of 9 terrain following vertical layers, from the ground level up to 4000 m elevation (located at 20 m, 50 m, 100 m, 200 m, 350 m, 500 m, 1000 m, 2000 m, 4000 m from the ground level).

The vertical layers resolution (see *Figure 5.17*) is higher near the surface, (Planetary Boundary Layer), where the transport and the dispersion of air pollutants take place, in order to investigate more accurately these dynamics and their interactions with the local orography.

Figure 5.17 Models Vertical Resolution

Source: ERM, 2014

The dispersion modelling temporal domain or simulation period is the time period simulated by the model; in the performed modelling studies the year 2013 was chosen as temporal domain.

Source of data – modelling of plants operated by SENELEC

The emission parameters for the existing facilities operated by SENELEC were provided by SENELEC and based on the ESIA performed for GTI-Dakar in 1998.

The existing power facilities operated by SENELEC consist of two units labelled as CIII and CIV hereinafter located west of the Project site. The following part of this Section presents details on the design, location and emissions for each of the above mentioned facilities.

It has to be noted that emission data considered in the modelling of the 'Current Scenario' are not representative of the real emissions of the SENELEC facilities, but are based on atmospheric emission limits; thus the modelling study assumed that the SENELEC facilities will operate at their maximum capacity. Moreover, the model conservatively considered that the SENELEC facilities will operate continuously during the year, as no data on the actual operating hours were available.

CIII Plant

The CIII currently contains one oil fired boiler driving a steam turbine still operating (plus two other turbines not operated anymore), with an installed capacity of 27.5 MW. The steam turbine and associated plant are housed within a single structure located west of the GTI-Dakar site. The stack emerges 3 m above the roof of the structure. The key features of the boiler, turbine and stack are presented in *Table 5.4.*

Table 5.4 CIII Plant Specifications

301	
Capacity	27.5 MW
Age	1966
Stack height (m)	28
Stack diameter (m)	1.94
Stack exit temp (K)	453
Exhaust flow (Am^3s^{-1})	48.4
Boiler Manufacturer	Babcock (France)

The boiler that supply the steam turbine is permanently run on fuel oil with the exception of occasional start up and shut down for routine maintenance where a lighter gas oil (DDO) is used.

As stated in the ESIA 1998, emission rates for NO_x have been calculated based on emission concentrations for power plants presented in the USEPA Guidance Manual AP42. Emission rates for SO_2 have been calculated based on the a fuel sulphur content of 0.61% (provided by WG Carter and Associates) and on fuel consumption data (provided by SENELEC). NOx and SO_2 emissions rates calculated for the CIII Plant are presented in the following *Table 5.5.*

Table 5.5 Pollutant Emission Rates from the CIII Plant

Stack	NO_x [(a)] [g/s]	SO_2 [(b)] [g/s]
301	10.5	28.0

(a) The calculation is based on emission factors presented in the USEPA Document AP-42 Compilation of Air Pollution Emission Factors Volume I: Stationary Point and Area Sources, 1995.
(b) The calculation is based on the fuel sulphur content and on the fuel consumption for each unit.

<u>CIV Plant</u>

The CIV consists of three diesel engines with a total installed capacity of 58 MW (labelled as 401 402 and 403 in the following Tables) and two diesel engines with a total installed capacity of 32 MW (labelled as 404-405 in the following Tables). The diesel engines are housed within a structure located about 400 m west of the CIII steam turbine. The key features of these engines and stacks are presented in *Table 5.6*. NOx and SO_2 emissions rates calculated for the CIV Plants are presented in the following *Table 5.7.*

Based on the information taken from the ESIA performed for GTI-Dakar in 1998, three diesel engines 401, 402 and 403 will burn a fuel characterised by a Sulphur content of 1.5%. With regard to the diesel engines 404 and 405, stack and emission data where based on the constructor specification, assuming a fuel sulphur content of 2% (the maximum allowed by the Senegalese law).

Table 5.6 CIV Plant Specifications

Parameter	401	402	403	404	405
Capacity	19 MW	19 MW	20 MW	16 MW	16 MW
Age	1990	1990	-	-	-
Stack height (m)	35	35	35	40	40
Stack diameter (m)	1.8	1.8	1.8	1.6	1.6
Stack exit temp (K)	673	673	673	453	453
Exhaust flow (Am^3s^{-1})	149.1	149.1	149.1	43.3	43.3
Diesel Engine Manufacturer	Sent-Pielstick (France)/18PC 4-2	Sent-Pielstick (France)/18PC 4-2	18PC 4-2B	Wartsila/18 V46	Wartsila/18 V46

Table 5.7 Pollutant Emission Rates for the CIV Plant

Stack	NO_x [a] [g/s]	SO_2 [g/s]
401	20.0 [a]	33.0 [b]
402	20.0 [a]	33.0 [b]
403	20.0 [a]	33.0 [b]
404	62.5 [c]	40.75 [c]
405	62.5 [c]	40.75 [c]

(a) The calculation is based on the emission factors presented in the USEPA Document AP-42 Compilation of Air Pollution Emission Factors Volume I: Stationary Point and Area Sources, 1995.
(b) The calculation is based on the fuel sulphur content and on the fuel consumption for each unit.
(c) The calculation is based on the Wartsila 18 V46 diesel engine specification.

Assumptions considered for the modelling of air dispersion of atmospheric emissions from the power plant GTi Dakar

During the combustion process, two nitrogen based pollutants are generated:

- nitrogen dioxide (NO_2); and
- nitric oxide (NO).

Together these comprise emissions of oxides of nitrogen. NO_2 is the pollutant of interest from a health perspective as this is considered the more toxic of the two, with NO being largely inert. The emissions from the combined stack will comprise, initially, primarily NO, but through various chemical reactions that will take place in the atmosphere, a proportion of the NO will be converted to NO_2. This is due to the chemical reactions taking time to occur and also 'mopping up' other atmospheric chemicals such as ozone, a process which will limit the reaction rate and therefore limit the generation of NO_2. The conversion of NO to NO_2 is in part a function of the amount of ozone in the ambient air, and the travel time of the plume in the atmosphere (with time, more ozone is entrained into the plume and more conversion can therefore take place).

A number of international agencies have developed guidelines for the conversion of NO to NO_2. A summary of the main guidelines are set out below in *Table 5.8*. The ratios set out in *Table 5.8* indicate that a wide range of ratios to convert NO to NO_2 are recommended by a variety of country agencies. On the basis of the recommended ratios, assuming that the suggested ratios are equally valid, a conservative conversion ratio of 75% has been assumed for long term conversions, whereas an average conversion ratio of 50% has been assumed for short term conversions. These conversion factors have been applied in the results interpretation[1] .

[1] U.S. EPA 40 CFR Part 51

Table 5.8 Recommended NO to NO_2 Conversion Ratio

Country	Averaging period	Recommended Conversion Ratio
United States	24 hours	75%
	Annual	75%
Germany	24 hours	60%
	Annual	60%
United kingdom	Short term (1 hour)	35%
	Annual	70%
Hong Kong	24 hours	20%
	Annual	20%
Ontario, Canada	24 hours	52%
	Annual	68%

Dust emissions

During the combustion process particulate matters of different sizes are generated. However, Senegalese AQS and IFC guidelines sets air quality standards for PM10; the latter are defined as all particles equal to and less than 10 microns in aerodynamic diameter; particles larger than this are not generally deposited in the lung.

All the particulate matter emitted by the Project emission sources has been conservatively assumed as PM10; thus modelled concentrations of PM10 have been overestimated and conservatively compared against in force air quality standards.

Dry and Wet Depositions

The model does not account for dry and wet deposition or photochemical reactions of the pollutants which in reality takes place and would reduce macro pollutants concentrations in the atmosphere. Thus results are overestimating the likely actual contribution of the sources. The approach again is on the safe side of assumptions and gives a conservative picture maximising pollutants modelled concentration values over the sampling domain.

Results of air quality measurements undertaken in December 2014 and January 2015

In order to confirm the results of the air quality baseline modelling, a monitoring campaign was launched by ContourGlobal - Cap des Biches at the end of November 2014, based on the modelling results of impacts on ambient air quality (cf. *Section 8.5*) and with a focus on NOx, NO_2 and SO_2.

The technology used for monitoring atmospheric concentrations of NOx/NO_2 and SO_2 is passive sampling by means of diffusion tubes, left on the field for a period of 4 weeks.

The six monitoring sites have been defined, after a technical meeting with DEEC organized on November, 27th, 2015. These sites are showed in *Figure 5.13*.

Five monitoring sites (S2, S3, S4, S5 and S6) are located in the nearby residential areas thus in correspondence of sensitive receptors. Site 1 (S1) is located at the Power Plant fence line with the existing operating SENELEC CIII plant, running on HFO (also near the operating Aggreko containerised power generation units, also running on HFO). It is thus located in an industrial area (*Figure 5.13*), and does not characterise a sensitive receptor point. Moreover, this monitoring station is close to the Senelec facility CIII and to the Aggreko units. The latter are currently operative and their contribute was recorded in the undertaken baseline measurements, however they are not expected to be in operation once the Project will become operational.

Preliminary results (27/11/2014 to 23/01/2015, ie. 2 months) are reported in *Table 8.11* and *Table 5.10*. The monitoring results are likely to have been influenced by emissions from the following facilities operating nearby the proposed ContourGlobal Cap des Biches project site, particularly Aggreko containerised units which are not expected to be in operation when the Project will become operative.

Table 5.9 NOx and NO2 Ambient Measured Concentrations

Site	Date on	Date off	NO_x Ambient measured Concentrations [μg/m³]	NO_2 Ambient measured Concentrations [μg/m³]	Senegalese and IFC standards set on NO_2 annual average concentration [μg/m³]	% of AQS at current baseline
1st Set of Tubes						
S1	27/11/2014	22/12/2014	188.77	49.27	40	123%
S2	27/11/2014	22/12/2014	25.56	17.06	40	43%
S3	27/11/2014	22/12/2014	-	-	40	-
S4	27/11/2014	22/12/2014	27.03	19.68	40	49%
S5	27/11/2014	22/12/2014	14.33	11.27	40	28%
S6	27/11/2014	22/12/2014	21.19	9.06	40	23%
2nd Set of Tubes						
S1	23/12/2014	23/01/2015	36.74	26.03	40	65%
S2	23/12/2014	23/01/2015	16.83	15.04	40	38%
S3	23/12/2014	23/01/2015	35.89	8.91	40	22%
S4	23/12/2014	23/01/2015	23.80	18.56.	40	46%
S5	23/12/2014	23/01/2015	14.28	12.72	40	32%
S6	23/12/2014	23/01/2015	20.25	13.57	40	34%
Overall Sampling Period						
S1	27/11/2014	23/01/2015	112.755	37.65	40	94%
S2	27/11/2014	23/01/2015	21.195	16.05	40	40%
S3	27/11/2014	23/01/2015	35.89*	8.91*	40	22%*
S4	27/11/2014	23/01/2015	25.415	19.12	40	48%
S5	27/11/2014	23/01/2015	14.305	12.00	40	30%
S6	27/11/2014	23/01/2015	20.72	11.32	40	28%

**Data refers to the period 23/12/2014-23/01/2015, as no data were collected at the monitoring site 3 during the first sampling period.*

Table 5.10 SO2 Ambient Measured Concentrations

Site	Date on	Date off	SO_2 Ambient measured Concentrations [μg/m³]	Senegalese standards set on SO_2 annual average concentration [μg/m³]	% of AQS at current baseline
1st Set of Tubes					
S1	27/11/2014	22/12/2014	27.85	50	56%
S2	27/11/2014	22/12/2014	4.18	50	8%
S3	27/11/2014	22/12/2014	-	50	-
S4	27/11/2014	22/12/2014	4.08	50	8%
S5	27/11/2014	22/12/2014	2.99	50	6%
S6*	27/11/2014	22/12/2014	3.66	50	7%

Site	Date on	Date off	SO_2 Ambient measured Concentrations [µg/m³]	Senegalese standards set on SO_2 annual average concentration [µg/m³]	% of AQS at current baseline
2nd Set of Tubes					
S1	23/12/2014	23/01/2015	13. 84	50	7%
S2	23/12/2014	23/01/2015	2.69	50	1%
S3	23/12/2014	23/01/2015	14.82	50	7%
S4	23/12/2014	23/01/2015	6.68	50	3%
S5	23/12/2014	23/01/2015	2.66	50	1%
S6	23/12/2014	23/01/2015	2.15	50	1%
Overall Sampling Period					
S1	27/11/2014	23/01/2015	20.85	50	42%
S2	27/11/2014	23/01/2015	3.43	50	7%
S3	27/11/2014	23/01/2015	14.82**	50	30%**
S4	27/11/2014	23/01/2015	5.38	50	11%
S5	27/11/2014	23/01/2015	2.83	50	6%
S6	27/11/2014	23/01/2015	2.91	50	6%

** Sample un-named but deemed to be SQA6*
***Data refers to the period 23/12/2014-23/01/2015, as no data were collected at the monitoring site 3 during the first sampling period.*

Monitoring results shows that NO_2 and SO_2 baseline concentrations are well below inforce AQS at sensitive receptors (sites from S2 to S6). Therefore on the base of the monitored data received to date the local airshed at sensitive receptors can be classified as undegraded.

Monitored SO_2 concentration at the fence line (monitoring site S1) is below the limit for each single monitoring period and for the overall monitoring period of two months. Monitored NO_2 concentration at the fence line is below the limits for the overall monitoring period of two months. NO_2 concentration at the fence line exceeds the limit in the first monitoring period but falls below the limit in the second monitoring period. The NO_2 exceedance during the first monitoring period is recorded at the Power Plant fence line, thus in an industrial area which does not represents a sensitive receptor. Moreover the high NO_2 concentration recorded at the monitoring site S1 is highly influenced by the operation of the Senelec Plant CIII and of the Aggreko units. The latter are not expected to be in operation when the Project will become operative.

5.3.9 Noise level

This section includes a description of existing acoustic conditions in the project area. This will enable an evaluation of the acoustic contribution made by the Project to the current situation, taking account of existing SENELEC installations.

In June, noise measurements in the field were carried out by LAME (Laboratoire Africain de Métrologie et d'Essais). Measurements were taken every 6 hours for 24 hours, at the limits of the ContourGlobal - Cap des Biches project site (for a period of 2 minutes at each control point) and at the three receptors (for a 15 minutes period).

Figure 5.18 shows the location of measurement points and *Table 5.11* presents the ambient noise levels measured ($LAeq_{,T}$, LMin, LMax).

Figure 5.18 Noise measurement campaign

Source: *LAME, June 2014*

Table 5.11 Ambient noise levels measured (baseline, without Project)

Location	Time	Duration	LMin	LMax	$LAeq_{,T}$
BM5	10:00	2-min	66.3	67.2	66.9
	16:00	2-min	60.6	63.6	61.9
	22:00	2-min	62.9	63.3	63.1
	04:00	2-min	59.0	59.1	59.1
BM8	10:00	2-min	64.6	65.7	65.1

Location	Time	Duration	LMin	LMax	$LAeq_{,T}$
	16:00	2-min	65.6	66.2	65.9
	22:00	2-min	68.2	69.5	68.6
	04:00	2-min	61.2	61.6	61.5
New plant, lagoon side	10:00	2-min	62.5	65.4	64.1
	16:00	2-min	54.9	55.5	55.2
	22:00	2-min	64.0	65.5	64.9
	04:00	2-min	48.3	57.4	49.6
SENELEC sub-station	10:00	2-min	63.8	64.0	64.3
	16:00	2-min	63.9	64.6	64.3
	22:00	2-min	65.0	66.0	65.3
	04:00	2-min	62.0	65.0	63.3
SENELEC TAG2	10:00	2-min	83.4	84.7	83.8
	16:00	2-min	86.8	87.4	87.0
	22:00	2-min	87.2	87.5	87.3
	04:00	2-min	71.2	75.7	73.4
Waste water treatment plant	10:00	2-min	56.4	57.8	57.2
	16:00	2-min	55.5	56.0	55.7
	22:00	2-min	58.8	60.3	59.7
	04:00	2-min	48.9	59.7	50.8
Diokoul (residential area)	10:00	15-min	50.5	56.3	52.5
	16:00	15-min	50.7	52.6	51.8
	22:00	15-min	52.7	57.5	55.5
	04:00	15-min	47.7	49.8	48.7
SENELEC 1 housing (for SENELEC employees)	10:00	15-min	58.9	60.6	59.5
	16:00	15-min	61.0	62.2	61.4
	22:00	15-min	60.0	61.3	60.7
	04:00	15-min	60.0	60.9	60.3
SENELEC 2 housing (for SENELEC employees)	10:00	15-min	55.8	58.7	56.7
	16:00	15-min	55.5	57.3	56.0
	22:00	15-min	57.8	58.9	58.1
	04:00	15-min	52.6	53.7	53.4

Source: LAME, June 2014

5.4 *TERRESTRIAL BIOLOGICAL ENVIRONMENT*

5.4.1 *Methodology*

In order to collect the maximum amount of information, a bibliographic review was undertaken to describe the general characteristics of the study area. Bibliographic research was carried out by consulting several works on similar subjects (publications, reports, posters, etc.). This part of the work revealed certain aspects relating to vegetation, flora and fauna, as well as current Senegalese legislation.

In addition to the initial bibliographic study, in June 2014 a collection of flora data was carried out in the area in which the Project is to be installed. Samples of several species, not identified in the field, were taken back to the laboratory for identification.

An inventory of fauna was made in advance; all animal species seen during field reconnaissance work were listed. This reconnaissance of animal species was associated with a description of the types of habitats in which these fauna resources were found.

5.4.2 Study area

The area for the study of the biological environment covered the area in which the Project is to be installed (2.99ha). An evaluation of natural habitats was also undertaken in the Project study area (2km radius – see *Chapter 5.2*). This evaluation was based on the interpretation of satellite photos, followed by confirmation/validation in the field.

5.4.3 Natural habitats

A natural habitat is an area that is homogenous in terms of its ecological conditions and vegetation (grasses, bushes and trees), sheltering animal species that spend all or part of their lifecycle in this area. In the Project area, natural habitats are not very diverse due to the artificialization of the environment and the small surface area concerned.

In the Project area and the near study area (2km), land use is dominated by urbanised areas (Darou Salam Azur district to the east and SENELEC plant and housing to the west). The dominant natural habitat is a deteriorated to highly deteriorated bush covered savannah, in some places being urbanised. The presence within this habitat of some relicts (woody) should be noted, such as *Faidherbia albida.*

In the installation parcel, natural habitats can be classed in three categories:

- Area of market gardening in the centre of the parcel;
- Re-wooded area at the eastern and western edges of the parcel; and
- Damp area, to the south-east of the parcel, due to run-off from the storage lagoons at the Rufisque waste water treatment plant.

These three types of habitats are the result of anthropic activities.

Within the extended study area (2km), bush-covered savannah areas represent 96 ha (i.e. less than 12% of the terrestrial surface area included in the study area), of which over 60% are highly deteriorated and are currently being urbanised. Details of land use are presented in *Section 5.8*.

5.4.4 *Flora*

Methodological approach

The small surface area of the parcel (2.99 ha), the predominant presence of the grass stratum, the relative homogeneity of the bush stratum and the major anthropization of the natural habitat resulted in an inventory being made using the itinerant sampling method (*Chevalier, 1948* and *Aubreville, 1959*). This methodology consists of travelling through the environment in every direction, noting all the plant species found.

A list was drawn up after systematic listing of all the species observed. The various books consulted for identification of the nomenclature are listed at the end of this report. These various approaches or methodologies enabled the establishment of a list of the flora in the project area and its surroundings.

Results

Woody vegetation at the site comprises xerophyte species represented by *Faidherbia albida* (protected species), *Accacia nilotica* (*Fabaceae*), *Calotropis procera* (*Euphorbias*), as well as species planted by land users (see *Section 5.7.4*) such as *Eucalyptus alba*, *Acacia nilotica*, *Casuarina equisetifolia*, *Azzadirachta indica* or *Tamarix indica*. This reforested area is located to the west of the parcel, along the length of the fence and in several areas located inside the site. The aim of reforestation was to reduce the action of hydric and wind erosion.

The grass layer is formed by several short cycle grass species. Close to the shore, halophile formations are represented solely by grasses that are highly rESIAtant to salt, such as *Salsola sp* and *Salicornia sp*.

The agricultural area occupies the central section of the site, where subsistence farming is carried out comprising market gardening plantations and fruit trees. A few forest trees have also been planted in this section. According to the expert's report on the evaluation of the assets of the Diop family's orchard, the following species are found most frequently on the parcel: jujube, lemon, annona, eucalyptus and prosopis.

The south-east section of the site is characterised by a slight depression that receives run-off water from the Rufisque waste water treatment plant adjacent to the site. Vegetation consisting of high grasses such as *Phragmites australis (Figure 5.19)* and *Bauhinia rufescens* and *Faidherbia albida*, populate the area.

Figure 5.19 ***Phragmites australis***

There are cactus plants along the length of the maritime shore. They are generally used to help to reinforce stabilisation of coastal dunes and thereby combat aggression from big waves during high tides.

Figure 5.20 ***Coastal strip of cactus plants***

Table 5.12 ***List of species inventoried in the site perimeter (excluding cultivated species)***

Species name	Average density (plants/ha)	Vulnerability (IUCN status)
Acacia nilotica	50	NL
Gossypium sp (cotton)	67	NL
Eucalyptus alba	22	NL

Species name	Average density (plants/ha)	Vulnerability (IUCN status)
Caesalpinia sp	2	NL
Solanum sp	1	NL
Leptadania hastata	17	NL
Azzadirachta indica	17	NL
Salsola sp	-	NL
Salicornia sp	-	NL
Phragmites australis	-	LC
Tamarindus indica	83	NL
Faidherbia albida	1	NL
Lantana camara	1	NL
Calotropis procera	83	NL
Casuarina equisetifolia	8	NL
Parkinsonia acuelata	1	NL
Bauhinia rufescens	7	NL
Opuntia tuna	-	NL

LC: least concern
NL: species not listed

5.4.5 *Fauna*

Methodological approach

The itinerant sampling method was used. This methodology consists of travelling through the project site and zone of influence, noting all the animal species found and presence indices observed.

Results

The power plant is located in a highly anthropised peri-urban area. Natural habitats have been replaced by urbanised areas, or else are in a poor state of conservation (*Section 5.4.3*).

Bird life observed at the site is not very diversified. The presence of the black-winged stilt was observed (*Himantopus himantopus*), along with the spur-winged lapwing (*Vanellus spinosus*) and the western reef heron (*Egretta gularis*).

Figure 5.21 Spur-winged lapwing (Vanellus spinosus)

During a visit to the site in 2013, the presence of a black kite (*Milvus migrans*) was observed (nesting on the recovery boiler – this equipment will not be reused as part of the Project). No nesting activity was observed, however, in June 2014, neither in the Project site or in the existing facilities.

Rainbow agamas (*Agama agama*) are observed on the parcel where existing installations are located. Traces of lizards were also found linking the islands of vegetation present on the installation site to the parcel where the WWTP is located.

No mammal or any trace likely to indicate the presence of mammals on the site was found during the visit.

Due to the poor state of conservation of natural habitats at the site notably, very little diversity of fauna species is likely to be present at the site.

5.4.6 Threatened and/or protected species

Flora

None of the species found during the inventory undertaken on the area to be covered by the power plant is classified as either endemic or threatened in the Sahelo-Sudanian region(1) area or in West Africa. However, the presence of two *Faidherbia albida* (*Table 5.12*) specimens was observed, which are considered to be threatened at national level. This plant species is also partially protected under article R-63 of the Forestry Code. This partial protection means that prior authorisation has to be obtained before clearing the ground, in application of article R-61 of the same code. An itinerant

(1) This is the eco-geographic area contained between isohyets 350 and 600 mm.

inventory carried out within the study area, and more particularly to the east of the site, identified numerous *Faidherbia albida* plants in areas not concerned by the Project.

None of the species listed is considered to be vulnerable (see *Table 5.12*).

Fauna

As mentioned in *Section 5.4.5*, a black kite was observed in 2013 to be nesting on existing installations. This species is fully protected by the Hunting Code [(1)]. However, black kites are very common in the zone of influence and the presence of nesting birds was due to stoppage of the combined cycle in March 2011. This nest was not observed during the June 2014 visit. The site and the surroundings of the ContourGlobal - Cap des Biches power plant do not therefore represent an important area for this species, and this presence is not synonymous with any particular sensitivity in terms of the fauna.

5.4.7 Sensitive and/or protected natural areas

No sensitive and/or protected natural area is located within the Project study area. The closest protected natural areas are:
- Thiès classified forest, located 28km to the east of the site
- The Popenguine nature reserve located 25 km to the south.

5.5 MARINE ENVIRONMENT

There are few studies available that describe the state of Haan Bay, within which the Project area is located. In 1994, SENELEC ordered a study intended to measure the degree of sedimentation around their seawater drawing structure. Prior to that, the Dakar Thiaroye Centre de Recherches Océanographique (*CRODT, 1994*) carried out a study on algae in the bay.

More recently, the Bureau de Recherches Géologiques et Minières (BRGM) worked with the Environment Ministry to carry out a study on the coastal area, covering water quality, bathymetry and biodiversity across the whole of Senegal (*BRGM, 1992*). For Haan Bay, this work was undertaken with the aim of drawing up an action plan for the environment hoping to respond to the needs of a range of user groups and activities such as industry, fishing, leisure and biodiversity conservation.

Hydrology and bathymetry

The bay is relatively shallow, with depths of around 3 to 5m along the whole coast (*CROT, 2006*). It reaches a depth of about 50m at a distance of 5km from the coast. It is as from this area that the continental ocean plate commences, whose depth varies from 25 to 100m. At between 35 and 45km from the coast the plate plunges down and depths rapidly reach several hundreds of metres.

(1) Law n°86-04 of 24th January 1986 and Decree n°86-844 dated 14th July 1986

Figure 5.22 below presents the bathymetric profile at the installation area, up to a distance of 50km from the coast.

Figure 5.22 Bathymetry at the Project installation area

Source: *ERM based on the altitudinal data of SRTM 90m (Shuttle Radar Topography Mission)*

Hydrological studies carried out by the BRGM (dry season in 1992) indicate a trend in surface water movements southwards, due to prevailing wind conditions (up to 15 cm/s), with underlying counter-currents (around 5 cm/s) in lower water layers, moving towards the north of the bay. These phenomena have a direct influence on the dispersal of discharge into the marine environment.

Seasonal variations are also likely to modify dispersal conditions in the Cap des Biches area:

- From December to April: current parallel to the coast, mainly moving southwards, and mainly influenced by the Alizé trade winds blowing during this period
- From May to November: current parallel to the coast, mainly northwards, and mainly influenced by the monsoon wind.

Temperatures and salinity

Surface water temperatures are recorded daily by SENELEC. These temperatures, presented in *Table 5.13*, vary from 18°C in January to 33°C in August.

Table 5.13 Average monthly temperature of the surface of the ocean, Cap des Biches (1996)

Month	°C	Month	°C
January	18	July	30
February	20	August	33
March	22	September	30
April	24	October	27
May	26	November	22
June	28	December	19

Salinity of the water, in the project area, shows a minimum value of 35.44%, and maximum values of 35.61 ‰ (*CRODT, 2006*).

Water quality

The results of the Haan Bay study carried out by BRGM indicate a high level of organic pollution. High concentrations of organic matter and clearly linked to the quantities of untreated domestic waste water that are discharged into the bay. This is coherent with a report from the World Bank on the state of the environment in Senegal, which claims that most residual urban water is discharged, untreated, into the ocean (*World Bank, 1994*). Other sources of pollution are industry and ballast cleaning by large ships, particularly in Dakar's main port.

Available data on dissolved oxygen show relatively average values, of around 65%, which decrease with depth (*CRODT, 2006*).

Turbidity decreases from the coast outwards to sea and from the surface downwards. Values recorded in the project's zone of influence are relatively low, from 6 to 7 ppm (*CRODT, 2006*).

Waves and tides

The small coast, at Rufisque, is influenced by two types of waves:

- Waves from the north-west (320° to 20°), which move in a rotational movement around the Cap Vert peninsula and can reach an annual maximum height of 4.25m. These waves are characterised by an annual average amplitude of 1.7m and an annual average period of 7.1s. Waves from the north-west depend strongly on Alizé trade winds from the north and occur mainly between October and January.

- Waves from the south-west (180° to 200°) which are created in the South Atlantic. They occur between around the month of July and reach their maximum between August and September (equivalent to the rainy season), before gradually disappearing in about October. Waves from the south-west are characterised by an annual average amplitude of 1.4m and an annual average period of 7.0s.

These waves mainly lead to two types of coastal currents, which are currents that are perpendicular to the coast and currents along the coast, in a north-south direction. In a general way, whatever the direction simulated, waves tend, as they propagate, to be directed perpendicularly to the isobaths. Thus, in the surroundings of the study area, the wave direction is generally between 200 and 230°N (*DEEC/AGETIP/EFFAGE*).

With regard to tides, the Senegalese coasts are characterised by a semi-diurnal tide, with a micro tidal system. Difference between high and low water is relatively small, with annual averages of between 0.5m (low water) and 1.6m (high water). In the Dakar region, average difference is 1.2m for high water and 0.60m for low water.

Tidal currents are very low in the project area; their speed is less than 0.3 knots, i.e. less than 0.15 m/s (*Niang Diop, 1995*).

The elevation rate of sea level is 1.4mm per year (*Elouard et al., 1977*; *Emery and Aubrey, 1991*). Seasonal differences in sea level varied between 9 and 25cm, i.e. an average of 20 cm. These seasonal variations in sea level can be attributed to upwellings (*Verstraete, 1985*).

Biodiversity

The Senegalese coastal waters are in the transition area between the marine ecosystems in the Gulf of Guinea and the Canary Islands. The area enjoys the seasonal upwelling of deep water (November to April) bringing water rich in nutritional elements to the surface and stimulating the production of plankton.

Fish stocks are reputed to be abundant off Haan Bay, both for pelagic and demersal species such as mullet, herring, African carp and prawns (*World Bank, 1994).* The bay is also a major spawning ground (*Itaf Gningue, 1997*). Fishing is a relatively important economic activity for local inhabitants.

BRGM studies (1992) identified two dominant phytoplankton groups, including 71 species of diatoms and 40 species of dinophyta. The algae studies carried out by CRODT in 1985, concentrating on the Haan Bay zone, identified three dominant species, including:

- *Ulva* genus species: 50% of samples
- *Cladophora* genus species: 35% of samples
- *Hypnea* genus species*:* 15% of samples

Coastal area

The sandy coastline is relatively damaged in the Cap des Biches area and a phenomenon of green tide occurs at certain times of the year in the Cap des Biches area (*Figure 5.23*). This phenomenon would not appear to be linked to the presence of power plants, the activities of which do not cause any significant emissions of substances that could lead to algae proliferation (mainly phosphate and nitrate).

In certain sectors of the town of Rufisque, the beach suffers from the effects of coastal erosion. In places, a protective wall has been built to protect dwellings. To the south-east of the Project area, a think sandy strip, 10 to 30m wide, remains. According to some studies, data on coastal erosion phenomena is estimated at between 1.2 and 1.3 m/an (*Diallo, 1982, Sall, 1982, Niang-Diop, 1995*).

Figure 5.23 Green tide phenomenon

5.6 LANDSCAPE

The study area landscape is an urban landscape with a strong industrial dominant, easily identifiable by the many chimneys, storage tanks and electricity cables visible from the dwellings to the south-east (Darou Salam Azur district). This landscape is shown in *Figure 5.24*.

In parallel, the coastal landscape, represented by long, narrow sandy beaches, shows a high anthropic component, symbolised by the many dwellings on the coast as well as shell gathering activities. This landscape is shown in *Figure 5.25*.

Figure 5.24 Industrial landscape seen from Rufisque cemetery

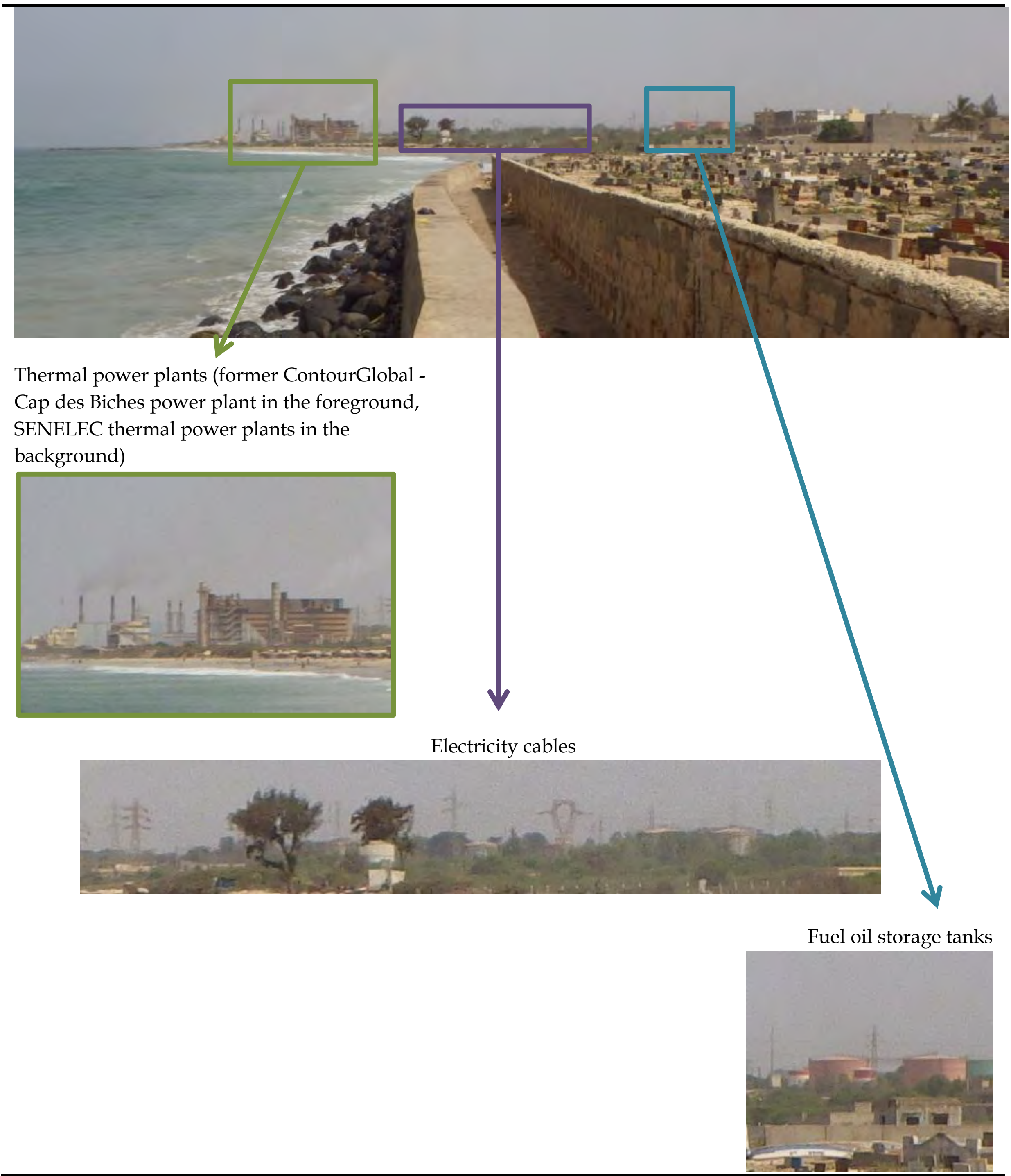


Figure 5.25 Coastal landscape seen from the surroundings of the power plant (photograph taken from the edge of the Project site, looking south-eastwards).

Blue: traces of shell gathering activities
Orange: West of Rufisque - Darou Salam Azur district

5.7 HUMAN AND SOCIOECONOMIC ENVIRONMENT

5.7.1 Introduction

This chapter reviews the project's socioeconomic environment, the baseline of which is drawn up at national, regional and local levels. It presents the economic and social conditions in the baseline, using secondary data obtained from the various planning and analysis departments, as well as databases and documents obtained from the technical partners of the State of Senegal, who are active in the economic and social development of the country and the region. These sources are supplemented by information obtained from observations in the field and consultations with the various stakeholders.

Within the context of the socioeconomic component of the ESIA, two levels of influence have been considered with regard to the study area:

- A zone of influence extended to include the whole of the Town of Rufisque and the district (formerly a municipality district - *commune d'arrondissement*) of West Rufisque, an area affected by the project's indirect socioeconomic impacts.
- A restricted study area, covering the Darou Salam Azur district, a perimeter where the Project's impacts and effects will be potentially directly felt by the population.

A detailed description of public consultations undertaken for the Project is included in *Chapter 5.9*.

5.7.2 *Administrative organisation of the study area*

Administrative organisation

Located in the Sahelian region, in the westernmost part of Africa, Senegal is a member country of the West African Econoic and Monetary Union (WAEMU) It covers a surface area of 196 722 km². Senegal has 14 regions, 45 departments, 113 municipalities, 46 municipality districts, 133 districts and 340 rural communities since the 2008 territorial reform. The number of villages was estimated at 13 550 in 1988.

The project area is within the jurisdiction of the municipality of West Rufisque, which is limited to the east by the Kheury Souf districts, to the north by the Guendel, Ndar Gounaw and SantaYalla quarters, to the west by the department of Pikine (Municipality of Mbao) and to the south by the Atlantic Ocean. The Town of Rufisque is sub-divided into three municipality districts: East Rufisque (4.7 km²), North Rufisque (3 km²) and West Rufisque (9.9 km²).

The capital of the department of the same name, the Town of Rufisque covers an estimated surface area of 42 km². Outside the industrial area located in the territory of West Rufisque, the town centre (historic centre of Rufisque) concentrates most of the town's administrative and commercial activities.

Local governance and organisational dynamic

The current context of local government in Senegal is characterised by the implementation of Act III of the decentralisation law (Law n°2013-10 dated 28th December 2013 and containing the General Local Authorities Code with Act III of decentralisation). This new general Code repeals and replaces laws n°96-06 containing the Local Authorities Code, n°96-07 containing the transfer of jurisdiction to region, municipalities and rural communities and n°96-09 dated 22nd March 1996 setting out the administrative and financial organisation of a municipality district and its relations with the town.

The different administrative levels in the study area are:

- The town of Rufisque, represented by the mayor of the town
- The municipality of West Rufisque, represented by the mayor of the municipality
- The Darou Salam Azur district, represented by the district delegate and grassroots organisations.

The two levels of local authorities which are the Town of Rufisque and the Municipality of West Rufisque are run by councils elected by universal suffrage and each have their own responsibilities to assume within a given area. They are, however, subject to a legality check by State representatives: the Prefect and Sub-Prefect (administrative authorities), respectively for the Departments and/or the Town and Municipality.

In principle, there is no hierarchy between local authorities, however the mayor of the town associates the mayor of the municipality with the examination of general conditions for the building and operation of infrastructure and equipment projects planned within the limits of the municipality. The Mayor of the Municipality must also inform the Town Mayor of any investments made under the jurisdiction of the municipality.

The Town is instituted to pool the competencies of several municipalities with territorial homogeneity. Amongst others, the main competencies transferred to the Town are the following:

- Management of waste and the combat against insalubrity
- Hospital management and maintenance
- Participation in universal health cover
- The surveillance and conservation of historic sites and monuments
- The establishment of the Town Planning Plan (PDU), the Planning and Land Use Guidelines (SDAU), planning maps with details of agreed land use areas, urban renovation areas and urban consolidation
- Drafting and implementation of the town development plan (PDV)
- Implementation of the contract with the State for the creation of development projects.

The Municipality groups inhabitants from within the perimeter of one locality made up of districts and/or villages. Districts and villages form the basic administrative units (administered by district Delegates or village chiefs).

The municipality council is responsible for the following, which are likely to concern the Project to a greater or lesser extent:

- The general land use plan
- Projects for the development, allotment and equipment of areas used for housing, as well as the authorisation to install dwellings or camps
- Use and decommissioning of land in the national domain
- The creation, modification or suppression of fairs and markets
- The classification, re-classification, opening, straightening, aligning, extension, widening and suppression of public roads and squares
- The regime and terms of access and use of water sources of all kinds
- Environmental protection
- The creation and management of municipal woods and protected areas
- The drafting of municipal action plans for the environment
- The management of waste and the combat against insalubrity

The district delegate acts as State representative in the various districts and works in collaboration with district public figures and populations. Elders are considered to be the spokesmen for populations in relation with district delegates and administrative and religious authorities.

Associations are highly developed in the Municipality of West Rufisque. These includes Economic Interest Groupings (GIE) and Women's Groups (GPF) active in the fields of commerce and fish processing.

These groupings also organise "Tontines" (joint savings associations), in order to carry out income generating activities to improve the living standards of the women taking part.

The Darou Salam Azur district also has commissions in charge of the management of local development (commission responsible for the management of disputes, environment commission, elders' commission, social commission etc.).

The Environment Commission (APROPRE) was set up in the Darou Salam Azur district in 2009, at the same time as the social affairs and Elders' commissions. This commission deals with issues of salubrity and sanitation in the district and on the beach. Since 2011 it has had the status of association and enjoys legal recognition. It has dealt with reforestation with sheoaks, the layout of a sports course, the layout of a gymnastic area and clean-up operations in the surroundings districts and on the beach.

The following table presents the main associations and organisations working in the Darou Salam Azur district.

Table 5.14 Organisations active in the Darou Salam Azur district

Name of Organisation	Date of creation	Number of members				Field of activity
		M	W	Y	Total	
GPF ADAMA SEYDI	2010	0	60	20	80	Sewing and dying, shop
GPF KHADY DIENG LO	2006	0	70	0	70	Micro finance
GPF ABY GUEYE	2012	0	50	0	50	Micro finance
ASC BRA GUEYE MBAYE	2013	80	50	20	150	Health, youth and leisure, environment
COMMISSION DES SAGES	2009	05	0	0	05	Prevention and settlement of conflicts in the district
COMMISSION ENVIRONNEMENT	2009	06	01	0	07	Salubrity in the district and on the beach Reforestation
COMMISSION SOCIALE	2009	05	0	0	05	Creation of awareness of medial prevention. Awareness of other events linked to life in the district.

Source: *data from consultations, 2014*

5.7.3 *Demographic context*

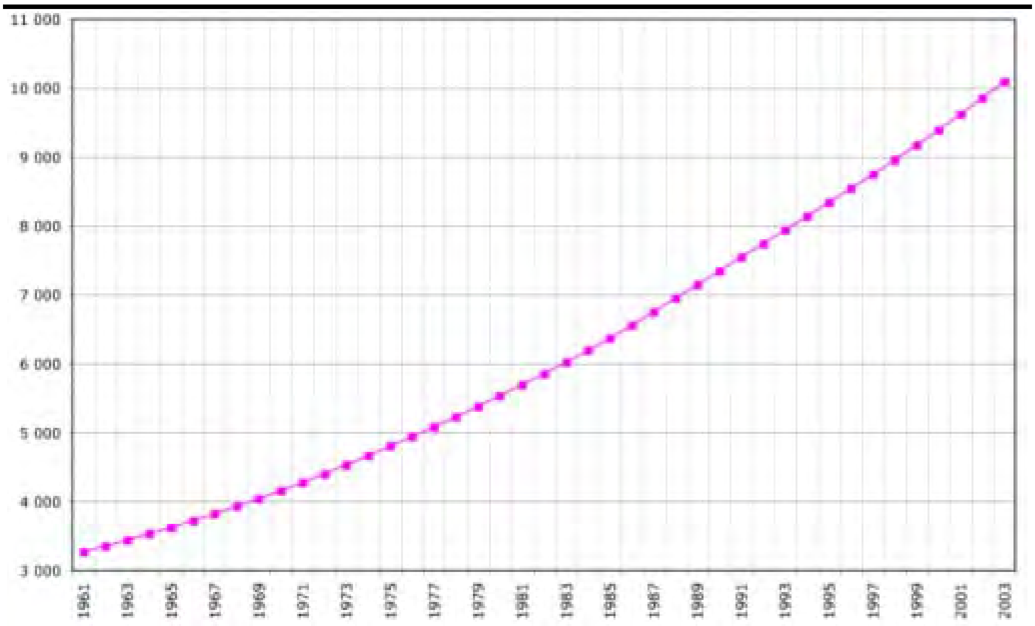
National context

Estimated at 14 million in 2014, the national rate of increase is 2.4% and corresponds practically to a doubling of the population every twenty-five years. The Senegalese population is young and unequally distributed across national territory, with a concentration in the west, in regions close to the coast, which are Dakar, Thiès, Kaolack, Saint-Louis and Ziguinchor.

Finally, the average density of the Senegalese population was estimated at 65.3 inhabitants/km² in 2011 (*ANSD, 2012*).

Due to the exodus from the countryside, the region of Dakar is undergoing rapid demographic growth, which is considerably larger than in the rest of the country. The share held by the City of Dakar in Senegal's demographics and economy is therefore tending to increase. Compared to the sub-region, Senegal is already highly urbanised. The urban population represents almost 50% of the total population, compared with around 33% on average in sub-Saharan Africa.

Figure 5.26 Evolution of demographics in Senegal (1961 – 2003)



Sources: *FAOSTAT, 2005*

Local context

The population of Rufisque has seen major development over recent years, with a growth rate of between 2.2 and 4.3%. With 15 000 inhabitants in 1930 and 74 351 in 1976 (*Dubresson, 1978*), the results of the 2002 census, published by the D.P.S in January 2006, estimate the population of the town of Rufisque at 154 975 inhabitants, and predict 173 000 inhabitants in 2010 and 192 000 in 2015.

Based on the census, 66% of the population is aged under 25 and women make up about 52% of the population.

Table 5.15 Distribution of concessions, homes and gender in the Rufisque municipality districts

Locality	Number			
	Concessions	Homes	Men	Women
West Rufisque MD	2229	3680	17259	17305
Centre Rufisque MD (North)	4591	6995	28294	28575
East Rufisque MD	4228	5857	27079	26770
TOTAL	11048	16532	72632	72650

Source: *2002 census*

The main ethnic groups in Rufisque are the Lébous, who are the native people and in the majority, the Wolofs, Halpularen, Sérères, Diola, Mandingue and Manjack.

5.7.4 Town planning, housing and land ownership context

Town planning and habitat

The area located directly around the Project is highly industrialised and does not contain any dwellings. The industry is mainly factories, former industrial installations and lagoons used by the waste water treatment plant which is located directly to the east of the site.

The Darou Salam Azur district, which is the nearest inhabited zone, is located at around 400m to the east of the Project area and developed as from 2004. It is limited to the east by 'Cité Gabon' and Diokoul, to the west by the ONAS waste water treatment station (Office National d'Assainissement du Sénégal), to the north by the Cité Bata estate and to the south by the sea. This district has developed rapidly over the past 10 years. However it contains very little infrastructure or basic socioeconomic equipment.

The district's population is estimated at 4 000 inhabitants living in 600 concessions. The Darou Salam Azur is residential and the type of habitat is marked by the predominance of modern, solid constructions organised around streets and a regular gridding (very few spontaneous settlements).

Land ownership and process for acquiring land

In Senegal land can be divided into three categories:

- The "State Domain" comprises public and private property in the property assets and rights that belong to the State. It is governed by law n° 76-66 of 2nd July 1976 containing the State Domain Code (CDE). Compensation is provided for in case of easement of public usefulness (article 7 CDE). The State may grant various types of occupation on its domain (authorisation to occupy on a temporary, revocable basis, ordinary lease, concession to rights to the surface area). The maritime domain forms an integral part of the State Domain.

- The "National Domain" comprises land that is not classified in the State Domain, not registered or whose ownership has not been entered into the mortgage conservation registry. The national domain is governed by law n° 64-46 of 17th June 1964 and its various implementation texts. The land in the national domain is divided into four categories: pioneer areas, urban areas, classified areas (protected spaces) and territorial areas which are areas intended for agriculture and stock rearing and grazing

- The "Individuals' Domain" or "Private Domain" which comprises registered land owned by private individuals. It is governed by the Civil Code and the decree of 26th July 1932 which reorganised the property regime in French West Africa.

Property rights at the Project site

As mentioned earlier, the Project will be built on a parcel of about 3ha, which is adjacent to the site of the existing power plant. This parcel is currently used for agricultural purposes.

An expert has been designated to supervise the inventory and compliance of the procedure to value the assets present on the parcel in question. A report was published in June 2014 (*Evaluation of the orchard property belonging to the family of Isma Diop, deceased, located at Cap des Biches*) which summarised the position and the results of the inventory.

Figure 5.27 Views of the agricultural area concerned by the Project

Sources: *ERM, June 2014*

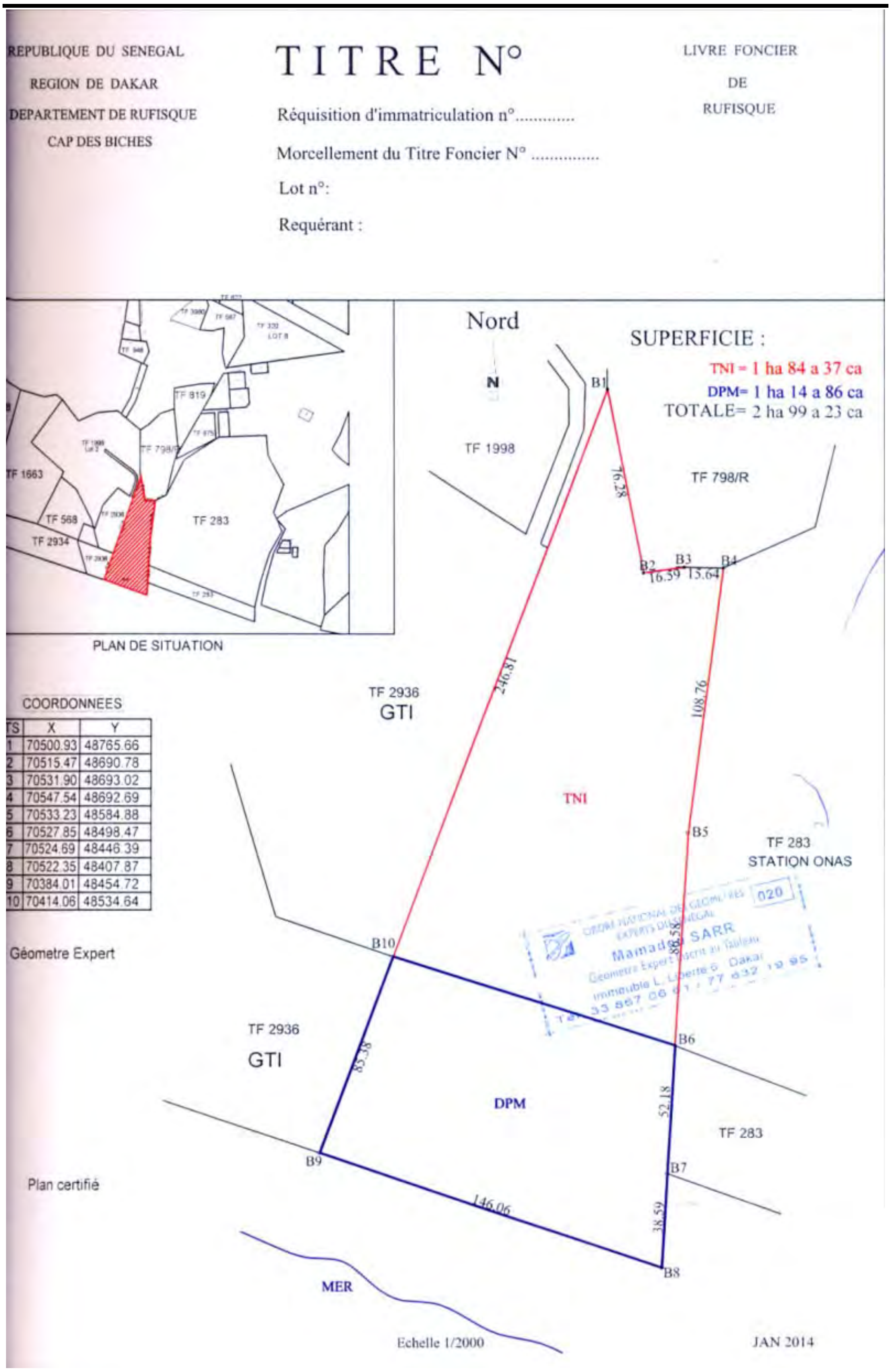
According to the expert's report, the land concerned by the Project's development comprises two parcels:

- A parcel belonging to the National Domain, of a surface area of about 1.84ha and considered to be TNI (Unregistered land), the allocation of which depends on the municipality of Rufisque; this land has been allocated to SENELEC, which will transfer it to ContourGlobal - Cap des Biches on a long lease, before the start of the works phase.
- A parcel of about 1.15ha belonging to the Maritime Public Domain (State Domain), the allocation of which takes place via the Ministry of Finance (Domains Administration). Procedures for the granting of this land to SENELEC are on-going with the Ministry of the Economy and Finance.

SENELEC and ContourGlobal - Cap des Biches have agreed that SENELEC will become the owner of the land that forms part of the national domain (transformation of the TNI into a land deed, TF) and that the parcel that is part of the Maritime Public Domain will be made available to it by the Domains Administration. SENELEC will then sign a lease with ContourGlobal - Cap des Biches for occupation of the area.

Correspondence between SENELEC and the various administrations with responsibility for allocation of land (Town of Rufisque, Town Planning and Housing Ministry, Ministry of the Economy and Finances, …) is contained in the expert's study carried out in June 2014.

Figure 5.28 Land registry map of the parcel concerned by the Project



Sources: *Report on the evaluation of disbursements, June 2014*

Compensation for unofficial occupiers

In parallel to the allocation of the land to SENELEC, a phase to compensate the land occupier was carried out, in which the family concerned participated, along with ContourGlobal - Cap des Biches, SENELEC and the Rufisque local authorities. This phase was supervised by the independent expert with responsibility for the disbursement evaluation procedure.

The land is occupied by one family (Mr Diop and his two children) and has been used for agricultural purposes for several years. Mr Diop has a market garden (okras, cucumbers and peppers), fruit trees and forest trees.

A commission comprising representatives of SENELEC, ContourGlobal -Cap des Biches, the expert and the farmer working on the parcel in question was set up in order to manage the issue of compensation and reach an agreement between the various parties.

Following the detailed inventory of assets present on the parcel, carried out in May 2014, the value of disbursements was assessed at 57 244 165 CFA F. This amount has been paid to the beneficiaries' designated representative.

5.7.5 Economic context

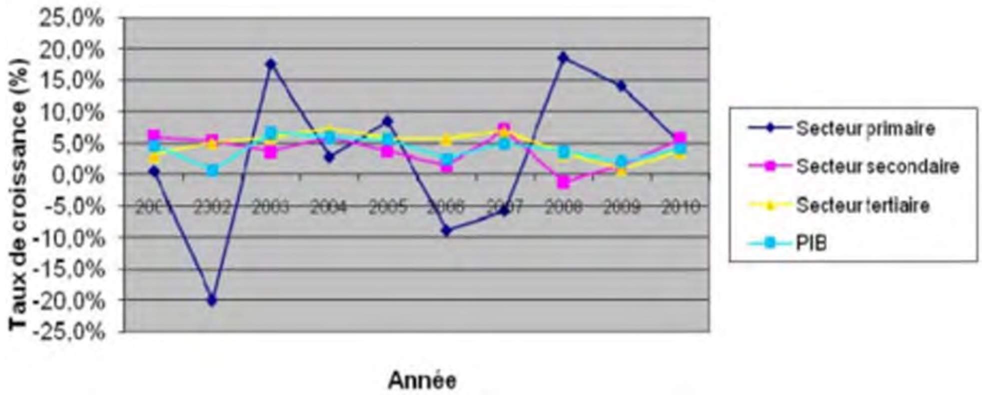
Economy

Senegal has seen sustained economic growth since the mid-nineties, with an increase in GDP volume close to 5% per year on average. This growth has permitted significant improvement in GDP per inhabitant.

The Senegalese economy is dominated by three sectors identified as strategic by the World Bank. These are the agricultural sector (particularly the arachide sub-sector), fishing and the services sector. Climatic imponderables, particularly repeated droughts due to the Sahelian position of Senegal, have had a major negative impact on the agricultural sub-sector, whose role in and contribution to GDP has dropped. The Senegalese economy also remains highly dependant on external transfers.

The Senegalese economy remains characterised by major fragilities. Firstly, economic growth would appear to have had a limited effect on the reduction of inequalities. Senegal remains characterised by a high degree of inequality, and by strong duality between the urban and rural worlds, with rural areas characterised by a very high incidence of poverty. The Sahelian nature of the country also strongly restricts the potential for agricultural development. The primary sector thus represents only 20% of Senegalese GDP, whilst occupying the majority of the active population (2001 figures, *Bertholet,* 2004).

Figure 5.29 *Actual growth rate in Senegalese GDP per sector of activity (2001-2010)*



Sources: *ANSD* [1]*, 2011*

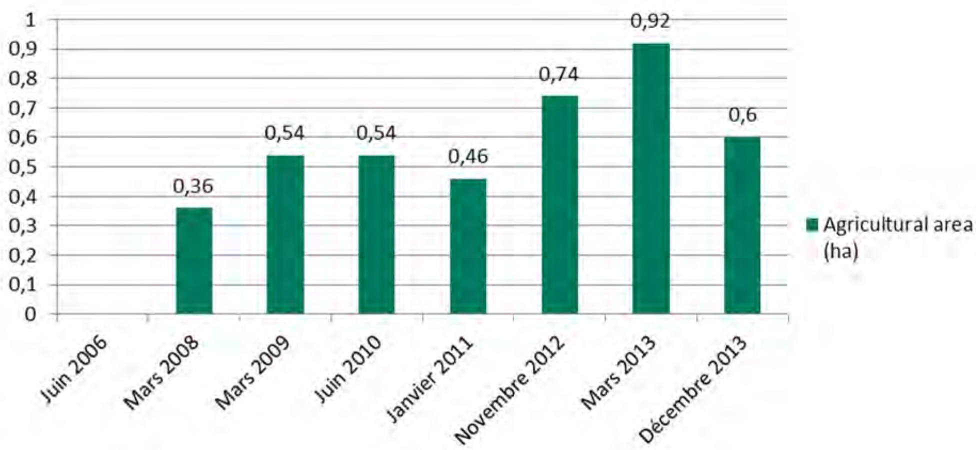
In the Project area, economic activities are mainly artisanal fishing, the tertiary sector and informal trade in particular. The few pockets where urban agriculture was still being carried out have practically disappeared over these past few years, specifically due to the pressure on land in the Rufisque area.

In the area where the Project is located, agricultural activities concerned mainly market gardening on a surface area of less than 1ha (see *Inset 5.2*).

Inset 5.2 *Market gardening activities in the installation area*

The northern section of the TNI is used for agricultural purposes (market gardening) over a variable surface area. A retrospective analysis of recent satellite images (June 2006 to December 2013) enabled evaluation of the surface area concerned by the market gardening activities at between about 0.3 and 0.9ha, depending on the years. No agricultural activity was visible before March 2008.

This development is shown in the figure below.



Most inhabitants work either in Rufisque town centre or in Dakar.

(1) National Agency for Statistics and Demographics

The extraction of sand and shells is also an activity that generates income for vulnerable populations, particularly on the beaches to the south-east of the Project area.

Industrial context

Many industries are present in the West Rufisque municipality. In addition to the power plant at Cap de Biches operated by SENELEC, the Socosim cement works and the Valda cosmetics / pharmaceuticals plant, lots of SMB are located in this area (Rufsac paper bag manufacturers, Cikatrans leather processing plant, Avisen poultry products, Shydrapa – cattle feed, Ghanisen – fish meal).

Employment

Table 5.16 below shows the distribution of the Senegalese population of working age, according to their occupation, for 2008. An analysis of this data shows that within this population, 45.1% of people are considered to be active and 54.9% to be inactive. Amongst the active population are 39.1% people in work and 6.0% unemployed. Pupils-students and housewives represent respectively 20.6% and 21.5% of the inactive population. The percentage of active population in work is around 56.0% for men compared with 23.1% for women, wherever they live. However, it is in the urban environment that most unemployed are found, around 7.7% compared with 4.7% in the rural environment.

A correlation is observed between the level of education and employment status. People who have studied in higher education represent 58% of the active population. People who did not go beyond primary education are more affected by professional inactivity, with this situation being less clear-cut in the rural environment (21.9%) than in the urban environment (28.7%). Disparities in the level of occupation are also observed between men and women, whether in the rural or urban environment, and whatever the level of education.

The data presented for an urban context is representative of the local situation in the Rufisque area.

Table 5.16 Distribution of the Senegalese population by occupation according to place of residence and gender (%)

Occupation	Urban			Rural			Together		
	Men	Women	Total	Men	Women	Total	Men	Women	Total
Worker	50.1	22.0	35.8	60.2	23.9	41.5	55.8	23.1	39.1
Unemployed	0.2	5.3	7.7	6.1	3.3	4.7	7.8	4.2	6.0
Active sub-total	**60.3**	**27.3**	**43.6**	**66.4**	**27.3**	**46.2**	**63.8**	**27.3**	**45.1**
Pupils / students	29.4	25.2	27.3	8.3	13.2	15.7	23.1	18.2	20.6
Housewives	0.0	38.8	19.6	0.0	44.3	22.8	0.0	42.0	21.5
Other	0.3	8.7	9.5	8.3	15.3	15.3	3.2	12.8	12.8
Inactive sub-total	**39.7**	**72.7**	**56.4**	**33.6**	**72.7**	**53.8**	**36.2**	**72.7**	**54.9**
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Sources: *ANSD: 2008*

Fishing

The municipality of West Rufisque is edged by a relatively big coastal strip which is the reason for the existence of traditional fishing districts. The sea is one of the municipality's main natural resources. Many of the inhabitants of the town of Rufisque and of the municipality of West Rufisque live from activities linked to fishing and fish processing (salting, smoking and drying, etc.).

There is a large fish quay in Rufisque located in the Municipality of East Rufisque and run by all the Town's stakeholders in fishing, organised in the economic interest grouping (EIG) ''Interprofessionnel Teung – Guedj de la pêche de Rufisque''. This EIG is responsible for managing the town's fish quay. Its management board is made up of fishermen, fishmongers and women working in fish processing.

At local level, the fishing areas are not located directly in the Project's study area, but much further out to sea.

According to a study dating from 2013 and carried out by the Institute of Environmental Sciences – ISE – in partnership with the USAID Com /Fish project, fishing activities in the Rufisque zone is tending to decrease, with fishermen heading more towards the areas Mbour, Joal, Gambia and Casamance. This observation was confirmed during the consultations.

The consultations confirmed that artisanal processing activities (drying in particular) take place on the beach, close to the power plant.

5.7.6 Social context

Schooling and access to education

In Senegal, according to UNICEF, school attendance rates are relatively low in nursery education (11% for boys and 12% for girls) and in secondary education (20% for boys and 16% for girls). In primary education, on the other hand, the rate is relatively high (75% on average).

There are four public primary schools in the municipality of West Rufisque, as well as a middle school (CEM) and two professional training centres. Near to the Project area there are also three private primary schools, a Koranic school (Darra) and a Franco-Arab school. *Table 5.17* below details the school establishments present in the study area.

In the field of education, the Municipality of West Rufisque has the following competencies:

- The building and equipment of elementary and nursery school, basic community schools and Franco-Arab schools
- Participation in the management and administration of nursery and elementary schools, daaras (Koranic schools, basic community schools and Franco-Arab schools
- The recruitment of educational and training staff for community nursery schools and basic education centres for illiterate young people and adults, as well as recruitment and responsibility for temporary staff in elementary and nursery schools, Franco-Arab schools and basic community schools
- Support for daaras
- Educational support
- The allocation and distribution of grants and school financial assistance
- Drafting and implementation of the municipal plan to combat illiteracy.

Table 5.17 School establishments located in proximity to the site

Name	Date of Creation	Type of construction	Number of teachers	Number of pupils			Level of equipment
				Total	Boys	Girls	
Public primary school	2001	Modern	06	380	193	185	-Electricity -Water -4 latrines
Maguette Ndoye private primary and secondary school	2005	Modern	14 women	420	210	150	-Electricity -Water -10 latrines
Koranic Daara El Hadji Ibrahima ciss	1974	Modern	2	30	30	0	None
Franco-Arab Daara	1999	Modern	2	100	40	60	-Electricity -Water -Computer

Source: *Data obtained from the consultation phase with stakeholders, 2014*

Sanitary context

There are three health stations in the Municipality of West Rufisque, for a population of over 50 000. The Maîmouna private clinic is also accessible but mainly frequented by wealthy families.
The Town of Rufisque has a hospital, several health stations and two health centres.

A study dating from 2005 states that 1.7% of children in the district suffered from severe malnutrition and 16.8% from moderate malnutrition.

In a more general context, malaria is the disease that most affects the communities located in the study area. According to the National Programme to Combat Malaria in Senegal, at national level it is the leading cause of morbidity and general mortality, particularly in children under 5 years old. Over 50% of the demand for health services year round in the country, is linked to malaria. According to health services questioned during consultations, other pathologies observed in the study area are linked to pulmonary problems and issues of hygiene and salubrity. These are diarrhoea and gastro-intestinal diseases.

The Regional Services for Statistics and Demography in Senegal indicate a prevalence rate of HIV/AIDS in Senegal of 0.7% (*EDS, 2005*).

Cultural and religious context

Islam is the main religion practised in the area (over 95% of inhabitants). Three mosques were observed in the Darou Salam Azur district. There are no other religious buildings for other religions located in the district.

In the north-west of the Project area, about 900m from the Project installation area, is located the Christian religious complex “Cité de la Paix”, which includes several religious buildings (charity home, church) in an area of about 10ha.

No cemetery or other holy site or sizeable cultural site where any specific practices, rites or statuses are carried out, was identified at the site where the future power plant is to be installed.

The closest cemetery is located on the coast in West Rufisque, at over 700m from the Project installation area.

Vulnerable groups

Vulnerability is linked to the resilience of an individual or group, i.e. his ability to deal with change whilst preserving his means of subsistence and social well-being. Resilience is often associated with the extent to which individuals have access to appropriate resources, such as equipment, social networks or any other means of potential subsistence to which they are tributary.

In the Project study area, the major categories of people who are considered to be vulnerable are:

- Women
- Old people
- Young people
- Marginal groups and ethnic minorities
- People who are disabled or suffering from chronic diseases.

Women are considered to be vulnerable because certain traditional practices tend to define their social status as being inferior to that of men, such as:

- The traditional structure of property inheritance
- Agricultural practices used: they work mainly on unpaid agricultural tasks whilst the men control commercial crop growing and agricultural income. Women use their production mainly for their own home requirements
- Decision-making at community level, in which they often play a limited role
- Social development in terms of literacy, level of education or general health conditions, to which women also have a low access rate.

Old people are generally considered to be vulnerable. They often depend on the younger generations to cover their elementary needs (housing, water, food). Old people normally prefer to keep their lifestyle and adapt less easily to change. Since they are not part of the active labour force, they are not generally in a position to benefit from the advantages usually associated with construction projects.

Young people (a group qualitatively defined according to their degree of independence in terms of their means of subsistence and their lifestyle) are considered to be vulnerable in view of the fact that they generally depend on their families and generally have difficulty getting started with an active life.

People with disabilities are generally considered to be vulnerable individuals in society and have less chance of benefitting from the Project's advantages. People living with HIV/AIDS and tuberculosis can also be considered to have disabilities since their ability to remain in good health and maintain their means of subsistence are often compromised by their illness.

According to the data in the Enquête de Suivi de la Pauvreté au Sénégal (ESPS II, 2010-2011), 46.7% of the Senegalese population lives below the poverty line (households that do not earn enough to cover the monthly expenditure required per person to buy the minimum food ration).

According to poverty indicators in households and individuals in the administrative circumscriptions in the Dakar region, in 2005 and 2006 Dakar was the region with the least poverty in Senegal (between 13.4% and 17%). In the Dakar region, the Pikine department had the lowest poverty rate (37.9 and 45.8%), followed by the department of Rufisque (between 33.2% and 40.6%).

According to the results of the study on the vulnerability of coastal communities and adaptation to climate change (*Institute of Environmental Sciences – ISE – in partnership with the USAID Com/Fish project, 2013*), the Rufisque/Bargny coastal community is extremely vulnerable on a socioeconomic level. Fishermen there earn on average less than 100 000 CFA francs per month. As for women working in fish processing, their monthly income is evaluated at less than 50 000 CFA francs on average.

5.7.7 Infrastructures and services

Road network

The transport sector plays a very important role in the Senegalese economy. According to a World Bank report on road transport (*Bertholet, 2004*), the road sector occupies an absolutely dominant position within the whole of the Senegalese transport sector for internal transport. Thus, road transport represents about 99% of internal passenger travel and 95% of goods transport.

AGEROUTE Senegal is an agency linked to the Ministry with responsibility for infrastructures which also deals, in general, with the implementation of all building, rehabilitation and road maintenance works, work on bridges and other structures as well as the management of the classified road network. This agency also works on the building, rehabilitation and maintenance of all the rest of the national network.

The Project area is located about 800m to the south of the N1 linking Dakar to the east of the country. This road is a major communication link for the region and is used to carry goods and people inland and into the sub-region. An asphalted road leads directly to the power plant from the N1.

Infrastructures and limitations encountered

Based on the information collected during the public consultations, the main limitations found in terms of infrastructures for the town of Rufisque are linked to:

- The evacuation and treatment of waste water
- Drainage of rain water
- The collection, transport and elimination of household waste
- The extension of spontaneous settlement areas (see Inset 5.3)
- Risks, nuisance and unpleasant odours from open channels.

Waste water treatment poses a problem in the Project area. The existence of open air rain water channels which cohabit with a network of waste water evacuation poses hygiene problems, particularly in the Guendel I, Léona, Cité Filaos, Thiokho and Diokoul districts.

In addition to the infrastructures presented in the chapter above (hospitals, schools, religious buildings, …), the Municipality of West Rufisque also has a bus station and a municipal abattoir.

Access to drinking water in the Project area and the town of Rufisque is guaranteed by the Société des Eaux (SDE).

There are some hotel complexes located in the Municipality of West Rufisque: the Kumba Lamba Complex, l'Auberge des Quatre Vents, l'auberge l'Oustal de l'Agenais and L'Oasis Camping du Désert.

Inset 5.3 Extension of spontaneous dwellings areas

The extension of areas of spontaneous dwellings is a phenomenon found across a very great majority of Senegalese land.
However, in the area close to the Project, urban expansion is limited by the following factors:
- to the north-west, the only houses are those of SENELEC employees; there is no plan to extend this company accommodation
- to the south-east (Darou Salam Azur district), the extension of settlements westwards is limited by the fences of the waste water treatment station (see map below).

Blue: area in which the new installations will be located
Orange: fenced limits of the WWTS

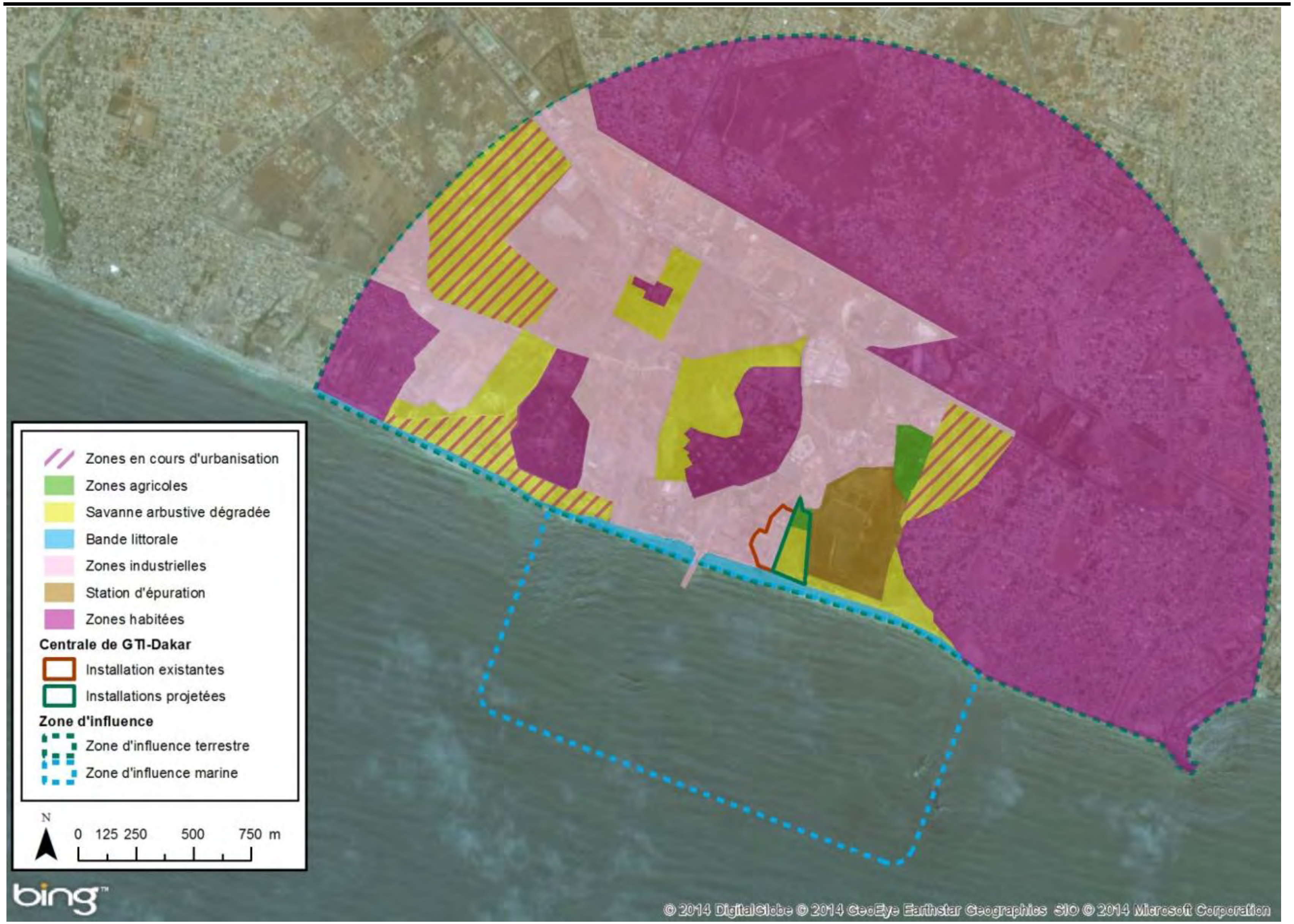
5.8 LAND USE

Figure 5.30 below presents a summary of land use, based on the information provided in previous sections. The surface areas and proportions of each type of usage are presented in *Table 5.18*.

Table 5.18 *Land use in the study area (2 km) – Surface areas*

Land use	Surface area	
	Ha	%
Agricultural areas	5	0.6%
Coastal strip	10	1.2%
Industrial areas	190	23.5%
Inhabited areas (including the SENELEC estate)	491	60.6%
Damaged bushy savannah	38	4.7%
Damaged bushy savannah currently subject to urbanisation	58	7.2%
Waste water treatment plant	18	2.2%
TOTAL	810	100.0%

Figure 5.30 Land use in the study area (2 km)



5.9 ECOSYSTEMS SERVICES

5.9.1 *Introduction*

This chapter presents the services rendered by ecosystems in the Project area. Services rendered by ecosystems are interactions between the natural environment and the human environment. Because of this, the chapter uses information from the initial state and the results of the various analyses presented in previous sections.

Inset 5.1 Definition and type of ecosystem services

Services rendered by ecosystems are the benefits that people draw from ecosystems. The Millennium Ecosystem Assessment[1] classified them into four main categories.

Supply services refers to the production, by ecosystems, of goods or products such as foodstuffs, wood, medicines, fibres and fresh water.

Regulation services refers to the natural processes that regulate an ecosystem such as climate, disease control, erosion, hydric flows and protection against natural hazards.

Cultural services refer to the provision, through ecosystems, of intangible benefits, such as recreational leisure activities, spiritual values or aesthetic pleasure.

Support services refers to natural processes such as the formation of soil, the nutritional cycle and primary production which act as support for other services rendered by ecosystems.

5.9.2 *Method*

The study of ecosystem services follows a preliminary identification exercise, the results of which are used to define the scope of the study and as a first stage in the ranking of services rendered by ecosystems within the study area. It is followed by an analysis of the baseline of services likely to be affected within the area, notably the importance of these services for beneficiaries and the availability of sustainable, accessible modifications. Results of the baseline analysis are then used to provide a definitive list of priority ecosystem services.

The study of ecosystem services is interconnected with several subjects contained in other chapters of the ESIA, notably those listed below:

- Geology and soils
- Water quality
- Biodiversity
- Cultural heritage
- Landscape
- Land use and means of subsistence
- Health of population

[1] Millennium Ecosystem Assessment, available from: www.maweb.org/en/index.aspx

5.9.3 *Study area*

The study area for services rendered by ecosystems takes the following factors into account:

- The area of potential influence of the proposed installation in terms of the availability and functionality of services rendered by ecosystems
- The probable distance that people are willing to travel on a regular basis to use natural resources
- The actual distribution of resources
- Current and potential usage of resources by the populations concerned

This analysis was carried out in the biological environment study area, that is the Projection installation area (5.5ha) and the zone of direct influence of the works, i.e. within a radius of 500m around the site.

5.9.4 *Preliminary identification*

Table 5.1 presents the results of a preliminary identification exercise. This was used to define a preliminary list of services rendered by ecosystems in the study area.

The World Resources Institute lists the five main direct factors on changes to ecosystems:

- local usages of land and plant cover
- exploitation and consumption of resources
- pollution
- introduction of invasive species
- climate change

In addition, indirect factors in changes to ecosystems can include demographic, economic, sociopolitical and religious or even scientific and technological factors, giving rise to changes in the consumption of resources.

Table 5.12 Preliminary identification of services study

Service category	Service	Resource
Supply	Foodstuffs: crop growing and fruit trees	Market gardening, jujube, lemon, annona, eucalyptus and prosopis.
Supply	Foodstuffs : fish and fishing activities : (fishing and processing)	Fish and shellfish
Supply	Extraction of sand and shells	Sand and shells

Service category	Service	Resource
Cultural	Value of the existence of biodiversity	Species recognised as having a medium to high conservation value At national level (protected and partially protected species)
Cultural	Aesthetic value	Landscape
Regulation	Erosion control	Cactus plants: *Tamarix indica*, *Eucalyptus alba*, *Accacia nilotica*, *Casuarina equisetifolia* and halophile formations *Salsola sp* and *Salicornia sp*.

6 DESCRIPTION AND ANALYSES OF PROJECT ALTERNATIVES

6.1 INTRODUCTION

The analysis of Project alternatives was carried out with account taken of the project's most essential components, that is

- The possibilities for total rehabilitation of the existing power plant
- The location of the power plant
- Technological choices for electricity production.

Before the analysis of the alternatives of each component, the "no project" option was the analysis of a separate analysis.

6.2 "NO PROJECT" OPTION

As stated in *Chapter 3* containing the project description, the current Senegalese energy context requires an increase in electricity production in order to secure the country's supply, thus guaranteeing the population better access to energy and encouraging economic development.

Social

From an economic and social point of view, the "no project" option is part of Senegal's current energy situation, characterised by the frequent cutting off of supply. On the other hand, the installation of the ContourGlobal - Cap des Biches thermal power plant will result, in the short term, in an increase in the region's electricity production capacity. Similarly, the Project may represent opportunities for local jobs and economic development.

Environmental

From an environmental point of view, the "no Project" option does not, by definition, represent any quantifiable change to current physical and biological characteristics. The non-increase in electricity production capacity could, however, lead to increased pressure on natural resources (particularly forestry) by populations with only limited access to this energy source (or even with no access at all) across the whole of the Senegalese territory with an electricity network.

The aim of this study is, in any case, to show that no notable modification will be made to the environmental features of the study zone.

6.3 *POSSIBILITIES OF TOTAL REHABILITATION OF THE EXISTING POWER PLANT*

As stated in *Section 3.1.3*, the existing power plant was shut down completely in July 2013, with any re-start being subject to total rehabilitation of existing installations.

The existing power plant was one of Senegal's most expensive power plants, due to the fact that it operated on diesel (which is more expensive than heavy fuel oil). The cost of rehabilitation would have amplified this price gap still further, resulting in a generalised increase in the cost of electricity.

This option was discussed between ContourGlobal - Cap des Biches and SENELEC, and was dismissed by mutual agreement, in view of the budgetary consequences associated with rehabilitation.

The only possible option was therefore to create a new power plant, operating more economically (heavy fuel oil), re-using as much current auxiliary equipment as possible (storage tanks, electricity transformer, etc.).

6.4 *LOCATION OF THE POWER PLANT*

The decision to create a new power plant re-using some of the existing equipment played a large part in the choice of the installation site.

The other criteria justifying this location are as follows:

- Land located within an area that is already highly industrialised, where non-industrial human activities are very limited.
- Presence of other thermal power plants already connected to the Senegalese electricity transport network. Since electricity transport lines are already scaled for the former power plant (of equivalent power) no modification of the electricity network is required.
- Proximity to the SAR refinery, thus simplifying fuel supplies. These supplies could be made simpler still if SAR creates a heavy fuel oil supply pipe (see Chapter 3).

6.5 *TECHNOLOGICAL CHOICES*

Technological choices made by ContourGlobal - Cap des Biches in the definition of the industrial process for the power plant's future configuration, concerned the following topics:

- Choice of fuel
- Choice of supply
- Choice of process.

Since the choice of fuel is linked to supply facilities, these two issues are considered together.

Choice of fuel and supply

Several fuels could have been used for this power plant project: heavy fuel oil, diesel (light fuel oil), coal and gas.

From and environmental and health point of view, coal was the least good solution due to atmospheric emissions (mainly SO_2) which are potentially not acceptable under Senegalese standards and international good practice. The power plant would therefore have had to be fitted with expensive equipment to treat atmospheric emissions. Conversely, natural gas was the best solution in terms of emissions, although the risk associated with its usage is potentially high.

From an economic point of view, heavy fuel oil and coal were the most profitable solution in the absolute, permitting energy production at the lowest cost possible. However a coal fired power plant requires additional investments, both in terms of equipment (to limit the classic negative effects of coal fired power plants) and in terms of controlling supply (the lack of coal resources in Senegal would involve massive imports of coal from the international market). Moreover, choosing coal would have required the installation of an unloading and storage area, thus significantly increasing the total surface area of the power plant.

The use of diesel was too expensive, and this option was quickly dismissed during initial discussions with SENELEC on the possibilities of rehabilitating the existing power plant.

The main benefits and disadvantages are detailed in the table below. It would thus appear that as things stand in terms of the possibilities open to ContourGlobal - Cap des Biches, the choice of a power plant running on heavy fuel oil is the best technological choice.

Note that the engines that will be installed will be convertible to natural gas, in case this energy source were to become available in Senegal.

Table 6.1 Benefits/disadvantages of the main fuels

Fuels	Environment /health	Economy / cost-effectiveness	Supply
Heavy fuel oil	2	1	2
Diesel	2	3	2
Coal	3	1	2
Natural gas	1	1	3

Scale from "1 – the most advantageous solution" to "3 – the most unfavourable solution"

Choice of process

The choice of process was mainly conditioned by the choice of fuel. The use of combustion engines was motivated by the use of heavy fuel oil. It was also the easiest and quickest technological choice to be implemented, optimising the Project's timetable.

The decision to install a Flexicycle too, associated with the combustion engines, was discussed with SENELEC. This choice, although it entails a substantial additional investment when the power plant is built, will result in savings of 6 to 7% in the cost of fuel, by recuperating heat generated by burning in the combustion engines. The additional amount of water consumed is very small compared to the increase in energy yield. This is therefore an improvement in both environmental and economic terms, reducing in the end the cost of kWh production by 3.7 CFA francs (taking account of the amortisation of the initial investment linked to the Flexicycle throughout the duration of the Project). This information is included in the table below.

Table 6.2 Economic comparison of the process with and without combined cycle

Characteristics	Without Flexicycle	Flexicycle
Installed power (MW)	49.5	53
Total cost of the Project (millions of Euros)	72.4	87.2
Cost of fuel (Euro/MWh)	120.9	112.8
Total cost of energy produced (CFAF/kWh)	103.2	99.5

Source: *ContourGlobal - Cap des Biches, 2014*

HFO supply by trucks or pipeline

As part of the Project design, ContourGlobal studied 2 options possibility for HFO supply: trucks or pipeline.

HFO supply by trucks is advantageous regarding the investment, as the unloading area is reused. However, this option will include an increase of road traffic that could induce higher risk regarding traffic safety.

HFO supply by pipeline requires the building of new equipment from SAR facility to the Project site, but present the advantage to limit the risk on traffic safety and to ensure a more stable HFO supply. Based on these considerations, supply by pipeline is considered as the best option. Even if the detailed characteristics of the pipeline are not known at time of undertaking this ESIA, it is possible to notice that:
It will be a short length pipeline (about 500 m), leaving from SAR existing pipeline and arriving to the Project site by going through Cap des Biches industrial area.

The pipeline will not go through residential areas; the building will not induce any resettlement.

- The pipeline will be maintained to ensure its integrity and tightness.

- As part of its in emergency response plan, ContourGlobal will develop procedures to respond to any incident involving the pipeline (hydrocarbon leak, fire, etc).

6.6 JUSTIFICATION FOR THE CHOICE OF THE PREFERRED VARIANT

The following criteria have been considered in the *Table 6.3*, in order to identify the preferred alternative for the Project:

- Feasibility:

1 when options are impossible to implement in the current state
2 for difficult solutions to implement
3 for solutions easy to implement

- Environmental aspects:
  - 1 for solutions that can lead to major environmental issues
  - 2 for solutions that can induce medium environmental issues

3 for solutions with low environmental implications

- Economics:

1 for solutions with significant economic implications
2 for solutions with average economic implications
3 for solutions with low economic implications

Table 6.3 Alternatives analysis summary

Critères	Option « without project »	Refurbishment	New power plant			
			LFO	HFO	Coal	Natural gas
Feasibility	2 The project without option induce the dismantling of facilities that would be the responsibility of SENELEC	2 Complicated technical feasibility, due to the significant decay of the old plant.	3 Technically feasible solution	3 Technicall y feasible solution	2 Solution requiring major port infrastructure, as well as high capacity storage	1 Natural gas is currently not available for the Project.
Environmental	2 Stopping production induce the perpetuation of containerized groups whose the impact on air quality is important	2 The existing plant induced significant withdrawals and discharges into the marine environment.	2 No release of SO_2.	1 Release of SO_2	1 Ash management	3 Best environmental alternative
Economic	1 The dismantling costs would not be offset by the profits from the power production and would be SENELEC's responsibility. The total cost may be even more important because power production using containerized groups is more expensive compared to other technologies.	1 The rehabilitation will be very expensive, and not compatible with the electricity feed-in tariff in Senegal.	1 LFO cost not compatible with the electricity feed-in tariff in Senegal	3 HFO cost compatibl e with the electricity feed-in tariff in Senegal	3 Coal cost compatible with the electricity feed-in tariff in Senegal	3 Gas cost compatible with the electricity feed-in tariff in Senegal
TOTAL	**5**	**5**	**6**	**7**	**6**	**7**

Thus, the creation of a new plant appears to be the best available option for the Project. In addition, two types of fuel get a better rating than the others: HFO and natural gas. Natural gas is the best environmental and economic compromise, but is however not available in the state for use in the Project.

In view of these various elements, the decision to establish a thermal power running with HFO, convertible to natural gas (when this fuel will be available to the plant) and associated with a combined cycle represents the best compromise in terms of social, environmental and economic (cost-effectiveness and cost of energy production) criteria.

7 STAKEHOLDER CONSULTATION

7.1 GENERAL METHODOLOGY AND TIMETABLE

As required by Senegalese regulations and by World Bank Group's sustainable development and social policies, performance of this ESIA has been based on consultations with all stakeholders affected by the Project. As shown in *Inset 7.1* below, listing requirements in terms of consultation as set forth by World Bank Group policies, the extent of this involvement must be proportional to the magnitude of impacts on communities affected.

Inset 7.1 Main requirements in the consultation process

The process used in consultation and information activities throughout the ESIA is recapitulated below:

1. Identify a sufficiently large sample of stakeholders in order to meet consultation objectives and record them in a stakeholder database. This sample is chosen such that it guaranteed representative involvement by the various types of stakeholders.

2. Prepare information carriers for the consultations, including notably data relating to the Project and contacts in the form of group meetings or interviews to meet specific, set objectives.

3. Prepare and carry out stakeholder consultation sessions, ensuring that the protocol is respected and that the consultation format (group meetings/interviews) is adapted to each specific group of stakeholders.

4. Record the consultation process, ensuring that stakeholder concerns appear in reports produced to then be the object of research or studies and showing how they have been taken into account in the Project decision and design.

5. Ensure that all information to be communicated is passed on sufficiently well in advance for it to be taken into account prior to the consultation and that it is accessible and relevant and can be understood (for example, non-technical summaries, relevant language and illustrations, etc.).

Within the context of the project to build the power plant, stakeholder participation and consultation took the form of information meetings and discussions with national and regional technical services, local elected representatives and members of local associations, as well as with communities neighbouring the ContourGlobal - Cap des Biches power plant development project, located in the municipality of West Rufisque.

The consultation was carried out at three different levels: local level, which involved mainly the villages and rural communities potentially concerned by the Project, whilst consultations at regional and national level were used to consult with the regional offices and national institutions concerned.

A consultation campaign took place between 25th and 27th June 2014, and another was held in October:

- The first was carried out during the preliminary organisation visit in June 2014. Its aim was to introduce the Project to some key stakeholders and to obtain their opinions with regard to the power plant development project.

- The second was organised in October 2014. Its aim was to inform stakeholders with regard to the scope of application of the study and of the proposed Project and to gain a better understanding of their questions and expectations in terms of the project.

The following stakeholders were consulted over the course of the two campaigns:

- National Senegalese authorities and institutions:
  - Environment and Classified Installations Office (DEEC)
  - The Environmental Impact Evaluations Office (DEIE) at the DEEC
  - The Classified Installations Division (DIC) at the DEEC
  - SENELEC.

- Regional Senegalese authorities:
  - Rufisque Prefecture
  - Departmental Office for Rural Development in Rufisque.

- Service in the Municipality of Rufisque
  - Rufisque fire service

- Local communities – Municipality of Rufisque-Ouest:
  - Rufisque town hall
  - Members of technical services
  - Darou-Salam Azure district, Rufisque

- Local communities – Villages in West Rufisque:
  - Consultation with fishermen
  - Consultation with village elders and chiefs
  - Directors of private and public schools
  - Consultation with women's groups
  - Consultation with users (swimmers, sportspeople, etc.)
  - Consultation with shell gatherers/users.

The list of the consulted persons is detailed in *Annex 9*.

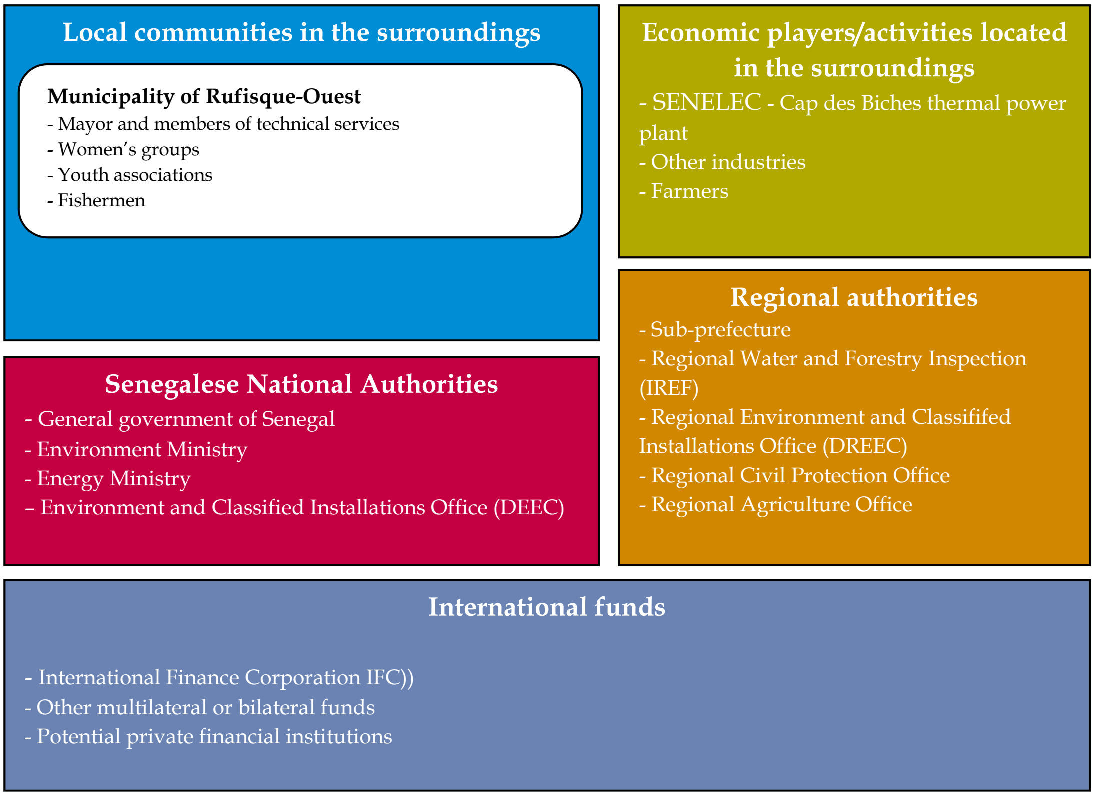
Figure 7.1 ***Photographs illustrating the public consultations held for the ESIA***

Top left: Consultation with elected representatives in the Municipality of West Rufisque. Top right: Focus group with fishermen. Bottom left: Focus group with the Association for Environmental Protection and Prevention. Bottom right: Focus group with shell gatherers/users.

7.2 *MAIN STAKEHOLDERS IN THE PROJECT*

Figure 7.2 presents the main stakeholders in proximity to the Project and other institutional or financial stakeholders with jurisdiction.

Figure 7.2 Main stakeholders in the Project



The Municipality of Rufisque-Ouest is the closest community to the Project (about 400m distance). Its inhabitants therefore represent the most important group of stakeholders, both in terms of interest in and influence on the Project. Meetings were therefore mainly concentrated on these communities.

7.3 CONSULTATION PROCEDURE

All the groups of villagers and services referred to in the table above were consulted separately. The various interviews took place as follows:

- presentation of the plan to extend the Cap des Biches thermal power plant and the challenges involved
- aims of the ESIA and the need to imply the public and local interested parties actively in the evaluation process
- collection of the questions, opinions and concerns raised by the people questioned
- answers by consultants from 2iEC and ERM in response to questions raised.

Consultations with local communities took place in the form of interviews with villagers and use of the "focus group" method, i.e. grouping the population by professional activity, centre of interest or age bracket.

7.4 *CONSULTATION WITH SENEGALESE AUTHORITIES*

Consultation with the Classified Installations Division (DIC) at the Environment and Classified Installations Office (DEEC)

Reminder by the Head of the DIC that the ICPE is distinct from that of the impact study (but complementary to it) and that the two can be launched in parallel.

It was thus recommended that ContourGlobal - Cap des Biches should submit an ICPE transmission file as soon as possible, in parallel to the ESIA, and including the following:

- Presentation of the Project
- Map of the location
- List of pressurised equipment.

Finally, the possibility of organising a visit to the power plant was addressed.

Consultation with the Environmental Impact Evaluation Office (DEIE) at the Classified Installations Division of the Environment and Classified Installations Office (DEEC)

After presentation of the planned Project and the current context of ContourGlobal - Cap des Biches installation, the Head of the DEIE agreed that the request for an audit set forth in the letter responding to the Project notice (letter n° 001607 MEDD/DEEC/DEIE/rd dated 19th June 2014) was not justified.

He also stated the need to undertake an in-depth impact study.

In order to optimise the timetable, it was agreed that ContourGlobal - Cap des Biches/ERM/2iEC would draw up a proposed report. After publication of this report by the DEEC, a new Project notice, accompanied by Terms of Reference, can be submitted.

Consultation with Rufisque Prefecture

Courtesy visit with information on the project. The Prefect offered his support for the Project, and hoped that the ESIA would be carried out with account taken of possible nuisance caused to populations, in order to avoid/suppress them.

Consultation with the Rufisque Rural Development Office

Courtesy visit intended to inform the Departmental Office of ContourGlobal - Cap des Biches's Project and the acquisition/compensation process with regard to the land where the new installations will be located.

The Head of the departmental office saluted this initiative.

Consultation with the Mayor of Rufisque

Information session held at Rufisque Town Hall with the DAGE and the Deputy Director of Town Planning. The Town of Rufisque, which is already involved in the procedure for acquisition of the land on which the extension project will be built, also made a commitment to facilitate implementation of the project. ContourGlobal - Cap des Biches was thus advised to proceed rapidly with payment of disbursements, in order to finalise acquisition of the land. ContourGlobal - Cap des Biches pointed out that the farmer had been authorised to continue farming until the start of the works.

The DAGE reminded the meeting that Contour Global – Cap des Biches was the third largest tax payer in the town of Rufisque (over 500 000 00 CFA francs per year).

Finally, the technical services in charge of planning committed to supervise the development of future urbanised areas in the Cap des Biches area closely, in order to ensure compliance with the exclusion area, which will be defined based on the conclusions of the hazard level study.

In terms of recommendations, the involvement and information of elected representatives in implementation of the Project was suggested.

Consultation in the Darou-Salam Azur district

Visit to provide information on the Project and the on-going ESIA procedure.

The District Head welcomed the project and wished to see some of the district's young people employed during certain phases of the Project (at least during the worksite phase). It was pointed out that priority will be given to local people wherever profiles correspond to the skills sought.

The District Head also said that the existing SENELEC power plants are already noisy and he hoped that the building of new installations would not constitute a new source of noise pollution for the inhabitants of Darou- Salam Azur.

It is important to note that the Darou Salam Azur district did much to facilitate the integration and work of the staff responsible for carrying out these consultations. This first characterisation enabled identification of the environmental and social issues linked to implementation of the project.

7.4.2 *Consultation with the Rufisque fire service*

The Rufisque fire service possesses equipment that is considered sufficient to combat any fires or accidents that may occur at Cap des Biches.

However, it will be necessary to organise regular training sessions at the power plant, to ensure:

- That ContourGlobal - Cap des Biches staff are trained in emergency procedures (in order to optimise intervention by emergency teams), and
- That the firemen are familiar with the terrain and with risk installations (in order to optimise the efficiency of their intervention).

7.4.3 *Consultation with local populations and stakeholders*

With regard to the project's impact, interviews were held with various stakeholders (district delegates, the directors of public and private, Arabic and French schools and focus groups were held with women's groups, fishermen, swimmers, sportspeople, and Environment Commission APROPRE and gatherers/users of shells.

Within the project impact zone, delegates and elders showed their willingness to work with the project.

In relation to the concerns expressed by villagers and local stakeholders met during the two consultation phases (June and October), preliminary suggestions and recommendations were expressed:

- Use of appropriate technology that takes account of the health and well-being of populations.

- Use of another form of fuel drainage, taking account of the marine ecosystem and of users working around this resource: fishermen, various users, etc.

- When new installations are created at the power plant, it would be a good idea to take account of the health of pupils in particular and of populations in general, using techniques that reduce emissions.

- Encourage as far as possible the recruitment of young people from the district and more particularly during the construction phase (which potentially corresponds to skills present at the site).

7.5 MAIN CONCLUSIONS OF THE PUBLIC CONSULTATION PROCEDURE

In a general way the Project was well received by the various people met during the consultations. Involvement, right from the very start of the process, of elected representatives and the local population, was well appreciated by all stakeholders met.

All the stakeholders consulted agree on the relevance of the project which, they believe, is a priority for the country in terms of improvement to energy production capacities and they also agreed on the fact that there will be lots of positive impacts on the town of Rufisque.

Local elected representatives recognised the fact that the shutdown of the current ContourGlobal - Cap des Biches power plant had had negative impacts on Rufisque (loss of municipal income and loss of jobs), and they made a commitment to work with the project.

At local level (Sub-Prefecture, Municipality and residents) the main concerns and expectations with regard to the studies to be carried out concerned the health impacts linked to operation of the power plant (particularly atmospheric emissions and noise pollution and impacts on the marine environment). In terms of access to jobs, expectations in terms of local employment (particularly amongst young people) were expressed.

To this end the Municipality has an Environment Commission, a "Coastline" Commission and a Social Commission which could be approached by ContourGlobal - Cap des Biches, if necessary.

Table 7.1 below presents the concerns expressed by the stakeholders as well as the suggestions and recommendations made during the consultations. Note that these remarks do not specifically concern the Project, but all industrial activities (and mainly electricity production) in the Cap des Biches area.

Table 7.1 Points raised by villagers and local stakeholders in proximity to the thermal power plant

Topics raised	Observations made	Inclusion of observations made as part of the study
Classified installations	The Classified Installations Office drew attention to the fact that the ICPE procedure is separate from that of the environmental and social impact study (but complementary to it). Both procedures can be undertaken in parallel.	The need to start a procedure of authorization ICPE was added to the ESMP, as requied by reommendations..

Topics raised	Observations made	Inclusion of observations made as part of the study
	ContourGlobal - Cap des Biches was therefore recommended to submit an ICPE transmission file as soon as possible. The Head of the DEIE agreed that the request for an audit expressed in the letter in response to the Project notice (letter n° 001607 MEDD/DEEC/DEIE/rd dated 19th June 2014) was not justified. He also stated the need to carry out an in-depth impact study. ContourGlobal - Cap des Biches/ERM/2iEC has drafted a proposed report, which will be published by the DEEC after a new Project notice accompanied by Terms of Reference.	
Impacts on populations	The Prefect of Rufisque gave a favourable opinion with regard to the project. However, he insisted on the fact that particular attention must be given to avoiding and/or attenuating potential nuisances for populations. Local elected representatives expressed the wish that the Project wold help to improve living conditions for populations, by offering family grants underprivileged and poor populations. The Head of Darou-Salam Azur district expressed his wish to see local young people from the district employed on certain phases of the Project (worksite phase). Villagers and local stakeholders expressed the wish to see the Project encouraging access to recruitment for young people from the district.	These recommendations have been considered through the definition of the ESIA methodology, particularly by always considering the inhabited areas as sensitive receptors. Attention was given to the most sensitive receptors (schools and health center). The results of technical studies (particularly air and noise) and the absence of significant impact also confirms that the Project design has been optimized in order to the nuisances to populations. Finally, concerning the other complaints issued, they will be part of the social responsibility policy that will be developed by ContourGlobal - Cap des Biches.
Impact on noise	The Head of Darou-Salam Azur district pointed out that existing SENELEC power plants are already noisy, and he hoped that the building of new installations would not constitute an additional source of noise pollution for the inhabitants of Darou- Salam Azur. Villagers and local stakeholders said that noise pollution is heard in the district, sometimes very loudly, due to existing installations that are currently in operation.	A specific noise modeling study was undertaken. Mitigation measures related to noise emissions were defined at Project design, in order to minimize these emissions.
Impact on Environment	Local elected representatives expressed their wish to see fishermen involved in and informed about the project. They also suggested that analyses of discharge should be carried out on a regular basis.	The fishermen were consulted specifically (« focus group ». Also, liquid discharge analyses are planned as part of the ESMP. In addition, interactions between the future thermal plant and the marine

Topics raised	Observations made	Inclusion of observations made as part of the study
	Villagers and local stakeholders noted marine pollution from fuel oil being discharged into the sea, leaving the beach dirty.	environment were imporved compared to previous configuration : - End of seawater sampling - Decrease of liquid discharges - Improvement of monitoring of the quality of liquid discharges •
Acquisition and Expropriation	The Departmental Office for the Rural Development of Rufisque saluted the particular attention paid by ContourGlobal - Cap des Biches to anticipate the acquisition/compensation process with regard to the land on which the new installations will be located. The Rufisque Town Hall advised ContourGlobal - Cap des Biches to proceed rapidly with the payment of disbursements, in order to finalise acquisition of the land.	The payment of disbursements was undertaken in conformity with Rufisque authorities advices.
Land use	The technical services in charge of planning committed to supervise the development of future urbanised area close to the Cap des Biches area strictly, in order to ensure compliance with the exclusion zone that will be defined based on the consultations of the hazard level study.	The hazard study allowed to define an exclusion zone on the basis of potential hazards associated with the plant operations. ContourGlobal-Cap des Biches will be in relation with the technical services, as part of the supervision of urbanism in the proimity of the plant.
Risk	The firemen from Rufisque requested that personnel from ContourGlobal-Cap des Biches be trained for risks associated with the operation of the plant, and that regular exercices should be performed. The Rufisque fire service required the organization of regular training sessions at the power plant.	Trainings and practices will be undertaken. Note that these were already in place as part of the operations of the former plant. In addition, a POI will be undertaken, in collaboration with the firemen and Civil Protection services.
Impact on air quality	Villagers and local stakeholders referred to atmospheric pollution from smoke dispersal.	Project impact on the air quality was studied through modeling. Modeling results do not show any significant impact from the Project on air quality.
Other impacts, not directly linked to the Project development	The presence of the WWTP alongside dwellings which emits bad odours, and the high voltage cables above dwellings.	This observation is not related to the Project, and thus was not taken into account in this study.

8 IDENTIFICATION AND EVALUATION OF POTENTIAL IMPACTS LINKED TO THE PROJECT

8.1 INTRODUCTION

Potential impacts will be linked to the various phases of the Project:

- Construction phase of the Project and the buildings and installations associated with it;
- Operation of the combined cycle thermal power plant, comprising three 16.5MW diesel engines associated with a heat recovery boiler operating a 3.5MW steam turbine (total power of the plant: 53MW); and
- Dismantling of the power plant, shut down and restoration of the site.

The main stages used to define the Project's impact and developed in chapter are summarised below:

- identification of activities relating to the Project and likely to cause environmental or social impacts
- identification of the sensitivity of environmental and social receptors likely to be affected by the Project
- detailed description of the potential environmental or social impacts identified, including identification of the proposed measures to control and mitigate impacts (control and mitigation measures are incorporated into the evaluation)
- Definition of the extent of potential residual environmental or social impacts resulting from implementation of the proposed mitigation measures.

8.2 IDENTIFICATION OF POTENTIAL IMPACTS LINKED TO THE PROJECT

An initial identification of potential impacts linked to the Project was carried out based on the description of the Project presented in *Chapter 3*, and based on the environmental issues identified within the context of analysis of the baseline of the site (see *Chapter 44*). *Table 8.1* below presents a recap of the issues identified.

Table 8.1 Main environmental and social issues identified

Topic	Comments	Environmental or social issues
Air quality	Non-deteriorated atmospheric basin, (no air quality standards exceeded on observation of the results of modelling the baseline conditions of air quality) (see *Section 8.5*).	Low to medium
Noise	Particularly high noise level at night measured during analysis of the baseline conditions (readings higher than Senegalese standards).	Low to medium
Groundwater	Aquifer not very deep but of mediocre quality. Relatively impermeable limestone-marl soils.	Low to medium
Surface water	No water course in the Project's zone of influence.	Nil
Soil erosion	Flat area.	Very low
Biodiversity (terrestrial habitats, fauna and flora)	Peri-urban, industrialised, highly anthropised environment. One partially protected plant species. One protected but not vulnerable animal species.	Low
Landscape	Flat, relatively monotonous landscape. Industrial area.	Low
Land use	Limited presence of agricultural activities in the installation area (1 unit). Acquisition of the parcel concerned and compensation already paid to beneficiaries by SENELEC.	Low to medium
Local agriculture and means of subsistence	Extended study area highly urbanised and industrial. Some parcels occupied by market gardening but decreasing rapidly due to urbanisation and industrialisation of the area. Activities linked to artisanal fishing (drying) and the collection of shells on the beach adjacent to the installation parcel – no direct impact by the project. Small informal shops.	Low to medium
Local economic & social context	Industrial area at the edge of an urban area (town of Rufisque) with a very high unemployment rate.	Low

Table 8.2 is a matrix for identifying impacts for the Project's ESIA. This matrix presents relationships between potential sources of environmental and social impacts caused by the Project, and the environmental and social elements likely to be affected by the Project, on the basis of information collected within the context of study of the baseline and the framework

mission. Areas where component sources coincide are dealt with in more detail in the following section.

Table 8.2 Matrix for identifying the potential impacts of the ContourGlobal - Cap des Biches thermal power plant

Factors within the milieu →		Environmental factors (physical and biologic)						Social factors				
Sources of impact ↓		Air quality	Noise	Water quality and resource	Soils	Biodiversity (terrestrial habitats, fauna and flora)	Landscape	Land use	Local agriculture and means of subsistence	Local economic and social context	Health and safety of communities and workers	Waste production
Construction	Change in land use			QE-1	QS-1	BFF-1		OF-1	A-1			
	Site machinery	QA-1	B-1								SS-1	D-1
	Building	QA-1	B-1	QE-2		BFF-2						
	Storage of chemicals			QE-3	QS-2						SS-2	
	Labour force			QE-2						ES-1		
Operation	Presence of the power plant						P-1					
	Supplies (water, heavy fuel oil, etc.)	QA-2		QE-4							SS-3	D-2
	Electricity production	QA-3	B-2	QE-5		BFF-2						
	Labour force			QE-2						ES-2		
	Storage of chemicals			QE-3	QS-2						SS-2	
	Run-off from the site			QE-5								

Key to understanding the identification matrix:

QA-1	Exhaust emissions and dust from site machinery – Dust emissions
QA-2	Exhaust emissions and dust from deliveries by truck
QA-3	Atmospheric emissions
B-1	Noise emissions from the worksite
B-2	Noise from the power plant in operation
QE-1	Complete clearance of soils which could lead to changes to run-off
QE-2	Increase in water consumption
QE-3	Pollution of surface water and groundwater due to the storage of chemicals
QE-4	Power plant's water requirements
QE-5	Liquid discharge from the operational phase
QS-1	Complete clearance of soils which could lead to changes in erosion
QS-2	Risk of soil contamination
BFF-1	Destruction of the habitats, flora and fauna found within the perimeter of the Project
BFF-2	Disturbance of fauna
P-1	Effect on the landscape of the power plant's buildings
OF-1	Modification of land use
A-1	Loss of agricultural land
ES-1	Effect on local employment
ES-2	Effect on local employment
SS-1	Workers' working conditions and risks for populations caused by the worksite
SS-2	Health impact linked to the storage and use of chemicals
SS-3	Safety of populations related to the increase in road traffic
D-1	Production of waste during the construction phase
D-2	Production of waste during the operational phase

8.3 METHOD USED TO EVALUATE IMPACTS

A preliminary identification of potential impacts linked to the Project was carried out based on the description of the Project provided by the client, referred to in the previous section.

A detailed evaluation of impacts was then carried out, looking one by one at the potential impacts identified during the framing phase in the field.

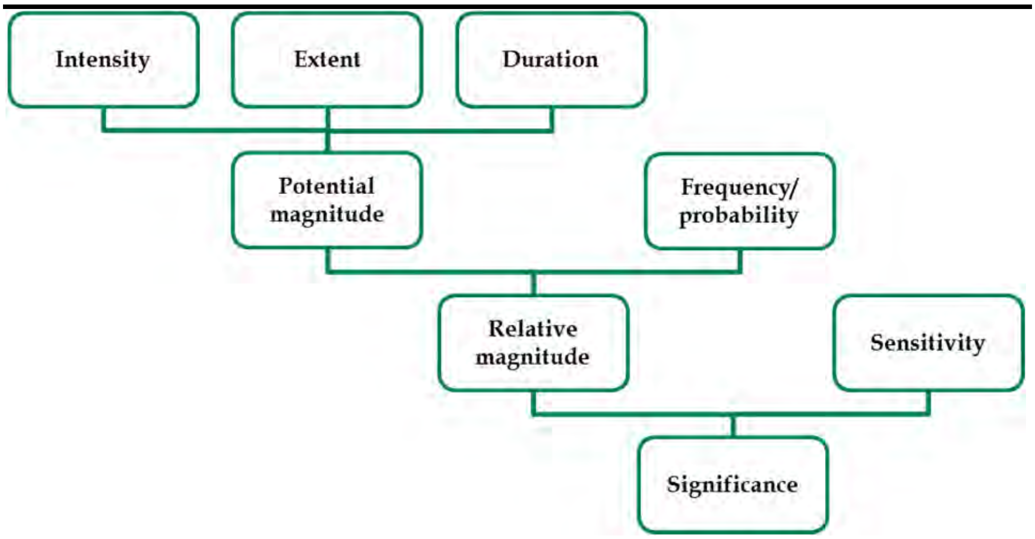
Potential impacts may be direct, indirect or caused, according to the Project's various phases of creation and operation. These terms are defined in *Table 8.3*.

Table 8.3 Definition of types of impacts

Type of impact	Definition
Direct	Impact that results from direct interaction between the project and a receptor / resource
Indirect	Impact that comes from direct interactions between the project and its environment following subsequent interactions within the environment.
Caused	Impact resulting from other activities (which are not part of the project) and which occur as a consequence of the project.

The importance of the Project's potential impacts is defined by evaluating the magnitude of an impact and comparing it to the characteristics of the milieu and its sensitivity to the expected changes. This approach is presented in *Figure 8.1*.

Figure 8.1 Method used to analyse impacts



Potential magnitude

The potential magnitude of an impact is a function of the extent, duration and intensity of the impact

- Extent:
  - local (limited to the site and its immediate surroundings)
  - regional (impacts that affect resources at regional level) or
  - national/international (impacts that affect resources of national importance or resources at national / international level).

- Duration of the potential impact:
  - Temporary (potential impacts lasting between a few hours and a few days)
  - Short term (potential impacts lasting between a few days and a few weeks)
  - Medium term (potential impacts lasting between a few weeks and a few months) or
  - long term (potential impacts lasting for a few years at least).

- Intensity:
  - Negligible (no perceptible change)
  - Low (perceptible change but no significant change to the environment or to human activities)
  - Moderate (perceptible change but the environment or human activities will not suffer from it in the long term)
  - High (the environment or human activity is affected in the medium or long term).
  - It should be noted that intensity is not necessarily a given fact and may depend on the receptor. In this case it is defined specifically in terms of the receptor using detailed criteria.

Relative magnitude

The potential magnitude weighted by frequency or probability factors is the impact's relative magnitude (see *Table 8.5*).

These frequency factors are:

- Frequency, which is the number of times that the impact takes place. It is evaluated on a semi-quantitative scale and relates to events occurring during so-called normal functioning periods. The impact may be:
- rare (rarely or never observed in similar activities)
- occasional (sometimes observed in similar activities) or
- high (regular in similar activities).

  OR

- Probability which is the characteristic that relates solely to unexpected events (for example a traffic accident, accidental discharge of toxic gases, etc.). The probability that an unplanned event occurs is evaluated on a qualitative scale (or semi-quantitative when the appropriate data is available) described in Table 8.4 below, and thus provides the degrees of occurrence of an action with a finite probability but which is likely to occur.

Both frequency and probability can be determined based on historic data, modelling, sectorial data and contributions from stakeholders, and based on the consultant's experience.

Table 8.4 Definition of frequency / probability

Frequency / Probability	Definition
Rare / Improbable	The event is not foreseeable but could occur at a given moment.
Occasional / Probable	The event is likely to occur at a given moment in normal operating condition.
High	The event will occur in normal operating condition (i.e. it is almost unavoidable).

Table 8.5 Criteria for evaluating relative magnitude

		Frequency / Probability		
		Rare	Occasional	High
Potential magnitude	Insignificant	Insignificant	Insignificant	Insignificant
	Low	Insignificant	Low	Low
	Medium	Low	Medium	Medium
	High	Medium	Medium	High

Sensitivity

Sensitivity is defined as the degree of aptitude of a milieu to react to external events. A whole range of factors is taken into account in the definition of sensitivity which may be of a physical, biological, cultural or human nature. In the end, sensitivity is held to be low, medium or high depending on the intrinsic characteristics of receptors and the consultant's expertise.

Magnitude of the impact

Once the characteristics of the relative magnitude of impacts and sensitivity of receptors have been defined individually, they are paired in order to define the importance of each impact (see *Table 8.6*). In the end it is a case of describing the degree of change that the impact is likely to make to a factor within the milieu (receptor, resources).

Table 8.6 Criteria for evaluating the importance of the impact

		Sensitivity		
		Low	Medium	High
Relative magnitude	Insignificant	Negligible	Negligible	Negligible
	Low	Negligible	Minor	Medium
	Medium	Minor	Medium	High
	High	Medium	High	High

Positive impacts

In cases where positive impacts are found, the analysis carried out is based mainly on the consultant's assessment. The scale thus assessed is compared to the receptor's ability to benefit from the positive effects anticipated, in order to evaluate the supposed importance of the positive impact studied.

8.4 CREATION OF MITIGATION MEASURES AND RESIDUAL IMPACT

One of the aims of an ESIA consists of suggesting mitigation measures in order to limit any potential negative impacts affecting all physical, biological and socioeconomic resources as well as receptors. The mitigation measure must be adapted and in proportion to the impact identified and must generally follow a hierarchy of measures – avoid, reduce, re-establish or compensate – in terms of the potential negative impacts identified.

The aim of mitigation measures is to prevent or reduce the importance of negative impacts whilst optimising the feasibility and potential benefits of the Project. Impact mitigation objectives are often established on the basis of legal standards or by referring to best practice. In the absence of any existing benchmarks, objectives specific to the project are established. The approach used to define the mitigation measures is based on the hierarchy of decisions and measures described in *Figure 8.2.*

Figure 8.2 Hierarchy of mitigation measures

Avoid at source – Reduce at source   Avoiding or reducing at source consists mainly of "developing" a project to ensure that a characteristic which is the origin of an impact is suppressed (e.g. a flow of waste materials is eliminated) or modified (e.g. reducing the volume of waste materials). It is often called minimisation.
Abate at source   This is a case of adding something to the basic design in order to reduce the impact – pollution control falls into this category. Often called "at chain end".
Reduce at receptor   If an impact cannot be reduced on site, measures can then be taken off site (e.g. efficient communication with authorities to help to control the level of interference in local communities).
Repair or re-establish   Some impacts result in unavoidable damage to a resource: e.g. land clearance. Repairing means mainly applying restoration or re-establishment measures, such as restoration of plant life on a seismic line.
Compensate in kind   If the other mitigation methods are impossible to apply or if they do not have full effect, compensation may then prove appropriate, to a certain extent, in case of loss, damage or general intrusion.

Residual impact

An impact remaining after application of mitigation measure(s) is called the residual impact.

8.5 IMPACTS ON AIR QUALITY

8.5.1 Method for evaluating potential impacts on air quality

Evaluation of potential impacts on air quality resulting from activities undertaken during the construction and operational phases, follows two different methods: a qualitative approach for the construction phase and a quantitative approach for the operational phase.

The choice of a qualitative evaluation method for the project's construction phase is based on the temporary and variable nature of atmospheric emissions produced during this phase. Potential impacts on air quality have been mainly estimated according to the type of emissions and the dispersal capacity of emissions into the atmosphere.

The quantitative method is used for the operational phase. Within the context of the quantitative method, emissions were considered to be continuous. The evaluation of potential impact is based on the following data:

- Concentrations of pollutants at ground level caused by operations at the project, calculated using a modelling study of atmospheric dispersal.
- Current air quality standards
- Baseline air quality conditions
- Sensitivity of receptors.

Within the context of the quantitative method, a modelling study was developed. Sensitive receptors were firstly identified as points of reference (see *Section 5.3.8*).

Method specific to the emissions of particles and dust during the operational phase

In order to evaluate potential air quality impacts by the power plant in operation, the *CALPUFF* atmospheric dispersal simulation model was used. This is a model that takes account of the complexity of terrain, the presence of surface water, interaction effects caused by coastal areas, effects caused by the presence of buildings, sweeping phenomena and the possible chemical transformations of pollutants. The CALPUFF modelling system (version 5.8) has been recommended by the US-EPA, since 29th June 2007 ([1]).

Definition of impact intensity criteria

Impact intensity is evaluated in terms of:

- Process contribution (PC): impact on air quality generated by combustion emissions
- Presumed environmental concentration (PEC): PC to which is added existing air quality.

The recommendations of World Bank Group standards [(2)] on the evaluation of impact intensity in terms of process contribution are as follows: "*the PC can be considered to be negligible when it represents less than 25% of applicable emission limit values*". This does not mean however that a PC higher than 25% systematically leads to a high impact. On the contrary, in this case a more detailed analysis should be carried out in the atmospheric basin in question (conditions defined in the baseline) in order to fine-tune conclusions.

Air quality evaluation criteria have been developed by ERM, in the absence of any national directives or guides to good practice.

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[1] http://www.epa.gov/scram001/dispersion_prefrec.htm#calpuff

[(2)]IFC (2007) Environmental, Health, and Safety Guidelines General EHS Guidelines: Environmental Air Emissions And Ambient Air Quality

Table 8.7 summarises impact evaluation criteria, as considered in this study.

Table 8.7 Evaluation criteria for the magnitude of impacts on local air quality

Intensity of impacts	Non-deteriorated atmosphere (Baseline < AQS)	Deteriorated atmosphere (Baseline > AQS)
Negligible	PC < 25% of AQS	PC < 10% of AQS
Low	PC > *25% of AQS, <50% of AQS*[(1)] and *PEC<100% of AQS*	PC > 10% AQS, <15% of AQS
Moderate	PC > 25% AQS, <50% of AQS and *PEC >100% of AQS;* or PC > *50% of AQS, <100% of AQS*[(1)] and *PEC <100% of AQS*	PC >15% of AQS, <25% of AQS
High	PC > 50% of AQS, <100% of AQS and *PEC >100% of AQS;* or PC > *100% of AQS*[(1)]	PC >25% of AQS

[(1)] In italics, criteria based solely on the PC, used to evaluate the intensity of impacts over the short term (e.g. hourly, daily concentrations)

AQS= Air Quality Standards

8.5.2 Recap of initial conditions

Modelling of air quality was carried out based on atmospheric emissions from the SENELEC power plants at Cap des Biches.

Table 5.2 shows that the maximum predicted concentrations of NO_2 and SO_2 over the long term are well below Senegalese air quality standards. Similarly, concentration values estimated in the long term for NO_2 and SO_2 receptors are of an order of size lower than the Senegalese standard (see *Table 5.3*).

The results of modelling initial conditions over the long term (annual cycle) did not show any exceeding of air quality standards at sensitive receptors identified.

Consequently the existing atmospheric basin is considered to be "non-deteriorated". This analysis is confirmed by the preliminary results from air quality monitoring (see *Section 5.3.8*), also below the air quality standards, with the exception of SQA1 station, located under direct influence from the electricity production facilities of Cap des Biches, among which some (containerised groups) will be stopped when the Project will start.

8.5.3 *Potential impacts during the construction phase*

Impact sources

The main sources of emissions during the construction phase are:

- Motorised equipment and energy generators used to supply electricity during construction activities
- Heavy machinery and vehicles: front loaders, trucks, compactors and pick-ups will be used for construction activities such as site preparation and the transport of materials and workers.

These emissions factors (elements considered to be emission sources) imply two types of potential negative impacts on air quality, as presented in the following paragraphs.

Emissions of pollutants into the atmosphere

The use of motorised vehicles and equipment (e.g. trucks, generators), will produce gas emissions from to the combustion of fuel oil and hydrocarbons. These emissions may cause an increase in pollutant concentrations in the atmosphere, such as carbon monoxide (CO), nitrogen oxides (NOx) and sulphur dioxide (SO2), from exhaust fumes.

The engines of vehicles and motorised equipment and energy generators will also generate atmospheric emissions. Consumption by the diesel engines of vehicles used is not quantifiable, apparently, and will evolve over the course of the construction phase (see *Section 3.5.5*).

The quantities of pollutants discharged into the air by site machinery and generators should be relatively small and will thus constitute occasional, temporary sources of emissions. In addition, emissions will be dispersed into the atmosphere at a distance from areas where people live and work. It can therefore be considered that emissions produced by the various sources during the construction phase should not produce any significant increase in levels of concentration of pollutant. The intensity of the potential impact is considered to be low and of only local scope.

In view of the nature of emissions sources, impacts should not be observed at a distance of any more than 0.5-1 km from the construction site. Emissions can therefore be considered to be of local scope only. The closest sensitive receptors will therefore be potentially affected by gassy emissions during the construction phase. However, due to the distance of receptors from the source of emissions, their sensitivity is considered to be low.

In a general way, the importance of impacts on air quality during site preparation and construction is evaluated as being negligible.

A description and characterisation of impacts are recapitulated in *Table 8.8*.

Emissions of particles and dust

During the construction phase, atmospheric emissions will be mainly linked to the dust generated by the various excavation activities (e.g. site clearance, scraping and levelling) and by dust in suspension due to the wind and the passage of vehicles on non-asphalted roads.

Emissions of particles and dust during the construction phase are by nature highly variable. For this reason a qualitative method has been used to evaluate their impacts. The risk of particle emission during the construction phase depends to a great extent on the type of soil, the type of activities, the prevalence of hot, dry weather during the work, the speed of prevailing winds and the ability of the wind to carry particles and dust towards potential sensitive receptors.

During the construction phase, potential sources likely to produce emissions of fine particles and dust are as follows:

- Excavation and levelling of the land prior to building the new installations
- Evacuation of materials excavated from the worksite
- Site clearance
- Excavations
- Concrete production operations.

The closest residential receptors likely to be affected by emissions of fine particles and dust emitted by activities taking place during the construction phase are the first dwellings located at about 400m from the project area. The sensitivity of the immediate surroundings of the Project site is considered to be low.

It is important to note that the transport of fine particles and dust varies according to the weather conditions observed in the study area. With regard to the project area, annual rainfall is estimated at between 500 mm and 600 mm. It is lower from October to June (dry season). During the dry season, evaporation is stronger, thus the probability of particle emissions by activities carried out during the construction phase will be higher during these months, compared to wetter periods (in the months of August and September). With regard to the wine, the project area is characterised by prevailing north and north-north-west winds (direction opposite to the sensitive receptors) which represent over 55% of annual winds. The prevailing winds are of moderate speed (between 3.5 and 5.4 m/s). The strongest winds (up to 7.9 m/s) are more commonly from the north.

In view of the information presented above, impact intensity is considered to be moderate on potential receptors and frequency of occurrence to be occasional.

Emissions of particles and dust may also come from the indirect transport of particles, due to adherence of dust to the wheels and chassis of vehicles entering the site and involved in the evacuating excavation materials. This phenomenon depends on several factors, as follows:

- The number of vehicles accessing the site
- The cleanliness of traffic routes at the site
- The installation of wheel and chassis washing units
- Weather conditions.

Particles and dust may also be emitted in case of dust clouds or accidental spillage from the vehicles during the transport of backfill earth or the evacuation of excavated earth.

In a general way, the importance of impacts on air quality during site preparation and construction is evaluated as being **minor.**

A description and characterisation of impacts are recapitulated in *Table 8.8*.

Evaluation of impacts on air quality during the construction phase

Table 8.8 Evaluation of impacts: air quality – construction phase

Impact criteria	Frequency /Probability	Magnitude	Sensitivity	Impact importance
Pollutant emissions				
Insignificant • Intensity: low • Extent: local • Duration: Temporary	Occasional	Insignificant	Low	Negligible
Emissions of particles and dust				
Low • Intensity: Moderate • Extent : Local • Duration: Short term	Occasional	Low	Low	Negligible

In conclusion, according to the evaluation method used, the impact on air quality of particle and dust emissions and the impact of exhaust fumes from site machinery and motorised machinery and energy generators during the construction phase will be **negligible**.

Measures to mitigate and control impacts on air quality during the construction phase

In order to minimise the emissions of pollutants by worksite machinery during the construction phase, the following measures must be applied on site:

- As default good practice, site machinery and generators will be regularly maintained and inspected by the contractor with responsibility for the works, and
- Atmospheric emissions discharged by all transport vehicles used during the construction phase (equipment, excavated earth or backfill, staff, etc.) will be reduced by minimising the number of journeys as far as possible.

Concerning the nuisance caused by particles and dust at the site and in its surroundings, the following good practices should be followed:

- Suitable management and maintenance of raw materials' storage areas to minimise clouds of particles
- Tarpaulin coverings on trucks during the transport of crumbly building materials or excavated earth or backfill
- Speed restrictions for vehicles travelling on non-asphalted roads
- Washing of vehicle wheels as they leave the site
- Covering of storages of materials likely to be carried by the wind (notably contaminated or hazardous materials)
- In case of activities on surfaces covered with fine materials, access roads and the site must be sprayed during construction activities to reduce dust production
- Check on correct functioning of vehicles and machines, and compliance of their emissions with current regulations
- Ensure that vehicles and machines are turned off when they are not being used.

8.5.4 Potential impacts during the operational phase

Characterisation of Project emissions during the operational phase

The main atmospheric emissions released by the Project during operation are linked to the activity of the three 18V46 generators, and to the SENELEC installations already in existence (already taken into account in the modelling of current atmospheric conditions – see *Section 5.3.8*).

The power plant will burn heavy fuel oil (HFO) with a maximum sulphur content of 2%, leading to emissions of nitrogen oxides (NOx), particles (such as PM), carbon monoxide (CO) and sulphur dioxide (SO_2).

Emission parameters for the ContourGlobal - Cap des Biches power plant are based on Wartsila engine specifications, which take into account the standards of the *IFC EHS Directive for thermal power plants* issued in December 2008 and in particular the emission limits expected for a reciprocating engine of over 50MW operating in a non-deteriorated atmospheric basin (characterised after modelling of baseline conditions – see *Section 8.5.2*).

Table 8.9 below presents the coordinates and characteristics of the Project's emission sources and *Table 8.10* shows the rate and composition of emissions considered as input data into the modelling study.

The engines can operate 24 hours a day and the model has therefore simulated continuous release of atmospheric pollutants for the rates presented in *Table 8.10* for the whole of the timespan (year 2013, 8760 hours). This approach therefore enabled identification of the concentration of pollutants at ground level that occurred for all weather conditions in 2013.

Note that the IFC's EHS Directives for thermal power plants do not mention an emissions limit for CO, including concentration in dry combustion gases.

Moreover, the concentration of PM in dry fumes [65 mg / Nm^3] exceeds the emission limit set by the IFC EHS Directives for thermal power plants [50 mg / Nm^3]. This excess was justified by the builder, in the declaration of particle emissions for ContourGlobal - Cap des Biches 3 x W18V46 and Flexicycle documents as follows: "*Due to the low temperature of exhaust fumes of 180 °C, particle emissions are above the limit of 50mg/ Nm^3. Without the Flexicycle, the temperature of exhaust fumes would be more than 300 ° C and particle emissions would comply with the limit of 50mg/Nm^3. However, the IFC also indicates that "environmental evaluation may justify more or less rigorous limits due to the ambient environment and technical and economic considerations as long as they comply with applicable ambient air quality standards and differential impacts are reduced to a minimum."*

Table 8.9 Characteristics of emission sources

Emission source	X	Y	Height of stack	Diameter of stack	Temperature of combustion gases	Speed of combustion gases
	UTM 28N [m]		[m]	[m]	[°C]	[m/s]
Engine 1 stack 1 (a)	252658	1628461	40	1.6	180	21.7
Engine 2 stack 2 (a)	252658	1628461	40	1.6	180	21.7
Engine 3 stack 3 (a)	252658	1628461	40	1.6	180	21.7

(a) *The three stacks are located next to each other and modelled as a single stack based on the standard modelling procedure for stack emissions (U.S. EPA EPA-454/R-92-019 Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised). This is reflected in the input data and the equivalent stack diameter model used in the model is based on 3 x 1.6 m in diameter.*

(b) *Engine stacks operate 24 hours a day.*

Table 8.10 Emission rate and composition

Source demission	Concentration in dry fumes, at 15% of O_2 (b) [mg/Nm³]				Emission rate [g/s]			
	NO_x	CO	PM	SO_2	NO_x	CO	PM	SO_2
Engine 1 stack (a)	1850	77	65	1205	62.5	2.6	2.2	40.75
Engine 2 stack (a)	1850	77	65	1205	62.5	2.6	2.2	40.75
Engine 3 stack (a)	1850	77	65	1205	62.5	2.6	2.2	40.75

(a) *The three stacks are located next to each other and modelled as a single stack based on the standard modelling procedure for stack emissions (U.S. EPA EPA-454/R-92-019 Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised). Thus, the model considers that the sum of emissions produced by the 3 stacks is emitted by a single equivalent stack.*
(b) *Limit values to air emission based on the specifications of Wartsila 18 V46 diesel engines*

Results of modelling emissions inherent to the Project in operation

Study of emissions modelling simulates the PC caused by the operational phase of the project only. Maximum concentration values obtained within the simulation perimeter, for emissions estimates for NO_2, CO, SO_2 and PM are presented in *Table 8.11*. Senegalese air quality standards and the values of intermediate objective 1 of the IFC are listed in *Table 8.11*

Table 8.11 Maximum concentrations of atmospheric pollutants modelled

Pollutant	Average duration	Senegalese standards [µg/m³]	IFC standards (b) [µg/m³]	PC-concentrations modelled [µg/m³]
NO_2	annual	40	40	11.39
	1 h	200	200	548.30
SO_2	annual	50	-	9.90
	24 h	125	125	207.92
PM	annual	80	70	0.53
	24 h	260	150	11.22
CO	24 h	30 (a)	-	10.89

(a)Must not be exceeded more than once a year
(b)Intermediate objective-1

Note: PC= process contribution

Table 8.11 shows that the maximum hourly concentrations estimated for NO_2 and SO_2, exceed Senegalese air quality standards as well as IFC standards.

In order to fine-tune this evaluation for these two substances, maximum concentrations modelled were analysed at the seven sensitive receptors already identified. *Table 8.12* presents maximum concentrations estimated for NO_2 and SO_2.

Table 8.12 Maximum concentration modelled at air quality calculation receptors

		PC – Concentrations modelled [µg/m³]			
		NO_2		SO_2	
		Annual average	Maximum hourly concentration	Annual average	Maximum daily concentration
Senegalese standards [µg/m³]		40	200	50	125
Receptors					
ID	*Name*				
1	Private nursery and elementary school	2.32	192.96	2.02	29.16
2	"Cité Gabon" primary school	2.13	336.76	1.85	37.24
3	Nursery school	2.18	217.73	1.90	38.14
4	Koranic school	1.98	261.31	1.72	38.35
5	Koranic school	2.21	175.70	1.92	46.17
6	Koranic school	3.20	290.96	2.78	50.60
7	Health station	2.51	156.96	2.18	30.34

Note: PC = process contribution

Senegalese air quality standards are exceeded only by four of the seven sensitive receptors identified and solely for hourly concentrations of NO_2. They are never exceeded for SO_2 concentrations.

Maps of NO_2 and SO_2 concentrations, in the short and long term, are presented in *Figure 8.3*, *Figure 8.4, Figure 8.5* and *Figure 8.6.*

Figure 8.3 Map of maximum annual concentration of NO_2

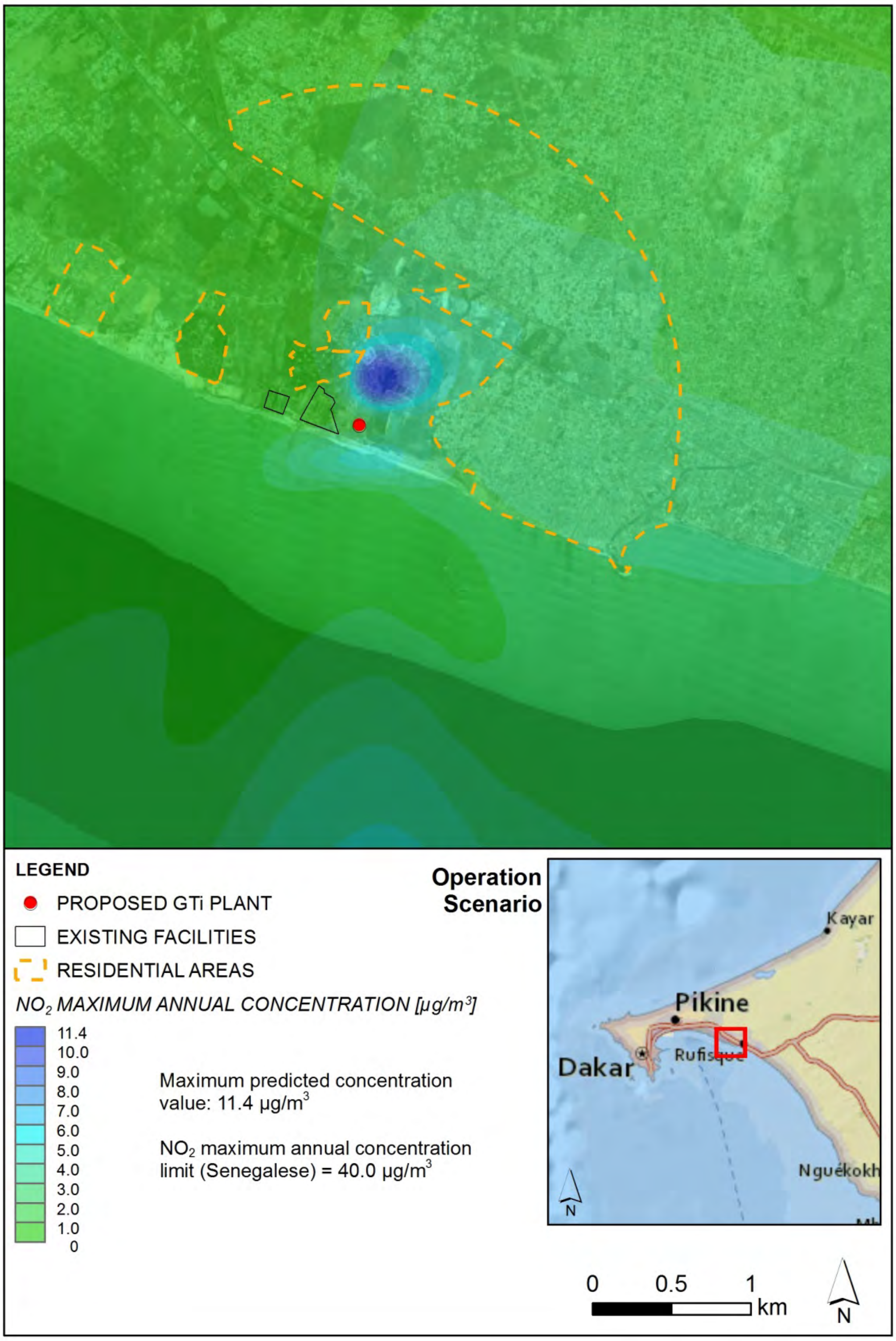


Figure 8.4 Map of maximum hourly concentration of NO_2

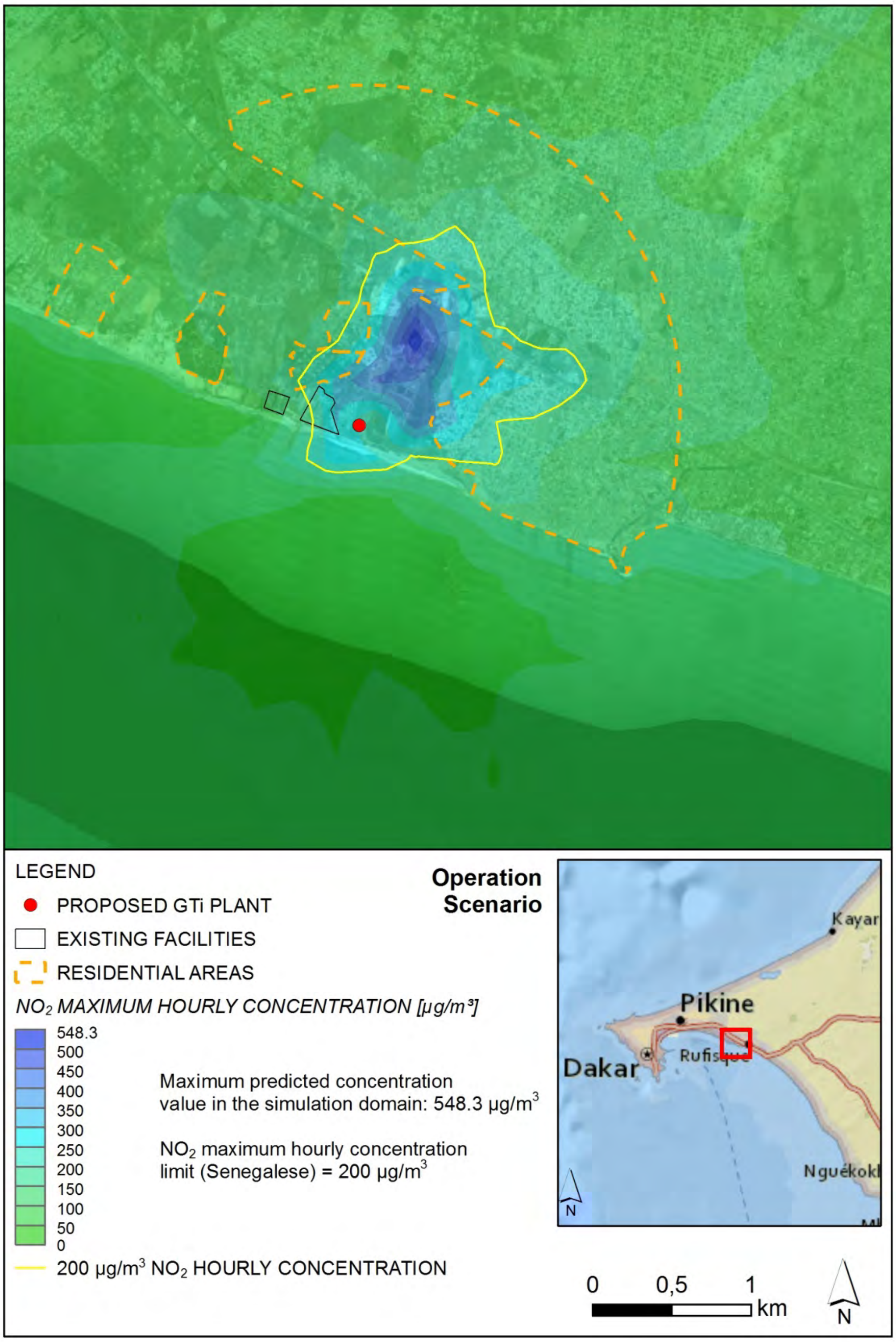


Figure 8.5 Map of maximum annual concentration of SO_2

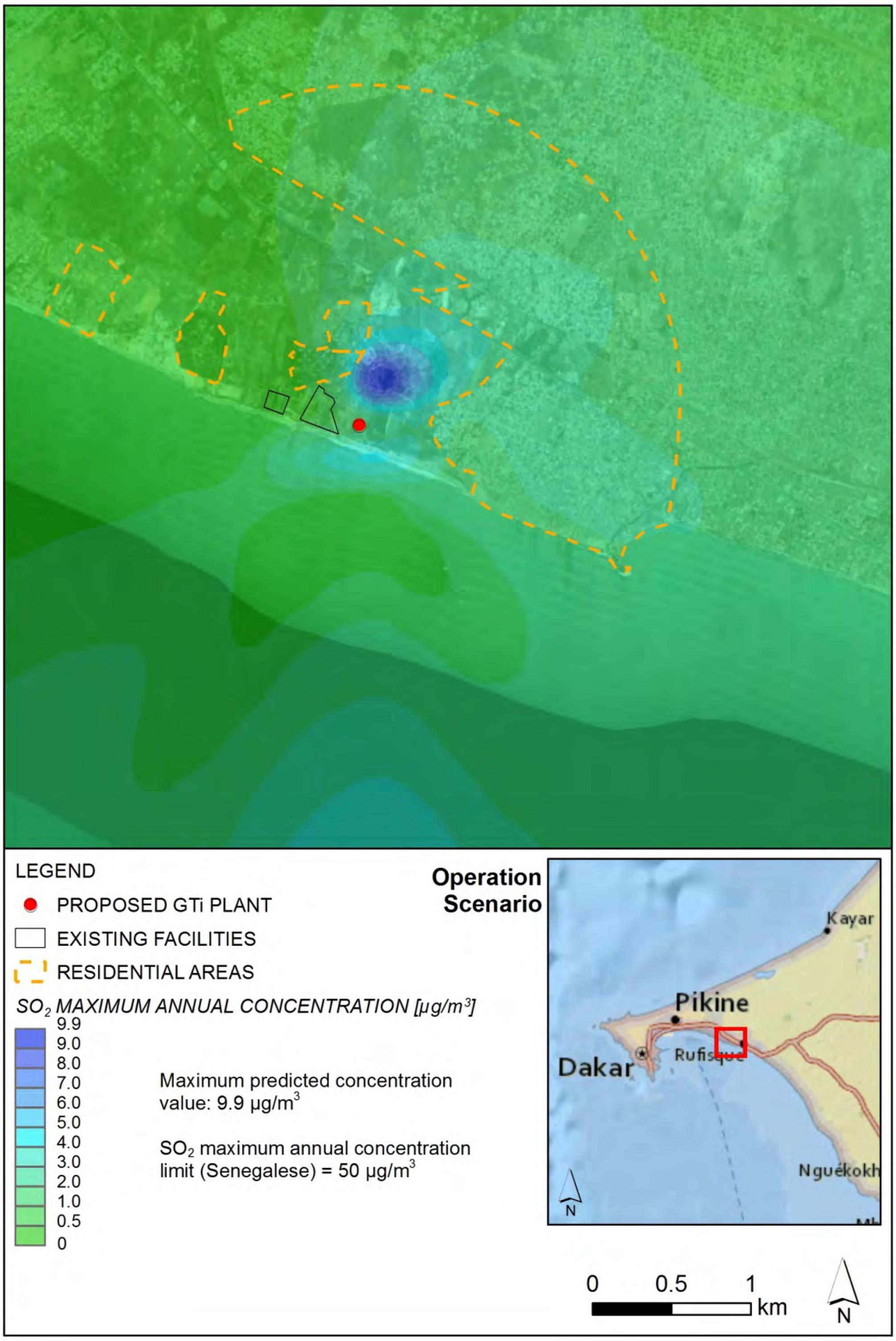
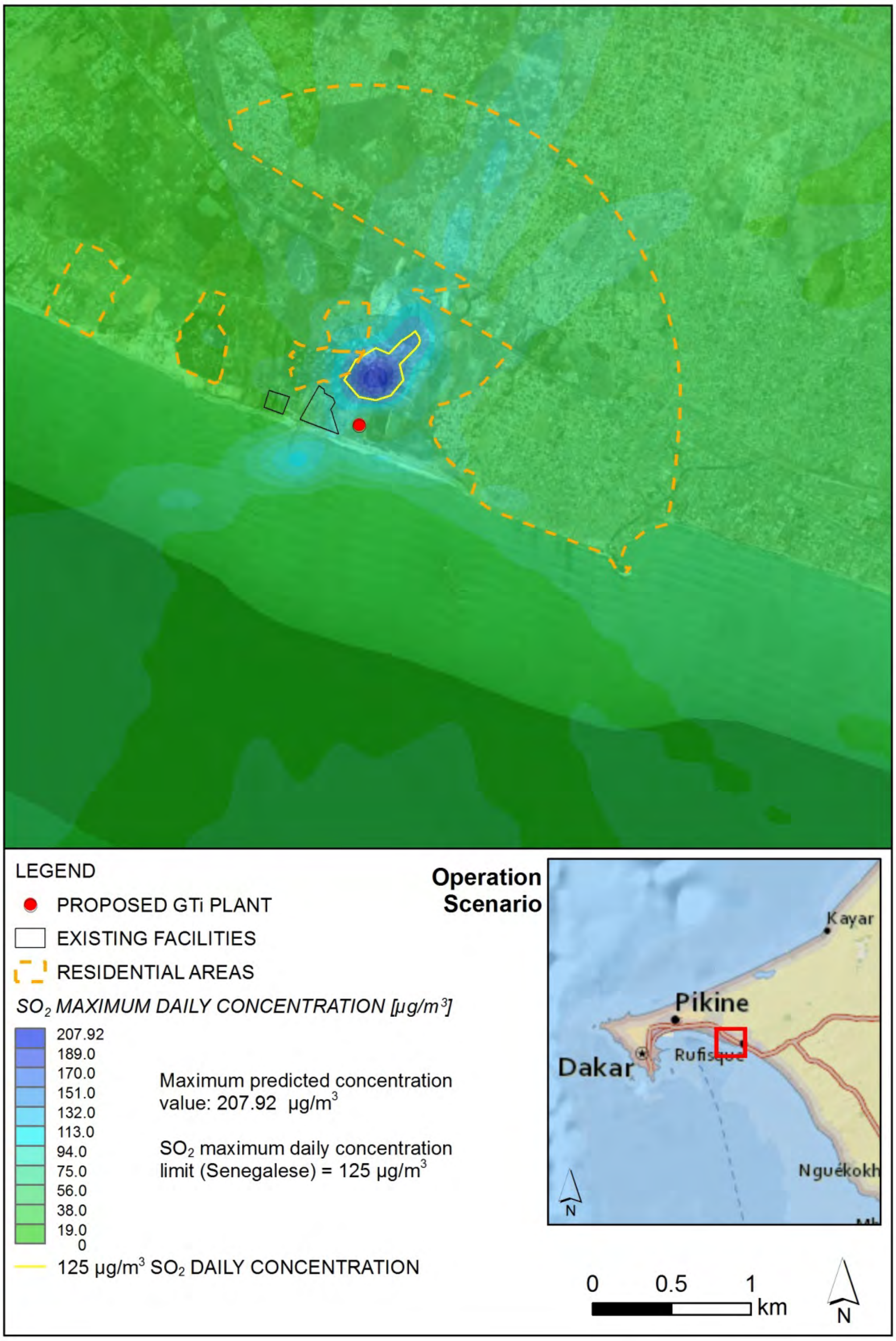


Figure 8.6 Map of maximum hourly concentration of SO_2



For a more in-depth analysis of the results in terms of the location where the maximum concentration is observed (outside the residential area) and from a receptor likely to see the biggest excesses ("Cité Gabon" primary school), time series of maximum hourly concentrations of NO_2 were simulated over the whole year and are presented below in *Figure 8.7* and *Figure 8.8* below.

Figure 8.7 ***Time series of hourly concentrations of NO_2 at the location where maximum concentration is observed***

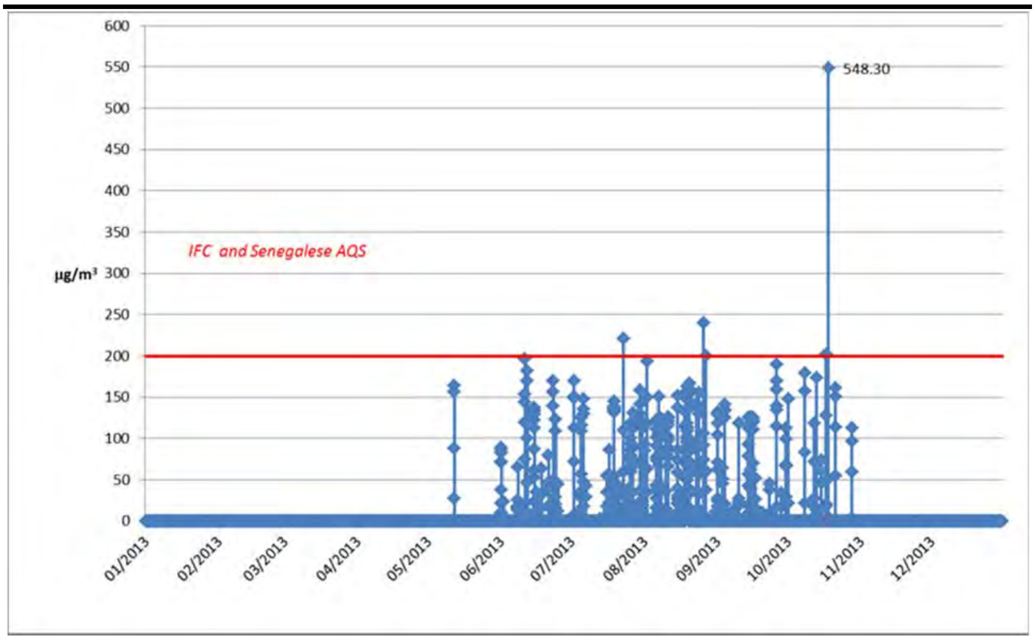
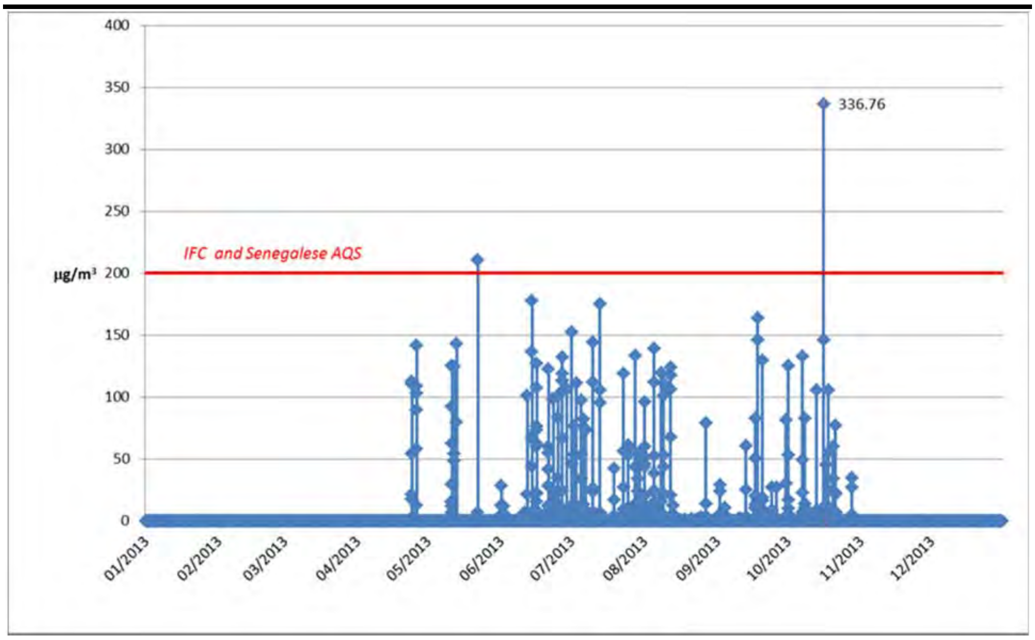


Figure 8.8 ***Time series of hourly concentrations of NO_2 at the "Cité Gabon" primary school (Receptor n°2)***



The time series in *Figure 8.7* shows that the limits established by the IFC and Senegalese legislation for hourly concentrations of NO_2, are exceeded five time 1 hour per year, i.e. less than 0.06% of the time.

At the sensitive receptor, only 2 occurrences of excess of 1 hour are predicted by the model (i.e. about 0.02% of the time). Moreover, the majority of estimated concentration values is well below air quality standards. More precisely, it is noted that for 98% of the time, hourly concentrations are 10% below Senegalese and international standards.

With regard to concentration levels of NO_2 and SO_2 during the rainy season (June to October), it is recalled that the modelling does not take account of damp deposits. Damp deposits are a factor that reduces the concentrations of pollutants in the atmosphere, a favourable phenomenon during the rainy season. For this reason, the modelling presented gives an overestimate of concentration values calculated. This is particularly true for the rainy season between July and September.

Results of the modelling of emissions from the Project superimposed over modelled baseline conditions

*Table 8.*13 provides a summary of total concentrations (Process Contribution PC+ air quality under initial conditions, modelled on the basis of emissions from SENELEC thermal power plants) or PEC (Predicted Environmental Concentrations) obtained from modelling studies carried out over the long term. The table indicates maximum concentration values obtained within the simulation perimeter, as well as Senegalese and IFC directives.

Note that only NO_2 and SO_2 have been taken into account in the analysis of the PEC, since the only data available on emissions for existing installations refers to NO_2 and SO_2. This approach is also coherent with the Project's emissions modelling results, for which only these two substances proved to be potentially problematic.

Table 8.13 shows that the PEC for NO_2 and SO_2 estimated over the long term are below applicable standards.

Table 8.13 Modelled concentrations of NO_2 and SO_2 over the long term

Pollutant	Parameter	Senegalese standard [µg/m³]	IFC standard (a) [µg/m³]	PC – modelled concentrations [µg/m³]	PEC modelled concentrations [µg/m³]
NO_2	Calendar year	40	40	11.39	16.65
SO_2	Calendar year	50	-	9.90	37.82

PC = process contribution
TPC = total predicted concentration

To fine-tune this evaluation, maximum TPC were analysed at the seven sensitive receptors previously identified. *Table 8.14* presents the PEC maximum at sensitive receptors for concentrations of NO_2 and SO_2 over the long term.

Table 8.14 Annual average estimated concentrations for NO_2 and SO_2 at the sensitive receptors identified

Simulation period		**PEC– modelled concentrations [µg/m³]** **NO_2** **Annual average**	**SO_2** **Annual average**
Senegalese air quality standards [µg/m³]		40	50
Receptors			
ID	*Names*		
1	Private nursery and elementary school	5.24	6.04
2	"Cité Gabon" primary school	5.08	5.94
3	Nursery school	5.03	5.85
4	Koranic school	4.85	5.71
5	Koranic school	4.95	5.75
6	Koranic school	6.37	7.18
7	Health station	5.43	6.19

TPC = total predicted concentration

As shown in *Table 8.14*, the TPC for NO_2 and SO_2 over the long term in sensitive receptors are of an order of size below quality standards.

The maps of concentration have been produced for concentrations of NO_2 and SO_2 over the long term, defined by SENELEC installations and the power plant in the proposed Project. Concentration maps have shown the spatial localisation of concentration maximums. Note that for annual concentrations of SO_2, the highest concentration values occurred over the sea.

Figure 8.9 Modelling of the Project's potential impact: Map of average annual maximum concentration of NO_2 (total concentration, project + environment)

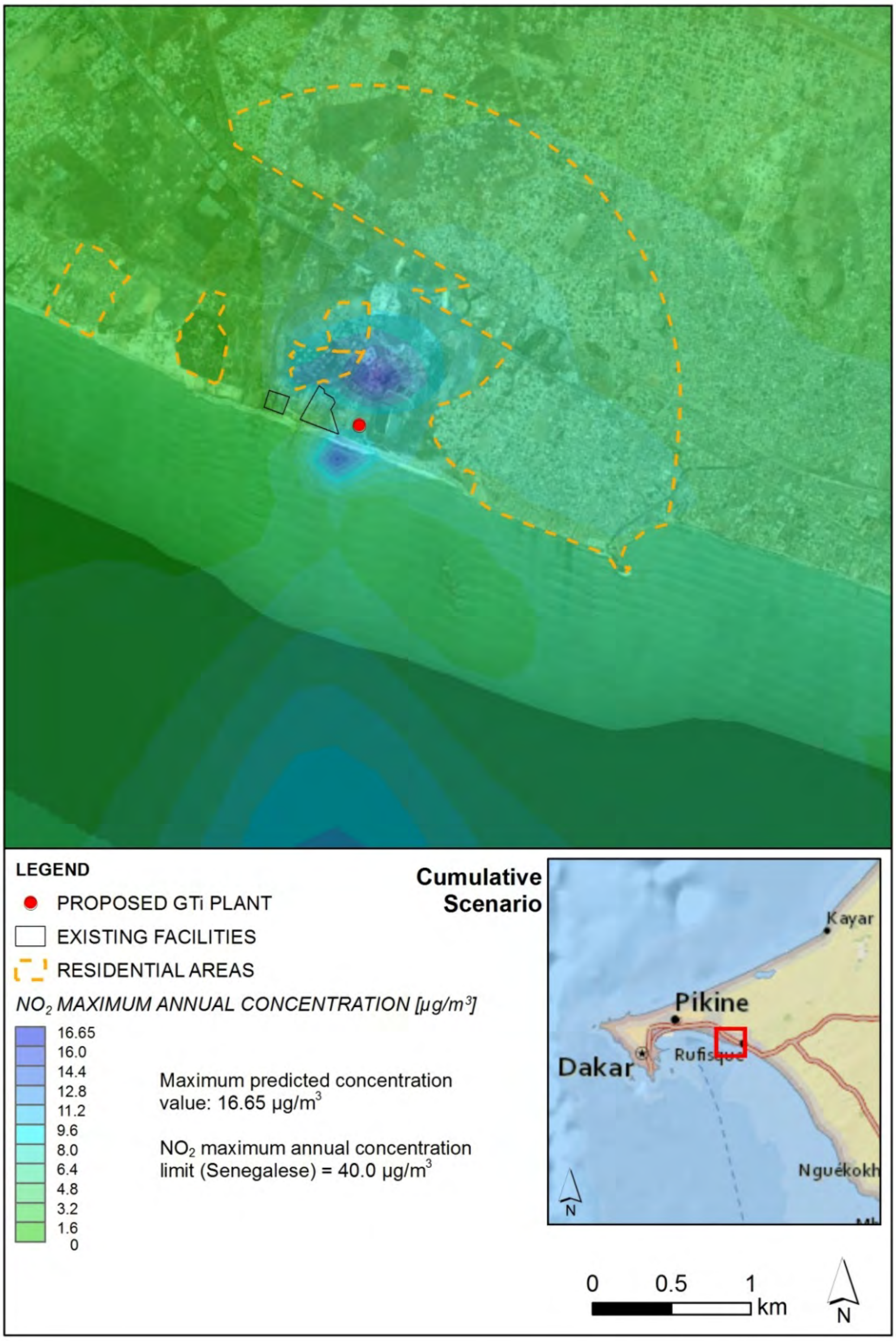
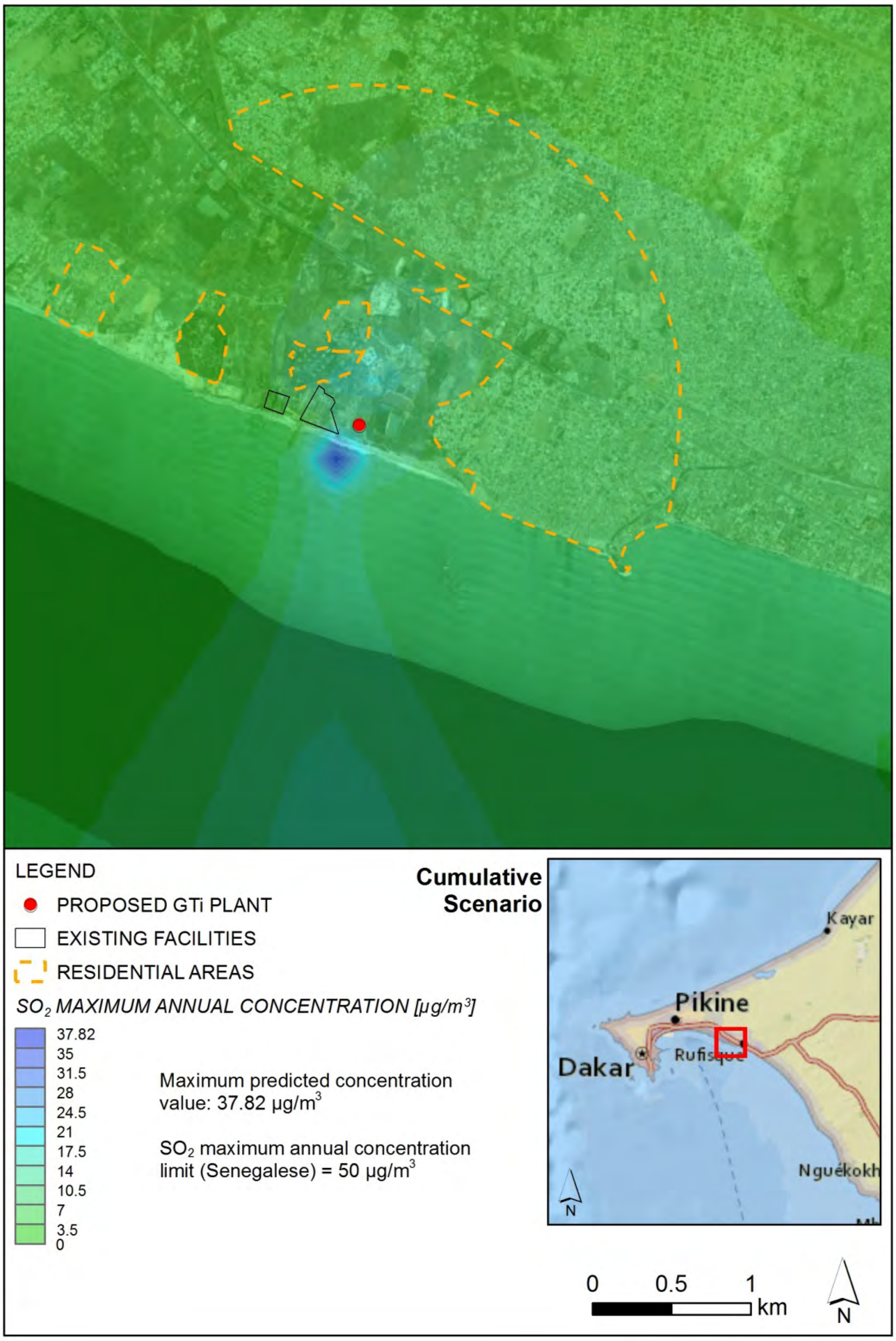


Figure 8.10 Modelling of potential impact: Map of average annual maximum concentration of SO_2 (total concentration, project + environment)



Results of the modelling of emissions from the Project superimposed over measured baseline conditions

Model results have been extracted at the six monitoring sites for NO_2 and SO_2 and reported in the following Tables along with monitored data and cumulative concentrations.

It has to be noted that the performed air quality measurements recorded the contribute of the Aggreko units which are not expected to be in operation once the ContourGlobal - Cap des Biches power station will become operative. Therefore the cumulative concentrations calculated are conservatively overestimated. *Table 8.15* and *Table 8.16* present NO_2 and SO_2 baseline data, PC and PEC at the six monitoring sites.

Table 8.15 NO_2 – Baseline data PC and PEC at Monitoring Sites

Site	NO_2 Ambient measured Concentrations [27/11/2014-23/01/2015] [µg/m³]	NO_2 Modelled annual concentrations PC [µg/m³]	NO_2 Cumulative concentrations PEC [µg/m³]	Senegalese and IFC standards set on NO_2 annual average concentration [µg/m³]	% of AQS for cumulative concentrations
S1	37.65	2.73	40.38	40	101%
S2	16.05	2.34	18.39	40	46%
S3	8.91*	2.14	11.05*	40	28%*
S4	19.12	0.18	19.30	40	48%
S5	12.00	2.39	14.39	40	36%
S6	11.32	0.74	12.06	40	30%

**Data refers to the period 23/12/2014-23/01/2015, as no data were collected at the monitoring site 3 during the first sampling period.*

Table 8.16 SO_2 – Baseline data PC and PEC at Monitoring Sites

Site	SO_2 Ambient measured Concentrations [27/11/2014- 23/01/2015] [µg/m³]	SO_2 Modelled annual concentrations PC [µg/m³]	SO_2 Cumulative concentrations PEC [µg/m³]	Senegalese and IFC standards set on SO_2 annual average concentratio n [µg/m³]	% of AQS for cumulative concentrations
S1	20.85	2.38	23.23	50	46%
S2	3.43	2.04	5.47	50	11%
S3	14.82*	1.86	16.68*	50	33%*
S4	5.38	0.16	5.54	50	11%
S5	2.83	2.07	4.90	50	10%
S6	2.91	0.65	3.56	50	7%

Site	SO_2 Ambient measured Concentrations [27/11/2014- 23/01/2015] [μg/m³]	SO_2 Modelled annual concentrations PC [μg/m³]	SO_2 Cumulative concentrations PEC [μg/m³]	Senegalese and IFC standards set on SO_2 annual average concentration [μg/m³]	% of AQS for cumulative concentrations

**Data refers to the period 23/12/2014-23/01/2015, as no data were collected at the monitoring site 3 during the first sampling period.*

PEC calculated for NO_2 and SO_2 at sensitive receptors (sites from S2 to S6) is well below in force air quality standards. PEC for SO_2 at the fence line (monitoring site S1) is below the limit, whereas PEC for NO_2 at the fence line exceeds the limit. This exceedance is recorded at the Power Plant fence line, thus in an industrial area which does not represents a sensitive receptor and is mainly influenced by the existing baseline concentrations. As previously stated the high NO_2 concentration recorded at the monitoring site S1 is highly influenced by the operation of the Senelec Plant CIII and of the Aggreko units. The latter are not expected to be in operation when the Project will become operative.

Emissions linked to road traffic

Traffic linked to site operations will be mainly generated by journeys made in light vehicles by staff, representing between 20 and 30 vehicles every day, and by traffic linked to the delivery of fuel oil by truck (daily average of about 10 trucks). The characteristics of emissions from engines are identical to those presented in *Chapter 8.5.3*.

Emissions from light vehicles and trucks will be occasional and transitory due to the low intensity of traffic. Amounts of pollutants discharged into the air should therefore be relatively low and will not cause any measurable impact on air quality around the site. Intensity should therefore be negligible and regional in size (in view of the fact that deliveries will come mainly from Dakar). Since the distance from the main sensitive receptors (schools, health station, dwellings, etc.) is 500m, sensitivity to gas emissions from vehicles and trucks during the operations phase is considered to be low.

Evaluation of the importance of the Project's impact

In view of the results of modelling, impacts linked to the Project's atmospheric emissions will be very limited and will not be significant for a very large part of the year. Some cases of authorised values being exceeded in the short term could take place, however. These excesses will however remain episodic and should not concern more than a few hours per year.

Over the long term, air quality readings in the Project area will remain below limits, even when current emissions from SENELEC power plants are included.

An evaluation of the air quality impacts of the Project when in operation is recapitulated in *Table 8.17*.

Table 8.17 ***Evaluation of potential impacts: impact on air quality – operational phase***

Evaluation criteria	Frequency /Probability	Magnitude	Sensitivity	Importance of the impact
NO_2 short term				
• Intensity: medium • Extent: local • Duration: short term	Very rarely exceeded	Medium	Medium	Minor
NO_2 long term				
• Intensity: low • Extent: local • Duration: long term	Very rarely exceeded	Low	Medium	Minor
SO_2 short term				
• Intensity: negligible • Extent: local • Duration: long term	Very rarely exceeded	Low	Medium	Negligible
SO_2 long term				
• Intensity: negligible • Extent: local • Duration: long term	Very rarely exceeded	Insignificant	Medium	Negligible
Emissions linked to road traffic				
Low • Intensity: negligible • Extent: regional • Duration: long term	High	Low	Low	Negligible

Measures to mitigate impacts on air quality during the operational phase

Impact by NO_x: The potential impacts of atmospheric emissions linked to operation of the power plant are mainly due to NOx emissions, however cases of applicable standards being exceeded are very rare (less than five times a year at receptor points).

SO_2emission limits: With regard to SO_2, ContourGlobal - Cap des Biches will ensure that this potential impact remains limited as much as possible, by ensuring that SO_2 concentration in the fuel delivered does not exceed 2%. A quality control on the heavy fuel oil used will thus be implemented and data relating to supplies (amount delivered and analysis results) will be recorded.

Air quality monitoring: In order to have available initial air quality data that is the most representative possible of actual conditions, ContourGlobal – Cap des Biches will lay passive diffusion tubes to measure monthly SO_2 and NO_2, averages prior to the operational phase. Measurements will be taken at about six sites. The location of the tubes will be defined in order to meet the following objectives:

-
- To evaluate the share of contribution made by surrounding activities to the ambient concentration of NO_2 and SO_2, and
- To ensure that the values modelled for initial air quality conditions are indeed in compliance with actual conditions.

This air quality monitoring will continue during construction and operational phases in order to check on the absence of any deterioration to air quality over the long term.

Finally with regard to emissions linked to road traffic, delivery vehicles will be the object of regular maintenance and will be inspected by the company responsible for supplies.

8.6 GREENHOUSE GAS EMISSIONS

8.6.1 Sources of emission

Construction phase

During the construction phase the main source of greenhouse gas emissions to take into account is transport of the goods and staff recapitulated in *Table 8.18*below. For goods we considered that they are carried by road from the port of Dakar (about 25 km). For staff, we considered that most of them live in the surroundings of the site, a maximum of 25km distant.

Table 8.18 Traffic expected at the site during the construction phase

Delivery	Approximate numbers of vehicles expected
Materials for producing concrete – cement, gravel, sand	2 deliveries per day on average for 10 months – 6 to 10 deliveries per day during peak activity periods
Steel and pipes	Up to 4 deliveries per day for 8 months
Technical equipment	5 deliveries for the engines 5 deliveries for the boilers 1 delivery for the turbine 2 deliveries for the transformers 5 deliveries for construction and tank assembly materials
Various	1 to 2 deliveries per week
Staff transport	16 to 20 buses per day (workers) Up to 30 to 50 cars per day (managers, management team and sub-contractors)

Operational phase

During the operational phase, the main sources of emissions will be:

- Heavy fuel oil combustion by the power plant with a nominal power of 53MW which will produce 425 GWh (contractual commitment).
- Traffic linked to site operations, mainly generated by journeys in light vehicles (between 30 and 60 per day) and visitors (relatively limited)
- Deliveries of fuel oil by truck (10 deliveries per day). Heavy fuel oil supplies will be brought by 30 ton truck from the SAR (Société Africaine de Raffinage) refinery in Dakar located less than 10km from the site (note that the hypothesis of the installation of a pipeline for the direct supply of heavy fuel oil has not been used here, in order to address the worst possible scenario).

8.6.2 *Evaluation of greenhouse gas emissions*

The perimeter and hypotheses used for this study are as follows:

- Only the main emitters listed above have been taken into account
- Dismantling and restoration of the site have not been evaluated
- Nominal production has been used for the evaluation
- The consumption of domestic fuel oil is negligible because it is mainly used on start-up of the power plant
- Greenhouse gas emissions from sea transport have not been evaluated
- Emission factors used are those taken from the ADEME[1] carbon report

Results

Table 8.19 below recapitulates the greenhouse gas emissions from the main emitters listed previously.

Table 8.19 ***Main greenhouse gas emissions***

		Construction (t Ceq)	Operation (t Ceq/ year)
Transport	Materials	20(1)	17(2)
	Staff	131	15
Materials, raw materials		-	419 900(3)
Total		**151**	**419 932**

Notes:
1. Transport of materials: steel, concrete, equipment etc.
2. Mainly fuel oil transport

3. Fuel oil consumed mainly by the power plant's engines.

[1] http://www.energies-davenir.com/bibliotheque-ea/production_energie_reseau_alimentation/bilan_carbone_guide_facteurs_emissions_V5.pdf

These emissions are negligible in view of total annual emissions in Senegal, which amounted to 20.3 million tons of carbon equivalent (t Ceq) in 2007 (source: UN[1]); they represent a contribution of around 2% to the country's annual emissions.

8.7 *IMPACTS OF NOISE EMISSIONS ON AMBIENT NOISE LEVELS*

8.7.1 *Methodology and criteria*

The evaluation of noise emission impacts was based on Senegalese standards and IFC standards on noise emissions and ambient noise levels.

Levels of importance are defined below:

- Negligible – the noise issue does not need to be taken into account in the decision process, no mitigation measure is necessary.
- Minor – the impact is significant, it should be taken into consideration, but it is sufficiently limited for noise management measures to guarantee levels below the set limits.
- Moderate – the impact is significant and mitigation measures must be planned. These measures are likely to modify the Project's design and cost.
- Major – The impact is large and mitigation measures must be implemented. These measures will modify the project's design and cost. Impacts will be undesirable if they are not dealt with.

Importance of impact during the construction phase

The works are planned to last for 12 months. The sensitivity of receptors considered is also a criterion in the evaluation of impact importance.

Noise limits chosen for daytime hours are shown in *Table 8.20.*

Table 8.20 Importance of impact linked to noise during the construction phase

Receptors	Noise levels (day time), LAeq (dB) Importance impact			
	Negligible	Minor	Moderate	Major
Sensitive receptors (residential areas, schools, health station)	<55	55-60	>60-65	>65

[1]http://unstats.un.org/unsd/environment/air_co2_emissions.htm

Importance of impact during the operational phase

Senegalese regulations (1) define noise limits of 55 to 60 dB during the daytime and 40 dB (A) during the night. This value is identical to that of the IFC standard (2) for daytime (55 dB $L_{Aeq\ 1\ hour}$), and is 5 dB (A) less for night-time. This is therefore a restrictive criterion compared to international standards.

Evaluation of the importance of the noise impact is based therefore on the absolute noise level: the modelled level must be compared with standards taken from the current international standards. These limits have been defined so that an impact is considered medium when it exceeds the IFC limit value.

The various limits are presented in *Table 8.21.*

Table 8.21 Importance of the impact linked to noise

Criteria	Impact importance							
	Day				Night			
	Negligible	Minor	Moderate	Major	Negligible	Minor	Moderate	Major
Absolute noise level $L_{Aeq,\ 1hr}$ (dB)	<50	50-55	>55-60	>60	<40	40-45	>45-50	>50

It is important to note that in certain cases exceeding the standard does not necessarily mean a big impact, it is possible to evaluate how far the standard is exceeded in order to characterise the impact.
Modelling methodology
Modelling of noise levels was undertaken with the SoundPLan Software, on a 10 km x 10 km study are, with a precision of 5m. This modelling has taken into account the topography (in particular the presence of basins in the lagoon unit of ONAS) as well as land use in the study area. An noise absorption coefficient of 0.8dB has been considered for the rural areas.

Meteorological conditions considered for the modelling were the following :

Atmospheric pressure : 1 009 mbar
Air temperature : 25°C
Humidity : 70%

8.7.2 *Summary of initial conditions*

As shown in *Section 5.3.9*, the measurement campaign carried out in the field revealed an acoustic climate already affected by major sources of noise, mainly from neighbouring electricity power plants operated by SENELEC.

(1) Article R 84 of Decree N°2001 – 282 of 12th April 2001 covering application of the Environment Code
(2) IFC General Environmental, Health, and Safety (EHS) Guidelines, World Bank Group, 2007.

Noise levels measured at sensitive receptors (the closest dwellings) in "Diokoul", "SENELEC 1 housing" and "SENELEC 2 housing" are described in *Table 8.22* below.

In view of noise levels existing by day, it is observed that only a very slight increase in noise levels could lead to Senegalese regulation levels being exceeded. At night-time certain cases of levels being exceeded are already observed. It would appear, therefore, that the Project's baseline is already a relatively noisy environment.

Table 8.22 ***Baseline at sensitive receptors (Daytime)***

Receptors	Background noise LAeq [dB(A)] (a)	Limits of ambient noise [dB(A)]
Daytime		
SENELEC 1 housing	59.5	55-60 (Senegalese standard) 55 (IFC)
SENELEC 2 housing	56.7	
Diokoul	51.8	
Night-time		
SENELEC 1 housing	60.3	40 (Senegalese standard) 45 (IFC)
SENELEC 2 housing	53.4	
Diokoul	48.7	

(a) Noise levels measured by LAME during the field campaign in June 2014.

8.7.3 *Modelling scenario used*

Construction

Noise produced by construction activities will be emitted during the daytime, between 07h00 and 19h00. To make evaluation easier, construction activities have been divided into two groups.

- Site preparation activities generating a lot of noise: sawing, excavation. These activities will require heavy construction vehicles and large equipment (excavators, dump trucks).

- Civil engineering and installation: activities generating a lot of noise such as the installation of concrete and asphalt units, the assembly of elements of the power plant, etc. These activities require large scale equipment: concrete mixers, cranes, generators, compressors.

The hypotheses used in terms of the intensity of noise sources are summarised in *Table 8.23*.

Table 8.23 ***Hypotheses relating to the intensity of noise sources – construction phase***

Equipment	Level of acoustic pressure at 10 m [dB(A)]
Site preparation	
Excavator	79
Bulldozer	81
Loader	68
Roller	76
Steam roller	82
Asphalt surfacer	84
Dump truck	87
Civil engineering and installation work	
Concrete mixer	80
Concrete pump	77
Tower crane	77
Mobile crane	82
Fork lift truck	67
Motorised compressor	75
Generator	74
Site truck	87

Source: ERM, based on standard BS 5228 *Code of good practice for basic information and procedures to control noise and vibrations.*

Operations

The least favourable scenario was simulated on the basis of the hypothesis that equipment operates simultaneously and at full load, 24 hours a day, without any change to the operating load by day or by night.

The main sources of noise identified for the Project and their acoustic performance are presented in *Table 8.24*. All noise sources have been assimilated to constructions or to occasional sources.

Table 8.24 ***Hypotheses on the intensity of noise sources – operational phase***

Unit	Equipment	Number of units	Level of acoustic pressure [dB(A)] (a)	Mitigation measure
Electricity production	Generation module (18V46 engine, generator, auxiliary module)	3	113	Standard panel wall
	Engine exhaust gas stack	3	198	Silencer (35 dB(A)) and boiler

Unit	Equipment	Number of units	Level of acoustic pressure [dB(A)] (a)	Mitigation measure
	Air inlet into the engine	6	99	Silencer (35 dB(A))
	Output ventilator	6	99	Silencer 1400 mm
	Cooling radiators	18	99	-
FLEXICYCLE system	Steam turbine	1	108	Standard panel wall
	Condenser cooled by air	1	105	-
	Exhaust gas from the gas boiler	3	90	-
	Heat recovery reservoir	1	85	-
	Water pump for washing the boiler	1	78	-
Compressed air system	Air compressor (180 m^3/h)	1	83	-
Oil lubrication system	Oil separation unit (pumps)	1	96	-
	Separation module (oil mist.)	3	74	-
Fuel treatment	HFO unloading pump (truck)	2	99	-
	HFO transfer pump	1	96	-
	HFO supply pump	1	91	-
	Oily water transfer pump	1	96	-
	Oily water supply pump	1	91	-
	Sludge transfer pump	1	96	-
Power transmission	Station auxiliary / Transformer	2	90	-

(a) Noise emission date was supplied by Wartsila for a W18V46 power plant. Where this type of data is not available, hypotheses were made on the basis of typical emission levels for equipment in a similar plant. All occasional sources were simulated at a height of 1.5m above ground.

8.7.4 Impacts during the construction phase

Potential impacts before mitigation

A qualitative evaluation was carried out to predict noise levels at receptors generated during the project's construction phase. Levels were modelled by

SoundPLAN at fixed distances from the emission sources presented in *Table 8.23*.

Table 8.25 describes noise levels, taking account of the project and the ambient noise observed at receptors during the construction phase.

Noise levels obtained meet noise limits at all receptors, with the exception of receptors n°8, 9 and 10 where predicted levels are slightly over 55 dB(A). This is mainly due to high background noise levels measured, whereas the project's contribution complies with noise limits. With regard to receptors n°8 and 9, these are SENELEC housing areas, directly associated with existing SENELEC thermal power plants.

Moreover, at receptor n°10, the increase in noise levels slightly exceeds 3 dB (A). However, the total noise level expected should remain very close to Senegalese and IFC standards, thus limiting any significant impact at the receptor concerned.

All the other receptors will comply with this IFC criterion concerning increases in noise levels compared to background noise.

Mitigation measures and residual impacts

Noise emissions are sufficiently low and receptors sufficiently distant from the Project to avoid being significantly affected. Consequently, no specific mitigation measure is necessary, beyond restricting work to daytime hours.

Table 8.25 Noise levels taking into account the project and ambient noise during the construction phase

ID	Receptors (c)	Ambient noise level LAeq [dB(A)] (a)	Predicted noise level LAeq [dB(A)]	Total noise level LAeq [dB(A)]	Increase over ambient noise [dB(A)] (b)	Daytime noise level standards [dB(A)]	Impact importance		
							Ambient noise (c)	Project contribution	Total level: project and ambient noise
1	Private nursery and elementary school	51.8	45	52.6	0.8	55-60 (Senegal) 55 (IFC) 3 (IFC – Increase over ambient noise)	Minor	Negligible	Negligible
2	"Cité Gabon" primary school	51.8	51	54.3	2.5		Minor	Negligible	Negligible
3	Nursery school	51.8	47	53.2	1.4		Minor	Negligible	Negligible
4	Koranic school	51.8	49	53.8	2.0		Minor	Negligible	Negligible
5	Koranic school	51.8	48	53.3	1.5		Minor	Negligible	Negligible
6	Koranic school	51.8	52	54.7	2.9		Minor	Negligible	Negligible
7	Health station	51.8	41	52.2	0.4		Minor	Negligible	Negligible
8	SENELEC 1 housing	59.5	54	60.7	1.2		Moderate	Negligible	Moderate
9	SENELEC 2 housing	56.7	52	58.0	1.3		Moderate	Negligible	Moderate
10	Diokoul	51.8	53	55.2	3.4		Minor	Negligible	Minor

(a) Noise levels measured by LAME during the field campaign in June 2014. In order to evaluate the increase in noise due to project contribution conservatively, the lowest ambient noise level observed during the day was used.
(b) IFC directives state that […impacts linked to noise should not lead to an increase by more than 3 dB in ambient noise at the closest off-site receptor].
(c) Receptors n°8 and n°9 are SENELEC employee housing, conservatively they have been considered as sensitive receptors.

8.7.5 Impacts during the operation phase

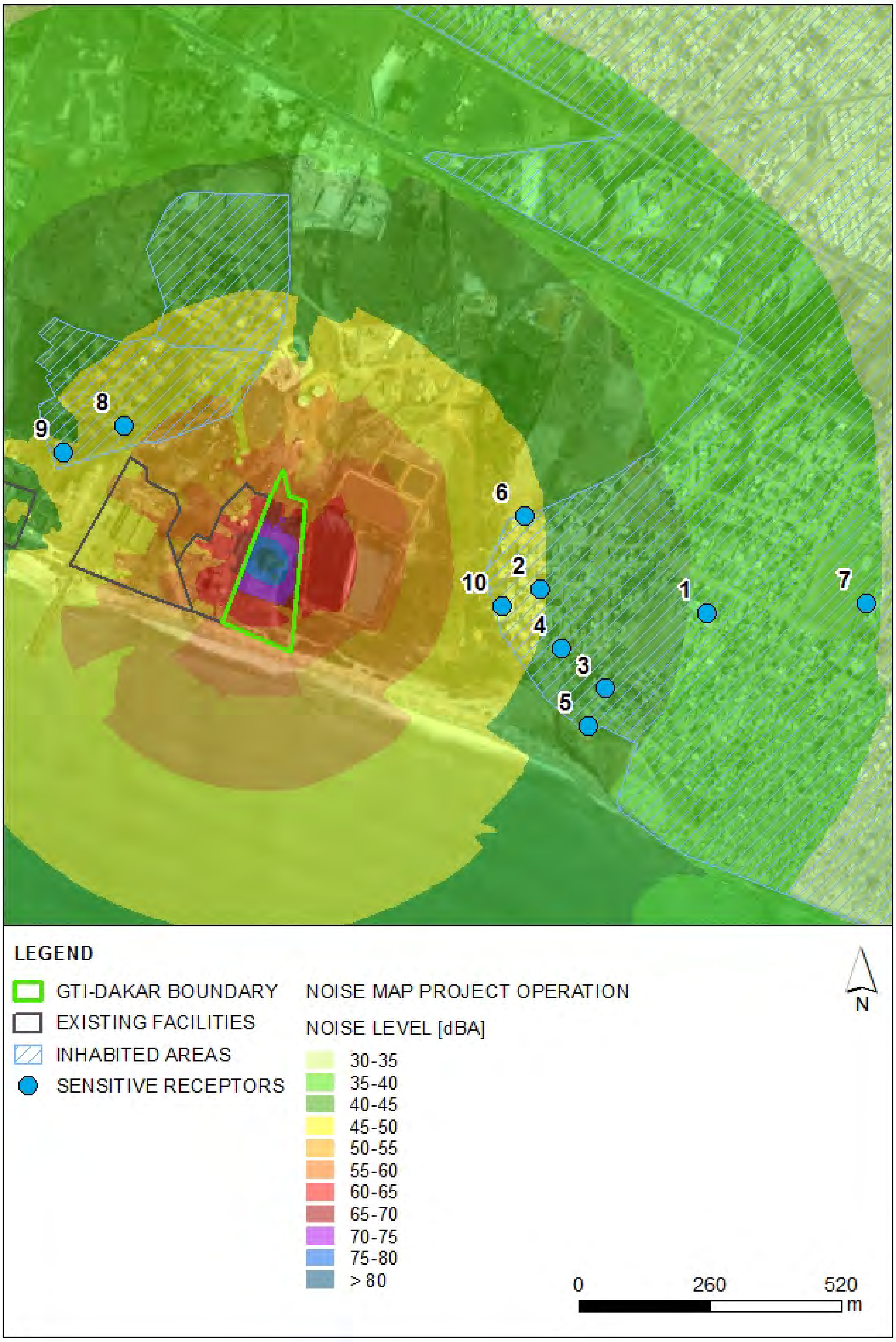
The noise contours map for the Project's operational phase only (excluding background noise) is shown in *Figure 8.11* below.

At the edge of the site, the maximum noise levels planned are between 60 and 65 dB(A) on the east side and between 65 and 70 dB(A) on the west side. Thus, the maximum value of 70 dB (A) indicated by the IFC at the edge of the site during operation, is complied with.

Table 8.26 and *Table 8.27* describe noise levels taking account of the project and the ambient noise observed at receptors during the operational phase. In order to better distinguish the various noise contributions made by existing installations, these Tables present the importance of impacts, for the project, the project noise and ambient noise.

Although project noise emissions do not vary between the day and the night (24 hour operation), the importance of the impact is different because the noise limit thresholds established vary between daytime and night-time.

Figure 8.11 Map of noise contours – operational phase



Potential impacts before mitigation – daytime

Levels obtained taking account of the project and background noise during the daytime comply with Senegalese noise limits for all receptors. On the other hand, receptors n°8 and n°9 show predicted noise levels above the IFC limit of

55 dB (A). This is due to high background noise levels, whereas the project's contribution meets noise limits.

In terms of Impact importance, the project's contribution is negligible compared to background noise. In fact, it should be noted that:

- The site's acoustic climate is already characterised by noise levels exceeding Senegal's and IFC's limits, both for daytime and night-time, as confirmed by noise measurements taken in June 2014, resulting in minor to moderate impact importance.

- Noise emissions generated by project operation are well below the ambient noise level measured in June 2014, at all receptors.

Potential impacts before mitigation – night-time

Noise levels obtained during the night-time exceed Senegalese and IFC standards for all receptors. However, the majority of sensitive receptors identified are schools, with no activities during the night-time. These receptors are not therefore taken into consideration for nocturnal emissions.

The increase above the background noise generated by operation of the Project's new installations is between 0.2 and 2.2 dB(A) during the night-time. The IFC's criterion for increases over background noise (3 dB (A)) is therefore met at all receptors, such that the impact can be considered to be acceptable in terms of this criterion.

Thus it can be said that the project will not increase the area's existing acoustic climate in any significant way, the area being mainly subject to noise emissions from existing SENELEC installations.

Mitigation measures and residual impacts

In terms of design, the use of silencers on stacks, air inlets and ventilators on ventilation output, and the installation of anti-noise panels for the generators and steam turbine have been planned.

During the operational phase, in compliance with international good practice, the following mitigation measures will be implemented by the Project:

- Fit diesel engine vehicles and compression equipment with silencers
- Prefer electric energy production over mechanical solutions, where possible
- Turn apparatus off when not in use
- Locate mobile equipment as far away as possible from receptors
- If possible, plan to carry out the various noisy activities at the same time, in view of the fact that the combined noise levels will probably not be very much higher than the level produced if operations were carried out separately

- Avoid the movement of heavy vehicles during the night.

Table 8.26 Noise levels taking into account the project and ambient noise during the operational phase – daytime

ID	Receptors (c)	Ambient noise level LAeq [dB(A)] (a)	Predicted noise level LAeq [dB(A)]	Total noise level LAeq [dB(A)]	Increase over ambient noise [dB(A)] (b)	Daytime noise limits [dB(A)]	Impact importance		
							Ambient noise (c)	Project contribution	Total level: project and ambient noise
1	Private nursery and elementary school	51.8	39.5	52.0	0.2	55-60 (Senegal) 55 (IFC) 3 (IFC – Increase over ambient noise)	Minor	Negligible	Minor
2	"Cité Gabon" primary school	51.8	45.3	52.7	0.9		Minor	Negligible	Minor
3	Nursery school	51.8	42.0	52.2	0.4		Minor	Negligible	Minor
4	Koranic school	51.8	43.9	52.5	0.7		Minor	Negligible	Minor
5	Koranic school	51.8	41.9	52.2	0.4		Minor	Negligible	Minor
6	Koranic school	51.8	45.9	52.8	1.0		Minor	Negligible	Minor
7	Health station	51.8	35.3	51.9	0.1		Minor	Negligible	Minor
8	SENELEC 1 housing	59.5	46.9	59.7	0.2		Moderate	Negligible	Moderate
9	SENELEC 2 housing	56.7	48.7	57.3	0.6		Moderate	Negligible	Moderate
10	Diokoul	51.8	47.0	53.0	1.2		Minor	Negligible	Minor

(a) Noise levels measured by LAME during the field campaign in June 2014. In order to evaluate the increase in noise due to project contribution conservatively, the lowest ambient noise level observed during the day was used.
(b) IFC directives state that […impacts linked to noise should not lead to an increase by more than 3 dB in ambient noise at the closest off-site receptor].
(c) Receptors n°8 and n°9 are SENELEC employee housing, conservatively they have been considered as sensitive receptors.

Table 8.27 Noise levels taking into account the project and ambient noise during the operational phase – night-time

ID	Receptors (c)	Ambient noise level LAeq [dB(A)] (a)	Predicted noise level LAeq [dB(A)]	Total noise level LAeq [dB(A)]	Increase over ambient noise [dB(A)] (b)	Night-time noise limits [dB(A)]	Impact importance		
							Ambient noise (c)	Project contribution	Total level: project and ambient noise
7	Health station	48.7	35.3	48.9	0.2	55-60 (Senegal)	Moderate	Negligible	Moderate
8	SENELEC 1 housing	60.3	46.9	60.5	0.2	55 (IFC)	Major	Moderate	Major
9	SENELEC 2 housing	53.4	48.7	54.7	1.3	3 (IFC – Increase over ambient noise level)	Major	Moderate	Major
10	Diokoul	48.7	47.0	50.9	2.2		Moderate	Moderate	Major

(a) Noise levels measured by LAME during the field campaign in June 2014. In order to evaluate the increase in noise due to project contribution conservatively, the lowest ambient noise level observed during the day was used.
(b) IFC directives state that […impacts linked to noise should not lead to an increase by more than 3 dB in ambient noise at the closest off-site receptor].
(c) Receptors n°8 and n°9 are SENELEC employee housing, conservatively they have been considered as sensitive receptors.

8.8 IMPACT ON WATER RESOURCES

8.8.1 *Impacts during the construction phase*

Water consumption

Water requirements during the Project's construction phase concern mainly:

- General domestic use for consumption by the labour force
- Cleaning and dust control
- Site maintenance
- Concrete preparation

The amount of water required for making concrete is estimated at about 900m^3, due to the fact that 2500m^3 of concrete will be necessary to build the power plant.

Water consumption for domestic purposes during the construction phase can be estimated at an order of 30 litres per person and per day (mainly for sanitation – shower, toilets, maintenance, etc.). Based on this very conservative data (in view of the fact that there will be no accommodation on site), the maximum daily consumption of domestic water can be estimated at 8m^3 per day during the peak activity period (200 workers).

About 1000m^3 of water should be used for sanitation purpose and 100m^3 of water for washing equipment and preventing dust rising.

In all, about 8000m^3 of water should be consumed during the construction phase.

Water will come from the existing SDE (Sénégalaise des Eaux) pipe at the existing power plant. It is interesting to point out that no water supply problem was identified as a concern by the stakeholders met during consultations. Sensitivity of the area is considered to be low.

A description and characterisation of the impacts are presented in *Table 8.28*.

Impacts on water and soil quality

Impacts of the construction phase on water quality can be from:

- Run-off loaded with matter in suspension (MES) from the work site, during rainy periods (mainly from the cleared areas on the site and heaps of excavated soil)
- Direct discharge of waste sanitation water
- Accidental leaks or spillages.

A list of the main products that will be used at the site, as well as an assessment of annual quantities, is provided in the hazards study in *Chapter 9*.

Rain water can be the vector for soil and therefore water pollution (by infiltration) as well as pollution of the marine ecosystem. It can, by run-off over the new parcels that have been cleared and/or waterproofed for the project, take with it and "diffuse" pollutants into the natural environment (soils either outside or inside the site and, potentially, the aquifer and the coast). Run-off water can thus become loaded with matter in suspension (MES) and various other components (such as hydrocarbons) that have accumulated during dry weather on the waterproofed surfaces (notably roadways). Indeed, the project will result in the creation of waterproofed surfaces that were previously non-existent (roads, concreted areas, etc.) up to a maximum of 2.99ha.

The main rainy season is in the months of August and September, with maximum rainfall that can reach 493mm and 365mm respectively (see *Chapter 4*). For calculation we will use the monthly August peak of 493mm as potentially falling all at once. This is a very conservative approach, in view of the fact that pollution is mainly collected during the first 30 minutes of a storm (the soil is then clean and risks of washing off are therefore very low).

The maximum amount of rain water running off in 1 day over the perimeter of the project (including the existing parcel and the area in which the new project is to be installed) measuring 30 000m^2 (this surface area is considered to be entirely waterproofed and therefore of run-off coefficient 1), and which will not filter down into the soil nor will be used by plants, is therefore as follows: Qp = (30 000*1)*(493/1000) / 30 = 493 m^3. The daily amount found is therefore 493 m^3.

The intensity of impacts by run-off will therefore be low. Good practice in terms of run-off management will be implemented by means of characterisation of the site's surface, draining ditches and sediment traps.

Waste water from the living infrastructures (mainly toilet facilities and canteen) are a source of organic and biological pollution that may be transferred to aquifers by infiltration into the soil. This water will also contain cleaning products and detergents.

Discharge of waste sanitation water from temporary buildings (toilets, …) and permanent installations (shower, cafeteria, toilets, …) will be collected and stored in a temporary septic tank during the construction phase. The septic tank will be emptied as often as necessary and its contents eliminated by an approved service provider.

During the construction work the quality of surface water and groundwater may also be affected by accidental spillage of chemicals, fuel or oil from the intermediate storage tanks or vehicles used on the site. Any slight changes will probably be reversible, but larger accidental spillages of fuel or chemicals could result in a medium term reduction in water quality.

No water course is located in the Project's area of influence. The sensitivity of surface water at the site is therefore nil.

Piezometric levels in the project's area are between 2m and 6m. Soils at the project are characterised by the presence of clay and limestone-marl formations. They can therefore be considered to be relatively impermeable. The sensitivity of the groundwater factor is therefore considered to be medium.

A description and characterisation of impacts are presented in *Table 8.28*.

Table 8.28 Evaluation of impacts on resources during the construction phase

Potential magnitude	Frequency /Probability	Relative magnitude	Sensitivity	Impact importance
Domestic usage and construction work – quantitative aspects				
Insignificant • Intensity: low • Scope: local • Duration: short term	High	Insignificant	Low	Negligible
Quality of surface water				
Insignificant • Intensity: negligible • Scope: local • Duration: short term	Occasional	Insignificant	Nil	Negligible
Quality of groundwater				
Insignificant • Intensity: low • Scope: local • Duration: short term	Occasional	Insignificant	Medium	Negligible

In conclusion, liquid discharge during the Project's construction phase will have a negligible impact on surface water and groundwater, from both a quantitative and qualitative point of view.

Mitigation measures

Within the context of general good practice in terms of water consumption during the construction phase, GTI Dakar will require the contractor with responsibility for the works:

- To optimise water consumption and minimise wastage
- Supervise water consumption in order to identify any over-consumption and provide a basis on which to improve efficiency.

The following measures will also minimise potential impacts on water quality during the construction phase:

- The impact of construction activities can be treated by minimising the surface area of bare earth and re-planting on berms as soon as possible. Temporary heaps of materials must be protected from erosion by using the lowest possible berm angle and integrating sediment traps in the drainage ditches. A drainage plan can be drawn up for this purpose.

- Good site management practice must be observed to ensure that products are properly stored on site (secondary retentions, double-walled tanks, overfill alarms, etc.) and that site machinery is check and maintained correctly and regularly.

- The drainage system will be installed prior to the start of construction operations.

- Regular check and maintenance of the drainage system and the waste water evacuation system (temporary and permanent septic tank). Keeping of a register of spillages and the results of checks carried out.

- The non-contaminated water drainage system will be separate from the contaminated water collection system.

8.8.2 *Potential impacts during the operational phase*

Water consumption

During the operational phase, water usage will be as follows:

- Flexicycle steam turbine
- Fire protection system
- Domestic and sanitation use
- Cleaning of floors and equipment
- Cooling systems (maintenance water).

Cooling water requirements will be limited and the cooling system using air will be designed with a closed loop. About 700m^3 of water will be stored on site with the context of the fire protection system. About 30m^3 of service water (raw service water, water for cleaning the boilers and maintenance water) and 100m^3 of demineralised water will be stored on site. The rest of the water used will be supplied directly by a dedicated pipeline connected to the SDE distribution network. Water will be distributed to the various buildings and equipment by means of buried pipes.

The volume required for the power plant's industrial purposes is estimated at about 72m^3/day, to which is added about 50m^3/day intended for domestic consumption. In all about 125m^3 should be consumed on a daily basis. Supplies will be through a pipeline connected to the SDE distribution network. This will therefore be a low intensity impact at regional level.

As specified in *Chapter 8.8.1* on the impact on water resources during the construction phase, sensitivity to this issue is considered to be low.

A description and characterisation of impacts are presented in *Table 8.29.*

Note that the new ContourGlobal - Cap des Biches power plant will no longer use sea water for cooling, unlike the former power plant which consumed about 150 m^3/h. This is a significant improvement due to implementation of the Project, which limits the project's discharge into the marine environment.

Liquid discharge

After start-up, the various flows of aqueous discharge will be as follows:

- Waste sanitation water
- Rain water
- Washing water
- Industrial water, mainly from purging of the cooling system and the steam turbine. This water may contain certain chemical elements from conditioning prior to use (softening / demineralisation, etc.) as well as trace of metallic ions from pipe corrosion.

The various treatment stages are presented in *Chapter 3.6.5*.

The effluent treatment unit will guarantee that waste water is evacuated as required by regulations [(1)]. A buffer tank will be created in which to store liquid effluent after treatment and prior to discharge. This tank will be sized to take account of any high rainfall episodes that could occur in the Project area, in order to avoid any overflow of effluent prior to discharge (see *Section 3.6.5*.

It should also be noted that no heated discharge will be made by the power plant in operation. This is a significant improvement compared to the power plant's previous configuration, in which heated water (after cooling in the secondary circuit) was discharged.

Average volumes discharged will be about 4 m^3/day. Discharge will be made into the marine environment via the SENELEC discharge canal located at the western edge of the existing ContourGlobal - Cap des Biches power plant. As explained in *Chapter 3*, this is a discharge canal shared with the SENELEC power plant which discharges into the sea. The existing SENELEC canal is designed to discharge into the ocean at an output rate of 20 000m^3/h, and

(1) Standard NS 05-061 of July 2001 relating to the discharge of waste water

previously took the cooling water discharged from the former ContourGlobal - Cap des Biches power plant (115m^3 /h – see *Section 3.1.3*). New discharge rates will be lower than those of the former power plant and the capacity of the canal is therefore sufficient to take the new discharge amount planned by ContourGlobal - Cap des Biches.

Solid sludge and residues from treatments will be collected for treatment and/or disposal by an independent waste management company.

The nature of the soils (clay formations) encourages run-off of water into the soils, which is then naturally drained towards the ocean. As mentioned previously, no permanent or temporary water course is located within the Project's area of influence. Consequently continental surface water is not concerned by the discharge of waste water. Nevertheless, any major run-off of contaminated water could reach the coast which is adjacent to the installation site. This will be avoided by means of a drainage system and the waterproofing of surfaces.

With regard to groundwater, the impact of discharge will be of low intensity and localised scope. This is an impact potential over the long term (operational lifespan of the power plant), of only occasional frequency (the volume of water discharged will depend, amongst other things, on the amount of rainfall). However, in view of the fact that no means by which to detect any excess is in place, apparently, abnormal functioning could lead to moderate or even high intensity.

A description and characterisation of impacts are presented in *Table 8.29.*

Evaluation of impacts on water resources during the operational phase

Table 8.29 Evaluation of impacts on water resources during the operational phase

Potential magnitude	Frequency /Probability	Relative magnitude	Sensitivity	Impact importance
Water requirements –quantitative aspects				
Low • Intensity: low • Scope: regional • Duration: short term	High	Low	Low to medium	Negligible
Quality of surface water				
-	-	-	Not applicable	-
Quality of groundwater – normal functioning				
Low • Intensity: low • Scope: local • Duration: long term	High	Low	Medium	Minor
Quality of groundwater – abnormal functioning				
High • Intensity: high • Scope: local • Duration: short term	Rare	Low to medium	Medium	Medium

In conclusion therefore, water use and liquid discharge linked to operation of the power plant will have a minor impact on water resources in normal functioning mode. In abnormal functioning mode, this impact could however become medium. Mitigation and control measures will limit the Project's impact on water resources, to make them acceptable.

Measures to mitigate and control impacts on water resources during the operational phase

The following measures will minimise the potential impacts of power plant operations on water quality:

- oily water will be treated in a deoiler prior to discharge into the SENELEC canal provided
- installations will be regularly checked
- an analysis of effluent prior to discharge will be carried out once a month. In case of discharge thought to be abnormal, analyses will be carried out (even if they are not directly part of the regular effluent monitoring round)
- every week samples will be taken of effluent prior to discharge. Samples will be kept between two monthly analyses and will only be analysed in case of abnormal measurement (in order to trace the source of the abnormality)
- results of analysis after treatment will be recorded and measures implemented in case of any measurement that exceeds limits.

In parallel of these mitigation measures, a piezometer network will be installed at the fuel storage tanks, in order to monitor groundwater quality and to verify the absence of accidental contamination. This measure allows limiting the impact on groundwater during abnormal finctioning.

8.9 IMPACTS ON BIODIVERSITY

8.9.1 Impacts during the construction phase

The power plant construction phase will start with preparation of the land on which the power plant will be built, and particularly with a phase preparing the 2.99ha of the parcel covered by the perimeter of the future power plant.

In view of the small surface area and the absence of any remarkable habitats on this parcel, the impact will be of low intensity and will be over the long term (no return to normal state). Finally the impact is considered to be local.

The installation area is occupied by three habitats influenced by anthropic activities: market gardening, reforested areas and a shallow wet area supplied by run-off from the Rufisque water treatment station's storage lagoons. Consequently, the sensitivity of habitats concerned by land clearance is considered to be low.

With regard to protected species in Senegal, two isolated specimens of a partially protected plant species (*Faidherbia albida*) and a protected bird (the black kite – *Milvus migrans*) have been observed at the installation site. None of these species is vulnerable or threatened at national or international level. Moreover, several specimens of *Faidherbia albida* were also identified in other sectors in the study area, such that the specimens located in the Project area do not represent any issue for conservation of the species at local level. The same is true for the black kite, large numbers of which can be found within the study area – the black kite is a species that is notoriously commensal with humans, which proliferates close to public waste dumps where it finds an abundance of food.

Finally no protected or sensitive area is located within the Project area or in its immediate surroundings. The closest protected area is 25km from the site.

In view of these various arguments, low sensitivity of the biodiversity to clearance operations has been taken into account in this ESIA.

A description and characterisation of impacts are presented in *Table 8.30*.

Building operations will result in the development of an industrial site on a peri-urban parcel of at least 3ha, which was previously partially cultivated by a local inhabitant. The parcel is already located within an industrial area, which explains why habitats and biodiversity are very limited there. Impact intensity will therefore be low and of local scope.

A description and characterisation of impacts are presented in *Table 8.30*.

In conclusion, the Project's impact on biodiversity will therefore be negligible.

Table 8.30 ***Evaluation of impacts on biodiversity during the construction phase***

Potential magnitude	Frequency /Probability	Relative magnitude	Sensitivity	Impact importance
Change in land use (clearance)				
Low • Intensity: low • Scope: local • Duration: long term	High	Low	Low	Negligible
Construction operations (disturbance)				
Low • Intensity: low • Scope: local • Duration: short term	Occasional	Low	Low	Negligible

8.9.2 During the operational phase

In operational phase, the project will not have any impact on biodiversity since the parcel concerned will have already been developed and surrounding areas (where sensitivity is also very low) will not be concerned by the Project.

A description and characterisation of impacts are presented in *Table 8.31*.

Table 8.31 ***Evaluation of the impacts on biodiversity during the operational phase***

Potential scope	Frequency /Probability	Relative scope	Sensitivity	Impact importance
Power plant operation				
Insignificant • Intensity: negligible • Scope: local • Duration: long term	Rare	Insignificant	Low	Negligible

No specific mitigation measure or additional control is required.

8.10 Impacts on the Landscape

8.10.1 Recap of initial conditions

The study area landscape is highly dominated by industrial activities, marked by the presence of several electricity generation installations.

No significant tourist activity was found in the Project area.

Finally, no landscaped area of interest is present in the surroundings of the Project site and the landscape does not have any sensitive characteristics in terms of heritage buildings or cultural heritage (archaeological sites, monuments or sites of intangible heritage) close to the proposed site or in the more extended study area (up to 10 km).

Sensitivity in terms of landscape impact associated with installation of a new power plant is therefore considered to be low.

8.10.2 *Potential impacts during the construction phase*

Evaluation of landscape impacts during the construction phase

Landscape impacts during the construction phase will be gradual, temporary and limited to the construction period.

In view of the project activities described in *Chapter 3*, those likely to generate potential impacts on perception of the landscape are as follows:

- The installation of temporary offices and signs
- Temporary storage works and installations
- The installation and movement of light and heavy construction machinery (including high cranes)
- Installation of lighting systems, including lighting pylons for activities
- The movement of special loads.

These activities will integrate easily into an area that is already highly dominated by industrial activities, such that the scale of the impact is considered to be small.

In view of the low sensitivity in landscape terms and the temporary and limited nature of this impact during the construction phase, this is therefore an impact of negligible importance.

Measures to mitigate and control impacts on the landscape during the construction phase

The mitigation measures described below form an integral part of good management practices in the construction phase. These measures, which are used to minimise visual and landscape impacts, are as follows:

- Machines and materials will be stored properly during works. High machines, including cranes, will not be left in place for any longer than necessary for the construction work

- Outdoor lighting of the construction work must be as discreet as possible and must not allow light to shine upwards or towards residential areas

- Work safety lighting (during construction and operations) will be directed downwards to limit light emissions in the area during the night-time.

8.10.3 *Summary of landscape impacts*

Table 8.32 Evaluation of impacts: land use and local infrastructures

Potential magnitude	Frequency /Probability	Relative scope	Sensitivity	Impact importance
Impacts during the construction phase				
Low • Intensity: low • Scope: local • Duration: temporary	High	Low	Low	Negligible
Impacts during the operational phase				
Low • Intensity: medium • Scope: local • Duration: long term	High	Medium	Low	Minor

•

8.10.4 *Potential impacts during the operational phase*

Evaluation of landscape impacts during the operational phase

The two main sources of visual and landscape impacts are the height and volume of the proposed infrastructures. The main potential impacts resulting from the Project can be summarised as follows:

- Long term visual and landscape impacts from new buildings on the Project's main site, particularly installation of the stack, which will be about 40m high and will be visible from the edge of the site
- Installation of reservoirs and of the main steam turbines block and the three engines (about 16 -18 m).

In addition to these potential impacts associated with the buildings are those linked to site lighting and, to a lesser extent, those caused by atmospheric emissions (even though their visibility will be very limited).

The scale of landscape impacts connected to the Project will be low, since they will be part of a landscape that is already highly dominated by industrial infrastructures.

In view of the low sensitivity of the landscape and the intensity of the change made by the Project, which is considered to be low (slight change made to landscape characteristics), the resulting impacts on the landscape during the operational are considered to be of negligible importance.

Measures to mitigate and control impacts on the landscape during the operational phase

The following mitigation measures are recommended throughout the power plant's operational phase in order to reduce visual and landscape impacts:

- Design, orientation and materials will be properly and reasonably developed to fit in with the site's existing characteristics and with the landscape's characteristics

- Appropriate usage of non-reflecting surfaces and coloured surface treatments

- External lighting as discreet as possible and directed downwards to limit light emissions in the area during the night-time.

8.11 IMPACTS ON LAND USE AND LOCAL INFRASTRUCTURES

Land use

Building the power plant on the new parcel will mean expropriation of a farmer who has been using the land concerned for market gardening and fruit trees for several years (see *Section 5.7.4*). However this farmer was not the owner of the land he was using.

As shown in *Chapter 4*, a land acquisition procedure has been implemented by SENELEC, in collaboration with ContourGlobal – Cap des Biches and a Senegalese surveyor who supervised the operations. A report was published in June 2014 (*Evaluation des biens du verger de la famille de feu Isma Diop sis au Cap des Biches*) which summarises the situation, results of the inventory and the value of disbursements. Since then an agreement has been signed with the beneficiaries and the planned compensation amounts have been paid. No conflict arose in the resolution of this issue.

Based on these considerations, potential impact intensity on land use of development of the power plant is low, of local scope and long term. The consensual approach used by SENELEC and ContourGlobal - Cap des Biches during the compensation procedure and the absence of any dwellings in the area concerned by development of the power plant suggest low sensitivity.

A description and characterisation of impacts are presented in *Table 8.33*.

Cultural heritage and traditions

As mentioned in *Chapter 4*, no historic or archaeological site was identified in the Project area during the investigations carried out during the socioeconomic study. No cemetery or place of worship is located close to the future power plant and will not therefore be affected by development of the

Project. The intensity of the potential impact linked to development of the power plant on local infrastructures, and cultural and religious heritage can therefore be considered to be low and of only local scope. The absence of receptors either directly or indirectly concerned by the power plant explains the low sensitivity.

Disruption on access roads

The power plant area is currently linked to the N1 highway that runs between Dakar and the rest of the country. This asphalted highway runs along the industrial zone and the SENELEC estate to reach, about 800m further on, the area in which the former power plant was located and finally the unloading quay that gives onto the bay. This road is not a direct access route to urbanised areas and is used very little by local populations.

No major modification to access routes needs to be planned for the Project development except a deviation towards the future power plant area from the main road, which will not have any significant impacts on local populations.

Impact intensity is considered to be low and of only local scope because it concerns the industrial zone only.

In view of the absence of any dwellings in the direct surroundings of the Project area, with the exception of the SENELEC housing estate, built to house managerial staff working at the power plant, sensitivity is considered to be medium based on a conservative approach.

A description and characterisation of impacts are presented in *Table 8.33*.

Evaluation of impacts on land use and local infrastructures during the construction phase

Table 8.33 Evaluation of impacts: land use and local infrastructures

Potential magnitude	Frequency /Probability	Relative magnitude	Sensitivity	Impact importance
Clearance of the area and changes made to use of the terrain – Land use				
Low • Intensity: low • Scope: local • Duration: long term	High	Low	Low	Negligible
Clearance of the area and changes made to use of the terrain - Cultural heritage and traditions				
Low • Intensity: low • Scope: local • Duration: long term	High	Low	Low	Negligible
Clearance of the area and changes made to use of the terrain - Disruption to access roads				
Medium • Intensity: low • Scope: local • Duration: long term	High	Low	Medium	Minor

In conclusion, the Project's impact on land use and local infrastructures will therefore be negligible to minor. The mitigation and control measures indicated below will reduce these impacts and maintain them at their lowest level.

Measures to mitigate and control impacts on land use

ContourGlobal - Cap des Biches will inform all those concerned of the planned start date for works as early as possible and at least three weeks in advance, to enable former users the possibility of cutting down trees and collecting the wood for heating. This measure will help to lessen the loss of the production area for the people concerned and will be in addition to the financial compensation paid by SENELEC on acquisition of the land.

8.12 IMPACTS ON THE LOCAL SOCIOECONOMIC CONTEXT AND LIVING CONDITIONS

8.12.1 Construction phase

Employment

An average of 85 workers will work on construction the power plant. The recruitment of local workers will be preferred as much as possible. It is estimated that of the average number of 85 jobs, at least 50 could be recruited locally from neighbouring urban communities (West Rufisque municipality). Workers will be employed for periods from several days (for specific construction works) up to 11 months (total duration of construction works excluding commissioning). Staff numbers will therefore vary throughout the construction phase. Some construction work will require intervention by qualified and specialised workers, who may be recruited from further away if the skills required are not available locally.

The construction work will therefore have a positive impact in terms of employment at both local and regional level.

A description and characterisation of impacts are presented in *Table 8.34*.

Local economy and inflation

The local economy is already perfectly well integrated into the industrial and urban context of the study area, such that the changes brought about by the arrival of workers in the area should be only limited.

Construction work at the power plant will have the consequence of creating a dynamic in the local economy of varying degrees, depending on distance from the power plant area and the size of the communities affected. It is expected that workers working on the worksite and neighbouring communities will be in contact with one another during rest periods and various types of commercial exchanges will take place: restaurants and catering, sales of basic equipment, various services. These potential impacts can be considered as positive for the communities concerned.

An inflation phenomenon linked to the presence of workers (who could lead to an increase in demand) is extremely unlikely. The local economy is already highly influenced by the proximity of Dakar and the N1 highway (which already sees a large flow of goods and people).

Concerning the economic activities presented in the study area (shell gathering, fishing, etc.), these will not be affected by installation of the power plant. The Project will not lead to any change to the coast likely to impact shell gathering activities.

Immigration and pressure on existing local infrastructures

In the case of construction of the ContourGlobal - Cap des Biches power plant, the probability of migration to the project area is very low. Indeed, the relatively limited size of the project and the fact that the site is located close to both the town of Rufisque and Dakar will have the effect of diluting the arrival of people looking for work at regional level. The sensitivity of local communities can therefore be considered to be low.

Agriculture

The Project area was used by a farmer for several year for market gardening and the growing of fruit trees, over a surface area of less than 1 ha.

The halting of these agricultural activities will not have any significant impact on the availability of agricultural products in the region in view of the urban context in which the project is located; towns act as places for the convergence of agricultural products, where they are sold on local markets.

Also, in view of the low density of agricultural activities in the study area, the creation of local jobs on the worksite to build the power plant will not have any real significant impact on agricultural production due to a reduction in the workforce on agricultural land and in orchards.

A description and characterisation of impacts are presented in *Table 8.34*.

Vulnerable groups

In the case of the study, no specific impact on a vulnerable group was identified.

Evaluation of impacts on the socioeconomic context and living conditions during the construction phase.

Table 8.34 Evaluation of impacts: socioeconomic context and living conditions during the construction phase

Potential magnitude	Frequency /Probability	Relative magnitude	Sensitivity	Impact importance
Socioeconomic context - Employment				
Low positive impact	-	-	Medium	Positive
Socioeconomic context – Local economy				
Low positive impact	-	-	Low	Positive
Socioeconomic context – Immigration and pressure on local infrastructures				
Insignificant to low • Intensity: low to moderate • Scope: local • Duration: short term	Occasional	Low	Medium	Negligible
Socioeconomic context - Agriculture				
Low • Intensity: low • Scope: local • Duration: long term	High	Low	Low	Negligible

The Project's impact on the local socioeconomic context will therefore be positive.

8.12.2 *Potential impacts during the operational phase*

The positive impacts described above, observed during the construction phase, that is employment and a dynamic in the local economy, will also be observed during the operational phase. On the other hand the importance of these impacts on the socioeconomic context during the operational phase will be more limited because the number of workers hired long term will be less than during the construction work phase.

Also, about 90% of the sixty or so permanent jobs at the power plant will be for qualified staff. The number of local jobs and jobs for young people will therefore be relatively limited during the operational phase. Operations will also lead to temporary jobs, the precise number of which is not known at this stage in the Project (estimated at between 10 and 25 employees, depending on requirements).

With regard to impacts linked to opportunist migration phenomena and pressure on local infrastructures during the operational phase, these can be considered to be negligible in view of the small number of people who will work at the site and the adaptation of local communities that should take place during the construction work phase (integration into communities of people working at the site, implementation of structured exchanges with power plant employees). The local economy may even draw a positive impact from operations, either directly with development linked to the new industrial activity in the urban community, or indirectly by presupposing the installation of future activities, attracted by this new industrial dynamic. However, in view of the relatively hypothetical nature of these positive impacts, they have not been included in the evaluation.

In terms of fishing activities, no favourable area is located in immediate proximity to the area where liquid effluent is discharged. Also, the volume of discharge will be limited and concentrations discharged will comply with current regulations (see *Section 2)*. The potential impact on fishing activities will not therefore be significant.

The description and characterisation of the impacts are present in *Table 8.35*.

Table 8.35 Evaluation of impacts: socioeconomic context and living conditions during the operational phase

Potential magnitude	Frequency /Probability	Relative magnitude	Sensitivity	Impact importance
Socioeconomic context – Employment				
Low positive impact	-	-	Medium	Positive
Socioeconomic context – Local economy				
Low positive impact	-	-	Medium	Positive

The impact of power plant operations on the socioeconomic context will therefore be positive.

8.12.3 *Main social management measures*

As far as possible, non-qualified jobs will be held as a priority by candidates from the neighbouring urban community. To achieve this, ContourGlobal - Cap des Biches and the various contractors working on the project will estimate as best possible the number of jobs requiring few or no qualifications, depending on the various stages in work at the site, in order to draw up a provisional recruitment timetable. This document and the main eligibility criteria will be communicated at local level, particularly within the Municipality of West Rufisque in order to encourage local employment (particularly the employment of young people). This approach should limit a perception of favouritism on the part of certain members of the surrounding communities by making the recruitment process as transparent as possible. However, this approach will not prevent any opportunistic migratory influx, but will mean that this phenomenon is restricted to a minimum.

In order to limit opportunistic immigration, the Promoter will specify clearly that no worker will be hired at the site gate, and will communicate very precisely on the formal recruitment process, in order to discourage as much as possible the local installation of opportunistic immigrants. ContourGlobal - Cap des Biches will also work in coordination with local authorities, notably the Municipality of West Rufisque.

8.13 IMPACTS ON THE HEALTH AND SAFETY OF LOCAL COMMUNITIES AND EMPLOYEES

The following phases of the Project will be likely to have an impact on the health and safety of local communities and employees:

- Use of labour during the construction and operational phases
- Traffic during the construction and operational phases
- Emissions and discharge from the power during the construction and operational phases
- Sanitary impact related to workers (HIV/AIDS)

The environmental, health and safety directive developed by World Bank Group for thermal power plants specifies that risks relating to health and safety at work associated with the development and operation of a power plant fall into the following categories:

- heat
- noise
- confined spaces;
- risk due to electricity
- risk of fire and explosion
- chemical risks
- dust

This directive also specifies that the risks that the construction and operation of a thermal power plant may pose for the health and safety of the population are, in many case, the same as for most infrastructures and major industrial installations, i.e. problems with the development of contagious diseases, safety and, above all, the risks linked to traffic due to development of the Project in the area concerned.

Issues related to major risks associated with the development and operation of the power plant (fire, explosion, etc.) and those linked to the presence of chemicals, will be covered specifically in the hazards study presented in *Chapter 9.*

8.13.1 *Potential impacts during the construction phase*

Health and safety of the labour force

Contruction phase will be directed by the Company Wartsila on behalf of ContourGlobal - Cap des Biches. A Health / Safety / Environment (HSE) management plan has been specifically developed ensuring compliance to international best practices and local Senegalese legislation. This plan is detailed in the *Annex 7*.

HIV-AIDS

As is the case for most development projects located in peri-urban areas, there is a risk that building the thermal power plant will lead to an increase in health problems. Health risks inherent to major development projects are those that result from poor living and hygiene conditions, sexually transmitted diseases and infections transmitted by vector. The most serious transmissible diseases during the construction work phase are, due to the mobility of the labour force, sexually transmissible diseases, such as HIV/AIDS. An influx of workers during the power plant's construction and operational phases is indeed likely to increase the risks of propagation of diseases amongst local populations: major construction projects often lead to the arrival of a large amount of male workers, temporarily distanced from their families. These men who find themselves alone for some time may tend to call on the services of prostitutes. These impacts should remain limited, however, on the one hand because the number of workers from outside the community will be relatively small (about 85 people) and on the other because no official worker accommodation will be available at the Project. The concentration of workers in the same small space is in fact often one of the factors that encourage the negative effects described above.

Malaria

In addition the pools of stagnant water observed on construction projects, even though they are temporary, encourage the development of mosquito larvae which are a vector for malaria. The intensity of this potential impact can be considered to be low, however, in view of the limited extent of the future power plant. Its scope is regional, on the other hand, in the short term. The sensitivity of neighbouring communities is considered to be medium.

A description and characterisation of the impacts are presented in *Table 8.36*.

Worker accommodation

At this stage is it planned that most of the workers working at the worksite will come from neighbouring communities (from as far as Dakar) and will not require any accommodation during this period. Some of the workers will come from surrounding towns (Municipality of West Rufisque, town of

Rufisque). The installation of temporary camps for worker accommodation is not therefore to be envisaged.

ContourGlobal – Cap des Biches Traffic

During the construction phase, traffic around the future power plant's installation area will increase significantly, in view of the fact that employees and equipment will have to be transported by road to the site (mainly from Rufisque and Dakar). In view of population density in certain areas, traffic risks could be increased. As specified in the environmental, health and safety directive developed by World Bank Group, road accidents are one of the main causes of death and injury amongst communities, and this is the case the world over.

ContourGlobal - Cap des Biches believes that around 20 journeys will be made per day for equipment deliveries, in addition to individual and collective vehicles transporting staff working at the worksite. Some of the workers working at the site will be from neighbouring communities, which will reduce journeys along the main road. These are short journeys however (less than 30km) along a major route that is already relatively saturated. The intensity of impact linked to the increase in road traffic is therefore considered to be medium.

Most of the traffic will used the N1 highway from Dakar eastwards and will turn off towards the site shortly before the town of Rufisque (Municipality of West Rufisque); this is a road where there is already a lot of traffic, which crosses built-up districts and urban areas, and where inhabitants are already used to lots of traffic; sensitivity is therefore considered to be medium.

Emissions and discharge

The construction phase will generate noise and atmospheric emissions and liquid effluent likely to have potential effects on the health of local communities and workers.

As mentioned in *Section 8.5.3,* the impact on air quality caused by the Project during the construction phase is considered negligible.

Noise emissions during the construction phase have been modelled according to the most unfavourable scenario, taking into account the closest receptors. The modelling described in *Section 8.7.4* concludes that there will be a low impact. This is a potential estimate, based on a penalising scenario, the actual occurrence of which is extremely unlikely.

Liquid effluent discharge during the construction phase will be mainly comprised of waste sanitation water and run-off water potentially loaded with MES. Estimates of this discharge, impact evaluation and associated mitigation measures are detailed in *Section 8.8.1.* Liquid discharge will take place in compliance with Senegalese regulations and impact is therefore considered to be negligible.

In all three cases, since the distance from the main sensitive receptors (schools, health station, dwellings, etc.) is at least 400m, sensitivity in terms of emissions and discharge is considered to be low due to the potential of dispersal and propagation of emissions. However, non-permanent receptors close to the worksite, such as people working in the surroundings during the daytime, must be taken into account. Impact analysis therefore considers medium sensitivity within the context of a prudent, conservative approach. It should also be remembered that no major potential impact on the environment has been identified with regard to emissions and discharge during the operational phase. The impact is of low intensity, of regional scope and short term. Impact is therefore negligible.

Evaluation of impacts on the health and safety of workers and communities during the construction phase

Table 8.36 Evaluation of impacts: health and safety of workers and communities during the construction phase

Potential magnitude	Frequency /Probability	Relative magnitude	Sensitivity	Impact importance
Health and safety of the labour force				
Insignificant to low • Intensity: low • Scope: local • Duration: short term	Occasional to rare	Low	Medium	Negligible
Use of labour: contagious diseases				
Insignificant to low • Intensity: low to moderate • Scope: local • Duration: short term	Occasional to rare	Low	Medium	Minor
Emissions and discharge				
Low • Intensity: negligible • Scope: regional • Duration: short term	High	Insignificant	Medium	Negligible
Resulting traffic				
Medium • Intensity: moderate • Scope: regional • Duration: short term	High	Medium	Medium	Medium

Measures to mitigate and control these various impacts on health and safety linked to construction of the Project are presented at the same time as those relating to operations in *Chapter 8.13.3*.

8.13.2 *Potential impacts during the operational phase*

Use of the labour during the operational phase

Operation of the power plant will take place in compliance with international good practice and Senegalese regulations in terms of the health and safety of workers.

ContourGlobal - Cap des Biches will develop a specific health and safety policy for its own employees. This policy will be stemming from Contour Global health and safety policy as presented in *Annex 7*.

Resulting traffic

As indicated in the World Bank Group's directive, operation of a thermal power plant leads to increased traffic, particularly in the case of power plants running on fuel oil transported by road

For this Project, supplies could be brought by truck from the SAR refinery located very close by. This short distance will limit potential risks linked to road transport to a great extent and the impact should therefore be of low to moderate scale. Should ContourGlobal, in coordination with SAR, confirm the option of supplying the plant with a pipeline, this impact would become negligible.

Emissions and discharge

The operational phase will generate noise and atmospheric emissions and liquid effluent likely to have potential effects on the health of local communities and workers.

The modelling of atmospheric emissions presented in *Section* 8.5.4 shows that the impact on air quality during the operational phase is negligible to minor, depending on whether short or long term emissions are taken into account. No impact on the health of communities and workers is therefore predicted.

Noise emissions during the operational phase have been modelled according to the most unfavourable scenario, taking into account the closest dwellings. The modelling described in *Section 8.7.4* concludes that there will be a minor impact notably because the Project's contribution to ambient noise levels is very low, due to the already industrialised nature of the area. The impact on communities' health is therefore negligible.

Aqueous effluent generated after treatment during the power plant's operational phase will comply with limits imposed by Standard NS 05-061 on waste water discharge (see *Section 8.8.2*). Mitigation and control measures implemented will lead to a minor impact on groundwater, which in any case is not used by the population downstream from the Project. The impact on community and worker health is therefore negligible.

In all three cases, the long distance (about 400m) of the Project area from the main sensitive receptors (schools, health station, dwellings, etc.) results in low sensitivity in terms of emissions and discharge.

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Evaluation of impacts on the health and safety of workers and communities during the operational phase

Table 8.37 Evaluation of impacts: health and safety of workers and communities during the operational phase

Potential magnitude	Frequency/ Probability	Relative magnitude	Sensitivity	Impact importance
Health and safety of labour				
Insignificant to low • Intensity: low • Scope: local • Duration: long term	Occasional to rare	Low	Medium	Negligible
Resulting traffic				
Low • Intensity: negligible • Scope: regional • Duration: long term	High	Low	Low	Minor
Emissions and discharge				
Medium • Intensity: Moderate • Scope: regional • Duration: long term	High	Low	Low	Minor

The Project's impact on the health and safety of communities during the operational phase is therefore evaluated as medium prior to the implementation of mitigation measures; implementation of the measures described below will reduce this impact to an acceptable level.

8.13.3 Mitigation measures

Health and safety of the labour force

GTI Dakar will use a health and safety management system that will identify risks and implement protective measures to preserve the health and safety of workers, in compliance with international good practice and Senegalese regulations.

Prevention of transmissible diseases

In order to reduce the potential impacts linked to an increase in sexually transmitted diseases, the Project will adopt and apply an HIV/AIDS prevention policy aimed at proactively creating awareness within the labour force of HIV/AIDS prevention and other contagious diseases. The Project promoter will establish a "code of conduct" right from the construction phase to ensure that employees behave in ways that will limit the increase in contagious diseases and discourage prostitution. This programme will also include an aspect intended to combat discrimination in the workplace based on HIV status.

During the construction phase, the Project will also minimise risks to the safety of local communities and Project employees by means of the implementation of coordination with local authorities and the local police, and the recruitment of security officers, in order to prevent criminality. A code of conduct will also be established for the attention of police forces and security officers to prevent the use of violence, coercion or intimidation.

In terms of worker accommodation, the promoter will ensure that the international standards presented in the chapter below are complied with. A specific process for recording worker complaints on issues of accommodation and living conditions will also be developed and updated to ensure transparency and accessibility.

Road traffic during the construction and operational phases

The implementation of measures intended to reduce the risks associated with the movements of trucks and other transportation vehicles on the roads leading to the power plant will include amongst other things:

- Compliance with speed limits by installing limitation around the power plant area for trucks carrying equipment during the construction phase and fuel oil during the operational phase.

- The installation of adequate signing in the Project's surroundings.

- Regular maintenance of vehicles to avoid a far as possible any kind of mechanical breakdown

- Awareness of the drivers and populations concerned of the risks associated with the presence of transportation trucks in the surroundings of the power plant area.

Emissions and discharge

The emissions and discharge mitigation and control measures already presented in *Chapters 8.5, 8.7* and *8.8* will also be efficient in attenuating potential impacts on the health of communities during the construction and operational phase. No additional mitigation or control measure is required.

8.14 ECOSYSTEM SERVICES

8.14.1 *Methodology*

The study of ecosystem services was carried out using the global methodology of impact study. The importance of the impact is evaluated according to the value / sensitivity of the receptor and the scale of this impact. In the case of services rendered by ecosystems, the analysis of the baseline produced a list of services rendered by ecosystems.

Value

The value of a service is based on a study of its importance to beneficiaries, the availability of sustainable alternatives and the resilience of species and habitats adjacent to the origin of the service.

To define the value, two aspects of services rendered by ecosystems in the study area are considered:

- The importance of the service for its beneficiaries
- The way in which it can be replaced, or not, by alternatives in other places (or "replaceability").

The importance to beneficiaries of services rendered by ecosystems is evaluated according to the following criteria and according to a scale from minor to essential:

- Intensity of usage: for example daily weekly or seasonal usage of a supply service. Number of villages downstream that rely on erosion or flooding control services.
- Scope of usage: for example at home or village level ; use as a means of subsistence, for trade, or both
- Geographic proximity (as far as possible)1
- Degree of dependency: for example the share in total protein consumption represented by fish or bush meat.

The replaceability of services rendered by ecosystems is evaluated according to the following criteria, on a scale from low to high:

- The existence of other geographic locations (other sites where the same service rendered by ecosystems is available and is sufficiently close to be used by the communities affected)
- The sustainability of the other geographical locations, in view of the risk of increase in the use of the resources, notably by taking account of other users as well as the current state of the resource and the threats facing it.

[1] By taking account of geographic proximity, the study favours services that profit local communities. National and world beneficiaries are indissociable from the study of services rendered by ecosystems and they are included where relevant. However, when everything is equal elsewhere, a service that benefits local communities will be given greater importance than a service enjoyed only by national or world stakeholders.

Low replicability indicates that there is no other or very few other geographic locations possible, whereas high replicability means that there are lots of other locations in the area.

Results on the importance and replaceability of services are used to assign a value to services rendered by ecosystems (see *Table 8.38*).

By means of an analysis of data referring to baseline and comments made by stakeholders with regard to services rendered by ecosystems, each service is given a value indicating its importance to beneficiaries and the availability of alternatives (replaceability) to the service.

Table 8.38 Criteria used to define the value of services rendered by ecosystems

		Replaceability / Resilience of the service		
		High (lots of geographic locations possible)	Moderate (a few geographic locations possible)	Low (a few to no other possible geographic location)
Importance to beneficiaries of the service rendered	Minor	Low	Low	Medium
	Moderate	Low	Medium	High
	High	Medium	High	Critical
	Essential	High	Critical	Critical

At the end of the ranking process, a final sustainability filter is applied to services with a high to critical value. By sustainable usage is meant maintenance of the biological, ecological and socioeconomic sustainability of the resource on which a particular service rendered by ecosystems is based.

These conditions are defined as follows:

- Biological sustainability indicates that the populations or resources used (for example fresh water) must not be subject to a continual reduction in terms of number / quantity.
- Ecological sustainability indicates that the density of populations or resources used must not be reduced to the point where the latter no longer fulfil their ecological role.
- Socioeconomic sustainability indicates that the density of populations or resources used must not be reduced to the point where the latter cease to be a significant resource for human users.

If it is found that the use of a service rendered by ecosystems is not sustainable in the study area, the service will not be considered to be a priority service rendered by ecosystems.

Magnitude

In the case of services rendered by ecosystems, the receptor is the service itself, supplied by the adjacent ecosystem. However, because the end beneficiaries are the human users of this service, the study takes into account the magnitude of an impact on a service rendered by ecosystems and the resulting magnitude of the impact on the human beneficiaries of this service.

The magnitude is classified in the following way:

- Negligible: in the normal bracket of natural variations
- Low: the impact leads to a small reduction in the availability or functionality of the service rendered by the ecosystems and/or has implications for only a small number of people compared to the whole of the population within the area of influence. A perceptible difference is observed compared to the baseline conditions.
- Medium: the impact leads to a moderate reduction in the availability or functionality of the service rendered by the ecosystems and/or has implications for substantial numbers of people compared to the whole of the population within the area of influence. Does not threaten the long term viability of the service.
- High: the impact leads to the loss of all or a significant proportion of the availability or functionality of the service rendered by the ecosystems and/or has implications for the majority of people in the area of influence. Long term viability of the service is threatened.

8.14.2 Evaluation of impacts on services rendered by ecosystems

Supplies: Crops and fruit trees

As explained in the description of the baseline of the site (see *Chapter 5.9*), land available for urban agriculture has almost disappeared in the project's area of influence. Some market gardening crops are present in the Project area.

The Project will cover a parcel of 2.99ha where agricultural activities are carried out, notably market gardening and fruit trees. After discussion with SENELEC, ContourGlobal - Cap des Biches listed all the assets on the installation site in mutual agreement with the farmer. Replaceability is considered to be low, due to the relatively low availability of alternative sites for crop growing. Importance is considered to be low in view of the fact that agriculture does not represent an essential means of subsistence for communities and the farmer will be financially compensated in compliance with current regulations. The value is judged to be medium.

Values conferred upon supply services are therefore high for "foodstuff" services and medium for "transformation" services.

Value of the existence of biodiversity

This service refers to the value globally placed on the protection of species and habitats considered to be "emblematic" or which have a particular value for conservation. The benefits are often at world or national level because the service excludes any physical or religious value, encompassing only the non-usage value attributed to the continued existence of a species.

No sensitive natural and/protected area is located in the near study area. The only classified forest found in the more distant study area is Pire Gourèye forest, which is over 25km from the Project area.

Importance for the community is considered to be low. Replaceability is high because the species present are neither vulnerable nor threatened. Value is low.

Aesthetic value

As mentioned in the chapter on landscape, there is no landscape of recognised interest in the study area. Pleasure found in the current landscape is considered to be low for the community, its replaceability is moderate and its value low.

Table 8.39 Analysis of services rendered in the area

Service	Description	Importance for the community affected	Replaceability	Value
Supply services				
Foodstuffs: Crops and fruit trees	Little agricultural activity due to the low availability of suitable agricultural land. The Project's installation site will cover a farm of about 3ha (mainly market gardening crops, notably peppers and okra, and fruit trees, mainly lemon and annona).	Low	Low	Medium
Cultural service				
Value of the existence of biodiversity	Only one partially protected plant species and one protected animal species (but which is common in the area) have been found on the installation site.	Low	High	Low
Aesthetic value	Landscape	Low	Moderate	Low

Impacts on supply services

Taking account of the analysis above, a description and characterisation of the impacts are presented in *Table 8.40*.

Table 8.40 ***Evaluation of impacts: supply services***

Potential magnitude	Frequency/Probability	Relative magnitude	Value of the ecosystem	Impact importance
Market gardening activities				
Low • Intensity: Low • Scope: Local • Duration: Long term	High	Low	Medium	Minor

In conclusion, the Project's impact on supply services is evaluated as being minor; this is therefore an acceptable impact, dealt with by the procedure for acquisition of the parcel and compensation paid by SENELEC to beneficiaries for the small surface areas being cultivated (less than 1ha).

Impacts on cultural services

In view of the fact that existence value is neither tangible nor easily quantifiable, the ESIA does not attempt to attribute a value to impacts on this service. On the other hand, the study of biodiversity examines the impacts on habitats and species. The associated impact therefore refers to the impact on biodiversity (*Section 8.9*).

A description and characterisation of the impacts are presented in *Table 8.40*.

Table 8.41 ***Evaluation of impacts: cultural services***

Potential magnitude	Frequency /Probability	Relative magnitude	Value of the ecosystem	Impact importance
Existence value of biodiversity – change in land use				
Low • Intensity: moderate • Scope: local • Duration: long term	High	Low	Low	Negligible

In conclusion, the Project's impact on cultural services is therefore evaluated as negligible; this is therefore an acceptable impact.

Impacts on cultural services

Impacts on the "aesthetic value" service relate to landscape and visual impacts. These impacts have been evaluated as being non-significant to moderate during the various phases of the project, according to the methodology used for specific areas in the Project study area.

A description and characterisation of the impacts are presented in *Table 8.42*.

Table 8.42 Evaluation of impacts: cultural services

Potential magnitude	Frequency /Probability	Relative magnitude	Value of the ecosystem	Impact importance
Aesthetic value provided by natural landscapes				
Specific methodology (developed in *Chapter 8.10*)			Low	Negligible

The Project's impact on cultural services is therefore evaluated as negligible.

8.15 IMPACTS LINKED TO SOLID WASTE

8.15.1 Potential impacts during the construction phase

Construction of the Project will generate the following types of waste:

- Excavated soils and materials excavated corresponding to the foundations of the main buildings
- Domestic waste
- Packaging of construction materials and raw materials (cement bags, wooden chests, etc.)
- Materials resulting from structural works (excess concrete, …)
- Greasy waste, batteries, empty drums and other special waste materials.

Concerning the excavated soils, volumes should be relatively small in view of the level topography and absence of any basements in the buildings (relatively small foundations). Some of the excavated soil can be used for levelling the land. The sub-contractor with responsibility for civil engineering will be contractually responsible for dealing with the soils and will contact the local authorities for details of places where the deposit of excavated materials is authorised.

Waste materials will be sorted according to their origin and treatment methods, in accordance with international waste management standards. Based on feedback and experience with similar projects, volumes of special waste materials produced during the construction phase should be small and most of the waste products can be easily reprocessed through existing facilities. Moreover, about 200 m^3 of ordinary waste (i.e. one truckload) will be generated every month.

Most of the hazardous waste will be mainly contaminated by oils and can be directly collected and disposed of based on contracts with recycling and industrial waste disposal companies in Senegal.

Waste materials will be sorted according to their origin and treatment methods. The collection of waste generated during the power plant construction phase will be managed by an approved service provider and will be in compliance with current regulations.

Sensitivity of the environment has been considered to be medium because the power plant will be installed on land of a certain economic value (agricultural) and because of the presence of a relatively shallow aquifer. The storage area for waste products will be waterproofed and covered to avoid the waste coming into contact with rain water.

Table 8.43 Evaluation of impacts: production of waste during the construction phase

Potential magnitude	Frequency /Probability	Relative magnitude	Sensitivity	Impact importance
Waste production				
Low • Intensity: low • Scope: regional • Duration: short term	High	Low	Medium	Minor

In conclusion, the impact of waste production during the construction phase is considered to be minor. This is therefore an acceptable impact if the mitigation and control measures described below are correctly implemented.

Mitigation and control measures:

To mitigate potential impacts linked to waste production, the following measures will be applied:

- Ensure the application of good maintenance and layout practices on the premises by workers, right from the start of the works.
- Develop and maintain an inventory of stocks in order to reduce the amount of waste generated due to materials out of date, materials that do not meet specifications or which are damaged or in greater quantities than required, and which identifies opportunities for re-using materials and equipment such as containers.
- A Waste Management Plan will be developed prior to the start-up of construction work and will include the collection and management of waste produced by the workers recruited to build the power plant. This plan will consider the current saturation of local storage centres (Rufisque, Dakar), in order to select the most suitable destination for disposal.
- Ensure that all staff know about and have received the necessary training for compliance and application of the Waste Management Plan as well as the procedures associated with it.

- All solid waste will be collected, stored, transported and disposed of ecologically and in complete safety by the service provider in charge. This service provider will be approved under the terms of current regulations.
- Service providers in charge of waste management will be selected according to their competence and the quality of their services.
- Performance reviews of service providers will be undertaken.
- Traceability of waste evacuation and processing will be guaranteed by the systematic recording of transport forms detailing the type of waste, the amount and its destination, and indicating the carrier's identity.

8.15.2 Potential impacts during the operational phase

The main waste products expected during start-up of the site are as follows:

- Domestic waste
- Sludge from the effluent treatment plant and the hydrocarbon separator
- Hazardous waste comprising lubricants and waste oils and their containers, used filters, oily rags, solvents used for cleaning, etc.
- Waste from the maintenance workshop.

In view of the expected level of activity, sludge will probably need to be collected once a month. This collection and the final processing of sludge will be dealt with by an approved company.

ContourGlobal - Cap des Biches will evaluate options for recycling, reusing or disposing of waste products generated, including sludge, depending on waste processing installations and service providers present in the site's surroundings. ContourGlobal - Cap des Biches will ensure that every waste flow is managed by an approved service provider.

For all waste treatment it is interesting to remember that ContourGlobal - Cap des Biches benefits from experience acquired with the existing power plant operations. Waste that was produced during operation of the existing power plant was managed by approved companies. For example, sludge and oily waste was collected by an approved company and sent to a cement factory for elimination. ContourGlobal - Cap des Biches will use its knowledge and local experience in the choice of collection and treatment companies for this new power plant.

Table 8.44 Evaluation of impacts: waste production during the operational phase

Potential magnitude	Frequency /Probability	Relative magnitude	Sensitivity	Impact importance
Waste production				
Low to medium • Intensity: low to moderate • Scope: regional • Duration: short term	High	Low to medium	Medium	Medium

In conclusion, the impact of waste production during the operational phase is evaluated as medium. Implementation of the mitigation and control measures described below will reduce this impact to an acceptable level.

Mitigation measures

A waste management plan must be implemented in order to guarantee the storage, collection and evacuation of waste, including liquid, solid, hazardous and non-hazardous waste. The plan will describe waste sorting, its transfer and disposal in appropriate places. This plan will include a procedure to monitor the performance of all sub-contractors involved. Moreover, it will benefit from the waste management plan implemented during the operation of the existing ContourGlobal - Cap des Biches thermal power plant. Notably with regard to limitations, management possibilities and feedback on waste management in the Project area.

The main objectives of this type of plan are to minimise the amount of waste generated, to maximise its reuse and recycling and to dispose of the remaining waste with a minimum impact on the environment. These objectives must be in agreement with legal and regulatory requirements.

Waste management must include:

- Information on the storage and retention of hazardous liquid waste
- The sorting and separation of hazardous and ordinary waste, associated with clear, understandable differentiation (to avoid any kind of confusion)
- The promotion of waste recycling, particularly used oils, containers, equipment, paper, plastics
- A ban on burning waste
- Storage and treatment of waste undertaken in a manner that protects the environment: use of specific installations, authorisation prior to burying waste, accreditation of specialised companies
- The traceability of hazardous waste, detailing the type of waste, quantity and identification of both carrier and destination.

This plan must provide information on waste monitoring and traceability and include details on training. It must also consider the tracking of waste after being taken in hand by accredited companies after leaving the site.

This plan will be completed by performance reviews of service providers in charge of waste management.

8.16 CUMULATIVE IMPACTS OF THE PROJECT WITH OTHER ACTIVITIES BEING DEVELOPED

Context

In the case of the Project developed by ContourGlobal - Cap des Biches, no other project currently being developed was identified during preparation of this study. Also, infrastructures existing in the study area were taken into account in analysis of the baseline, since current conditions in the study area are already under the influence of activities associated with these infrastructures and their impacts.

More particularly, the following issues have been the object of a cumulative analysis of Project impacts with existing infrastructures:

Air quality

Modelling carried out for the analysis of initial conditions took account of atmospheric emissions linked to the SENELEC power plants in Cap des Biches (see *Section 5.3.8*). Concentrations modelled under initial conditions were then added to those of the future ContourGlobal - Cap des Biches power plant in order to analyse future impacts on air quality (see *Section 8.5.4*).

Noise

Measurements taken for the baseline analysis took place when the SENELEC power plants and other nearby industries were in operation (see *Section 5.3.9*). The analysis of impacts on ambient noise (see *Section 8.7*) took these noise measurements into consideration, which were then added to the noise of the future ContourGlobal - Cap des Biches power plant in operation.

Marine environment

No data relating to liquid discharge from industrial activities in the Project area is available. However, it is important to note that the marine environment was under the influence of discharge from the former ContourGlobal - Cap des Biches power plant, shut down in July 2013 and which drew up and discharged about 115m^3/h of sea water when the combined cycle was operating. For this Project, no sea water will be drawn up and liquid discharge will be limited to a very modest flow of 4m^3/h. The cumulative impacts of the various infrastructures in the study area on the marine environment will therefore be less than those that existed up until July 2013, when the former ContourGlobal - Cap des Biches power plant was still in operation.

Mitigation measures

The mitigation measures presented in the previous sections will reduce the Project's interactions with the environment, thereby limiting cumulative impacts in the study area.

Moreover, the environmental monitoring that will take place, particularly the monitoring of air quality, will take into account the cumulative impacts of the various infrastructures in the surroundings of the Project area.

8.17 MITIGATION MEASURES AND RESIDUAL IMPACTS

This section recapitulates in table form the potential impacts linked to the Project's various components and the mitigation measures recommended in *Chapter 8*. Residual impacts after implementation of the various measures recommended are also evaluated.

Measures can be general or specific. General measures are intended to mitigate the Project's negative effects overall. Specific measures will aim to mitigate impacts on one environmental component in particular.

All this information is presented in *Table 8.45*.

Table 8.45 Summary of impacts and mitigation measures applicable to the Project

Activities	Environmental components affected	Impacts	Recommended mitigation and control measures	Importance of residual impact
Construction – Emissions from site machinery and vehicles	Air quality – concentration of atmospheric pollutants	Impact of NO_x, SO_2 and particles emissions on the main sensitive receptors (schools, health station, dwellings, etc.)	• Regular maintenance and site machinery and generators by the contractor in charge of the works • Reduction, as far as possible, in the number of journeys in order to limit the amount of atmospheric emissions discharged by all the transport vehicles used during the construction phase (equipment, excavated soils or backfill, staff, etc.)	Negligible
Construction – Dust emissions	Air quality	Impact of particle and dust generation on the main sensitive receptors (schools, health station, dwellings, etc.)	• Management and maintenance suitable for raw materials storage areas in order to minimise the flight of particles • Trucks covered with tarpaulins when carrying crumbly construction materials or backfill or excavated soils • Speed limits for vehicles travelling on non-asphalted tracks • Washing of vehicle wheels on leaving the site • Covering of storage areas used for materials likely to be blown away by the wind (notably contaminated or hazardous materials) • In case of activities on surfaces covered with fine materials, access roads and the site must be sprayed during construction activities to reduce dust production. • Check on the correct operation of vehicles and machinery and compliance of their emissions with current regulations • Ensure that vehicles and machines are turned off when not in use.	Negligible
Construction – Noise emissions from site machinery	Ambient noise	Impact on ambient noise in terms of neighbours (particularly the closest dwellings)	• No works during the night.	Negligible
Construction – Water consumption	Water resources	Impact of water consumption on available resources. The fact that there will be no drilling for a water supply (which will come initially from tankers and then using a dedicated pipeline), strongly reduces the impact on local resources (no competition).	• Optimise water consumption and minimise wastage • Supervise water consumption to identify any over-consumption and provide a basis from which to improve use-effectiveness.	Negligible

Activities	Environmental components affected	Impacts	Recommended mitigation and control measures	Importance of residual impact
Construction – Liquid discharge	Water resources	Impact of discharge on the quality of soils and water resources (potential contamination).	• The impact of construction activities can be addressed by minimising the surface area of bare soil and replanting on all berms as soon as possible. Temporary heaps of materials must be protected from erosion by using a reduced slope angle as much as possible and by integrating sediment traps into drainage ditches. This requires the establishment of a drainage plan. • Good site management practices must be observed to ensure that products are correctly stored on site (secondary retentions, double walled sides, overfill alarms, etc.) and that site machinery is regularly and properly checked and maintained. • The drainage system will be installed prior to the start of construction operations. • Regular checking and maintenance of the drainage system and the waste water evacuation system (temporary and permanent septic tank). Maintain a register of spillages and the results of controls carried out. • The non-contaminated water drainage system will be separate from the contaminated water collection system.	Negligible
Construction – Land clearance and other construction activities	Biodiversity	Construction operations will entail the development of a peri-urban parcel of less than 3ha, previously cultivated by a local inhabitant, to turn it into an industrial site. The parcel is already located in an industrial area, which explains why habitats and biodiversity are very limited there.	• Avoid or minimise the clearance of vegetation anywhere other than in the power plant works and construction areas.	Negligible
Construction – Presence of the worksite	Landscape	Visual and landscape impact of the presence of the works (machinery, storage, lighting)	• Machinery and materials will be stored properly during the works. High machines, including cranes, will not be left on site for any longer than necessary for the construction work. • The construction work's outdoor lighting must be as discreet as possible and must not allow the light to shine upwards or towards residential areas • Safety and work lighting (during construction and operations) will be directed downwards to limit light emissions in the area at night-time.	Negligible
Construction – Land clearance and other construction	Land use and local infrastructures	Impacts linked to the change in land use: construction the power plant on the new parcel will mean expropriation of a farmer who was	• A procedure to acquire the land has been implemented by SENELEC, in collaboration with ContourGlobal – Cap des Biches and a Senegalese surveyor who supervised operations. A report was published in June 2014	Negligible to Minor

Activities	Environmental components affected	Impacts	Recommended mitigation and control measures	Importance of residual impact
activities		using the land but did not own it. A land acquisition procedure has been implemented by SENELEC, in collaboration with ContourGlobal – Cap des Biches and compensation payments have been made. No major modification to access roads is to be planned for development of the Project, except the creation of a deviation towards the future power plant area from the main road, which will not have any significant impact on local populations.	(Evaluation of the assets of the orchard owned by the family of the late Isma Diop located in Cap des Biches) summarising the situation, inventory results and the value of disbursements. Since then an agreement has been signed with the beneficiaries and the agreed compensation amounts have been paid. There was no report of any dispute in the resolution of this issue. • The Project Promoter will ensure that the land acquisition procedure implemented by SENELEC and validated by the Municipality of West Rufisque and the Domains Administration has been properly complied with.	
Construction – labour requirements	Socioeconomic context and living conditions	With regard to impacts of the construction phase on employment and the local economy, these will be positive impacts linked to the creation of jobs requiring no qualifications and a dynamic for the economy. The impact on agriculture (in terms of local economic activity generating income) will be negligible, in view of the small surface area concerned (1ha).	• As far as possible, jobs requiring no qualifications will be given in priority to candidates from the neighbouring urban community. To do this, ContourGlobal - Cap des Biches and the various companies working at the site will provide their best estimate of the number of jobs available requiring no or few qualifications, depending on the different stages in work at the site, in order to draw up a provisional timetable for recruitment. This document together with the main eligibility criteria will be communicated at local level. • In order to limit opportunistic immigration, the Promoter will clearly state that no worker will be hired at the site gate and will communicate very precisely on the formal recruitment process, in order to discourage as much as possible the local installation of opportunistic immigrants. ContourGlobal - Cap des Biches will also work in coordination with local authorities, notably the Municipality of West Rufisque.	Positive
Construction – construction activities and the ensuing influx of labour	Health and safety of populations	The construction phase could result in a risk to the health and safety of local communities and workers: - Risk in the worksite area - Contagious diseases (including STC) - Safety - Worker accommodation conditions - Resulting traffic Whereas almost all the impacts in the	• Limitation of access to the site, for example by the erecting of fences and notices and information on risks communicated to local communities • Prevention policy concerning HIV/AIDS, intended to create awareness proactively amongst workers with regard to the prevention of HIV/AIDS and other contagious diseases. • Compliance with speed limits, with limits set around the power plant area for trucks carrying equipment during the construction phase and fuel during the operational phase. • Installation of adequate signing in the Project's surroundings. Regular	Negligible

Activities	Environmental components affected	Impacts	Recommended mitigation and control measures	Importance of residual impact
		construction phase can be considered to be negligible to minor, the impact linked to road risk is evaluated as medium, before mitigation.	maintenance of vehicles to avoid any kind of mechanical breakdown • Create awareness amongst drivers and the populations concerned with regard to the risk associated with the presence of transport trucks in the power plant area surroundings.	
Construction – waste generation	Waste management	Waste generated by the Project during the construction phase could include special waste and hazardous waste which requires specific treatment. The amount generated would appear to mean an impact of medium importance before mitigation.	• Ensure application of good maintenance and layout practices by workers on the premises, right from the start of the works. • Develop and maintain an inventory of stocks in order to reduce the amount of waste generated due to materials being out of date, materials that do not meet specifications, which are damaged or more than required and identifying opportunities for the reuse of material and equipment such as containers. • A Waste Management Plan will be developed prior to start-up of the construction works and will include the collection and management of waste produced by the workers recruited to build the power plant. This plan will take the current saturation of local storage centres (Rufisque, Dakar) into considerations in its selection of the most suitable destination for disposal. • Ensure that all the staff is aware of and have received the necessary training for compliance with and application of the Waste Management Plan and its associated procedures. • All solid waste will be collected, stored, transported and disposed of ecologically and in complete safety by the service provider in charge. This service provider will be approved under the terms of current regulations. • Service providers in charge of waste management will be selected according to their competence and the quality of their services. • Performance reviews of service providers will be undertaken. • Traceability of the evacuation and processing of waste will be guaranteed by systematic recording of transport forms detailing the type of waste, the quantity and destination, and indicating the carrier's identity.	Minor

Activities	Environmental components affected	Impacts	Recommended mitigation and control measures	Importance of residual impact
Operations – gas and dust emissions linked to operations at the power plant	Air quality – concentration of atmospheric pollutants	Impact of CO, NO_2, SO_2 emissions and particles on the main sensitive receptors (schools, health station, dwellings, etc.) This impact mainly concerns NO_2, for which the maximum authorised limit could be exceeded on rare occasions (less than five times a year). This excessive amount remains however within acceptable limits in terms of current international standards.	• ContourGlobal - Cap des Biches will ensure that SO_2 concentration in the fuel delivered does not exceed 2%. • A quality control will take place on the heavy fuel oil used and data relating to supplies (quantity delivered and analysis results) will be recorded. • ContourGlobal - Cap des Biches will monitor air quality by means of laying passive diffusion tubes to measure monthly averages of SO_2 and NO_2. • These tubes will be installed at 6 points at the edge of the power plant and in the areas most sensitive to atmospheric emissions.	Minor
Operations – gas and dust emissions linked to road traffic	Air quality – concentration of atmospheric pollutants	Impact of CO, NO_2, SO_2 emissions and particles from traffic resulting from the operational phase (particularly the transport of fuel).	• Regular maintenance of transportation vehicles will mitigate exhaust gas emissions as best possible.	Negligible
Operations – noise emissions from equipment at the power plant (engines, stack, dry coolers, etc.)	Ambient noise	Impact on ambient noise in terms of local populations (particularly the nearest dwellings), particularly at night.	• Equip vehicles running on diesel engines and compressor equipment with silencers • Prefer the production of electricity over mechanical solutions, where possible • Turn apparatus off when not in use • Locate mobile equipment as far away from receptors as possible • Wherever possible plan to perform noisy activities all at the same time in view of the fact that combined noise levels will probably not be higher than the level produced if operations were carried out separately • Avoid the movement of heavy vehicles during the night.	Minor
Operations – Water consumption	Water resources	Impact of water consumption (linked to the industrial process and domestic requirements) on available resources. Supply from a pipeline rather than a well will make the impact negligible before mitigation measures are implemented.	• Optimise water consumption and minimised wastage • Supervise water consumption to identify any over-consumption and provide a base from which to improve efficiency.	Negligible

Activities	Environmental components affected	Impacts	Recommended mitigation and control measures	Importance of residual impact
Operations – Liquid discharge	Water resources	Impact of the discharge of liquid effluent (industrial, rain and sanitation water) on the quality of the resource (groundwater). The effluent treatment process will limit the impact of discharge. Impact on groundwater quality during abnormal functioning	• Oily water will be treated in a deoiler prior to discharge in the SENELEC canal used for this purpose • Check on the installations will be carried out regularly • An analysis of effluent prior to discharge will be carried out once a month. In case of any discharge believed to be abnormal analyses will be carried out (even if they are not directly part of the regular effluent monitoring process) • Samples will be taken of effluent prior to discharge every week. The samples will be kept between two monthly analyses, and will be analysed only in case of an abnormal measurement (to trace the source of abnormality) • Results of analyses performed on exiting treatment will be recorded and measures taken in case of any excessive result • A network of piezometers will be installed at the fuel oil storage tanks, in order to monitor groundwater quality and verify the absence of accidental contamination.	Minor
Operations – Power plant operation	Biodiversity	During the operational phase the project will not have any impact on biodiversity since the parcel concerned will have already been developed and surrounding areas (where sensitivity is also very low) will not be concerned by the Project.	• No specific mitigation measure or additional check is required.	Negligible
Operations – Presence of the power plant	Landscape	Visual and landscape impact due to the presence of the power plant: presence of the stack and the turbines block, as well as lighting.	• The design, orientation and materials will be suitably and reasonably developed in order to fit in with the characteristics of the existing site and with the characteristics of the landscape. • Appropriate usage of non-reflecting surfaces and coloured surfaces • External lighting as limited as possible and directed downwards to limit light emissions in the area during the night-time.	Minor
Operations – labour requirements	Socioeconomic context and living conditions	The effects of the construction phase on employment and the local economy will represent positive impacts with the creation of jobs requiring no qualifications and a dynamic for the economy.	• As far as possible, jobs requiring no qualifications will be given in priority to candidates from the neighbouring urban community. To do this, ContourGlobal - Cap des Biches and the various companies working at the site will provide their best estimate of the number of jobs available requiring	Positive impact

Activities	Environmental components affected	Impacts	Recommended mitigation and control measures	Importance of residual impact
			no or few qualifications, depending on the different stages in work at the site, in order to draw up a provisional timetable for recruitment. This document together with the main eligibility criteria will be communicated at local level. • In order to limit opportunistic immigration, the Promoter will clearly state that no worker will be hired at the site gate and will communicate very precisely on the formal recruitment process, in order to discourage as much as possible the local installation of opportunistic immigrants. ContourGlobal - Cap des Biches will also work in coordination with local authorities, notably the Municipality of West Rufisque.	
Operations – construction activities and the associated influx of labour	Health and safety of populations	During the operational phase the only interactions of the Project with communities will concern risks linked to road traffic (trucks bringing fuel oil supplies).	• Contacts with traffic regulation authorities during the project's peak activity times. This collaboration could also mean taking the most suitable the routes and journey time, particularly during the construction phase which will generate the most traffic.	Minor
Operations – waste generation	Waste management	In addition to household waste, Project operations will generate hazardous waste (used oil, etc.) as well as sludge containing hydrocarbons.	• A waste management plan will be implemented in order to guarantee storage, collection and disposal of waste, including liquid, solid, hazardous and non-hazardous waste. The main objectives of this plan are to minimise the amount of waste generated, to maximise its reuse and recycling and to dispose of remaining waste so as to have minimum impact on the environment. Waste management should include: • Information on the storage and retention of hazardous liquid waste • The sorting and separation of hazardous and ordinary waste with clear, understandable differentiation to avoid any confusion) • Promotion of waste recycling, particularly used oils, containers, equipment, paper, plastics • A ban on burning waste • Storage and treatment of waste in a manner that protects the environment: use of specific installations, authorisation prior to burying waste, accreditation of specialised companies. • Traceability of the transport of hazardous waste, detailing the type of waste, the quantity and identification of the carrier and the destination. • This plan should provide information on the tracking and traceability of	Medium

Activities	Environmental components affected	Impacts	Recommended mitigation and control measures	Importance of residual impact
			waste and present aspects relating to training. It should also consider the tracking of waste after being taken in hand by accredited companies after leaving the site.	

9 HAZARD STUDY

9.1 INTRODUCTION

9.1.1 *Presentation of the study*

This chapter presents the study of the hazards and accidents in the operation and refurbishment of the heavy fuel oil power plant located in Dakar, and the methods to be used for prevention and protection from them.

This study has been performed in accordance with the Hazard Studies Guidelines[1] of the Ministry of Environment and Nature Protection of the Republic of Senegal and the Directorate of Environment and Classified Facilities. The standard methodology for hazard studies ("*Etude de dangers*") developed by the Order of September 29, 2005[2] and the Circular of May 10, 2010[3] of the French regulation has also been considered.

9.1.2 *Perimeter of the Project*

ContourGlobal - Cap des Biches has a 52 MW thermal power station at Cap des Biches, Rufisque. The power station operating permit was granted to ContourGlobal - Cap des Biches by the Ministerial Order No. 006562 / MEPN / MEMI / DEEC of 19 August 1998, and power generation began on December 2000. The facility is registered in the Special Register of Classified Facilities (registration number: 4221).

The project under development by ContourGlobal - Cap des Biches includes the refurbishment of the existing station, which has been disused since July 2013. This project has been agreed with SENELEC, based on production forecasts at regional and national level, and in the medium and long term.

One proposal for upgrade includes replacement of the main power generation equipment (turbines, boilers, cooling system) with more recent models and updated technology. This new technology encompasses diesel engines that, in combination with a heat recovery boiler feeding a steam turbine, are able to

(1) Hazard study guideline, Republic of Senegal, DECF – Ministry of Environment and the Nature Protection; October 2005 (*Guide d'étude de danger, République du Sénégal, DEEC - Ministère de l'environnement et de la protection de la nature ; version octobre 2005*)

(2) Order of September 29, 2005 related to the assessment and the consideration of the probability of occurrence, kinetic, intensity of the effects, and severity of consequences of potential accidents ; within the Hazard studies of the classified facilities subject to approval (*Arrêté français du 29 septembre 2005 relatif à l'évaluation et à la prise en compte de la probabilité d'occurrence, de la cinétique, de l'intensité des effets et de la gravité des conséquences des accidents potentiels dans les études de dangers des installations classées soumises à autorisation*)

(3) Circular of May 10, 2010 summarising methodological rules that are applicable to Hazard studies, the assessment of the approach to reduce risks at the origin and Plans for prevention of technological risks (PPTR) in classified installations in force with law of July 30, 2003 (*Circulaire française du 10 mai 2010 récapitulant les règles méthodologiques applicables aux études de dangers, à l'appréciation de la démarche de réduction du risque à la source et aux plans de prévention des risques technologiques (PPRT) dans les installations classées en application de la loi du 30 juillet 2003*)

operate in combined cycle mode. Alternatively, the existing facilities could be refurbished (i.e. the fuel storage tanks).

9.2 *METHODOLOGY*

The hazard study has been prepared considering the methodological guidelines published by the DECF[1], and with a view to compliance with the Senegalese law. Its objective is to identify and assess the major risks associated with the project implementation.

The steps of the hazard study are as follows:

- Identification of potential risks

- Preliminary risk assessment, including the identification of potential hazards, a review of accidents and an assessment of the residual risks considering the prevention methods to be used

- Detailed assessment of the residual risks for the selected scenarios

- Risk ranking conclusions.

A major technological risk is an event related to a loss of control of an industrial plant, such as a fire, explosion, or the major emission of toxic substances. It causes a serious hazard that can have immediate or delayed consequences for humans and/or the environment, which can occur inside or outside the facility. This can involve one or more dangerous substances.

The following definition makes a clear distinction between hazard and risk:

- A hazard is a situation that has intrinsic potential to cause damage to people and property. In the industry, the hazard may be related to products, processes and equipment.

- A risk is the probability of hazard occurrence. An accidental event is characterised by the severity of its effects and the likelihood of their occurrence.

The nature of technological risks at a power generation site is very diverse. Risks can generally fall into several categories:

- Fire
- Explosion
- Accidental spill of harmful products
- Escalation of minor incidents to major accidents

(1) Hazard study guideline, Republic of Senegal, DECF – Ministry of Environment and the Nature Protection; October 2005 (*Guide d'étude de danger, République du Sénégal, DEEC - Ministère de l'environnement et de la protection de la nature ; version octobre 2005*)

- Accidents with an external origin to the site (malevolence, etc.).

In addition to technological risks, there are natural hazards (i.e. storm, earthquake) that may have an impact on the site.

The hazard study also enables the assessment of the significant hazards on the site, that is, those that have a high probability of occurrence and/or those that can lead to serious consequences for humans, the environment and facilities.

The hazard study will involve the identification and assessment of key potential major hazards that may occur in the thermal power station. The identification will be methodical and systematic, and will analyse the specific hazards and risks associated with the products to be used, the proposed facilities and the chosen process, as well as to the environment as a potential "target" or as a potential aggressor. The identification will rely on the provision of accident data from several official sources. Following identification, prevention and protection measures to reduce risks will be proposed for inclusion in the final plant design.

The risk ranking assessment is based on the matrix (see *Table 9.1*) of the hazard study guideline prepared by the Directorate of Environment and Classified Facilities.

Table 9.1 ***Risk classification matrix***

LEVEL OF RISK		**Consequences**				
		5	**4**	**3**	**2**	**1**
Probability	**5**	25	20	15	10	5
	4	20	16	12	8	4
	3	15	12	9	6	3
	2	10	8	6	4	2
	1	5	4	3	2	1

Acceptable risk: No action is required.

Significant risk: The facility must propose a reduction plan to be implemented in the short, medium and long terms.

Unacceptably high risk: A detailed study of major accident scenarios will be required. The facility must take immediate reduction measures (implementing prevention and protection methods).

25 Risk level: Probability x Severity

The Probability/Severity levels considered are determined based on *Table 9.2*, and the hazard study guidelines mentioned above.

Table 9.2 Severity and probability scale used in the EDD

Probability Scale		Severity Scale	
Score	Meaning	Score	Meaning
1 = Unlikely	Never seen in the industry. Almost impossible in the facility.	1 = Negligible	- Minor impact on staff - No shutdown - Low environmental impacts
2 = Unusual	Previous occurrence in this industrial sector. Possible in the facility.	2 = Minor	- Medical care for staff - Minor damage - Small production loss - Minor impacts on the environment
3 = Occasional	Previous occurrence in the facility. Occasional but can occur in the facility.	3 = Important	- Staff seriously injured (extended work shutdown) - Limited damages - Partial production shutdown - Localised impacts on the environment
4 = Likely	Occurs 2-3 times a year in the facility.	4 = Critical	- Life disabling injury - Significant damage - Production shutdown - Important impacts on the environment
5 = Continual	Occurs more than 3 times a year in the facility.	5 = Catastrophic	- Loss of life - Widespread damages - Long production shutdown

9.3 DESCRIPTION OF ENVIRONMENT AND SITE

9.3.1 Description of the environment

The site is located in an industrial area, close to a wastewater treatment plant, with an agricultural area located to the north.

The plant is located at the edge of the Atlantic Ocean, which is considered the most sensitive receptor in terms of potential pollution (wastewater or hydrocarbons discharge).

The nearest human receptors are the SENELEC staff accommodation units, located 300 m west of the site; and the village of Diokoul, which is 400 m to the east of the site.

9.3.2 Description of installations and processes

The layout map of the facility is provided in Annex 6.

Considering the objectives of the development of a hazard study, the facilities and processes that are identified as sensitive are:

- The power generation system, including:
    - Three Wartsila 18V46 engines, with a nominal power of 11.4 MW each
    - The steam turbine for the combined cycle system

- The storage in tanks, including:
    - HFO
        - A 3000 m^3 storage tank fed by the pipeline
        - Two 1480 m^3 storage tanks
        - 50 m^3 buffer tank
        - 100 m^3 service tank
    - LFO
        - 120 m^3 storage tank
        - 100 m^3 service tank
    - Oils
        - 35 m^3 oil tank
        - 20 m^3 waste oil tank
        - 16 m^3 service tank
    - Water
        - Raw water: 1400 m^3
        - Deionized water: 200 m^3
        - Fire: 700 m^3
    - Effluents: 80 m^3 (wastewater) and 50 m^3 (oily water)

9.4 IDENTIFICATION OF POTENTIAL RISKS

9.4.1 *Inventory and characteristics of the products used*

The following products will be used on site:

- Heavy fuel oil, as fuel under normal conditions
- Light fuel oil or diesel as back-up
- Various chemical products (i.e. acids, products for water treatment)
- Industrial gases (nitrogen, oxygen, etc.).

Heavy Fuel Oil

A maximum volume of 6110 m^3 of heavy fuel oil will be stored on site, with characteristics as noted below. Heavy fuel oil is supplied by pipeline from the storage tanks of *Société Dakaroise d'Entreposage*. Company's pipeline operation limit is set at the retention basin of the 3000 m^3 storage tank.

Main physico-chemical characteristics:

• Colour	:	Brown/black
• Odour	:	Oily
• Physical state	:	Viscous liquid
• Flash point	:	73° C
• Steam pressure	:	0.02 to 0.791 kPa at 120 °C
• Flammability limit	:	Not applicable
• Density	:	965 kg/m^3 at 15°C
• Sulphur content	:	1.33 ppm

Incompatibility, stability, reactivity:

The product is stable under normal conditions of storage and use.

Potential impacts on health:

- Inhalation: Harmful by inhalation. Exposure to decomposition products may be a risk to health, with serious effects potentially being delayed.
- Ingestion: No known effects
- Skin contact: Grease should be immediately removed from skin. May eventually cause dryness and irritation.
- Eye contact: May cause eye irritation.

Toxicity and ecotoxicity:

- Acute oral toxicity – DL 50, rat: > 5g/kg
- Acute dermal toxicity – DL 50, rabbit: > 2g/kg
- Ecotoxicity – CE 50 (48 hours), water flea: 2mg/l
- Ecotoxicity – NOEC (72 hours), algae: < 1mg/l
- Acute ecotoxicity – CL 50 (96 hours), fish: 79mg/l

Diesel or domestic heating oil

Domestic heating oil will be used during the start-up of engines or in case of emergency. Quantities used will be low, which explains the difference in storage capacity compared to heavy fuel oil. Only 220 m^3 of domestic heating oil will be stored on site. Domestic heating oil will be delivered by tankers when needed.

Main physico-chemical characteristics:

• Colour	:	Yellow
• Odour	:	Characteristic
• Physical state	:	Fluid at 20 °C
• Flash point	:	> 55° C
• Steam pressure	:	< 10 hPa at 40 °C
• Flammability limit	:	Around 0.5 and 5 % in volume of

		steam in the air
• Density	:	820 to 845 kg/m³ at 15 °C
• Sulphur content	:	1.3 ppm

Incompatibility, stability, reactivity:

The product is stable under normal conditions of storage and use.

Potential impacts on health:

- Inhalation: Irritating to respiratory system. Prolonged exposure may cause nausea and headaches.
- Ingestion: Burns of mouth, throat, and/or the stomach as well as nausea, faintness or vomiting.
- Contact with skin and eyes: Burns.

Toxicity and ecotoxicity:

- Acute oral toxicity – DL 50, rat : > 675mg/kg
- Acute dermal toxicity – DL 50, rabbit : > 890mg/kg
- Ecotoxicity – CL 0 (48 hours), water flea : 50mg/l
- Ecotoxicity– CL 100 (46 hours), fish: 500mg/l

Chemical products

Many chemical products are present on site. However, they are stored in small quantities. Risks of severe accidents for the population or the environment associated with those are considered negligible when precautions are considered. Risks of work accident linked with these chemical products are analysed in *Section 9.13*. *Table 9.3* shows the average amount of key chemicals products used and stored on site.

Table 9.3 Main chemical products used and stored on-site

Product / Description	Function	Average amount used per year	Average amount present on site
Cleanblade GTC1000 – aqueous solution	Turbine cleaning	1, 500 L	400 L
Corrshield MD4154 - sodium nitrite solution	Corrosion inhibitor in the water/steam cycle	2, 200 L	1, 000 L
Cortrol OS7780	Oxygen absorber	3, 300 L	1, 400 L
Depositrol BL5310	Cooling water chemical products	2, 000 L	2, 000 L
Hydrochloric acid	Various uses	3, 000 kg	600 kg
Hypersperse MDC220 (Phosphonate)	Scale inhibitor	1, 000 L	900 L
Optiperse HP5494 – phosphate polymer / solution	Boiling feed water treatment	8, 000 L	6, 350 L
Sodium hypochlorite	Various uses	3, 000 kg	3, 000 kg
Spectrus CT1300 – ethanol and dimethylbenzylammonium	Biocide	1, 000 L	

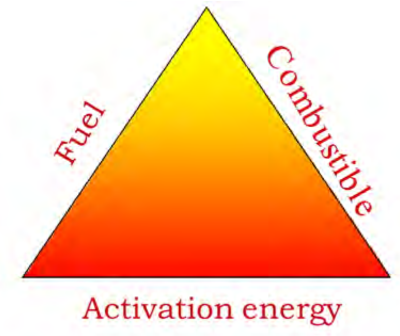
Product / Description	Function	Average amount used per year	Average amount present on site
Spectrus NX1100	Bactericidal		1, 000 L
Steamate NA0540E - Morpholin	Corrosion inhibitor	3, 300 L	2, 200 L

9.4.2 *Hazards of the products used*

Fire hazard

Fire is a combustion that comes uncontrolled in time and space. For liquid hydrocarbons, vapours emitted by the heated liquid burn, rather than the liquid itself.

The combustion process is a chemical oxidation reaction of a fuel by an oxidizer. The reaction requires a source of energy. Three conditions must be met simultaneously for combustion, according to the principle of the "fire triangle", as shown below.



1. Presence of fuel: Material able to burn (i.e. coal, petrol, butane)
2. Presence of combustive: Body that, combined with fuel, enables combustion (i.e. oxygen or air)
3. Presence of a source of energy (energy required to start combustion).

The absence of one of the three elements prevents combustion from occurring.

A source of ignition may come from:

- Maintenance or repair activities, including hot spot works (welding, grinding, cutting)
- A spark of electrical origin or the impact of steel objects hitting the same metal
- Negligence of a smoker
- An electrical fault (e.g. overheating of an electric cable in poor conditions; an electrical connection poorly implemented)
- Mechanical heating.

In general, the consequences of a fire are myriad, and include:

- Damages caused to property
- Release of gaseous and potentially toxic combustion products
- Movement of pollutant substances with the extinguishing waters.

Thus, a fire can cause air, surface and ground water or soil pollution.

As part of a hazard study, the most harmful impact to consider during a fire is its thermal radiation. The impacts on humans and equipment caused by thermal radiation are presented in *Table 9.4*.

Table 9.4 Impacts on humans and equipment caused by thermal radiation

Heat fluxes received by the receptor	Impacts
40 kW/m^2	Spontaneous ignition of wood within 40 seconds
36 kW/m^2	Likely fire spread on hydrocarbon reservoirs, even when they are water-cooled
27 kW/m^2	Spontaneous ignition of wood within 5 and 15 minutes
20 kW/m^2	RESIAtance of concrete structures for fewer than 5 minutes
12 kW/m^2	Unlikely fire spread on hydrocarbon reservoirs, even when they are water-cooled
9.5 kW/m^2	- Pain threshold in 6 seconds - Lethal exposure threshold of 30 seconds
8.4 kW/m^2	- Beginning of spontaneous combustion of wood and paints - Unlikely spread of fire on uncooled hydrocarbon reservoirs - Intervention by persons protected with fireproof outfits
5 kW/m^2	- Broken windows by thermal effect - Pain after 12 seconds - Blisters after 30 seconds - Lethal exposure threshold of 60 seconds - Rapid response for protected persons (firefighters)
3 kW/m^2	- Pain after 30 seconds (light outfit) - Lethal exposure threshold of 120 seconds
2 kW/m^2	Damages to PVC cables
1.5 kW/m^2	Acceptable threshold of continuous radiation to unprotected people, usually dressed
1 kW/m^2	Solar radiation in the equatorial area
0.7 kW/m^2	- Skin reddening - Burns with extensive exposure

Risk of explosion (overpressure wave)

None of the products present in the facility can cause an explosive cloud, because the fuels used have low volatility limits. In this case, overpressure waves only occur in confined tanks, following vessel bursts, and following a fireball.

An explosion is a rapid transformation of a hardware system, which leads to a large emission of gas, possibly accompanied by the significant emission of heat.

The main event of an explosion is the sudden increase in pressure that causes a blast effect, a pressure wave and in some cases, projections (missiles). This sudden overpressure can have devastating impacts on people and buildings.

In addition, the maximum rate of pressure rise is an important feature of the explosion strength.

Table 9.5 describes the effects of pressure waves associated with explosions.

Table 9.5 Effects of Pressure Waves Associated with Explosions

Overpressure (mbar)	Effect
5	5% of exposed windows shatter
20	50% of exposed windows shatter
50	Very slight damages to structures, risk of injuries
80 - 100	Slight damages to metal structures
140	Lower limit of serious damage to structures, first mortality effects
150 – 200	Concrete walls collapse
200	Metal structures shatter
250	Storage tanks break
200 – 400	Large trees flatten
500	Filled wagons turn over, brick walls (20-30 cm thick) burst

Risks related to toxic products

Most chemical products have an effect on the body. Certain substances, declared toxic, have acute and/or chronic adverse effects and may:

- Induce cancer, tumours or neoplastic effects on humans
- Cause genetic modifications and therefore a mutation that remains in the lineage
- Cause malformations in the development of human embryos
- Cause irritation or sensitisation of the skin, eyes or respiratory tract
- Reduce mental or motor skills or alter the behaviour of humans
- Harm human health by producing reversible or irreversible bodily injuries that put lives at risk, or cause death by inhalation, epidermal, ocular, oral or any other means of exposure, independently of the quantity, concentration or dose used over any time period.

Inhalation, skin contact and ingestion are pathways into the body.

The effects on humans of a toxic substance are multiple and of varying severity. They are linked to several factors including the toxicity of the product, the product concentration, the duration of exposure, the sensitivity of the target person, and body penetration method.

Heavy fuel oil, domestic heating fuels and lubricating oils may contain polycyclic aromatic hydrocarbons (PAHs), some of which have been proven to be carcinogenic in animal studies. Prolonged contact with these can also cause skin dryness and nausea.

With respect to the aquatic environment, the considered hydrocarbons have the following characteristics:

- High chemical oxygen demand (COD)
- Low solubility in water
- Slow biodegradability.

Microorganism respiration that leads the biological oxidation process in the case of excessive presence of hydrocarbons slows down biodegradation processes. In forming a layer, this hinders gas exchange with the atmosphere and photosynthetic reactions.

Heavy fuel oil and domestic heating fuel may therefore be toxic to water and aquatic organisms, and this also likely to be the case for the lubricating oil.

Given their physicochemical characteristics and the biological data available, these products can also be harmful to wildlife and terrestrial and aquatic flora.

However, there is no product on site that presents an acute toxicity in humans.

<u>Toxic effects of fire smoke</u>

In the particular case of fire smoke, American, English, Japanese and French statistical summaries indicate that intoxication by smoke, and in particular carbon monoxide and hydrogen cyanide, is the leading cause of fire deaths.

The smoke includes all gaseous products and particles emerging from a burning body or a body at high temperature. Fire smoke conveys a multitude of toxic gases which can lead to poisoning. In the case of a hydrocarbon fire, toxic gases present in smoke are mainly carbon monoxide (CO), carbon dioxide (CO_2) and particles of unburnt matter.

Fire smoke conveys incandescent particles called soot, which form a true aerosol of solid particles. These particles enter the respiratory system and cause not only an obstruction of the pulmonary system and increased heat stress, but also a toxic effect due to their caustic nature (attack of body tissues).

Carbon monoxide prevents the binding of oxygen to haemoglobin, which carries oxygen to cells. In addition, CO binds to myoglobin present in the muscles, which explains its disabling effect. The decrease in the binding of oxygen to haemoglobin is around 50% if there is 0.84% of CO in the air. CO is considered to be responsible for one third of deaths from smoke inhalation. *Table 9.6* below shows the physical effects associated with exposure to carbon monoxide.

Table 9.6 Physical effects associated with exposure to carbon monoxide

CO concentration (ppm)	CO content in the air (%)	Physical effect
100	0.01	No symptoms
250	0.025	Possible light headaches after 2-3 hours of exposure
500	0.05	Headaches after 1-2 hours, nausea, dizziness
750	0.075	- Headaches after 0.5 -1 hour - Nausea, unconsciousness after 2 hours of exposure
1000	0.10	- Headaches, dizziness, nausea - Unconsciousness after 1 hour - Without care, death after 3 - 4 hours of exposure
1500	0.15	- Headaches, dizziness, nausea - Unconsciousness after 30 minutes - Without care, death after 2 -3 hours of exposure
2000	0.20	- Unconsciousness after 20 minutes. - Without care, death after 1 - 2 hours of exposure
5000	0.50	- Unconsciousness after 10 minutes. - Without care, death after 30 minutes of exposure
> 10 000	> 1	- Immediate unconsciousness - Death after 2 – 3 minutes of exposure

Carbon dioxide, a compound similar to carbon monoxide, is also found in fire smoke. In addition to its toxicity (narcosis), it leads to an increase in respiratory rate, thus facilitating penetration of other toxic substances in lungs.

The risk of air pollution remains secondary for fuel storage in comparison to the risk of fire or water pollution, in terms of environmental protection.

In case of an accident, individuals exposed to smoke should have adequate respiratory protection.

9.4.3 *Risks related to facilities*

Product storage and usage methods involve their own hazards.

Storage of Heavy Fuel Oil and diesel in fixed or fragile roof tanks

There are several hazards associated with storing liquid fuel in tanks, including:

<u>Explosion of gaseous phase</u>
This event involves the accumulation of flammable vapours in the gaseous phase of the tank, as well as ignition. This causes a sudden increase in pressure within the tank and the release of a pressure wave during the tank breakdown.

<u>Fireball after a slow pressurisation of the tank</u>

This hazard is more specific because it occurs when a tank is caught in a fire. The risk occurs when the product within the tank evaporates faster than it is evacuated by the breathing vents. This causes an increase of tank pressure, followed by breakdown, resulting in a short and intense thermal flux that is received by the receptors during the combustion of the fireball. The pressure wave resulting from the event is limited.

Tank fire

This is a secondary event resulting from a loss of confinement. A tank fire can occur after a weakening of the structure of the tank. The pressure in the gaseous phase of the tank created by the heating can cause a roof collapse and the ignition of the tank content.

Boil-over

A boil-over is a large scale event caused by the evaporation of the water layer at the bottom of the tank or water mixed with fuel. A pool fire or tank fire can lead to the evaporation of this water, which may result in the spraying of burning hydrocarbons.

The term Thin-Layer Boil-Over (TLBO) is used for lighter hydrocarbons. The amount of oil likely to be involved in the eruptive event is lower in this case.

Retention fire basin

This hazard involves the retention basin of the tanks. A loss of containment in a tank causes a hydrocarbons flow and the formation of a liquid layer. There is a risk of retention basin fire if liquid or liquid steams meet an ignition source.

Combustible products Transportation

Transportation of combustible products by pipelines does not generates other hazards that those linked to the inflamability of the product. However, in case of a loss of containment of pipelines outside bunds, a free hydrocarbon pool may form and result in a pool fire if ignited.

Power generation

Engines do not involve any particular risk, other than those related to rotating elements (i.e. projection parts) in case of uncontrolled overspeed for instance. These hazards are limited to the immediate surroundings of the facilities, in the power generation buildings.

Combined cycle

The combined cycle or cogeneration aims to recover the heat of the combustion gases of the engines, for heating the water and transforming it into steam. This steam is then used in a turbine in order to generate power and improve the system performance. The three heat recovery boilers provide a total flow rate of 7783 kg/hr of steam (14.5 barg, 328 degC)

Steam production does not involve any particular hazard, while the turbine has similar hazards to those of the engines. The main hazard of this facility is related to the buffer storages of pressurised steam in tanks. The bursting of a pressure tank would result in the release of a pressure wave. The consequences of this would be limited to the immediate vicinity of these facilities and the associated buildings. This type of risk has not been considered in the detailed risk analysis.

9.4.4 Hazards associated with the external environment

There are various types of hazard related to the environment, including the impact of potential neighbouring industrial facilities, and risks of natural origin (i.e. earthquakes, landslides, storms, floods).

The population density in the future plant area is low. The plant is located in an industrial area next to a wastewater treatment plant. An agricultural area is located at the north of the site. The nearest residential area is located approximately 400 m to the east of the site.

Natural Conditions

There is a risk associated with storm and lightning. Thunderstorm activity has no influence on the facilities. However, lightning can be detrimental to facilities due to the use of flammable liquids – a lightning strike can cause a fire in the fuel storage tanks.

The site is located in seismic zone 0-1. This means that the seismicity of the area is negligible but not zero to low. The definitions are as follows:

- *Zone 0* "negligible but not zero" seismicity: There is no special seismic recommendation. Historically, no quaking above VII has been observed.

- *Zone I* "low seismicity" :
    - Historically, no quaking above or equal to VII has been observed
    - The return period of a quake above VIII is above 250 years
    - The return period of a quake above VII is above 75 years.

There is *a priori* no other extreme weather events that may pose a major risk to the facilities of the station. Flood risks were taken into account as part of the design of the stormwater network.

Malicious Act

Malicious acts may occur in the case of an intrusion on the plant boundaries, but the potential hazard is difficult to quantify. Regular patrolling of the area and the presence of CCTV cameras would reduce this risk.

9.5 ACCIDENT REVIEW

9.5.1 Methodology

The analysis of accidents which have occurred at similar facilities to the power station is essential to the hazard study. Considering a much broader statistical population (the entire world), the study of accidents enables:

- Identification (at least for the most likely accidents) of the type of potential accidents that may occur within a facility
- Assessment of the probability of occurrence of each type of accident
- Assessment of the potential severity of each type of accident
- Identification of appropriate prevention and protection measures, on the basis of the conclusions of published post-accident surveys.

In order to get an overview of the different types of accidents that can occur at power generation and distribution areas, ERM has conducted a brief review of accidents reported internationally over several years. This overview is based on a query of the ARIA database of the Directorate of Pollution and Risks Prevention, dependent on the French Ministry of Environment, which is available on the internet [1]. It essentially includes an inventory of more than 40,000 accidents occurring worldwide between 1900 until today, with detailed industrial accidents analysis sheets, as well as articles and technical recommendations.

9.5.2 Results

Assessment of the hazards encountered

Research using the ARIA database was carried out for power generation and distribution activities and hydrocarbons storage, using the following keywords:

- Fuel; fuel oil; diesel; diesel oil
- Power Station; Combined cycle

(1) http://www.aria.developpement-durable.gouv.fr

Using these search terms, the database lists 55 accidents since 1981. Some involve facilities that are different from those of the present study (e.g. nuclear stations, coal use) and these have not been considered. 46 accidents have occurred in facilities similar to the Dakar power station.

Table 9.7 presents the results of the ARIA database consultation. The hazardous event, the involved product and equipment, the cause, the activity or the operation and the consequences of each listed accident are indicated in the table.

It is important to note that this list is non-exhausitve and that in most cases, for accidents outside of France, only the most significant events are listed in this database. The statistics will thus be only for accidents happening in France in order to avoid overestimation causes and consequences of accidents linked with this type of facilities.

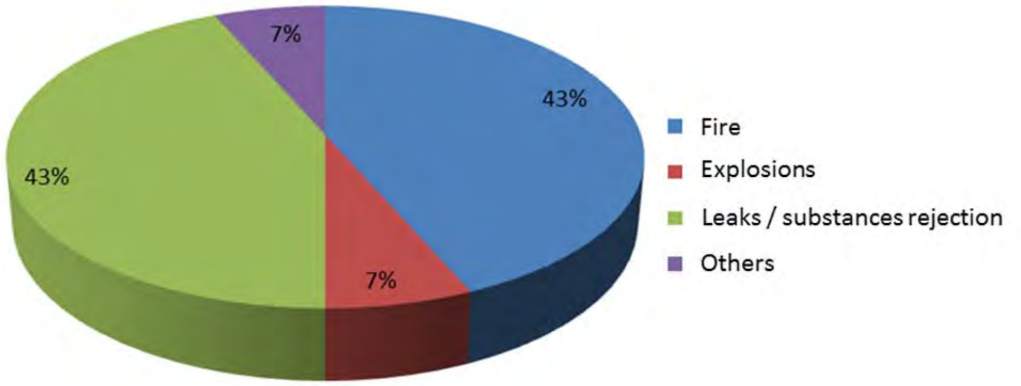
Table 9.7 Results of the consultation of the ARIA database

Ref. BARPI	Date	Location	Hazardous event				Product involved				Equipement involved							Cause					Operation / Activity					Consequences				
			Explosion	Fire	Spill of Liquid / Leak	Other	Fule / Diesel	Oil	Vapor	None / Other	Boiler	Generator	Diesel Group	Canalisation	Elctrical Cabinet	Storage	Other / Unknown	Human error	Equipment failure	Natural factor	External factor (tampering)	Other / unknown	Production	Storage	Unloading / Supply	Maintenance	Other /Unknow	Human	Social	Material	Environmental	None
45591	15/08/2014	France		X				X				X										X	X									X
42812	27/09/2012	France		X						X		X							X				X						X			
42622	19/08/2012	France		X						X		X							X				X						X			
43150	11/07/2012	France			X		X										X		X						X						X	
40969	22/09/2011	France			X		X										X		X								X				X	
38230	20/05/2010	France		X			X				X								X				X									X
39184	09/05/2010	France		X						X					X				X								X					X
37152	19/09/2009	Zambia		X						X							X					X	X					X		X		
37139	28/07/2009	France			X		X									X		X						X							X	
37224	01/06/2009	France			X		X							X					X						X						X	
36192	29/05/2009	France		X				X								X						X				X						X
36176	07/05/2009	France		X			X					X							X				X					X				
35992	27/01/2009	France			X		X									X						X			X							X
35748	17/01/2009	France			X		X									X						X			X						X	
34718	16/06/2008	France			X		X							X				X								X						X
33899	22/11/2007	France		X			X						X						X				X									X
34118	07/11/2007	USA	X						X		X								X				X					X				
32177	03/09/2006	France		X			X							X					X				X					X				
32030	14/07/2006	Lebanon		X	X		X									X					X			X							X	
28097	23/09/2004	China	X							X	X								X							X		X				
28389	17/07/2004	France	X						X		X							X	X				X							X		
27392	21/06/2004	Algeria	X				X									X						X		X				X				
25834	29/10/2003	France			X		X										X					X					X				X	
25653	29/09/2003	Netherlands				X				X	X							X								X		X				

Ref. BARPI	Date	Location	Hazardous event				Product involved				Equipement involved							Cause					Operation / Activity					Consequences				
			Explosion	Fire	Spill of Liquid / Leak	Other	Fule / Diesel	Oil	Vapor	None / Other	Boiler	Generator	Diesel Group	Canalisation	Elctrical Cabinet	Storage	Other / Unknown	Human error	Equipment failure	Natural factor	External factor (tampering)	Other / unknown	Production	Storage	Unloading / Supply	Maintenance	Other / Unknow	Human	Social	Material	Environmental	None
21513	09/12/2001	France	X	X	X			X				X							X				X							X		
20905	08/08/2001	UK	X							X		X										X	X					X				
19283	11/09/2000	France			X		X									X		X						X							X	
18924	10/08/2000	USA	X	X	X		X					X										X	X					X	X			
17544	04/04/2000	USA	X							X		X										X				X		X				
17318	27/12/1999	France			X		X										X			X							X				X	
16836	13/09/1999	Pakistan		X						X		X										X	X						X			
16550	06/08/1999	Saudi Arabia		X						X		X										X	X						X			
15931	25/07/1999	Colombia	X							X		X										X				X		X	X			
15807	09/05/1999	Taiwan	X	X						X		X										X	X						X	X		
15776	09/05/1999	Pakistan	X	X						X							X					X				X			X	X		
14945	17/01/1999	USA	X	X						X							X					X	X						X			
12184	26/12/1997	France			X		X							X					X								X				X	
14085	10/07/1997	France			X		X										X		X				X								X	
11623	28/06/1997	Russia		X						X							X					X	X						X	X		
6641	22/01/1995	Georgia	X							X							X				X		X							X		
3799	18/08/1992	France			X			X								X				X				X							X	
3795	16/08/1992	France		X			X					X							X				X							X		
3901	06/03/1992	France			X					X							X					X					X				X	
6556	10/05/1991	Salvador	X							X							X				X		X							X		
1659	01/01/1990	USA	X							X							X					X	X					X				
1122	14/03/1989	France		X				X				X										X	X								X	
25754	28/11/1984	France	X						X		X											X				X		X				
6052	19/12/1982	Venezuela		X			X									X		X						X				X	X	X		

Figure 9.1 shows the distribution of accidents by type of hazard for those who occurred in France.

Figure 9.1 **Distribution of Accidents by Type of Hazard**



Consequence Analysis

Table 9.8 shows the consequences per type of accident for each of the 28 events identified in France.

Table 9.8 ***Consequence analysis***

	Fire	Explosions	Leaks	Others
Total number of events	12	3	15	1
• Human consequences	2	2	0	1
• Social consequences	2	0	0	0
• Consequences on the environment	1	0	12	0
• Hazardous materials released	2	1	1	0
• No consequences (other than material)	5	0	2	0

Analysis of this table demonstrates that the vast majority of accidents are caused by fires or oil spills (not burning). However for almost 50% of events, fires do not have human or environmental consequences. The large number of oil leakage events emphasises the importance of controlling ignition sources.

It should be noted that fire is generally caused by generators and transformers, through bursting or surges. However, accidents involving transformers rarely cause significant impacts given the physical separation between transformers on site.

Example scenarios from accidents recorded in the ARIA database are detailed hereinafter.

Example of consequences on the environment (Réf. BARPI n°19283)

A power plant discharged 5 t of heavy fuel oil in a ditch following a handling error. An employee raised the alarm.

Causes: Poor positioning of a manually-operated valve led to a return of heavy fuel oil in one of the two 150 m³ light fuel tanks of the plant. Hydrocarbons boiled over in the retention basin connected with a sump that drains rain to a sludge-oil separator tank with a hay filter. With the sump valve opened, the retention basin did not fulfil its role and the oil spill resulted.

Consequences: the hydrocarbons join at 3 km from the rivers, the pollutants 8km. The operator and private companies specialised installed 6 dams. Oil and waste was recovered for several months. Fuel oil is stored in two trays of 2,900 and 6,500 m³.

Example of human consequences (Réf. BARPI n°42812)

A third party informed about the presence of a fire on two of the four generators of a power plant that supplied an isolated area.

Cause: material disfunctioning

Consequences: Distribution of electricity shut off automatically, impacting upon 750 people. Firefighters extinguished the flames and the plant operator restored power at 5pm. A firefighter and two employees of the plant were hospitalised.

Example of explosion of gaseous phase of a tray followed by a boil-over (Réf. BARPI n°6052)

In a thermal power plant, the overheated gaseous phase (80°C instead of 65°C) in a 40 000 m3 tray filled at 40% of heavy fuel oil (FO – PE = 71°C) explodes.

Cause : ignition by 2 employees during a gauging work

Consequences : the ejected frangible fixed roof falls into the 33 000 m3 basin. After a 6hr fire tray, a boil over occurs. A fire ball rises up to 300 m, a wave of hydrocarbon on fire submerges the merlons (H=6m) and spreads until 400 m on a lower level. It floods the basin of another tray of FO and destroys 60 vehicles located on the only access road, as well as 70 houses and 2/3 of the plant. 160 persons are killed, among which 40 firemen, and 500 other persons are hurt. Total costs of the damages are estimated at 300 MF. The unique access road, narrow and sinuous, goes on a lower level of the basin. It is obstructed with rescue and press vehicles as well as numerous onlookers. The roof fall destroys the aspersion crown of 4'. Forty thousand persons mainly inhabitants from the township are evacuated by the army and relocated in tents.

Example of an explosion at a boiler (Réf. BARPI n°25754)a

An explosion occurs on a new boiler in a thermal plant (10 t of steam/h). This auxiliary boiler was aimed to complete the steam supply needed for the heating of the heavy fuel oil of the storages and for the cooling of the burners of unit station 3. This is a home type wave boiler with three smoke revolution generators. Combustion gases are directed to the back of the boiler, then redirected to the front through the lower smoke tubes, before they are redirected to the stack located at the back via the upper tubes. It should be working on a buffer on the network, in parallel to another boiler of a same type (stopped the day of the accident) and with the steam transformers producing bleeder steam from the turbine generators.

Cause : unknown

The accident occurs at the end of the starting tests of the boiler, which was supervised by one technician from the company that built the product and 2 technicians from the boiling room.

Consequences : during the accident, an end of the home tube was separated from the tubular plate, creating a breach on the rear face of the boiler. The water, contained in the boiler, under the action of instantaneous vaporization of the steam contained under pressure (13 bar), escaped through this breach, propelling the boiler ten meters behind. The steam from the boiler went through the handling span, blew into the wall of the mechanical workshop and, by vaporizing partially at atmospheric pressure, occupied a much larger volume, inducing burns to the personnel of the workshop. The explosion resulted in 1 death and 17 injured ; all were located in the mechanical workshop. Although for some calculation codes, boiler characteristics are not acceptable, this one was however compliant with ISO standard and French norm NFE 32.104. Hydrocarbons heavier than water at boiler functioning temperature ware present in the supply water. They deposit in the home tube that would induce vaporization, and thus an elevation of the metal temperature that becomes greater than the maximal guarantee temperature of the concerned metal. There are indeed possibilities of contamination of the steam circuit by fuel oil during its heating: during recovery of steam condensates, it can be admitted in the supply system of the boiler. Real working conditions at the time of the explosion are not known with certainty, the conjunction of the presence of fuel oil in the supply water and limit calculation characteristics made the accident happen.

9.6 PRELIMINARY RISKS ANALYSIS

9.6.1 Measures taken to reduce the risk of injury

The measures taken to prevent hazards and mitigate their consequences have been defined using the project design, and are also based on pre-identified hazards. In addition to these preventive measures, specific intervention measures will be implemented in case of accident.

A more comprehensive description of the prevention and protection measures will be included in the Internal Operation Plan (IOP), to be performed by the operator before the operational phase of the plant.

Numerous passive safety devices will be installed in the plant, including:

- Vents appropriately sized on the tanks
- Protection against lightning on chimneys and covering the entire area of the plant
- Protection against static charges related to land on each storage tank.

In order to mitigate the risks, in addition to active safety systems the following systems will be installed:

- Distance level meters with high and low level alarms on each tank

- A firefighting system with fire and gas detection equipment to minimise the risk of fire and the resulting damage

- Procedures for preventive maintenance and inspection will be implemented.

9.6.2 *Preliminary risk analysis*

Following the preliminary risk analysis, 35 scenarios were initially identified as being high risk, and these have been selected for quantitative analysis and detailing. Analysis includes a map for each scenario, allowing accurate assessment of the severity of each event.

The following scenarios have been studied for each tank:

- Tank fire
- Boil-Over/Thin-Layer Boil-Over
- Fireball following slow pressurisation
- Explosion of gaseous phase
- Retention basin fire (common or individual)

In addition to tank scenarios, the risks of pool fire in case of leakage when unloading trucks and on pipelines was studied in detail.

The 3000 m^3 heavy fuel oil tank is powered by a pipeline managed by the Société Dakaroise d'Entreposage until the level of the retention basin. Only the section of pipeline operated by GTI Dakar is considered in the hazard study.

Table 9.9 presents the list of scenarios studied in the detailed risk analysis of the plant.

Table 9.9 List of the scenarios studied in the detailed risk analysis

Reference Scenario	Effect	Equipment
S01.a	Tank fire	HFO pre-storage
S01.b	Tank fire	HFO storage 1
S01.c	Tank fire	HFO storage 2
S01.d	Tank fire	HFO buffer
S01.e	Tank fire	HFO service
S01.f	Tank fire	LFO storage
S01.g	Tank fire	LFO service
S02.a	Boil-over	HFO pré-stockage
S02.b	Boil-over	HFO storage 1
S02.c	Boil-over	HFO storage 2
S02.d	Boil-over	HFO buffer
S02.e	Boil-over	HFO service
S02.f	TLBO	LFO storage
S02.g	TLBO	LFO service
S03.a	Fireball following slow pressurisation	HFO pre-storage

Reference Scenario	Effect	Equipment
S03.b	Fireball following slow pressurisation	HFO storage 1
S03.c	Fireball following slow pressurisation	HFO storage 2
S03.d	Fireball following slow pressurisation	HFO buffer
S03.e	Fireball following slow pressurisation	HFO service
S03.f	Fireball following slow pressurisation	LFO storage
S03.g	Fireball following slow pressurisation	LFO service
S04.a	Explosion of the gaseous phase	HFO pre-storage
S04.b	Explosion of the gaseous phase	HFO storage 1
S04.c	Explosion of the gaseous phase	HFO storage 2
S04.d	Explosion of the gaseous phase	HFO buffer
S04.e	Explosion of the gaseous phase	HFO service
S04.f	Explosion of the gaseous phase	LFO storage
S04.g	Explosion of the gaseous phase	LFO service
S05.a	Retention basin fire	Retention basin of HFO pre-storage
S05.b	Retention basin fire	Retention basin of HFO storage 1
S05.c	Retention basin fire	Retention basin of HFO storage 2
S05.d	Retention basin fire	Retention basin of LFO storage
S05.e	Retention basin fire	Retention basin of service tanks
S06	Pool fire	Unloading area
S07	Pool fire	Pipelines

9.7 DETAILED RISK ANALYSIS

The hazards associated with the use of fuel oil were modelled to determine their severity, according to the standard forms 'Tank/Retention Basin Fire', 'Boil-Over', 'Thin Layer Boil-Over' and 'Tank Slow Pressurisation' developed by INERIS (1) (National Institute for Industrial Environment and Risks), as well as the for 'Tank Internal Explosion' developed by the GTDLI (2) (Working Group on Deposits of Flammable Liquids). Only overpressure and thermal effects have been studied.

Considering that the flash point of fuel oil is above 55°C, it was assumed that the amount of steam produced during a rejection would not be sufficient to produce a flammable cloud. For the same reason, it is considered that a leak of heavy fuel oil from a pipeline under pressure would not ignite and produce a flame jet.

Only the effects of a pool fire will be studied in the case of a tank, tanker or pipeline leakage.

Equipment characteristics
Table 9.10 shows the dimensions of the studied tanks.

(1) INERIS is a French public institution whose mission is to contribute to the risk prevention caused by the economic activities to the health and safety of persons and property, and the environment (http: //www.ineris .com /)
(2) The GTDLI is an industry working group set up by the Ministry of Environment in France to develop specific tools for the flammable liquids sector.

Table 9.10 Tank characteristics

Tank	Number	Available volume (m^3)	Height (m)	Diameter (m)
HFO pre-storage	1	3, 000	12.6	18
HFO storage	2	1, 480	11.4	13.5
HFO buffer	1	50	3.6	4.5
HFO service	1	100	7.2	4.5
LFO storage	1	120	4.7	6
LFO service	1	100	7.2	4.5

Table 9.11 presents the dimensions of the retention basins and the unloading area.

Table 9.11 Dimensions of the retention basins and loading area

Retention basins	Number	Width (m)	Length (m)
HFO pre-storage	1	28	14
HFO storage	2	22	22
LFO storage	1	9	9
Service tank	1	16	32
Loading area	1	8	19

Hazards Modelling

The effect distances were calculated based on thresholds relating to human life as shown in the Senegalese methodological guidelines for hazard studies. Threshold values are provided in *Table 9.12*.

Table 9.12 Threshold values for human life

Threshold	Heat level		Overpressure level (mbar)
	Radiation (kW/m^2)	Thermal dose ($(kW/m^2)^{4/3}.s$)	
Irreversible effects threshold SEL	3	600	50
Lethal effects threshold SEL	5	1000	140
Threshold of very significant lethal effects SELS	10	2600	350

The table shows two thermal levels, dependent on the exposure period and/or the duration of the hazardous event:

- Radiation for more than two minutes of exposure period, for example a pool fire
- Thermal dose for an exposure period of less than two minutes, for example a fireball or a tank boil-over.

Modelling results

Effect distances calculated with GTDLI and INERIS models are provided for the following:

- 1.5 m of target height
- From the centre of the tank for storage tank scenarios
- From the edge of the retention basins for retention basin and unloading area fires
- From the discharge point for pipelines.

Table 9.13 presents the modelling results and the initial probability and severity of the risks (without taking account the eventual risk measures in place). The hazard contours for each scenario are provided in *Box 9.1* .

Box 9.2 shows the cause-consequence trees for each scenario studied.

Table 9.13 Modelling results of the hazardous events

Reference Scenario	Hazardous event	Equipment	Distance to thresholds (m)			Initial Probability	Initial Severity
			SEI	SEL	SELS		
S01.a	Tank fire	HFO pre-storage	35	0	0	2	3
S01.b	Tank fire	HFO storage 1	30	20	0	2	3
S01.c	Tank fire	HFO storage 2	30	20	0	2	3
S01.d	Tank fire	HFO buffer	15	15	10	2	3
S01.e	Tank fire	HFO service	15	15	0	2	3
S01.f	Tank fire	LFO storage	20	15	0	2	3
S01.g	Tank fire	LFO service	15	15	0	2	3
S02.a	Boil-over	HFO pre-storage	155	115	0	2	4
S02.b	Boil-over	HFO storage 1	100	70	0	2	4
S02.c	Boil-over	HFO storage 2	100	70	0	2	4
S02.d	Boil-over	HFO buffer	0	0	0	2	4
S02.e	Boil-over	HFO service	0	0	0	2	4
S02.f	TLBO	LFO storage	15	10	0	2	4
S02.g	TLBO	LFO service	10	10	0	2	4
S03.a	Fireball following slow pressurisation	HFO pre-storage	90	75	40	2	4
S03.b	Fireball following slow pressurisation	HFO storage 1	70	55	30	2	4
S03.c	Fireball following slow pressurisation	HFO storage 2	70	55	30	2	4
S03.d	Fireball following slow pressurisation	HFO buffer	25	20	5	2	4
S03.e	Fireball following slow pressurisation	HFO service	25	20	10	2	4
S03.f	Fireball following slow pressurisation	LFO storage	35	25	10	2	4
S03.g	Fireball following slow pressurisation	LFO service	25	20	10	2	4
S04.a	Explosion of gaseous phase	HFO pre-stockage	80	40	25	2	5

Reference Scenario	Hazardous event	Equipment	Distance to thresholds (m)			Initial Probability	Initial Severity
			SEI	SEL	SELS		
S04.b	Explosion of gaseous phase	HFO stockage 1	65	30	20	2	5
S04.c	Explosion of gaseous phase	HFO stockage 2	65	30	20	2	5
S04.d	Explosion of gaseous phase	HFO buffer	25	10	10	2	5
S04.e	Explosion of gaseous phase	HFO service	35	15	10	2	5
S04.f	Explosion of gaseous phase	LFO storage	45	20	10	2	5
S04.g	Explosion of gaseous phase	LFO service	35	15	10	2	5
S05.a	Retention basin fire	Retention basin of HFO pre-storage	50	40	20	2	3
S05.b	Retention basin fire	Retention basin of HFO storage 1	40	30	20	2	3
S05.c	Retention basin fire	Retention basin of HFO storage 2	40	30	20	2	3
S05.d	Retention basin fire	Retention basin of LFO storage	25	20	15	2	3
S05.e	Retention basin fire	Retention basin of service tanks	45	35	20	2	3
S06	Pool fire	Unloading area	35	30	20	4	2
S07	Pool fire	Pipelines	30	25	20	3	2

9.7.1 *Detailed analysis of scenario 1 – Tank fire*

Description

A tank fire can occur following a lightning strike on the relevant tank. This causes the collapse of the tank roof and the ignition of its content. Fire can also occur, for example, during maintenance work on the roof.

In the initial stages of a fire, the tank walls are cooled by the liquid that is still cold. As the fire advances, this liquid is consumed, reducing levels in the tank and increasing the contact surface between the flames and bare metal walls. If the walls are not cooled from the outside, the steel will lose its structural properties and weaken after a few minutes of direct contact, causing the rupture of the tank and the spill of its contents into the retention basin.

Severity and Probability

The distances to the thermal radiations of interest have been calculated with the tool developed by the GTDLI and are presented in *Table 9.13*.

No hazardous effects are expected outside the boundaries of the site. Since the distances to hazardous thermal radiations remain in the surroundings of the tanks, the impact on staff will be minor. The severity of tank fire scenarios is primarily related to structural damage to the relevant tank. Severity is considered as Level 3 - *Important*.

The probability level is determined to be 1 - *Unlikely*, considering that the site has lightning protection systems and that for tank maintenance work, certain procedures have been developed (emptying of tank before work, insulating the tank in case heat sources are used, permit to work etc.).

The level of tank fire risk is therefore considered to be *Acceptable*.

9.7.2 Detailed analysis of Scenario 2 – Boil-over

Description

A Boil-Over is a large-scale event involving a tank or bund fire and causing the evaporation of the water layer at the bottom of the tank or mixed with the fuel. It can be caused by:

- Tank fire resulting in a temperature rise inside the tank
- Retention basin fire containing the tank and evaporation of a water bottom after a long-term thermal exchange through radiation and conduction between the firebox
- and the tank
- The combination of these two effects

Three conditions must be met in order for a boil-over to occur:

- The presence of water (in the bottom of the tank) to be transformed into steam
- The formation of a heat wave that enters into contact with the water bottom located under the hydrocarbons layer
- A sufficiently viscous hydrocarbon so as to prevent the steam from easily passing through from the bottom.

A boil-over can also occur on a tank containing a less viscous liquid. The event is called Thin Layer Boil-Over (TLBO) because the amount of hydrocarbons involved is lower than in a conventional boil-over. Effect distances will be less important.

Severity and Probability

The distances to the thermal radiations of interest have been calculated with the method developed by INERIS within the OMEGA 13 document and are presented in *Table 9.13*.

Since this event occurs following a tank fire or bund fire and its kinetic is relatively slow (tank subject to a constant thermal radiation for a few hours), it may occur only if the fire has not been detected manually or by the fire and smoke detectors and could not be extinguished by internal and/or external resources. Its probability is therefore 1 - *Improbable*.

For the same reasons, site personnel would be evacuated from dangerous areas before a boil-over occurs. However, such an accident could cause severe damage to facilities and result in an operating loss of the plant. Severity is therefore 4 - *Critical*.

The risk level is therefore *Important.* In order to limit the probability of occurrence of such an event, it is advisable to act on the presence of water in the bottom of the tank, by proper tank design and regular draining of accumulated water.

9.7.3 Detailed analysis of Scenario 3 – Pressurisation and fireball

Description

Tank pressurisation occurs when a tank is exposed to a fire. The risk in this scenario is that the product contained evaporates faster than it is emitted from the vents, which causes an increase in the tank pressure and its eventual breakdown. The result is the transformation of a large amount of liquid product into a fireball when this breakdown occurs. The consequences of this are a short and intense thermal flux received by the receptors during the combustion of the fireball. The pressure wave resulting from the event remains limited.

Severity and Probability

Effect distances were calculated according to the model developed by the UFIP and are presented in *Table 9.13*. Distances to hazardous thermal radiations slightly exceed site thresholds in the north. However, it is considered unlikely that there will be irreversible effects to people external to the facility.

The tank pressurisation occurs if the tanks is exposed to thermal radiations and, if the vents are not able to reduce the pressure fast enough and if the fire cannot be controlled by internal or external methods. Therefore the likelihood of occurrence is 1 - *Improbable*.

Due to the very low kinetic of this scenario (tank subject to a constant flow of heat for several hours), the site personnel would be evacuated from hazardous areas before the fireball could occur. However, such an accident could result in an operating loss of the plant. Severity is therefore *4 - Critical*.

The risk level is *Important*. It should be noted that this hazard only occurs if the tank is exposed to thermal radiations. Any action undertaken to limit the fire, and in particular, its duration (e.g. drainage of the retention basin, fire suppression) will reduce the probability of pressurisation. Furthermore, cooling the tank during the fire will limit the temperature and the pressure rise in the tank.

It can be noticed that this scenario cannot occur if the vents of the tanks are designed for this scenario (API2000 standard or equivalent).

9.7.4 Detailed analysis of scenario 4 – Gaseous phase explosion

Description

Tank gaseous phase explosion can be caused by maintenance work on the tank (hot point work or spark generation) or by a lightning, leading to the ignition of the gas inside the tank.

Tanks bursting can be divided into several successive or simultaneous phases:

- Chemical reaction of internal combustion
- Tank breakdown including wall destruction
- Projectiles emission
- Pressure wave propagation in the environment
- Internal (conduction with the wall) and external (radiation, convection) heat exchanges.

If the storage tank contains air, the vapour pressure can be sufficient for the air/steam mixture, or at least a percentage of the gaseous phase, to be within flammability limits.

Once this scenario occurs, a number of potential sources of ignition enable the mixture to be set alight, including:

- Electrostatic spark, mechanical or electrical (the temperature of the vapour mixture is above the flash point)

- Hot source (above the auto-ignition temperature of the vapour mixture) such as tank wall heated in a fire, hot point works.

The internal explosion can result in an overpressure wave and the production of missiles. For the modelling the following can be considered:

- The pressure inside the tank increases in an uniform manner throughout the space

- Pressure effects generated in the external environment after containment breakdown are no longer influenced by the combustion.

Consequently, we can consider that the explosion parameters are exclusively determined by the bursting pressure of the tank walls and the characteristics of the compressed vapours.

Bursting
The occurrence of an explosion in an enclosure containing hydrocarbon vapours causes severe internal overpressure. No vertical fixed roof storage tank can contain and control such a variation. The internal pressure of the tank then increases and causes tank breakdown.

It must be ensured that tanks are constructed according to the standards of CODRES (French construction code for vertical cylindrical steel tanks) or equivalent. In this way, they are frangible, that is to say that the junction shell/roof is weaker than the shell/bottom junction. Therefore, as a result of an accidental internal overpressure, the tank breaks at the shell/roof assembly and not at the shell/bottom. Such a rupture decreases the consequences of a sharp and sudden increase in the internal pressure.

A static calculation shows that the energy absorbed by the destruction of the wall represents a minor percentage (about 1%) of the chemical energy initially present, considering that the mixture is at its stoichiometric proportions with air. The tank roof will then tear and the roof will be expelled like a missile, absorbing 60% of the residual energy.

Aerial shockwave propagation
As discussed in the previous paragraph, an important part of the chemical energy initially present is absorbed. Only a percentage of this energy is available for the propagation of the pressure wave in the environment. There is therefore a volume (equal to the volume of the tank) of flue gas under pressure (equal to the static burst pressure of the reservoir), creating an overpressure wave which propagates in the air.

Heat exchanges
Heat exchanges, both internal and external, are also responsible for the loss of original chemical energy. These are difficult to estimate (it can be assumed about 5% of the initial energy).

If the tank contains liquid at the time the gaseous explosion occurs, the content will be discharged into the retention basin and burn as a retention basin fire.

Severity and probability

Overpressure effect distances were calculated according to the model developed by the GTDLI and are presented in *Table 9.13*.

The explosion causes are related to exceptional events (maintenance, lightning etc.). The probability is therefore 1 - *Improbable*.

If an explosion does occur, the effects would be severe for staff on site but also for surrounding tanks and equipment. This could result in a significant operating loss. The severity level is therefore 5 - *Catastrophic*.

As a result, the risk level is *Important*. The probability of occurrence of this event is mitigated by reducing the probability of ignition (using grounding equipment, lightning protection, procedures and maintenance works etc.) and by reducing the likelihood of the concentration to reach the hydrocarbon LEL (ventilation of the gaseous phase).

9.7.5 Detailed analysis of Scenario 5 – Retention basin fire

Description

For the retention basin fire, consideration is given to the loss of containment of a tank (pipelines leakage, tapping breakdown, tank breakdown) by external aggression or corrosion, or the overflow that a spreading liquid pool will generate. In the case of the HFO pre-storage tank, a supply pipeline leak may also generate a hydrocarbons pool in the retention basin.

Ignition of the surface vapours causes the ignition of the liquid pool, which can cause a retention basin fires. This event can also result from a leak in a portion of the transfer pipeline located in the retention basin.

In order to reduce the risk of spillages, the retention basin shall be designed to have sufficient capacity to contain the maximum tank storage volume. Otherwise, the fire can spread outside the area and cause damage to other plant equipment. It should also be ensured that tank dikes are rESIAtant enough to absorb the shockwave caused by a complete tank breakdown.

There are five retention basins on site:

- Retention basin of the HFO pre-storage tank (28m x 41m)
- Retention basins of the two HFO storage tanks (32m x 15.7m)
- Retention basin of the LFO storage tank (9m x 9m)
- Retention basins of the eight service tanks (14.7m x 32m)

Severity and probability

Distances to the thermal radiations of interest have been calculated using the tool developed by the GTDLI and are presented in *Table 9.13*.

All retention basin fires have effects with various levels of importance outside the area. However, the hydrocarbons pool remains contained on the retention basin. It is therefore very unlikely that staff members will be injured by this event. The severity level is mainly related to structural damages and operating losses, and is considered as 3 - *Important*.

A leak may occur on a tank, tapping or portion of pipeline, but the probability of ignition of HFO remains low. Frequency level is estimated as 1 - *Improbable*.

The risk level is *Acceptable*.

9.7.6 *Detailed analysis of Scenario 6 – Unloading area fire*

Description

A loss of containment can occur when unloading a tanker. Three types of losses of containment are considered:

- A tanker leak
- Leak in the unloading arms and related equipment
- Leak on lines towards the storage tanks.

Hydrocarbons spreading will remain limited to the size of the unloading area (8 m x 19 m).

Severity and Probability

Distances to the thermal radiations of interest have been calculated using the tool developed by the GTDLI and are presented in *Table 9.13*.

A leak during tanker unloading is considered common, but generally the procedures in place limit the amount of hydrocarbons released and the probability of ignition of the fluid. The frequency level of this scenario is considered as 3 - *Casual*.

In case of fire at the loading area, staff and/or tanker drivers may not have time to evacuate the area. Some may suffer burns that require care. The severity of this scenario is 2 - *Minor*.

The risk level is therefore *Important*. However, it should be noted that the probability of ignition of the hydrocarbons discharged is relatively low. In addition, risk is further reduced due to the implementation of preventive measures (i.e. absence of hot spots near the loading area and equipment earthing).

9.7.7 *Detailed analysis of Scenario 7 – Pool fire*

Description

For pool scenarios, the loss of containment by external aggression or corrosion of hydrocarbons-transfer pipelines is considered. Ignition of the surface vapours can lead to a pool fire. As a consequence of the fire, the size of the pool will quickly reach a balance between the supply and the combustion. The following assumptions were considered:

- Maximum flow Q in pipelines: 20 m^3/h – around 4.5 kg/s

- Surface flow q of heavy fuel oil combustion: 0.0225 kg/m²/s

The diameter D of the pool is calculated so that the combustion rate Q equals the maximum feed flow of the pool. This balance is translated into the following relationship:

$$\frac{\pi . D^2}{4} = \frac{Q}{q}$$

Then

$$D = \sqrt{\frac{4. Q}{\pi . q}}$$

The diameter of the pool fire in balance is 16 m. Effect distances of a 16 m diameter circular pool fire were reported throughout the pipelines outside the retention basins.

Severity and probability

Distances to the thermal radiations of interest have been calculated using the tool developed by the GTDLI and are presented in *Table 9.13*.

A hydrocarbon leak in this type of pipeline and the ignition of the pool is very unlikely on such a site. The probability level is therefore considered as 2 - *Rare* - this event is not common but still possible in the facility.

The severity level depends on the capacity to control the leak. In this case, the severity of this scenario is estimated to be 2 - *Minor* because this type of leakage is easily detectable and the event can be easily halted by stopping the pumps.

The risk level is therefore considered *Acceptable*.

9.7.8 Summary of technological risks

Table 9.14 summarises the risks in terms of likelihood and severity. The risk quantification takes into account the preventive and protective measures identified for each scenario. The kinetic of the scenario (hazard occurrence rate) is also provided.

Table 9.14 Summary of the risk assessment

Reference Scenario	Hazard	Equipment	Kinetic	Distance to thresholds (m)			Final Probability	Final Severity
				SEI	SEL	SELS		
S01.a	Tank fire	HFO pre-storage	Fast	35	0	0	1	3
S01.b	Tank fire	HFO storage 1	Fast	30	20	0	1	3
S01.c	Tank fire	HFO storage 2	Fast	30	20	0	1	3
S01.d	Tank fire	HFO buffer	Fast	15	15	10	1	3
S01.e	Tank fire	HFO service	Fast	15	15	0	1	3

Reference Scenario	Hazard	Equipment	Kinetic	Distance to thresholds (m)			Final Probability	Final Severity
				SEI	SEL	SELS		
S01.f	Tank fire	LFO storage	Fast	20	15	0	1	3
S01.g	Tank fire	LFO service	Fast	15	15	0	1	3
S02.a	Boil-over	HFO pre-storage	Slow	155	115	0	1	4
S02.b	Boil-over	HFO storage 1	Slow	100	70	0	1	4
S02.c	Boil-over	HFO storage 2	Slow	100	70	0	1	4
S02.d	Boil-over	HFO buffer	Slow	0	0	0	1	4
S02.e	Boil-over	HFO service	Slow	0	0	0	1	4
S02.f	TLBO	LFO storage	Slow	15	10	0	1	4
S02.g	TLBO	LFO service	Slow	10	10	0	1	4
S03.a	Fireball following slow pressurisation	HFO pre-storage	Slow	90	75	40	1	4
S03.b	Fireball following slow pressurisation	HFO storage 1	Slow	70	55	30	1	4
S03.c	Fireball following slow pressurisation	HFO storage 2	Slow	70	55	30	1	4
S03.d	Fireball following slow pressurisation	HFO buffer	Slow	25	20	5	1	4
S03.e	Fireball following slow pressurisation	HFO service	Slow	25	20	10	1	4
S03.f	Fireball following slow pressurisation	LFO storage	Slow	35	25	10	1	4
S03.g	Fireball following slow pressurisation	LFO service	Slow	25	20	10	1	4
S04.a	Explosion of gaseous phase	HFO pre-storage	Very fast	80	40	25	1	5
S04.b	Explosion of gaseous phase	HFO storage 1	Very fast	65	30	20	1	5
S04.c	Explosion of gaseous phase	HFO storage 2	Very fast	65	30	20	1	5
S04.d	Explosion of gaseous phase	HFO buffer	Very fast	25	10	10	1	5
S04.e	Explosion of gaseous phase	HFO service	Very fast	35	15	10	1	5
S04.f	Explosion of gaseous phase	LFO storage	Very fast	45	20	10	1	5
S04.g	Explosion of gaseous phase	LFO service	Very fast	35	15	10	1	5
S05.a	Retention basin fire	Retention basin of HFO pre-storage	Fast	50	40	20	1	3
S05.b	Retention basin fire	Retention basin of HFO storage 1	Fast	40	30	20	1	3
S05.c	Retention basin fire	Retention basin of HFO storage 2	Fast	40	30	20	1	3
S05.d	Retention basin fire	Retention basin of LFO storage	Fast	25	20	15	1	3
S05.e	Retention basin fire	Retention basin of service tanks	Fast	45	35	20	1	3
S06	Pool fire	Unloading area	Fast	35	30	20	3	2
S07	Pool fire	Pipelines	Fast	30	25	20	2	2

Table 9.15 shows the risk classification within the matrix presented in Section above.

Table 9.15 ***Risk Classification in the DEEC Matrix***

RISK LEVEL		Consequences				
		5	4	3	2	1
Probability	5					
	4					
	3				S06	
	2				S07	
	1	S04	S02 & S03	S01 & S05		

9.8 DOMINO EFFECTS ANALYSIS

The domino effects of a scenario can cause, by their proximity, other hazardous events and an increase in the severity of the initial event.

When the hazard is an explosion or a long-term thermal radiation, there is a risk of domino effects.

Domino effect threshold values are provided in *Table 9.16*.

Table 9.16 ***Thresholds of domino effects***

Threshold	Thermal level (kW/m²)	Overpressure level (mbar)
Threshold of the domino effects	10	140

Modelling results of the domino effect thresholds are provided in *Table 9.17*.

Table 9.17 ***Distance to domino effect thresholds and potential domino effects***

Scenario Reference	Hazard	Equipment	Distance to thresholds of the domino effect (m)	Potential domino effect
S01.a	Tank fire	HFO pre-storage	N/A	-
S01.b	Tank fire	HFO storage 1	N/A	-
S01.c	Tank fire	HFO storage 2	N/A	-
S01.d	Tank fire	HFO buffer	10	S02.g, S03.g
S01.e	Tank fire	HFO service	N/A	-
S01.f	Tank fire	LFO storage	N/A	-
S01.g	Tank fire	LFO service	N/A	-
S04.a	Explosion of gaseous phase	HFO pre-storage	40	Service tanks breakdown
S04.b	Explosion of gaseous phase	HFO storage 1	30	HFO storage 2 tanks and LFO storage tanks breakdown
S04.c	Explosion of gaseous phase	HFO storage 2	30	HFO Storage 1 tank breakdown

Scenario Reference	Hazard	Equipment	Distance to thresholds of the domino effect (m)	Potential domino effect
S04.d	Explosion of gaseous phase	HFO buffer	10	HFO service tank breakdown
S04.e	Explosion of gaseous phase	HFO service	15	HFO buffer tanks breakdown
S04.f	Explosion of gaseous phase	LFO storage	20	-
S04.g	Explosion of gaseous phase	LFO service	15	-
S05.a	Pool fire	Retention basin of HFO pre-storage	20	S02.a, S02.d, S02.e, S02.g, S03.a, S03.d, S03.e, S03.g
S05.b	Retention basin fire	Retention basin of HFO storage 1	20	S02.c, S02.f, S03.c, S03.f
S05.c	Retention basin fire	Retention basin of HFO storage 2	20	S02.b, S03.b
S05.d	Retention basin fire	Retention basin of LFO storage	15	S02.b, S03.b
S05.e	Retention basin fire	Retention basin of service tanks	20	S02.a, S02.d, S02.e, S02.g, S03.a, S03.d, S03.e, S03.g
S06	Pool fire	Unloading area	20	S02.b, S02.c, S03.b, S03.c
S07	Pool fire	Pipelines	20	S02.a, S02.d, S02.e, S02.f, S03.a, S03.d, S03.e, S03.f

N/A : Not affected
- *: No sensitive equipment within the domino effect area*

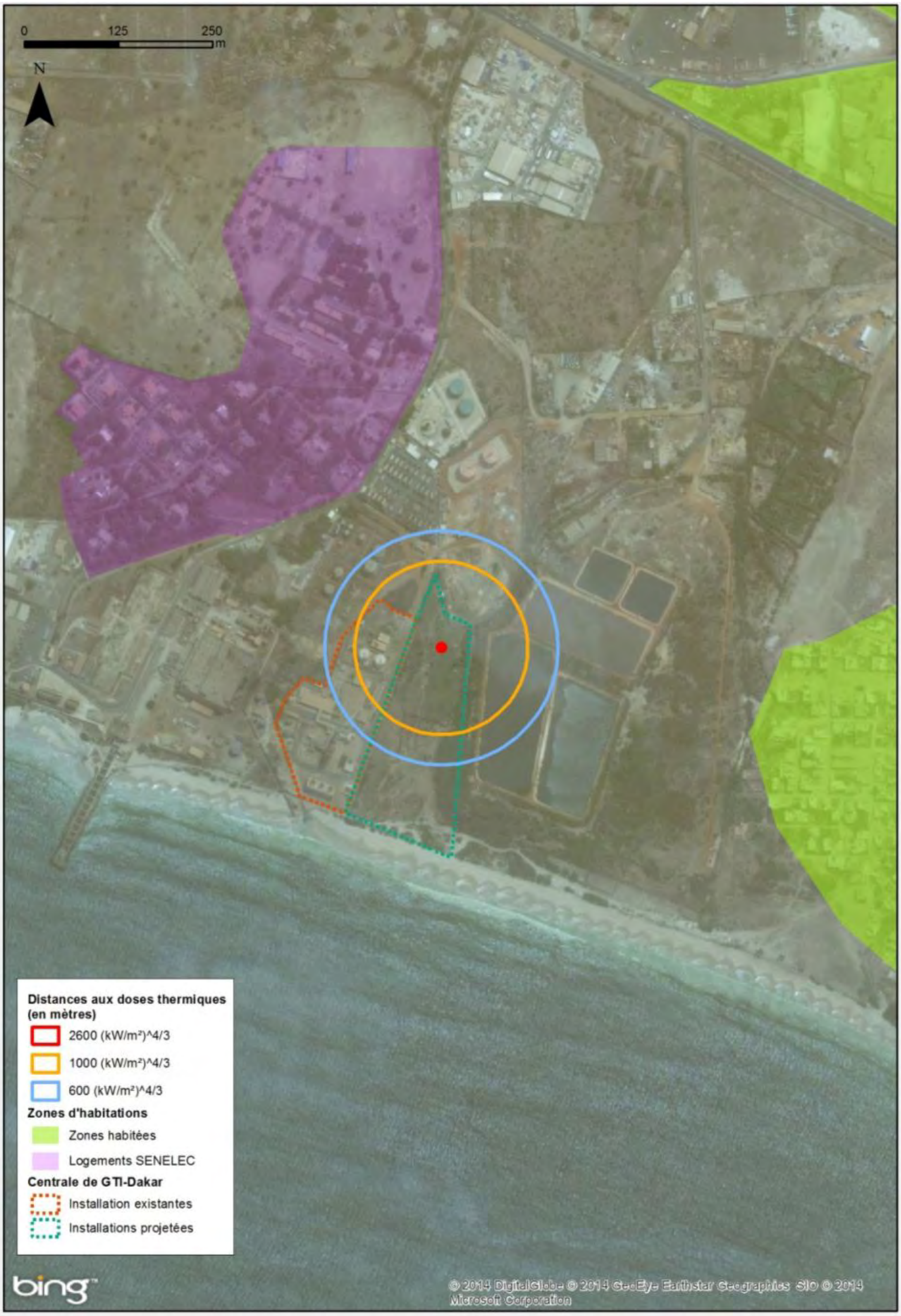
In order to avoid a worsening of consequences by domino effects in the case of storage tank or retention basin fire and overpressures, safety distances between areas of hydrocarbon storage and areas of electricity generation will be implemented as well as protective measures (sprinklers, fire walls, etc.).

Worst case scenario

Considering the location of the equipment taken into account in the domino effect analysis, the worst case scenario is the worsening of the consequences of a retention basin (S06.a) or tank fire (S01.a) on the 3000 m^3 HFO tank, by domino effect. If fire is not controlled, a boil-over (Scenario S02.a) may occur in this tank. This scenario has the major effect distance of 115 m for the first lethal effects and 155 m for irreversible effects.

Figure 9.2 below presents the effect distances.

Figure 9.2 Hazard contour of boil over scenario



According to *Figure 9.2*, hazard contour of the upper bound scenario does not reach the closest inhabited areas from the site. SENELEC residences (North West from the facility) are located at 82m from the hazard contour relating to « 600 kW/m² » and the residential area of Diokoul (East from the facility) is located at 270 m from this hazard contour. These distances represent additional safety buffer zones in case of the main hazardous scenario identified would occur. In this case no inhabited areas would be affected.

9.9 *TAKING INTO ACCOUNT NEIGHBOURING HAZARDS*

This assessment identified and took into account the following neighbouring hazards around the project area:

- SENELEC power plants CIII and CIV, as well as associated hydrocarbons storage facilities; and
- *Société Dakaroise d'Entreposage's* facilities, solely dedicated to hydrocarbons storage.

These neighbouring hazards shall be taken into account in the emergency planning (POI).

9.9.1 *SENELEC*

The 'étude de dangers' of SENELEC power plants CIII and CIV (Quartz Afrique, 2009) identifies 12 major scenarios:

- Scenario 1.1.b): BOIL-OVER of Heavy Fuel storage tank (2002) following an uncontrolled tank fire;
- Scenario 1.2: Vapour phase explosion on fixed-roof storage tank (1001) due to internal overpressure;
- Scenario 1.5: Pool fire at the C3 road tankers temporary unloading area C3 following a major diesel oil release;
- Scenario 2.2.a): Vapour phase explosion on 90 m3 diesel oil fixed-roof storage tank due to internal overpressure;
- Scenario 4.1: Explosion inside combustion zone on boiler 302 or 303 as a result of unburnt combustible (heavy fuel) presence
- Scenario 4.3: BLEVE on boiler 302 or 303 water drum due to sudden water vaporisation;
- Scenario 5.2: Electric transformer explosion following a short-circuit;
- Scenario 7.1.a): Retention area fire following loss of containment on diesel oil storage tank 1002;
- Scenario 7.1.b): BOIL-OVER on heavy fuel storage tank (1003 or 1004) following an uncontrolled tank fire;
- Scenario 7.2: Vapour phase explosion on fixed-roof storage tank (1002) due to internal overpressure; and
- Scenario 7.5: Pool fire at the C3 road tankers temporary unloading area C3 following a major diesel oil release.

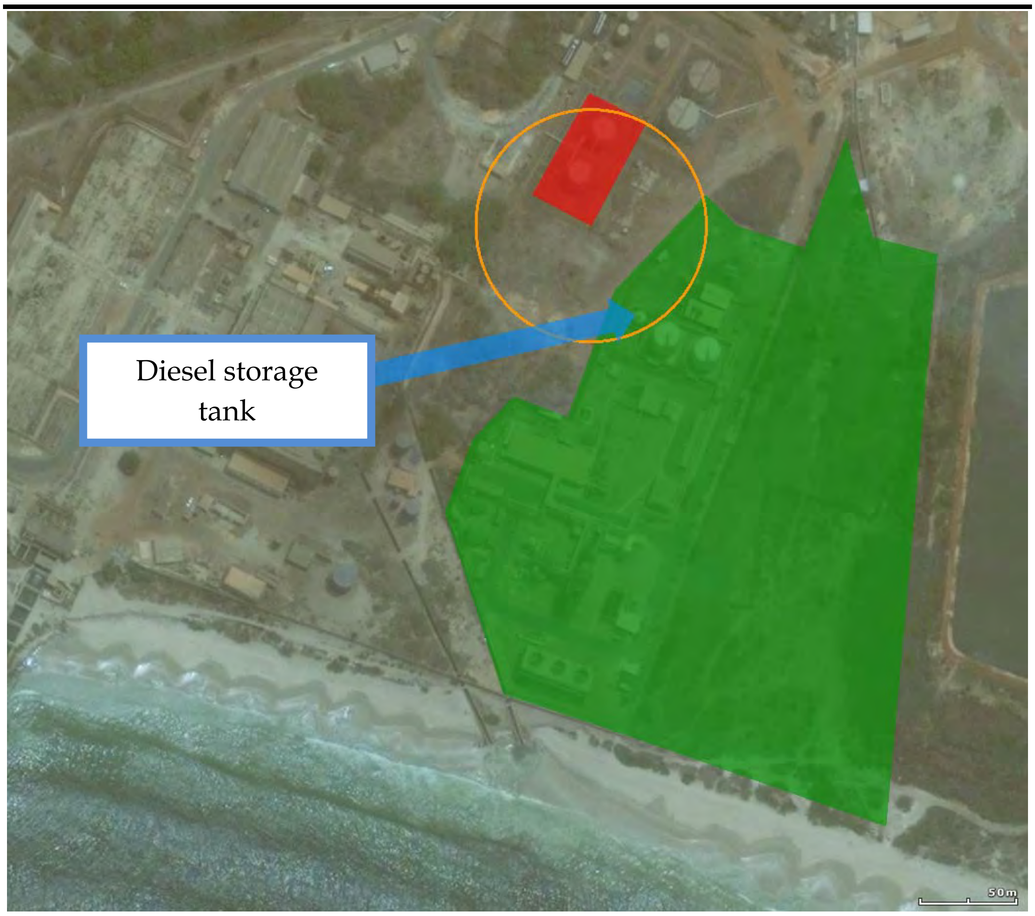
According to the 'étude de dangers', and using reference values of 10 kW/m² and 140 mbar as thresholds for domino effect for thermal and overpressure impacts, risk of escalation due these scenarios is contained within SENELEC site enclosure, except for scenario 1.1.a (Retention area fire following a loss of containment on diesel oil storage tank 1001) whose impact distance was assessed as 59 m for escalation (cf. *Figure 9.3*).

In case of SENELEC tank 1001 retention area fire, diesel oil storage tank would be impacted with thermal flux high enough to result in escalation. To avoid this escalation scenario, exposed tank walls shall be cooled using fire nozzles for the whole duration of the SENELEC fire.

However, if no preventive measure is set up in case of a SENELEC fire, there is a risk of tank damage resulting in containment loss, fire and/or explosion. Risks associated with these accidentshave been assessed in this 'étude de dangers' (scenarios S01.f, S04.f et S05.d).

Risks associated with SENELEC facilities do not therefore modify the de dangers' conclusions.

Figure 9.3 ***Domino effect impact zone associated with SENELEC diesel oil storage tank 1001 retention area fire***



Legend: red = Tank 1001 retention area / orange = 59m radius impact zone / green = ContourGlobal facilities (old and new)

9.9.2 Société Dakaroise d'Entreposage - SDE

The 'étude de dangers' of SDE (*TSE3P, 2013*) identifies 6 major scenarios:

- Scenario A: Fire / explosion of hydrocarbons tank (Fuel 380) ;
- Scenario B: Retention area fire ;
- Scenario C: Loss of containment on a tank ;
- Scenario D: Explosion of an hydrocarbons road tanker at site entrance ;
- Scenario E: Hydrocarbons piping rupture and ignition ; and
- Scenario F: Pool fire.

Among these scenarios, the following ones may have the potential to impact ContourGlobal facilities:

- Scenario A: 30 m from tank centre
- Scenario B: 47 m from the edge of retention area
- Scenario D: 14 m from site entrance

Impact distances of these scenarios, as indicated in the 'étude de dangers', do not, however, actually reach ContourGlobal facilities.

Figure 9.4 Domino effects linked to SDE facilities

Legend: red = retention area and site entrance area / orange = 30m radius impact circle / blue = 47 m radius impact circle / yellow = 14 m radius impact circle / green = ContourGlobal site (old and new facilities)

9.10 *RISK CONTROL MEASURES*

According to the classification matrix included in the guidelines of the DECF, some accidents have a high risk level. The associated hazards are:

- Scenario 2 « Boil-over » and especially for HFO pre-storage tank and HFO storage tank.
- Scenario 3 « Slow pressurisation and fireball in tanks »
- Scenario 4 « Explosion of the gaseous phase of the tanks »
- Scenario 6 « Fire in the unloading area »

The risk levels of the remaining scenarios are considered as *Acceptable* based on the guideline of the DECF:

For scenarios with high risk, it is recommended to check that risk control measures are sufficient and reasonable for the associated risk to be considered as acceptable in the context of current knowledge.

Table 9.18 outlines the risk control measures identified on the site, their functions and the scenarios for which they apply.

Table 9.18 Risk control measures

Risk control measures	Function	Scenario
Regular purge of the water of the tanks	Remove aqueous phase of the storage tanks in order to avoid Boil-Over	S02
High Level Independent alarms on the tanks	Prevent tank flood in the retention basin	S02 S03
Hydrocarbon detectors in the retention basins	Detect leaks and enable the operator to control leak consequences	S02 S03 S05
Internal and external firefighting methods (i.e. water network, foam, fire/smoke/heat detectors)	Fire control and prevention of domino effects	S02 S03 S06
Vents appropriately sized on the tanks	Prevent pressure rise within the tanks	S03
Ventilation of gaseous phase of the tanks	Prevent the gaseous phase to reach the LEL of the hydrocarbon stocked	S04
Review procedures during tank maintenance or works	Prevent ignition of gaseous phase of the tank	S04
Emergency stop button on each loading station, control of equipment prior to its use	Control leaks related to tankers unloading	S06

Risk control measures	Function	Scenario
Classified areas, approved equipment, lightning protection, equipment grounding	Prevention of ignition sources	All
Works and maintenance procedures (approved companies, staff training, work authorisation)	Control accidents related to works and maintenance activities	All
Procedures related to people and vehicles circulation (closed areas around tanks, speed limit within the site, signage, operator round, closure)	Control accidents related to traffic and as a result of a malevolent act	All
Tank and equipment construction in accordance to the 'state of the art', and maintenance procedures in place	Reduce losses of containment related to corrosion and structural or construction defaults	All

Conclusions of the risk control measures

The risk measures identified enable control of risks related to major scenarios.

Purges and regular checks of the water bottom facilitate a very low probability of Boil-Over occurring. Moreover, the sound management of the firefighting methods can also prevent this event.

The fireball following slow pressurisation scenario can only result if the vents on the tanks are not designed to cope with such an event. Therefore, it is advised that vents be sized on the tanks, and checks and maintenance operations be regularly made to reduce the likelihood of a fireball event occurring.

The explosion of the gaseous phase of a tank is very unlikely during normal operations. Good control of ignition sources and works is required to limit the likelihood of this event occurring. During maintenance operations inside the tanks, review procedures of the tank (degassing) must be respected to prevent ignition of residual gases.

At the loading area, the consequences of a leak can be easily controlled by an operator (i.e. emergency stop button). Major leaks related to a traffic accident are very unlikely due to traffic procedures (i.e. speed limits, signage) applied to the site. The control of ignition sources also reduces the fire risk at the unloading.

9.11 BASIC PRINCIPLES OF THE INTERNAL EMERGENCY PLAN

9.11.1 *Emergency Procedures*

Specific measures aimed at mitigating the consequences of an accident will be defined in the IOP that will be implemented as part of the operation of the plant. These measures are related with the physical devices aimed to reduce the consequences (i.e. fire protection system), as well as the procedures to be implemented.

These procedures will include, among others:

- Warning signal to the population (i.e. factories staff, staff of the fields close to the station)

- Warning system of the external intervention methods.

Regular exercises will be carried out with the emergency services and communities to assess the real intervention capabilities and potential implementation problems of the procedures.

9.11.2 *Training*

Staff training on the various hazards of the plant and emergency procedures should be conducted to adequately respond to every hazardous situation. These trainings will need to be repeated as much as necessary, in order to guarantee an optimal reactivity in case of an incident.

9.11.3 *Consequence reduction features*

Devices are installed at sites of sensitive equipment in the plant in order to mitigate the consequences of a potential leak. These include:

- Waterproofed retention basin around storage tanks
- Paved retention area at the loading space
- Paved retention areas at the transformers with an oil recovery basin.

9.11.4 *Fire detection and protection system*

The fire detection and protection system of the site will comply with national requirements and international standards (NFPA10, NFPA11, NFPA14, NFPA16, NFPA20, NFPA24, NFPA30 and NFPA850: 2010 "Recommended Practice for Fire Protection for Electric Generating Plants'').

For an immediate response to local fires, the site is equipped with numerous 6 kg and 12 kg powder extinguishers, located in strategic locations, and 5 kg CO_2 fire extinguishers for electrical fires.

The new fire pumps with 300 m3/h capacity are adapted for the firewater needs as specified in Section 6.2 of NFPA 850:2010 standard. Firewater capacity should be at least 600 m^3 to provide protection for at least 120 min at a flow rate of 300 m^3/h. The existing firewater tank has a capacity of 750 m^3 and is in line with this requirement.

The engine room is equipped with heat sensors (hot point) and smoke detectors (optical beams). It is also furnished with a 100 L foam area (3% mixing ratio, 200 L/min water flow) and 10 portable water extinguishers (9 L). The engines are also protected by a sprinkler network.

Detection and fire protection systems are also present at:

- The control room (smoke detector, portable CO_2 extinguishers)
- The electrical room (smoke detector, portable and mobile CO_2 extinguishers
- The compressed-air generating plant (heat detector, portable CO_2 extinguisher, water intake)
- The workshop and warehouse (heat and smoke detectors, sprinkler, dry-chemical portable extinguisher)
- Plant transformers (flood and sprinkler, dry-chemical portable extinguishers)
- The steam turbine (heat detectors, mobile foam and dry-chemical portable extinguishers)
- Fuel oil treatment unit (smoke detector, dry-chemical portable and mobile extinguishers, water intake)
- The fire pump (dry-chemical portable extinguisher, sprinkling network, water intake)
- The heat recovery unit (heat detection, dry-chemical portable extinguishers, water intake)
- Tanks (sprinkling network to cool in case of thermal radiation exposure, foam mobile extinguishers, water intake)

The alarm system of the plant meets the following principle:

- The control room where the alarm system is located is continuously occupied by personnel
- The plant is divided in different alarm areas in order to facilitate the location of a potential fire
- The sound and light alarms are located in such a way that they can be heard or seen from any areas inside or outside
- When the ambient noise level is above 105 dB, visual alarms will beed to be installed.

In addition to these fire protection systems, improvements have been made at the design phase to reduce the risk to the minimum. Indeed, fire doors, specific ventilation system, or an integration of the main electrical equipment in metal boxes have been implemented.
The following principles have been implemented for the fire alarm system:

- The fire alarm centre is located in the control room which is continuously occupied by a member of the staff

- The Power Plant is divided in fire alarm zones in order to ease locating an eventual fire

- Every room is provided with a suitable amount and type of detectors, including manual alarm call point

- Alarm bells, sirens and flashing lights are located so that they can be heard or seen everywhere inside and where needed outside the buildings.

- When the average ambient sound level is greater than 105 dB, visual flashing alarms are implemented.

The implementation of the fire protection system will also reduce the risk of accidents, by avoiding any spread to other plant equipment. It is therefore also a risk prevention system.

9.11.5 External intervention methods

The station is close to a major road and several cities, including Dakar, which enables an optimal response time.

The response period of the different Civil Protection services as well as the methods to be used should be discussed with the Civil Protection Directorate during consultation of the technical services. A specific analysis will be done as part of the ORP in order to include new facilities of the station refurbishment and modification. Training exercises should be carried out regularly with external intervention groups.

9.12 HAZARD STUDY CONCLUSIONS

This hazard study has been prepared in accordance with Senegalese regulations, building on the methods described in French regulations and international standards.

The equipment that has been considered by the present study is related to:

- Hydrocarbons storage
- Unloading hydrocarbons by road tankers

- Hydrocarbons-transfer pipelines between various tanks and site units.

Table 9.19 summarises all of the studied scenarios and provides for each scenario its principal causes and consequences, its initial probability, severity and risk ranking, the preventive and protective risk measures in place and its final probability, severity and risk ranking.

Potential hazards of the facilities have been modelled and assessed in terms of their severity and probability of occurrence. The scenarios have been classified according to the criteria of the Senegalese guideline (see *Table 9.1* and *Table 9.2*). None of the scenarios have an intolerable risk level. Scenarios with a high risk level have risk measures (see Paragraph 8) in order to obtain a risk as low as possible in the current "state of the art".

Finally, to further minimise these risks or limit their consequences, particularly within the site, an Internal Organization Plan (IEP) or Emergency Plan will be developed following the principles outlined in Paragraph 9 and including emergency procedures in case of incident occurrence on neighbouring industrial sites.

As such, considering the control risk measures proposed and the absence of inhabited areas within the risk areas associated with each potential accident identified, the Project is considered acceptable.

Table 9.19 Table recapitulating the scenarios considered in the Hazards Study

Scenario reference	Effect	Equipment	Causes	Main consequences	Cinetic	Probability	Seriousness	Level of risk	Preventive measures	Protective measures	Residual probability	Residual seriousness	Residual risk
S01.a	Tank fire	HFO pre-storage	Lightning Maintenance	Material	Quick	2	3	Important	Lightning protection and maintenance procedures	Fire water network/foam	1	3	Acceptable
S01.b	Tank fire	HFO storage 1	Lightning Maintenance	Material	Quick	2	3	Important	Lightning protection and maintenance procedures	Fire water network/foam	1	3	Acceptable
S01.c	Tank fire	HFO storage 2	Lightning Maintenance	Material	Quick	2	3	Important	Lightning protection and maintenance procedures	Fire water network/foam	1	3	Acceptable
S01.d	Tank fire	HFO buffer	Lightning Maintenance	Material	Quick	2	3	Important	Lightning protection and maintenance procedures	Fire water network/foam	1	3	Acceptable
S01.e	Tank fire	HFO service	Lightning Maintenance	Material	Quick	2	3	Important	Lightning protection and maintenance procedures	Fire water network/foam	1	3	Acceptable
S01.f	Tank fire	LFO storage	Lightning Maintenance	Material	Quick	2	3	Important	Lightning protection and maintenance procedures	Fire water network/foam	1	3	Acceptable
S01.g	Tank fire	LFO service	Lightning Maintenance	Material	Quick	2	3	Important	Lightning protection and maintenance procedures	Fire water network/foam	1	3	Acceptable

Scenario reference	Effect	Equipment	Causes	Main consequences	Cinetic	Probability	Seriousness	Level of risk	Preventive measures	Protective measures	Residual probability	Residual seriousness	Residual risk
S02.a	Boil-over / BOCM	HFO pre-storage	Fire + water in the tank bottom	Meterial (human consequences unlikely due to slow cinetic)	Slow	2	4	Important	Fire alarms, smoke detectors, fire water network/foam, purges hydrocarbon detectors in secondary containment	Fire water network/foam	1	4	Important
S02.b	Boil-over / BOCM	HFO storage 1	Fire + water in the tank bottom	Meterial (human consequences unlikely due to slow cinetic)	Slow	2	4	Important	Fire alarms, smoke detectors, fire water network/foam, purges hydrocarbon detectors in secondary containment	Fire water network/foam	1	4	Important
S02.c	Boil-over / BOCM	HFO storage 2	Fire + water in the tank bottom	Meterial (human consequences unlikely due to slow cinetic)	Slow	2	4	Important	Fire alarms, smoke detectors, fire water network/foam, purges hydrocarbon detectors in secondary containment	Fire water network/foam	1	4	Important

Scenario reference	Effect	Equipment	Causes	Main consequences	Cinetic	Probability	Seriousness	Level of risk	Preventive measures	Protective measures	Residual probability	Residual seriousness	Residual risk
S02.d	Boil-over / BOCM	HFO buffer	Fire + water in the tank bottom	Meterial (human consequences unlikely due to slow cinetic)	Slow	2	4	Important	Fire alarms, smoke detectors, fire water network/foam, purges hydrocarbon detectors in secondary containment	Fire water network/foam	1	4	Important
S02.e	Boil-over / BOCM	HFO service	Fire + water in the tank bottom	Meterial (human consequences unlikely due to slow cinetic)	Slow	2	4	Important	Fire alarms, smoke detectors, fire water network/foam, purges hydrocarbon detectors in secondary containment	Fire water network/foam	1	4	Important
S02.f	Boil-over / BOCM	LFO storage	Fire + water in the tank bottom	Meterial (human consequences unlikely due to slow cinetic)	Slow	2	4	Important	Fire alarms, smoke detectors, fire water network/foam, purges hydrocarbon detectors in secondary containment	Fire water network/foam	1	4	Important

Scenario reference	Effect	Equipment	Causes	Main consequences	Cinetic	Probability	Seriousness	Level of risk	Preventive measures	Protective measures	Residual probability	Residual seriousness	Residual risk
S02.g	Boil-over / BOCM	LFO service	Fire + water in the tank bottom	Meterial (human consequences unlikely due to slow cinetic)	Slow	2	4	Important	Fire alarms, smoke detectors, fire water network/foam, purges hydrocarbon detectors in secondary containment	Fire water network/foam	1	4	Important
S03.a	Fireball due to slow pressurization	HFO pre-storage	Uncontrolled fire next to a tank	Material (human consequences unlikely due to slow cinetic)	Slow	2	4	Important	Vents on tanks, fire alarm, smoke detector, hydrocarbon detectors in secondary containment	Fire water network / foam	1	4	Important
S03.b	Fireball due to slow pressurization	HFO storage 1	Uncontrolled fire next to a tank	Material (human consequences unlikely due to slow cinetic)	Slow	2	4	Important	Vents on tanks, fire alarm, smoke detector, hydrocarbon detectors in secondary containment	Fire water network / foam	1	4	Important
S03.c	Fireball due to slow pressurization	HFO storage 2	Uncontrolled fire next to a tank	Material (human consequences unlikely due to slow cinetic)	Slow	2	4	Important	Vents on tanks, fire alarm, smoke detector, hydrocarbon detectors in secondary containment	Fire water network / foam	1	4	Important
S03.d	Fireball due to slow pressurization	HFO buffer	Uncontrolled fire next to a tank	Material (human consequences unlikely due to slow cinetic)	Slow	2	4	Important	Vents on tanks, fire alarm, smoke detector, hydrocarbon detectors in secondary containment	Fire water network / foam	1	4	Important

Scenario reference	Effect	Equipment	Causes	Main consequences	Cinetic	Probability	Seriousness	Level of risk	Preventive measures	Protective measures	Residual probability	Residual seriousness	Residual risk
S03.e	Fireball due to slow pressurization	HFO service	Uncontrolled fire next to a tank	Material (human consequences unlikely due to slow cinetic)	Slow	2	4	Important	Vents on tanks, fire alarm, smoke detector, hydrocarbon detectors in secondary containment	Fire water network / foam	1	4	Important
S03.f	Fireball due to slow pressurization	LFO storage	Uncontrolled fire next to a tank	Material (human consequences unlikely due to slow cinetic)	Slow	2	4	Important	Vents on tanks, fire alarm, smoke detector, hydrocarbon detectors in secondary containment	Fire water network / foam	1	4	Important
S03.g	Fireball due to slow pressurization	LFO service	Uncontrolled fire next to a tank	Material (human consequences unlikely due to slow cinetic)	Slow	2	4	Important	Vents on tanks, fire alarm, smoke detector, hydrocarbon detectors in secondary containment	Fire water network / foam	1	4	Important
S04.a	Vapour explosion	HFO pre-storage	Lightning maintenance Hot spot	Human and material	Very quick	1	5	Inacceptable	Lightning protection Maintenance procedures		1	5	Important
S04.b	Vapour explosion	HFO storage 1	Lightning maintenance Hot spot	Human and material	Very quick	1	5	Inacceptable	Lightning protection Maintenance procedures		1	5	Important
S04.c	Vapour explosion	HFO storage 2	Lightning maintenance Hot spot	Human and material	Very quick	1	5	Inacceptable	Lightning protection Maintenance procedures		1	5	Important

Scenario reference	Effect	Equipment	Causes	Main consequences	Cinetic	Probability	Seriousness	Level of risk	Preventive measures	Protective measures	Residual probability	Residual seriousness	Residual risk
S04.d	Vapour explosion	HFO buffer	Lightning maintenance Hot spot	Human and material	Very quick	1	5	Inacceptable	Lightning protection Maintenance procedures		1	5	Important
S04.e	Vapour explosion	HFO service	Lightning maintenance Hot spot	Human and material	Very quick	1	5	Inacceptable	Lightning protection Maintenance procedures		1	5	Important
S04.f	Vapour explosion	LFO storage	Lightning maintenance Hot spot	Human and material	Very quick	1	5	Inacceptable	Lightning protection Maintenance procedures		1	5	Important
S04.g	Vapour explosion	LFO service	Lightning maintenance Hot spot	Human and material	Very quick	1	5	Inacceptable	Lightning protection Maintenance procedures		1	5	Important
S05.a	Retention fire	HFO pre-storage retention	Loss of containment: external aggression or corrosion Overflow Loss of containment on the supply line	Material	Quick	2	3	Important	Maintenance and equipment inspection procedures High level alarms on tanks	Fire water network / foam	1	3	Acceptable

Scenario reference	Effect	Equipment	Causes	Main consequences	Cinetic	Probability	Seriousness	Level of risk	Preventive measures	Protective measures	Residual probability	Residual seriousness	Residual risk
S05.b	Retention fire	HFO storage 1 retention	Loss of containment: external aggression or corrosion Overflow Loss of containment on the supply line	Material	Quick	2	3	Important	Maintenance and equipment inspection procedures High level alarms on tanks Hydrocarbon detectors in secondary containment	Fire water network / foam	1	3	Acceptable
S05.c	Retention fire	HFO storage 2 retention	Loss of containment: external aggression or corrosion Overflow Loss of containment on the supply line	Material	Quick	2	3	Important	Maintenance and equipment inspection procedures High level alarms on tanks Hydrocarbon detectors in secondary containment	Fire water network / foam	1	3	Acceptable
S05.d	Retention fire	LFO storage retention	Loss of containment: external aggression or corrosion Overflow Loss of containment on the supply line	Material	Quick	2	3	Important	Maintenance and equipment inspection procedures High level alarms on tanks Hydrocarbon detectors in secondary containment	Fire water network / foam	1	3	Acceptable

Scenario reference	Effect	Equipment	Causes	Main consequences	Cinetic	Probability	Seriousness	Level of risk	Preventive measures	Protective measures	Residual probability	Residual seriousness	Residual risk
S05.e	Retention fire	Service tanks retention	Loss of containment: external aggression or corrosion Overflow Loss of containment on the supply line	Material	Quick	2	3	Important	Maintenance and equipment inspection procedures High level alarms on tanks	Fire water network / foam	1	3	Acceptable
S06	Pool fire	Unloading platform	Leak (corrosion or external aggression) at: - the cistern - unloading arms or related equipment - Lines in direction of the storage tanks	Human	Quick	4	2	Important	No hot spot near the unloading area Earthing of equipments Maintenance and equipment inspection procedures Experienced Staff	Fire water network/foam, emergency cut-off button to limit the quantity of hydrocarbon discharged	3	2	Important
S07	Free pool fire	Pipes	Containment corrosion loss or external aggression level of oil transfer pipelines	Human	Quick	3	2	Important	Maintenance and equipment inspection procedures Fire alarm Smoke detector	Fire water network/foam	2	2	Acceptable

9.13 OCCUPATIONAL RISKS – HEALTH AND SAFETY OF WORKERS

9.13.1 *Objectives*

The evaluation of professional risks is a regulatory obligation, as defined by *article 6 of decree 2006-1256* relating to employer obligations in terms of Health and Safety at Work, which stipulates that the employer must take the necessary measures to promote the health and safety of workers. It is the basis for any procedure to improve safety and working conditions.

The evaluation of professional risks is used to plan preventive action.

Professional risks are the source of professional illnesses and accidents at work.

A professional illness is defined as a symptom or sickness that is the consequence of longer or shorter exposure to a risk and which may cause lesions or even the death of the worker.

An accident at work is a sudden event and may cause physical injury or even the death of the worker.

The start point for professional risk prevention is an evaluation of these risks. This evaluation consists of identifying risks and then ranking them and planning the appropriate preventive action for each of the risks identified. This ranking is a function of the frequency of occurrence and the seriousness of damage caused.

It should be noted that the evaluation suggested in this chapter was made prior to the start-up of the power plant's construction and operational activities. It is therefore an analysis of the professional risks potentially caused by an installation of the same type as the ContourGlobal - Cap des Biches power station. This conceptual analysis does not therefore replace the evaluation of work station risks that will be carried out in parallel to the construction and operational phases, as soon as the work stations and work organisation have been defined in detail.

9.13.2 *Methodology*

The approach was follows:

- Inventory of work units (stations, jobs or work station)
- Identify risks by work unit: draw up an inventory of the properties intrinsic to the equipment, substances, working method, etc. that could cause damage to employee health
- List risks: note risks according to their level of seriousness and frequency in order to rank them and prioritise preventive action.
- Suggest preventive action: this action must decrease the risk (with influence on the seriousness and frequency of the risks identified).

Work units inventory

Division into work units is based on an analysis of the various activities of the companies that will be working (including ContourGlobal - Cap des Biches). Activities have been grouped in some cases, where they present similar types of risks.

Type of professional risks evaluated

The following list covers the types of risks potentially incurred by workers on a project such as the ContourGlobal - Cap des Biches project:

- Risks linked to the use of excavation machinery
- Risks linked to the use of manual tools
- Risks linked to manual handling
- Risks linked to repetitive movements
- Risks linked to noise
- Risks linked to work in excessive heat conditions
- Traffic risks
- Risks linked to the use of handling machinery
- Risks linked to objects falling
- Risks linked to the use of machines
- Risks linked to mechanical handling
- Risks linked to manual handling
- Risks linked to repetitive movements
- Risks linked to falls: from heights, on the level
- Electrical risks
- Chemical risks
- Risks linked to screen work
- Risks linked to solitary work
- Risks linked to work in a confined space
- Risks linked to hot environments
- Risks of fire and explosion.

Risk identification and evaluation

Risk identification is based on feedback (accidents and professional illnesses occurring within the sector of activities concerned), regulations (labour code and appendix texts) and on visits to similar sites.

A grading system has been used to evaluate the various risks identified. Criteria taken into account in this evaluation are:

- The frequency of occurrence of the accident / incident or professional illness
- The seriousness of the accident / incident or professional illness.

With regard to professional illnesses, the duration of an activity that may lead to a risk is taken into account to evaluate the seriousness.

Frequency and seriousness levels taken into account in the study are present in *Table 9.20*.

Table 9.20 ***Scale of frequency and seriousness***

Scale of Frequency		Scale of seriousness	
Score	Meaning	Score	Meaning
F1	Once every 10 years or less	G1	Reversible lesions, with no sick leave or sick leave of less than 2 days
F2	Once a year	G2	Reversible lesions with sick leave
F3	Once a month	G3	Irreversible lesions, permanent incapacity
F4	Once a week or more often	G4	Death

Risk is evaluated by the association of Frequency (F) with Seriousness (G). This enables the establishment of a "criticality matrix" and thus visualisation of low, moderate and high risks. Actions are then ranked from 1 to 3, based on this classification.

	F1	**F2**	**F3**	**F4**
G4	41	42	43	44
G3	31	32	33	34
G2	21	22	23	24
G1	11	12	13	14

Key to colours:

- A low risk will be given green. In this case, preventive action to take is given as level 3
- Yellow means a moderate risk. In this case priority of action to take is given a 2.
- A high risk is shown in red. This requires level 1 priority action.

	High risk with Priority 1 action
	Moderate risk with Priority 2 action
	Low risk with Priority 3 action

Note that all professional risks that could lead to the death of a worker are considered as high, even when the frequency of the risk is very low. This prudent and conservative approach highlights any residual risk of this type, in order to focus prevention efforts for workers.

Definition of prevention and protection measures

Prevention and protection measures to be implemented are defined for all risks identified. These measures are intended on the one hand to reduce risk frequency (by attenuating risk factors) and on the other to reduce seriousness (for example by implementing worker protection measures). With regard to risks of level 4 seriousness (death) it should be noted that protection measures rarely reduce the consequences associated with the activity. Therefore only prevention measures (aimed at reducing frequency of occurrence) reduce the criticality of such a risk.

The residual risk after implementation of protection measures will therefore be of the same type as the initial risk, but its criticality level will have been mitigated.

9.13.3 *Inventory of project activities*

The various activities in the construction and operation of the thermal power plant project, and the risks to which staff may be exposed are identified in *Table 9.21*.

Table 9.21 Inventory of Project activities and of associated potential professional risks

Phases	Activities	Work station or staff exposed	Professional risks
Construction phase	Excavation work (manual or mechanical)	Staff doing the work, machinery operator or staff present on the site	- Risks linked to the use of excavation machinery - Risks linked to the use of manual tools - Risks linked to manual handling - Risks linked to repetitive movements - Risks linked to same-level falls - Risks linked to noise - Risks linked to work in excessive heat conditions
	Moving material on site by truck and crane	Operators or staff present on the site	- Traffic risk - Risks linked to the use of handling machinery - Risks linked to objects falling - Risks linked to work in excessive heat conditions
	Unloading material and equipment	Staff doing the work	- Risks linked to the use of machines - Risks linked to mechanical handling - Risks linked to manual handling and repetitive movements - Risks linked to objects falling - Risks linked to work in excessive heat conditions
	Welding work	Staff doing the work	- Risk linked to chemicals - Risks linked to repetitive movements

Phases	Activities	Work station or staff exposed	Professional risks
	Installation of equipment (mechanical or manual)	Staff doing the work	- Risks linked to the use of machines - Risks linked to mechanical handling -
	Backfill and profiling (manual or mechanical)	Staff doing the work, machinery operator or staff present on the site	- Risks linked to mechanical handling - Risks linked to manual handling and repetitive movements - Risks linked to the use of machines - Risk linked to chemicals -
Operational phase	Functioning of installations	Staff working on operation of the power plant (control room)	- Risks linked to same-level falls - Risks linked to screen work - Electrical risk - Chemical risk
	Maintenance of installations	Staff maintaiing installations	- Risks linked to noise - Electrical risk - Risks linked to falls : from height and at same level - Risks linked to solitary work - Risks linked to work in confined spaces - Risks linked to hot environments
	Surveillance of installations	Staff working on maintenance of installations	- Risks linked to noise - Electrical risk - Risks linked to falls : from height and at same level - Risks linked to solitary work - Risks linked to hot environments
	Unloading	Staff unloading trucks	- Chemicals risks - Risks of fire and explosion - Risks linked to the use of machines
	Administrative work	Administrative staff	- Risks linked to same-level falls - Risks linked to screen work
	Other connected activities (cleaning, deliveries, maintenance etc.)	Sub-contractor staff	- Risks linked to same-level falls - Risks linked to mechanical handling - Risks linked to manual handling and repetitive movements -

9.13.4 *Analysis of occupational risks*

The various risks to which staff may be exposed are defined in *Table 9.22* below together with prevention measures.

Table 9.22 Analysis of initial professional risks and presentation of residual risks

Project phase	Activities	Station or staff exposed	Risks identified	Potential damage (lesion, health affected)	Initial seriousness 1 to 4	Initial frequency 1 to 4	Initial risk level	Prevention measures	Residual seriousness 1 to 4	Residual frequency 1 to 4	Residual risk level
Construction phase	Excavation work	Staff doing the work, machinery operators or staff present on the site	Risks linked to the use of excavation machinery	Machinery / pedestrian collision: injury, death	4	3	43	Implement a traffic plan and signs on the worksite. Machinery maintenance. Train machinery operators in driving rules. Clear traffic movement routes. Assist the operator during excavation work.	4	1	41
			Risks linked to the use of manual tools	Cuts, fractures	3	4	34	Train staff in the handling of these tools. Provide staff with gloves.	2	2	22
			Risks linked to manual handling	Repetitive strain injury (RSI) Muscular pain	2	3	23	Limit daily load. Train staff in postures to use for manual handling. Implement mechanical assistance. Introduce regular rest times.	1	2	12
			Risks linked to repetitive movements	RSI Muscular pain	2	3	23	Introduce rest times. Implement mechanical assistance	2	2	22
			Risks linked to same-level falls	Injury, Fractures	2	3	23	Mark out and place signs in slippery areas	2	2	22
			Risks linked to noise	Temporary or permanent hearing loss	3	2	32	Provide workers with ear plugs and helmets with ear muffs and ensure that they are used	1	2	12
			Risks linked to work in excessive heat conditions	Heat stroke, dehydration	2	4	24	Avoid work during the hottest hours of the day. Supply workers regularly with bottles of water. Introduce regular breaks	1	2	12
	Movements of materials and equipment on	Operators or staff present on the site	Traffic risk	Vehicle / pedestrian collision:	4	2	42	Train drivers in driving rules	4	1	41

Project phase	Activities	Station or staff exposed	Risks identified	Potential damage (lesion, health affected)	Initial seriousness 1 to 4	Initial frequency 1 to 4	Initial risk level	Prevention measures	Residual seriousness 1 to 4	Residual frequency 1 to 4	Residual risk level
	site by truck and crane			injury, death							
			Risks linked to the use of handling machinery	Vehicle / pedestrian collision: injury, death	4	2	42	Implement a traffic plan and signs on the worksite. Machinery maintenance. Train machinery operators in driving rules. Clear traffic movement routes. Assist the operator during movements	4	1	41
			Risks linked to falling objects	Injury, fractures, death	4	2	42	Wear PPE (hard hat, protective eyewear, safety shoes) Check on installations and machinery likely to be the source of falling objects Limit storage heights Install protections to hold back falling objects	3	1	31
			Risks linked to work in excessive heat conditions	Heat stroke	2	4	24	Avoid work during the hottest hours of the day. Supply workers regularly with bottles of water. Introduce regular breaks	1	2	12
	Unloading materials	Staff unloading materials or present on the site	Risks linked to the use of machines	Injury, fractures, death	4	2	42	Emergency stop devices clearly identifiable on machines. Identify controls clearly to avoid any accidental start up. Safety devices on the machine in good working order. Check compliance of equipment by an approved organisation. Give instructions for work to be done on machines when stopped. Make employees aware of safety rules. Wear PPE	3	1	31
			Risks linked to mechanical	Death, injury, fractures	4	3	43	Use handling means adapted to the loads being carried. Follow the instructions given by the	4	1	41

Project phase	Activities	Station or staff exposed	Risks identified	Potential damage (lesion, health affected)	Initial seriousness 1 to 4	Initial frequency 1 to 4	Initial risk level	Prevention measures	Residual seriousness 1 to 4	Residual frequency 1 to 4	Residual risk level
			handling					equipment supplier. Check regularly on the condition of handling equipment. Employees must be trained in the use of this equipment.			
			Risks linked to manual handling and repetitive movements	RSI Muscular pain	2	3	23	Limit daily load. Train staff in postures to use for manual handling. Implement mechanical assistance. Introduce regular rest times.	1	2	12
			Risks linked to falling objects	Injury, fractures, death	4	2	42	Wear PPE (hard hat, protective eyewear, safety shoes) Check on installations and machinery likely to be the source of falling objects Limit storage heights Install protections to hold back falling objects	3	1	31
			Risks linked to working in excessive heat conditions	Heat stroke, dehydration	2	4	24	Avoid work during the hottest hours of the day. Supply workers regularly with bottles of water. Introduce regular breaks	1	2	12
	Welding work	Staff doing the work	Chemical risks	Death, burns, respiratory illnesses, irritation of the eyes or skin in case of repeated and prolonged contact with the product. Burns,	4	3	43	Provide PPE and ensure that it is worn Limit as much as possible the number of employees potentially exposed.	3	2	32

Project phase	Activities	Station or staff exposed	Risks identified	Potential damage (lesion, health affected)	Initial seriousness 1 to 4	Initial frequency 1 to 4	Initial risk level	Prevention measures	Residual seriousness 1 to 4	Residual frequency 1 to 4	Residual risk level
				Allergies							
			Risks linked to repetitive movements	RSI Muscular pain	2	3	23	Limit daily load. Train staff in postures to use for manual handling. Implement mechanical assistance. Introduce regular rest times.	1	2	12
	Installation of equipment (mechanical or manual)	Staff doing the work or operating machinery	Risks linked to the use of machines	Injury, fractures, death	4	2	42	Emergency stop devices clearly identifiable on machines. Identify controls clearly to avoid any accidental start up. Safety devices on the machine in good working order. Check compliance of equipment by an approved organisation. Give instructions for work to be done on machines when stopped. Make employees aware of safety rules. Wear PPE	3	1	31
			Risks linked to mechanical handling	Death, injury, fractures	4	3	43	Use handling means adapted to the loads being carried. Follow the instructions given by the equipment supplier. Check regularly on the condition of handling equipment. Employees must be trained in the use of this equipment. Wear PPE	4	1	41
			Risks liked to manual handling and repetitive movements	RSI Muscular pain	2	3	23	Limit daily load. Train staff in postures to use for manual handling. Implement mechanical assistance. Introduce regular rest times	1	2	12
			Risks linked to falls: from	Injury, Fractures	2	3	23	Mark out and place signs in slippery areas	2	2	22

Project phase	Activities	Station or staff exposed	Risks identified	Potential damage (lesion, health affected)	Initial seriousness 1 to 4	Initial frequency 1 to 4	Initial risk level	Prevention measures	Residual seriousness 1 to 4	Residual frequency 1 to 4	Residual risk level
			height and at same level								
			Risks linked to noise	Temporary or permanent hearing loss	3	2	32	Provide workers with ear plugs and helmets with ear muffs and ensure that they are used	1	2	12
			Electric risk	Death, burns	4	2	42	All interventions must be carried out by staff who have received authorisation. Have installations set up and checked regularly (electrical, pressurised devices) by qualified staff. Train staff in measures to take in case of fire.	3	1	31
	Backfill and profiling (manual or mechanical)	Staff doing the work, machinery operator or staff present on the site	Risks linked to mechanical handling	Death, injury, fractures	4	3	43	Use handling means adapted to the loads being carried. Follow the instructions given by the equipment supplier. Check regularly on the condition of handling equipment. Employees must be trained in the use of this equipment. Wear PPE	4	1	41
			Risks linked to manual handling and repetitive movements	RSI, muscular pain	2	3	23	Limit daily load. Train staff in postures to use for manual handling. Implement mechanical assistance. Introduce regular rest times	1	2	12
			Risks linked to the use of machines	Death, injury, fractures,	4	2	42	Emergency stop devices clearly identifiable on machines. Identify controls clearly to avoid any accidental start up. Safety devices on the machine in good working order. Check compliance of equipment by	3	1	31

Project phase	Activities	Station or staff exposed	Risks identified	Potential damage (lesion, health affected)	Initial seriousness 1 to 4	Initial frequency 1 to 4	Initial risk level	Prevention measures	Residual seriousness 1 to 4	Residual frequency 1 to 4	Residual risk level
								an approved organisation. Give instructions for work to be done on machines when stopped. Make employees aware of safety rules. Wear PPE			
			Chemical risks	Death, burns, respiratory illnesses, irritation of the eyes or skin in case of repeated and prolonged contact with the product. Burns, Allergies	4	3	43	Provide PPE and ensure that it is worn Limit as much as possible the number of employees potentially exposed.	3	2	32
Operational phase	Operation of installations	Staff working on power plant operation (control room)	Risks linked to same-level falls	Injury, fractures	2	3	23	Mark out and place signs in slippery areas	2	2	22
			Risks linked to screen work	RSI muscular pain	3	2	32	Lay out the work station so as to adopt good posture (position of the computer, screen adjustments, seat position, etc.)	2	1	22
			Electric risk	Death, burns	4	2	42	All interventions must be carried out by staff who have received authorisation. Have installations set up and checked regularly (electrical, pressurised devices) by qualified staff. Train staff in measures to take in case of fire.	3	1	31

Project phase	Activities	Station or staff exposed	Risks identified	Potential damage (lesion, health affected)	Initial seriousness 1 to 4	Initial frequency 1 to 4	Initial risk level	Prevention measures	Residual seriousness 1 to 4	Residual frequency 1 to 4	Residual risk level
			Chemical risk	Death, burns	3	2	32	PPE (gloves, mask, protection glasses) All interventions must be carried out by staff who have received authorisation. Have installations set up and checked regularly (electrical, pressurised devices) by qualified staff. Train staff in measures to take in case of fire.	1	2	12
	Installation maintenance	Staff maintaining installations	Risks linked to noise	Temporary or permanent hearing loss	3	2	32	Provide workers with ear plugs and helmets with ear muffs and ensure that they are used	1	2	12
			Electric risk	Death, Burns	4	2	42	All interventions must be carried out by staff who have received authorisation. Have installations set up and checked regularly (electrical, pressurised devices) by qualified staff. Train staff in measures to take in case of fire.	3	1	31
			Risks linked to falls: from height or at same level	Injury, fractures	2	3	23	Mark out and place signs in slippery areas	2	2	22
			Risks linked to solitary work	Injury, fractures	2	3	23	Reduce the number and length of interventions Depending on the work station and its specific characteristics, draw up instructions, train and inform staff.	2	2	22
			Risks linked to work in confined spaces	Death, injury	4	2	42	Create staff awareness Define operational methods before intervention Work in pairs.	1	2	12

Project phase	Activities	Station or staff exposed	Risks identified	Potential damage (lesion, health affected)	Initial seriousness 1 to 4	Initial frequency 1 to 4	Initial risk level	Prevention measures	Residual seriousness 1 to 4	Residual frequency 1 to 4	Residual risk level
								Ventilate confined spaces during interventions			
			Risks linked to hot environments	Heat stroke, dehydration	2	4	24	Plan for breaks in a cool place. Provide work clothes suitable for the temperature	1	2	12
	Surveillance of installations	Staff in charge of the surveillance of installations including security officers	Risks linked to noise	Temporary or permanent hearing loss	3	2	32	Provide workers with ear plugs and helmets with ear muffs and ensure that they are used	1	2	12
			Electric risk	Death, burns	4	2	42	All interventions must be carried out by staff who have received authorisation. Have installations set up and checked regularly (electrical, pressurised devices) by qualified staff. Train staff in measures to take in case of fire.	3	1	31
			Risks linked to falls: from height or at same level	Injury, fractures	2	3	23	Mark out and place signs in slippery areas	2	2	22
			Risks linked to solitary work	Injury, fractures	2	3	23	Mark out and place signs in slippery areas	2	2	22
			Risks linked to hot environments	Heat stroke, dehydration	2	4	24	Plan for breaks in a cool place. Provide work clothes suitable for the temperature	1	2	12
	Unloading	Staff unloading trucks	Chemical risks	Death, burns, respiratory illnesses, irritation of the eyes or skin in case of repeated	4	3	43	Provide PPE and ensure that it is worn Limit as much as possible the number of employees potentially exposed. …) Remove and ban the use of any source of flame close to the unloading area.	3	2	32

Project phase	Activities	Station or staff exposed	Risks identified	Potential damage (lesion, health affected)	Initial seriousness 1 to 4	Initial frequency 1 to 4	Initial risk level	Prevention measures	Residual seriousness 1 to 4	Residual frequency 1 to 4	Residual risk level
				and prolonged contact with the product. Burns, Allergies				Set up firefighting equipment.			
			Risks of fire and explosion	Death, injury, burns	4	3	43	Maintain installations periodically. Display pictograms with safety instructions. Remove and ban the use of any source of flame close to the installations, Set up firefighting equipment. Wear PPE	4	1	41
			Risks linked to the use of machines	Injury, fractures, death	4	2	42	Emergency stop devices clearly identifiable on machines. Identify controls clearly to avoid any accidental start up. Safety devices on the machine in good working order. Check compliance of equipment by an approved organisation. Give instructions for work to be done on machines when stopped. Make employees aware of safety rules. Wear PPE	3	1	31
	Administrative work	Administrative staff	Risks linked to same-level falls	Injury, fractures	2	3	23	Mark out and place signs in slippery areas	2	2	22
			Risks linked to screen work	RSI Muscular pain Fatigue	3	2	32	Lay out the work station so as to adopt good posture (position of the computer, screen adjustments, seat position, etc.)	2	1	21

Project phase	Activities	Station or staff exposed	Risks identified	Potential damage (lesion, health affected)	Initial seriousness 1 to 4	Initial frequency 1 to 4	Initial risk level	Prevention measures	Residual seriousness 1 to 4	Residual frequency 1 to 4	Residual risk level
	Other connected activities (cleaning, deliveries, upkeep excluding maintenance, etc.)	Sub-contractor staff	Risk linked to same-level falls	Injury, Fractures	2	3	23	Mark out and place signs in slippery areas	2	2	22
			Risks linked to mechanical handling	Death, injury, fractures	4	3	43	Use handling means adapted to the loads being carried. Follow the instructions given by the equipment supplier. Check regularly on the condition of handling equipment. Employees must be trained in the use of this equipment. Wear PPE	4	1	41
			Risks linked to manual handling and repetitive movements	RSI Muscular pain	2	3	23	Limit daily load. Train staff in postures to use for manual handling. Implement mechanical assistance. Introduce regular rest times	1	2	12

Prevention and protection measures will therefore reduce professional risks significantly. However, as pointed out in *Chapter 9.13.2*, the seriousness of some risks that can lead to death cannot be significantly reduced; in these cases the prevention measures suggested will reduc to a minimum the frequency of occurrence.

9.13.5 Summary of mitigation measures

Some risks such as those linked to vehicle and machinery movements on the worksite, those linked to extreme noise from machinery during the construction phase and those linked to contact with products and fires during the operational phases, may reach high levels and must therefore obligatorily be associated with the suggested prevention and protection measures.

Thus, in order to control the various risks and promote worker health and safety, ContourGlobal - Cap des Biches will ensure that safety measures are implemented and complied with.

Construction phase

ContourGlobal - Cap des Biches will require from the contractor responsible for engineering and construction:

- A risk analysis at work stations associated with construction activities, based on those identified in this report, and
- A worker risk prevention plan.

The risk analysis and prevention plan will be periodically reviewed and updated, notably at every new construction phase (excavation, civil engineering, assembly, testing).

They will be duly communicated to all sub-contractors working on the Project construction phase. Staff from ContourGlobal - Cap des Biches, the contractor and his sub-contractors will received training.

Operational phase

For the operational phase an evaluation of risks for worker health and safety will also be carried out and periodically updated.

It will take into account:

- The various accident events linked to Project operations and described in Section 9.4 and
- An accident risk analysis at work stations, on the basis of those identified in this report.

A plan to prevent risks to worker health and safety will be drawn up for the operational phase, and periodically updated. This plan will notably include an internal organisation plan (IOP) applicable to the process hazards already identified in this hazards study, as well as operational health and safety factors.

Making work stations safe

ContourGlobal - Cap des Biches will carry out analysis of work station risks, which will be updated regularly, notably in case of any change in the organisation of work stations or processes. This analysis will act as a reference for making work stations safe in terms of the prevention of risks to worker health and safety.

Evacuation procedure in case of fire

Right from the construction phase, ContourGlobal - Cap des Biches will ensure that an alert and evacuation procedure to implement in case of fire has been defined. Workers will be trained to follow this procedure. An alert and evacuation procedure will also be defined for the operational phase. This procedure will be periodically updated, notably in case of any significant change in site or process organisation.

9.14 *EXCLUSION ZONE AND SAFETY DISTANCE*

The hazards study presented above defined safety distances linked to the Project's industrial context and the potential risks involved. Irreversible effects could thus be felt at a distance of up to 155m from the storage areas in case of boil-over (1). The maximum distance for irreversible effects is 82m from the SENELEC accommodation and 270m from the inhabited area of Diokoul (see *Figure 9.2*). In view of these safety distances, risks to local people caused by the Project will be very limited (*Section 9.8*).

In addition, since boil-over is the scenario covering the greatest area (*Section 9.8*), and is a slow phenomenon, the maximum magnitude of which is of slow kinetics, this will enable the evacuation of users present at the site, where necessary, at the time of the accident. Moreover, this is an event considered to be improbable.

The general location of the site also allows for rapid intervention by emergency crews in case of an accident. The power plant is located 650m from the Highway N1 and 3km from the Rufisque fire station.

The least improbable scenario (considered to be occasional) is n° 6 which corresponds to a fire on a free pool of fuel oil after spreading over the unloading platform. In this case, the maximum area of irreversible effects would extend up to 35m from the engine fuel oil supply pipe. The area of

(1) Large scale phenomenon involving fire in the tank or retention vat, or leading to vaporisation of a water base, free water or in emulsion in the mass.

irreversible effects is therefore entirely contained within the perimeter of the power plant.

Thus, in every case, the maximum area for irreversible effects is 82m from the closest dwellings, which are the homes of SENELEC employees, and 270m from the Diokoul district, which is the closest public area.

It should be noted that urban expansion will be very limited in the Project area, thus avoiding any new dwellings being located within the safety distance. In fact, the location of SENELEC infrastructures to the west (power plant) and north-west (housing) will prevent any new installation of populations. Similarly, the presence of the Rufisque water treatment plant to the east will maintain the maximum area of effects at its current size. The WTP is fenced around its perimeter and a guard ensures surveillance of the installations (see *Section 5.7*).

Box 9.1 Hazard contours of each scenario

Dakar Power Plant

Unit HFO pre-storage

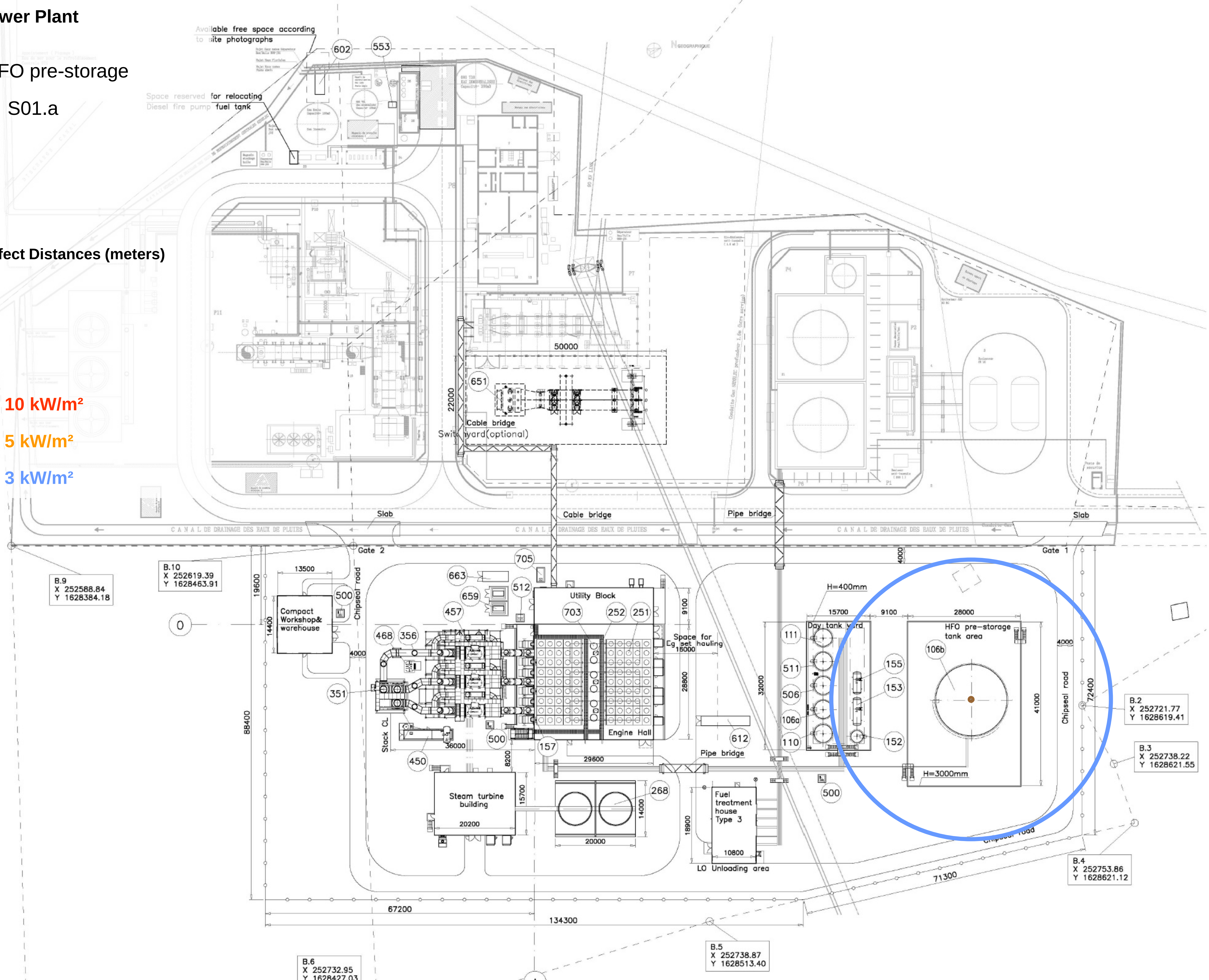
Scenario S01.a

Hazard

Tank Fire

Thermal effect Distances (meters)

NA	10 kW/m²
NA	5 kW/m²
35	3 kW/m²



Dakar Power Plant

Unit HFO Storage 1

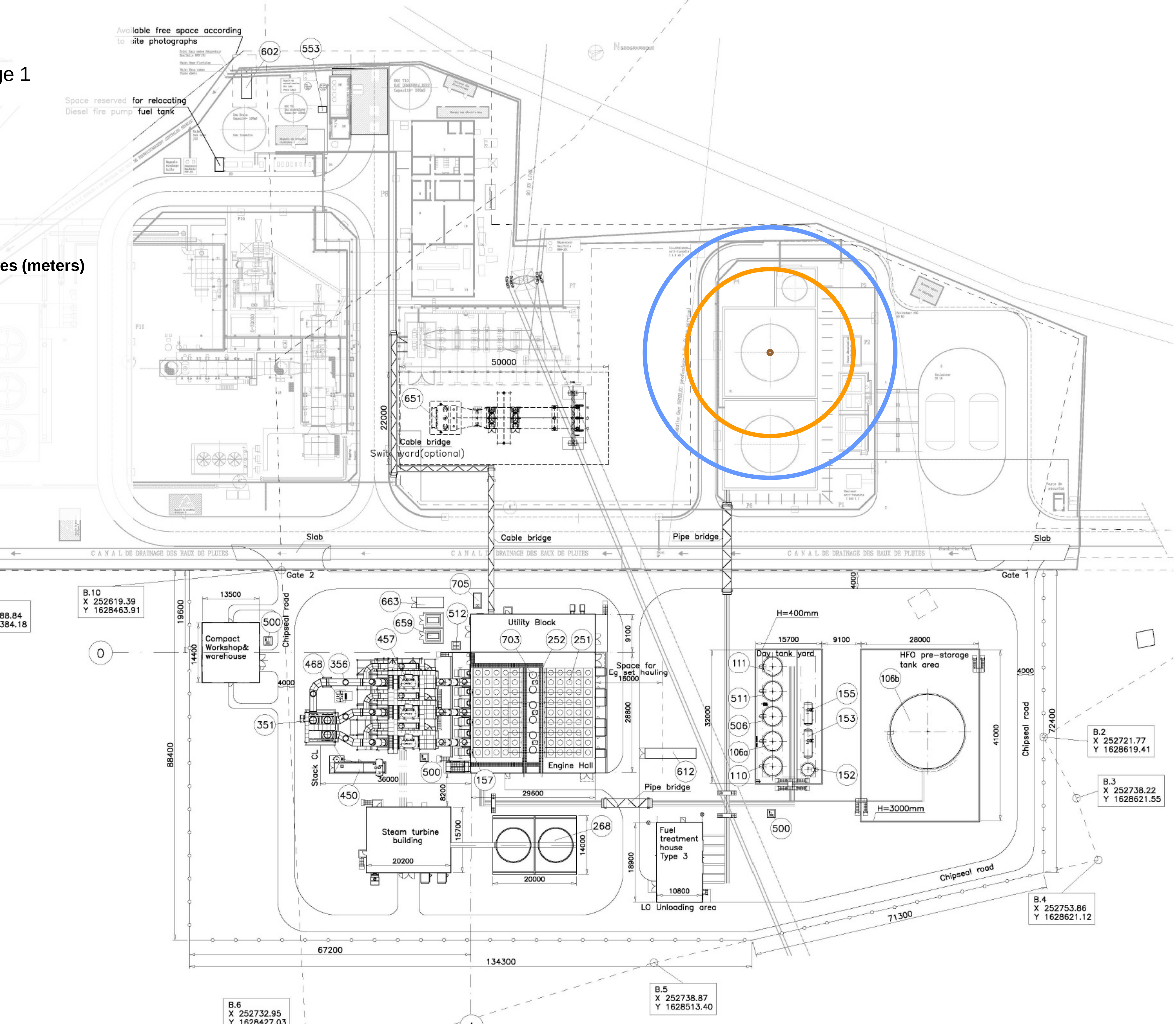
Scenario S01.b

Hazard

Tank Fire

Thermal effect Distances (meters)

NA	10 kW/m²
20	5 kW/m²
30	3 kW/m²



Dakar Power Plant

Unit HFO Storage 2

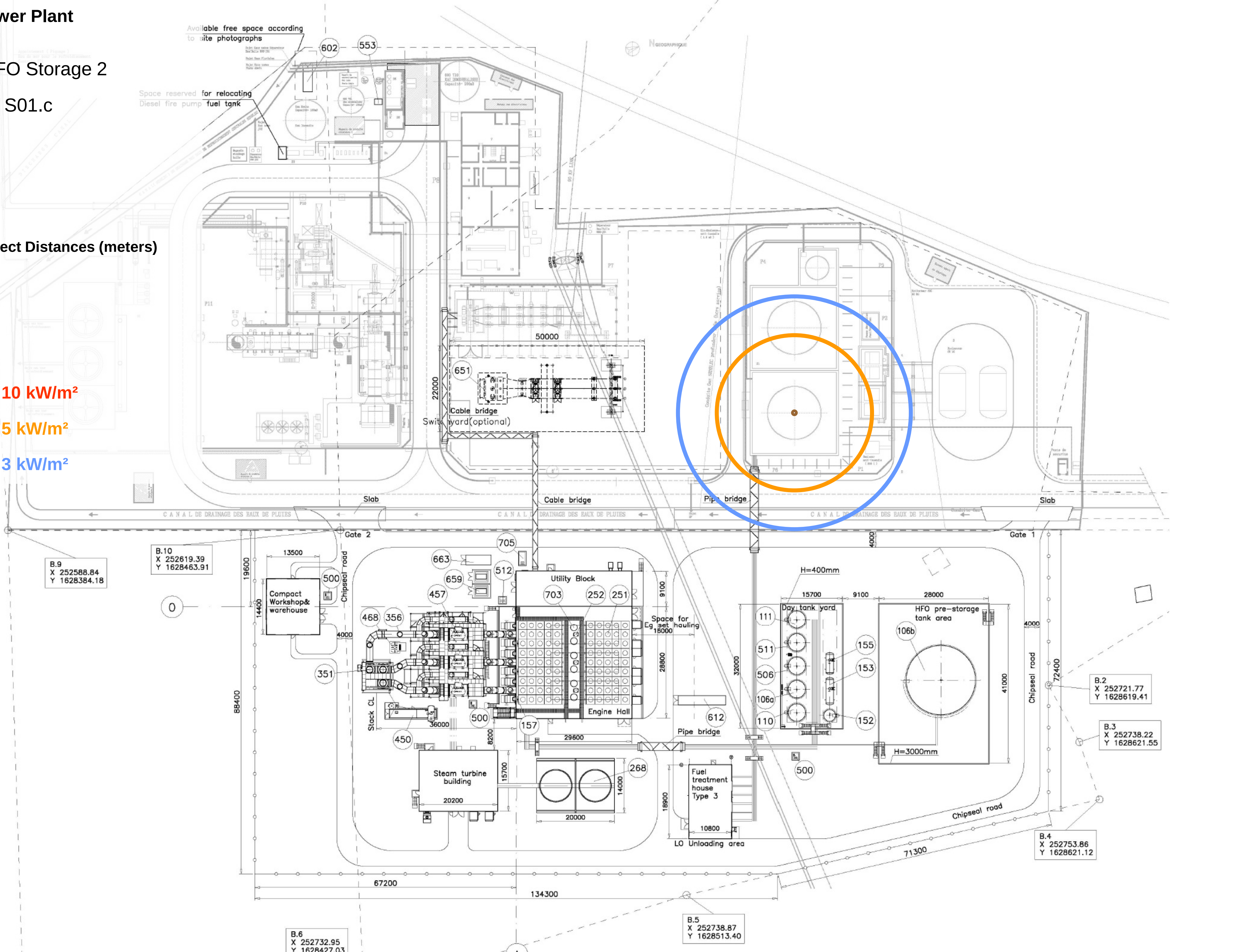
Scenario S01.c

Hazard

Tank Fire

Thermal effect Distances (meters)

NA	10 kW/m²
20	5 kW/m²
30	3 kW/m²



Dakar Power Plant

Unit HFO Buffer

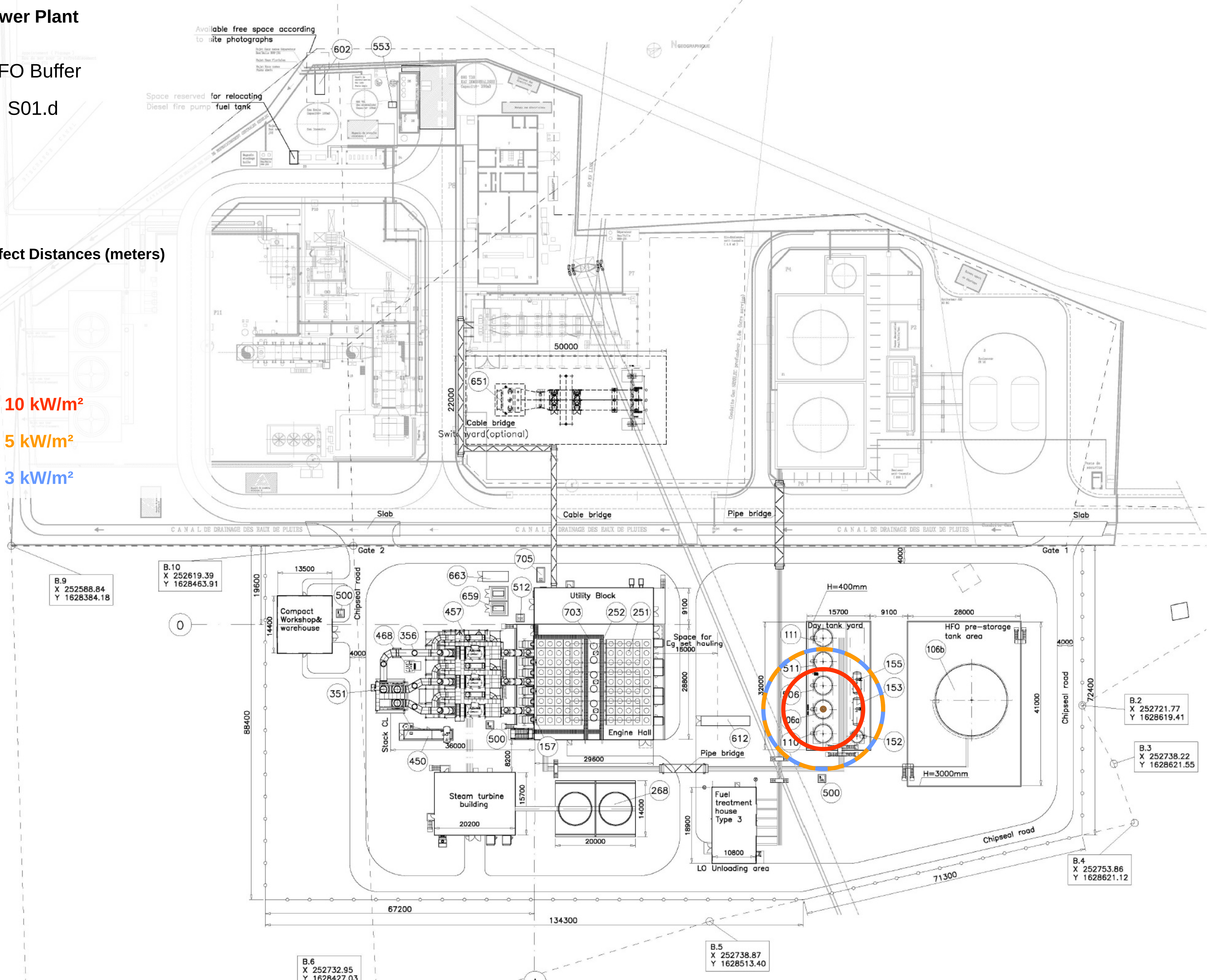
Scenario S01.d

Hazard

Tank Fire

Thermal effect Distances (meters)

10	10 kW/m²
15	5 kW/m²
15	3 kW/m²



Dakar Power Plant

Unit HFO Day tank

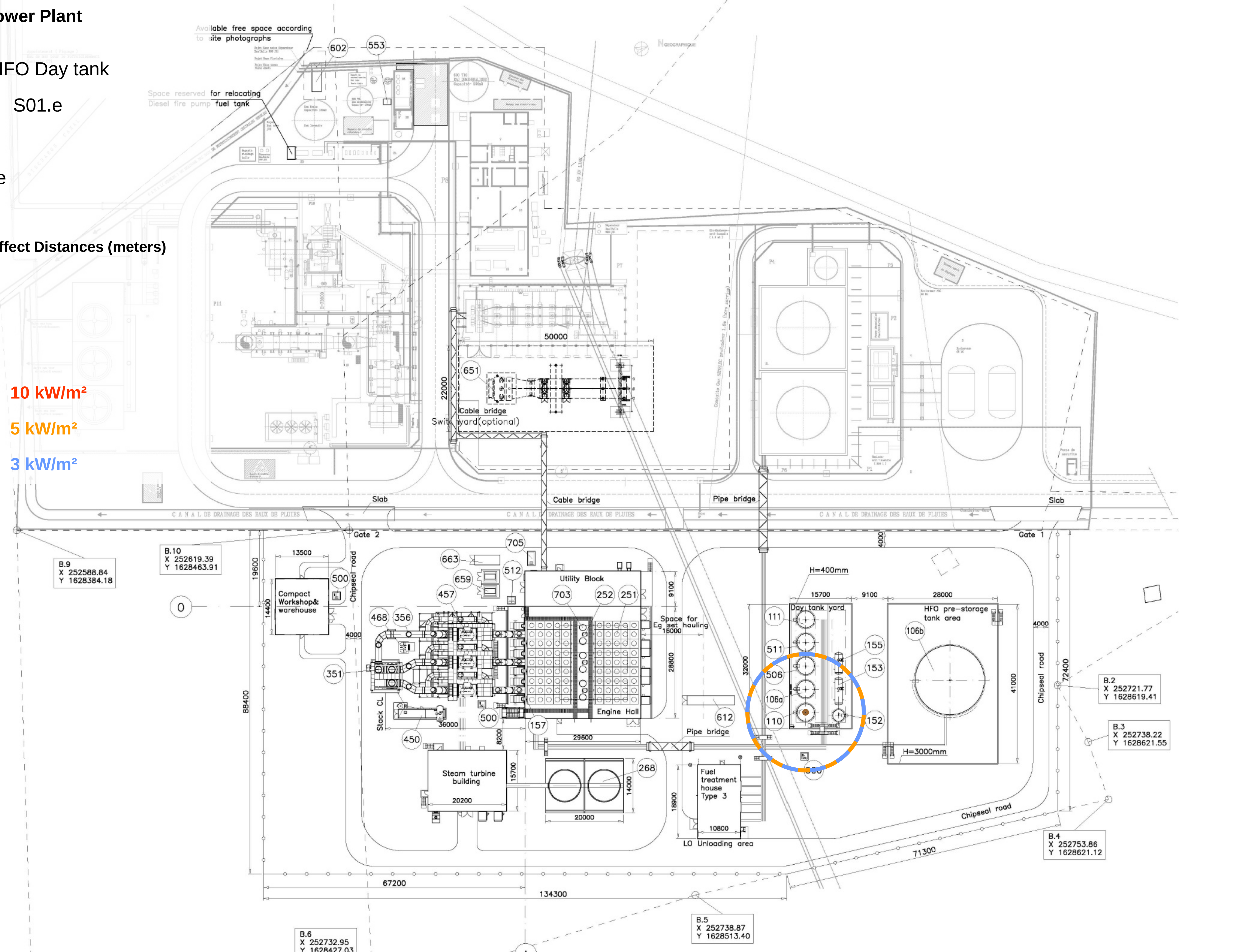
Scenario S01.e

Hazard

Tank Fire

Thermal effect Distances (meters)

NA	10 kW/m²
15	5 kW/m²
15	3 kW/m²



Dakar Power Plant

Unit LFO Storage

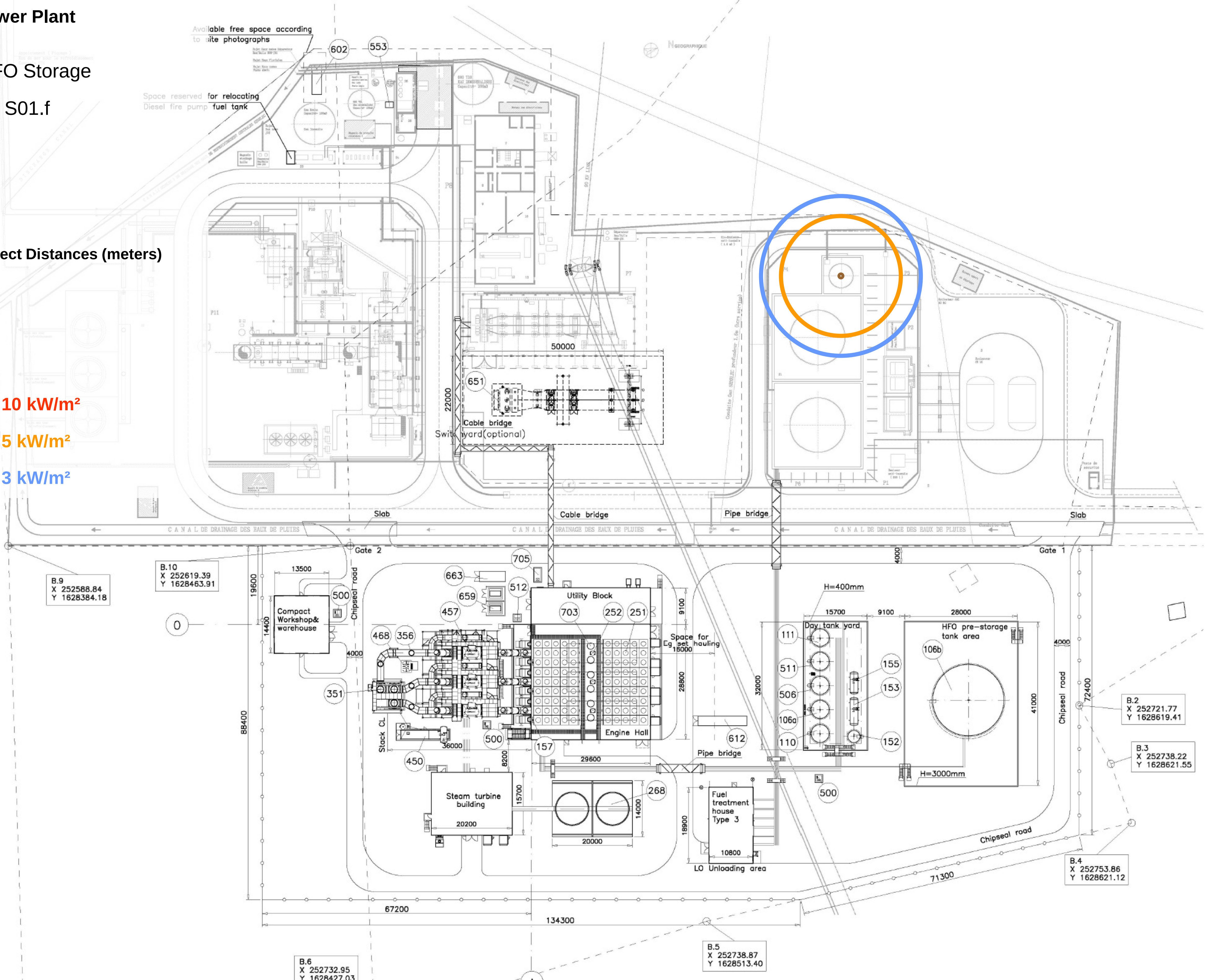
Scenario S01.f

Hazard

Tank Fire

Thermal effect Distances (meters)

NA	10 kW/m²
15	5 kW/m²
20	3 kW/m²



Dakar Power Plant

Unit LFO Day tank

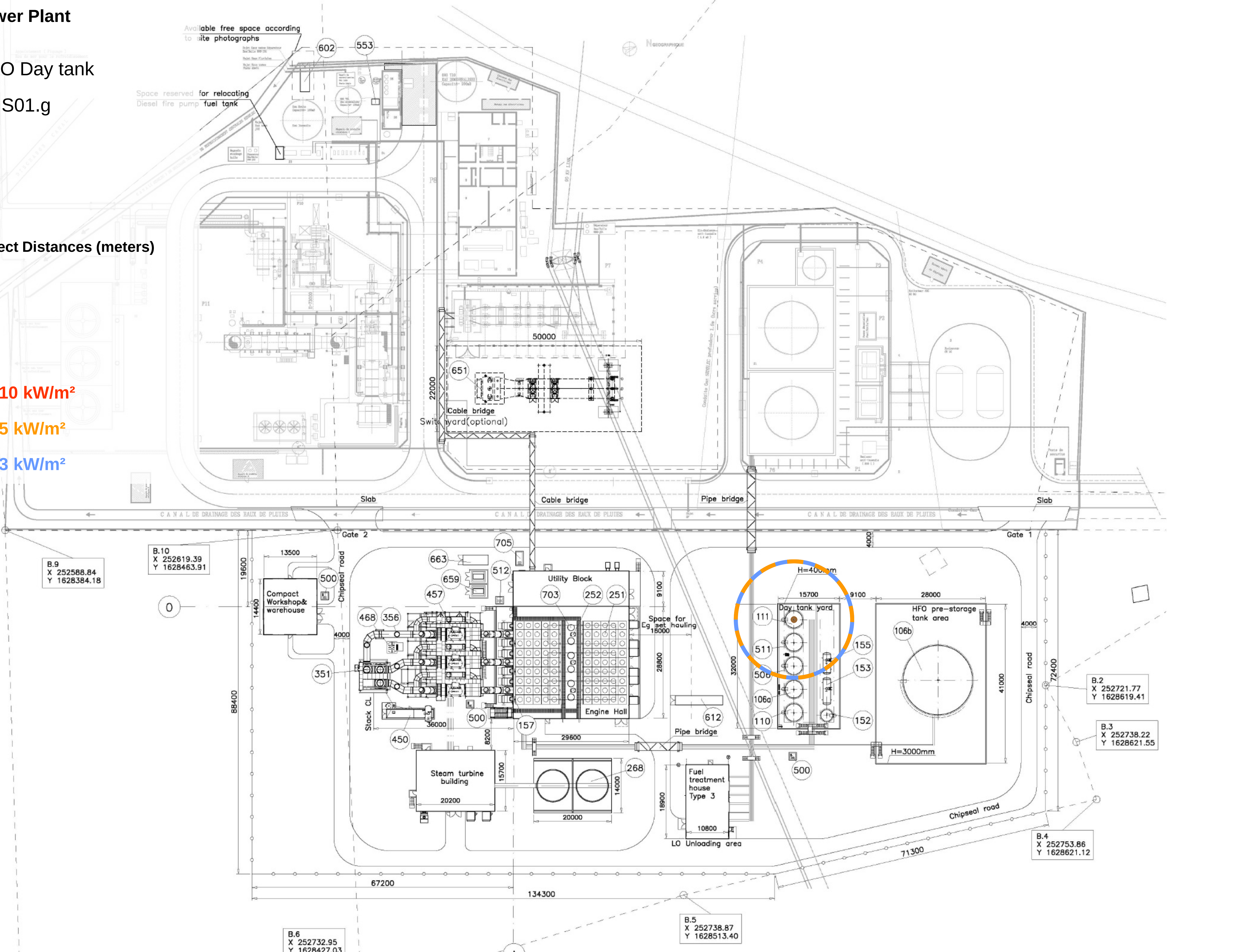
Scenario S01.g

Hazard

Tank Fire

Thermal effect Distances (meters)

NA	10 kW/m²
15	5 kW/m²
15	3 kW/m²



Dakar Power Plant

Unit HFO pre-storage

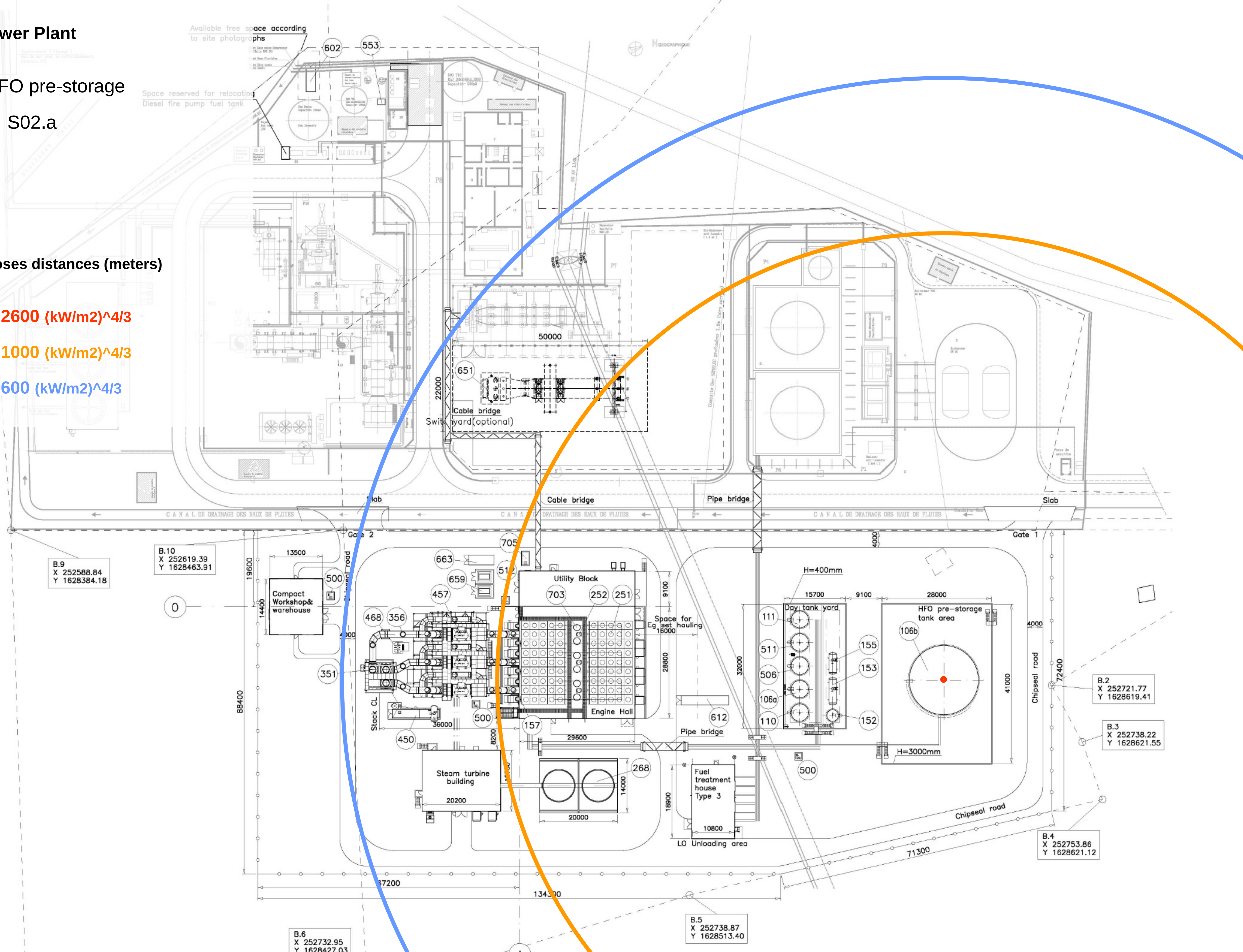
Scenario S02.a

Hazard

Boilover

Thermal doses distances (meters)

NA	2600 (kW/m2)^4/3
115	1000 (kW/m2)^4/3
155	600 (kW/m2)^4/3



Dakar Power Plant

Unit HFO Storage 1

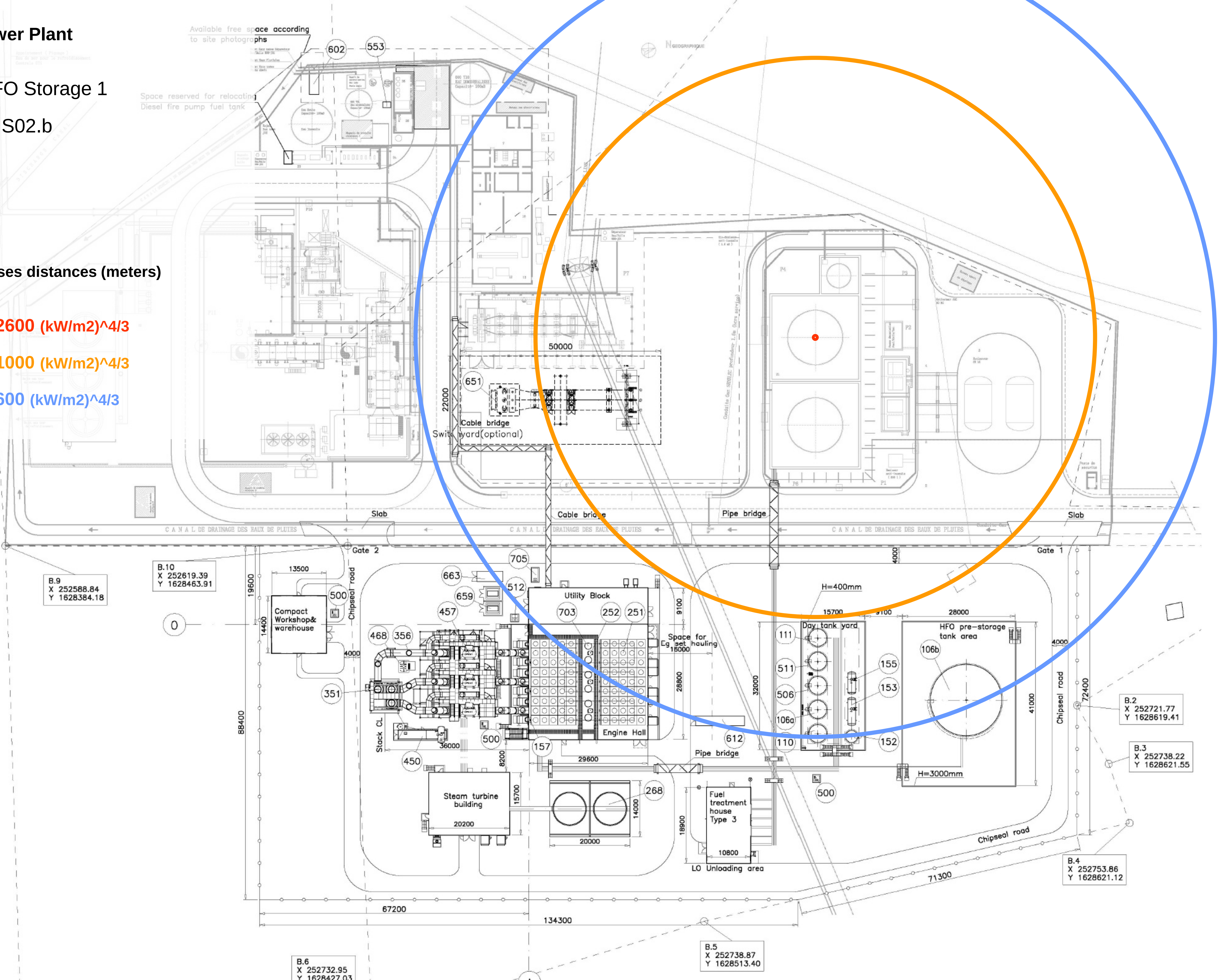
Scenario S02.b

Hazard

Boilover

Thermal doses distances (meters)

NA	2600 (kW/m2)^4/3
70	1000 (kW/m2)^4/3
100	600 (kW/m2)^4/3



Dakar Power Plant

Unit HFO Storage 2

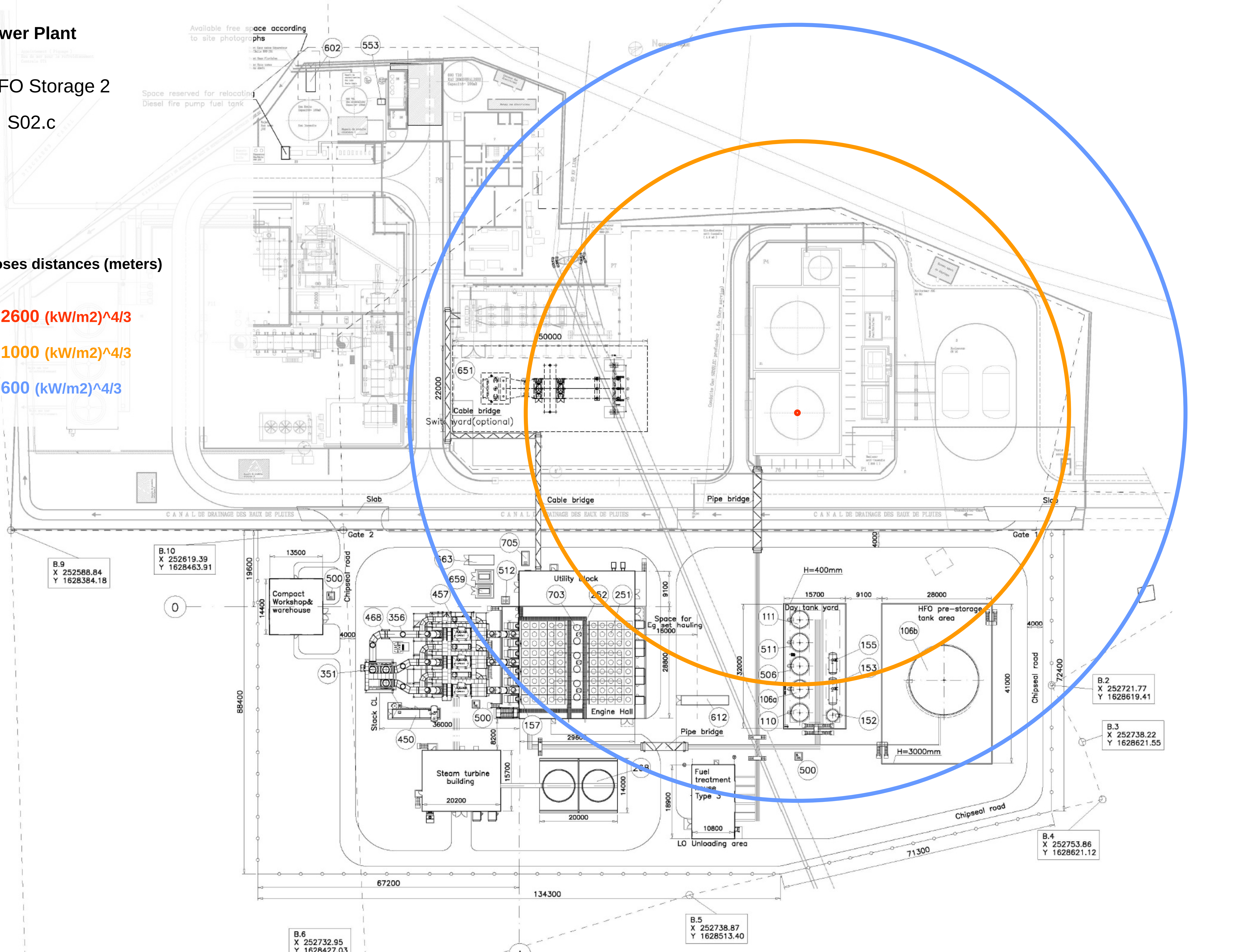
Scenario S02.c

Hazard

Boilover

Thermal doses distances (meters)

NA	2600 (kW/m2)^4/3
70	1000 (kW/m2)^4/3
100	600 (kW/m2)^4/3



Dakar Power Plant

Unit LFO Storage

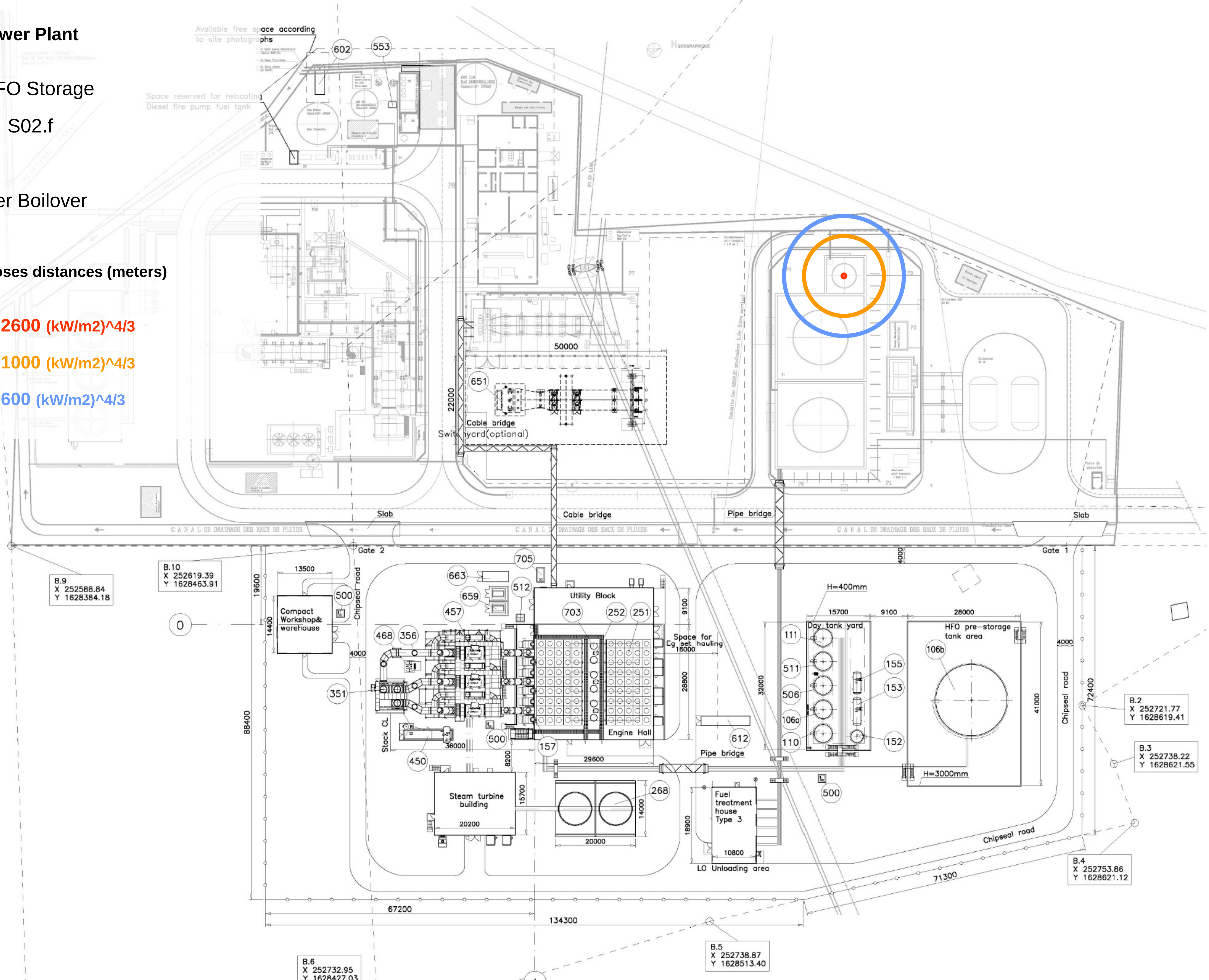
Scenario S02.f

Hazard

Thin Layer Boilover

Thermal doses distances (meters)

NA	2600 (kW/m2)^4/3
10	1000 (kW/m2)^4/3
15	600 (kW/m2)^4/3



Dakar Power Plant

Unit LFO Day tank

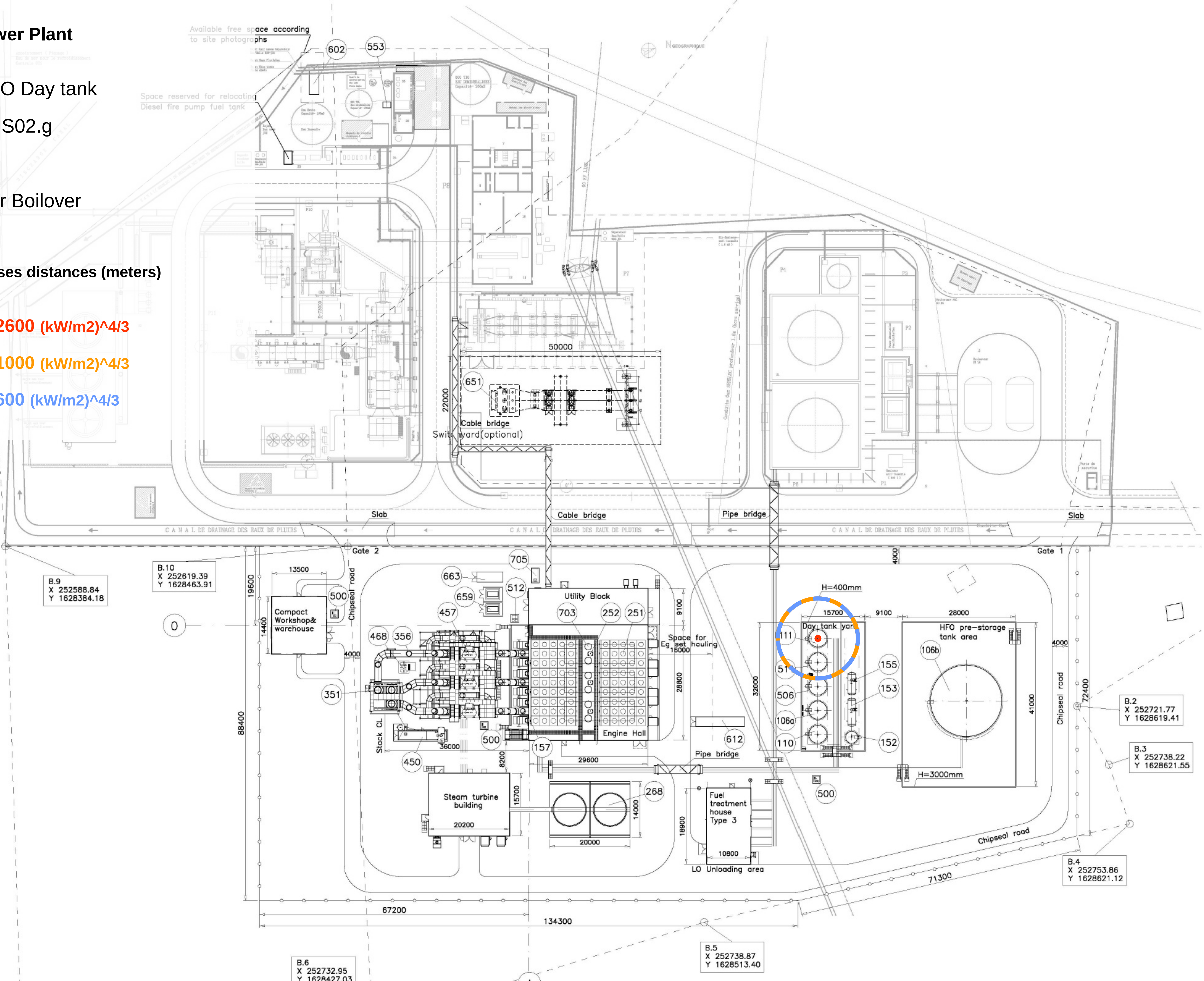
Scenario S02.g

Hazard

Thin Layer Boilover

Thermal doses distances (meters)

NA	2600 (kW/m2)^4/3
10	1000 (kW/m2)^4/3
10	600 (kW/m2)^4/3



Dakar Power Plant

Unit HFO pre-storage

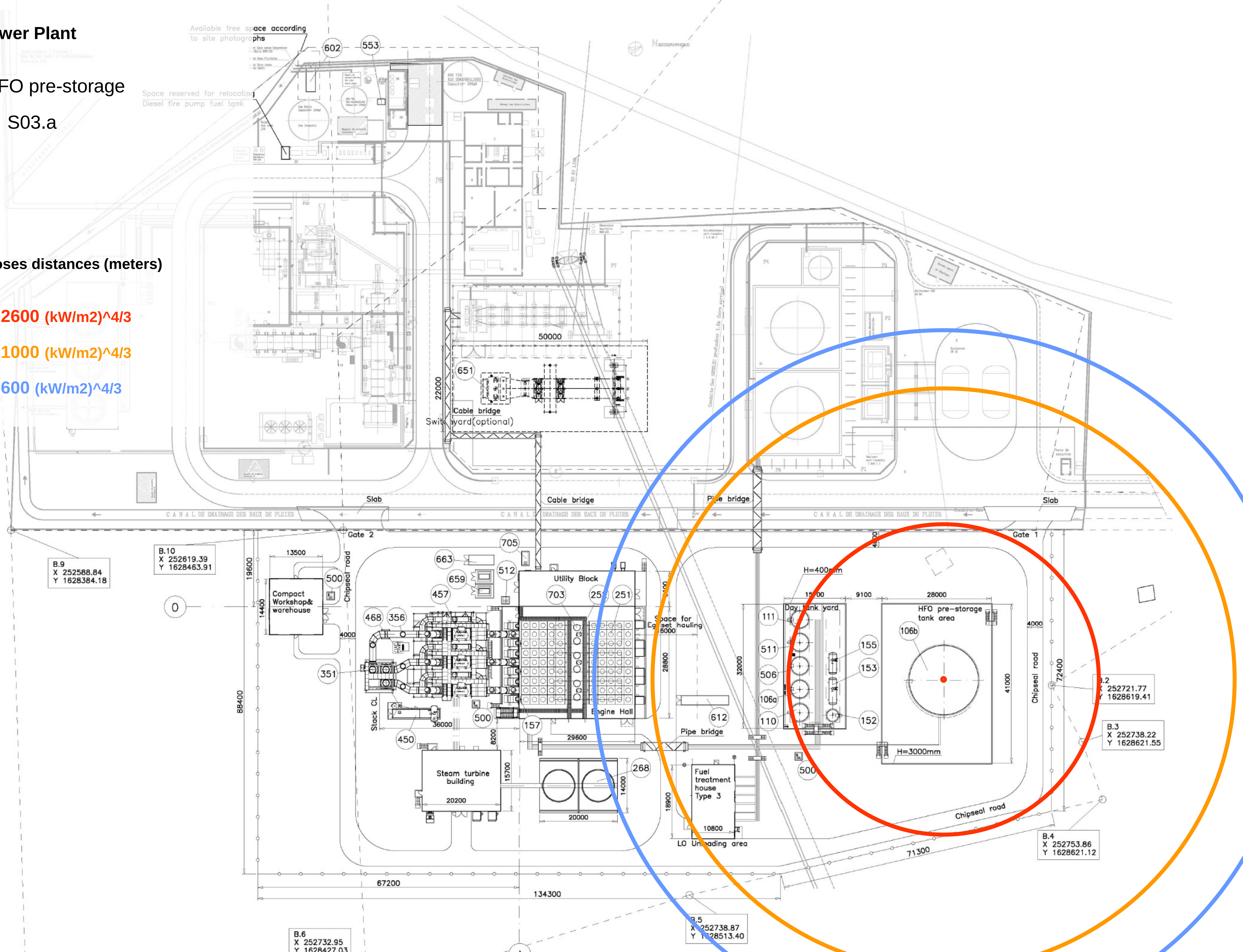
Scenario S03.a

Hazard

Fireball

Thermal doses distances (meters)

40	2600 (kW/m2)^4/3
75	1000 (kW/m2)^4/3
90	600 (kW/m2)^4/3



Dakar Power Plant

Unit HFO Storage 1

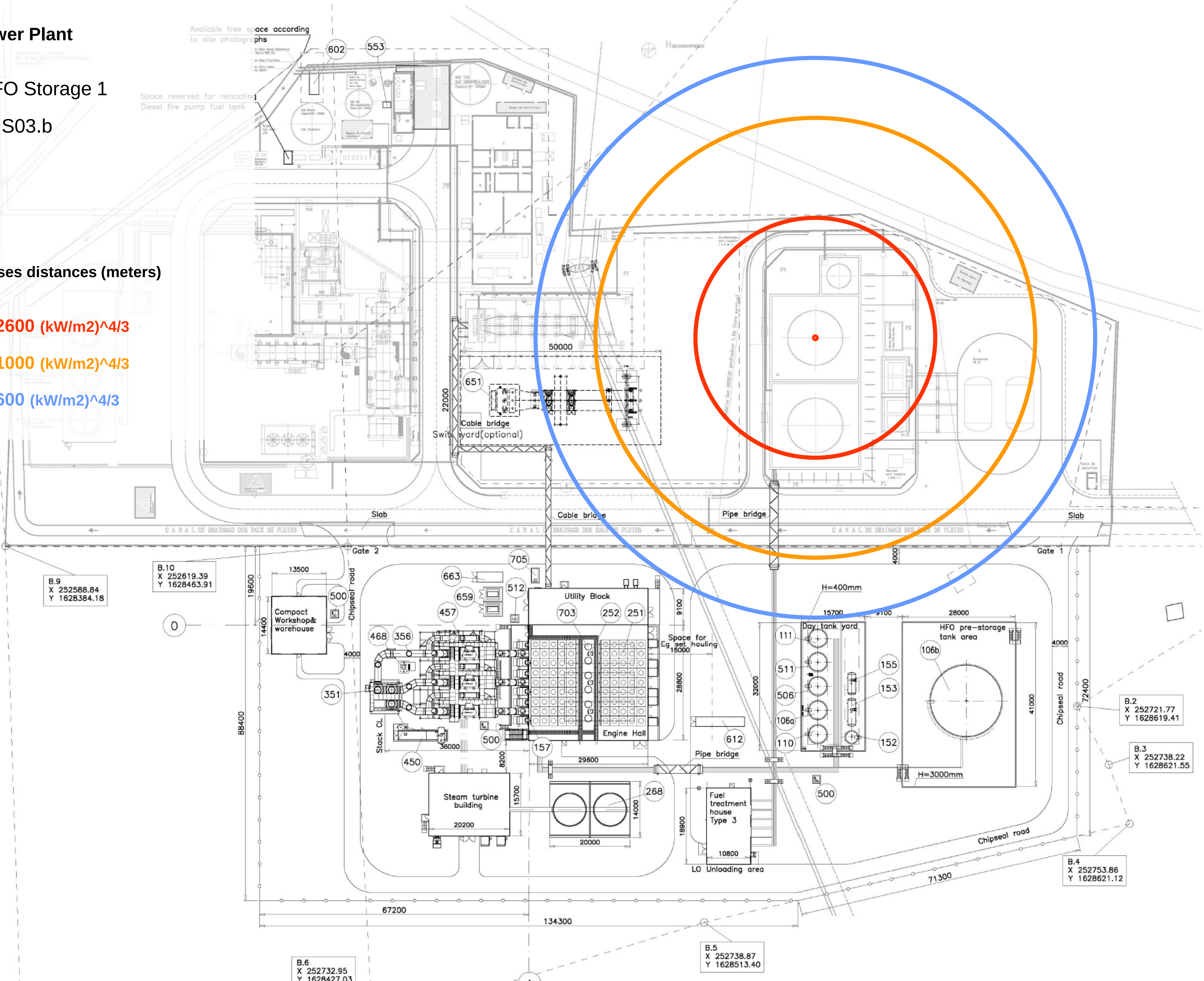
Scenario S03.b

Hazard

Fireball

Thermal doses distances (meters)

30	2600 (kW/m2)^4/3
55	1000 (kW/m2)^4/3
70	600 (kW/m2)^4/3



Dakar Power Plant

Unit HFO Storage 2

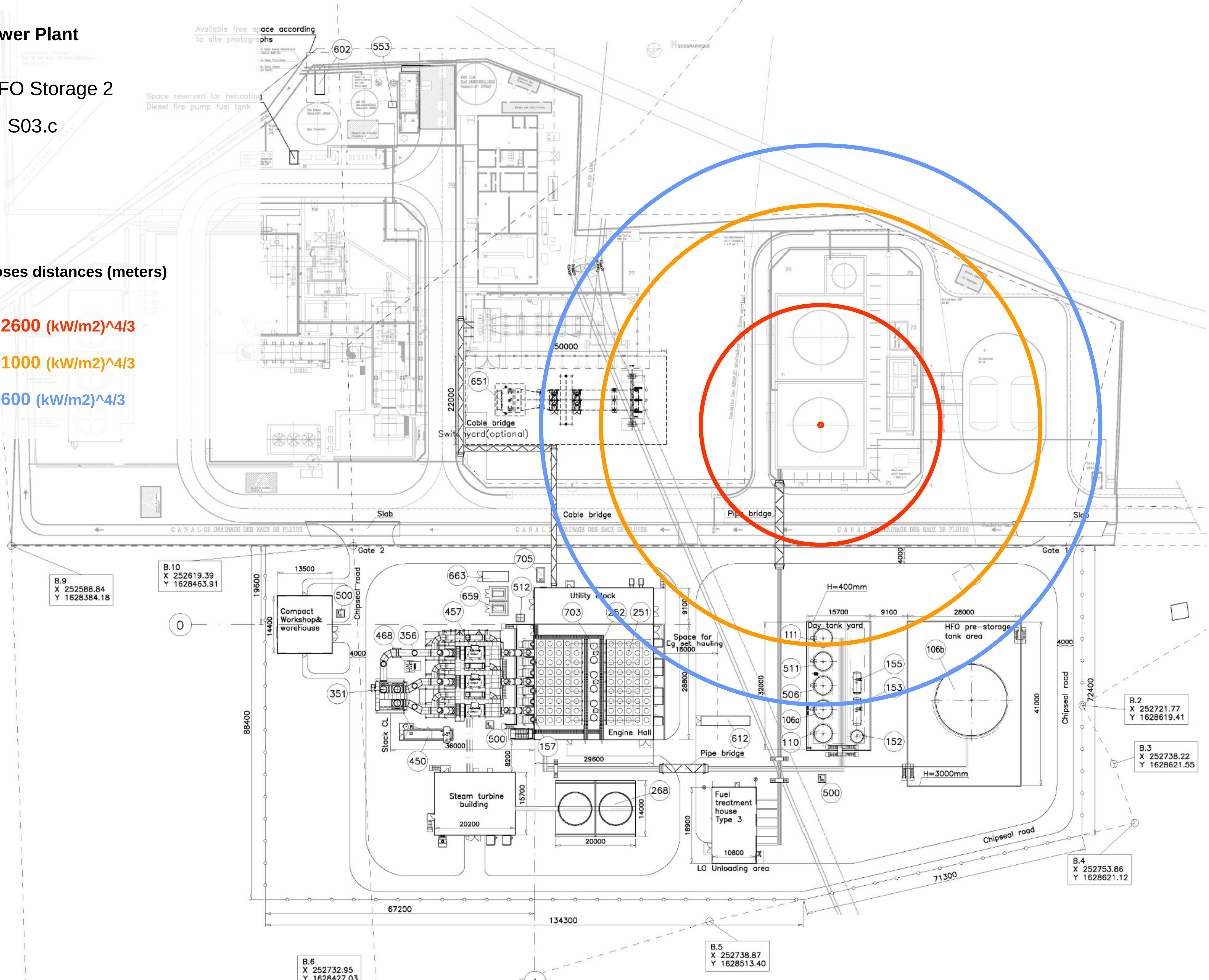
Scenario S03.c

Hazard

Fireball

Thermal doses distances (meters)

30	2600 (kW/m2)^4/3
55	1000 (kW/m2)^4/3
70	600 (kW/m2)^4/3



Dakar Power Plant

Unit HFO Buffer

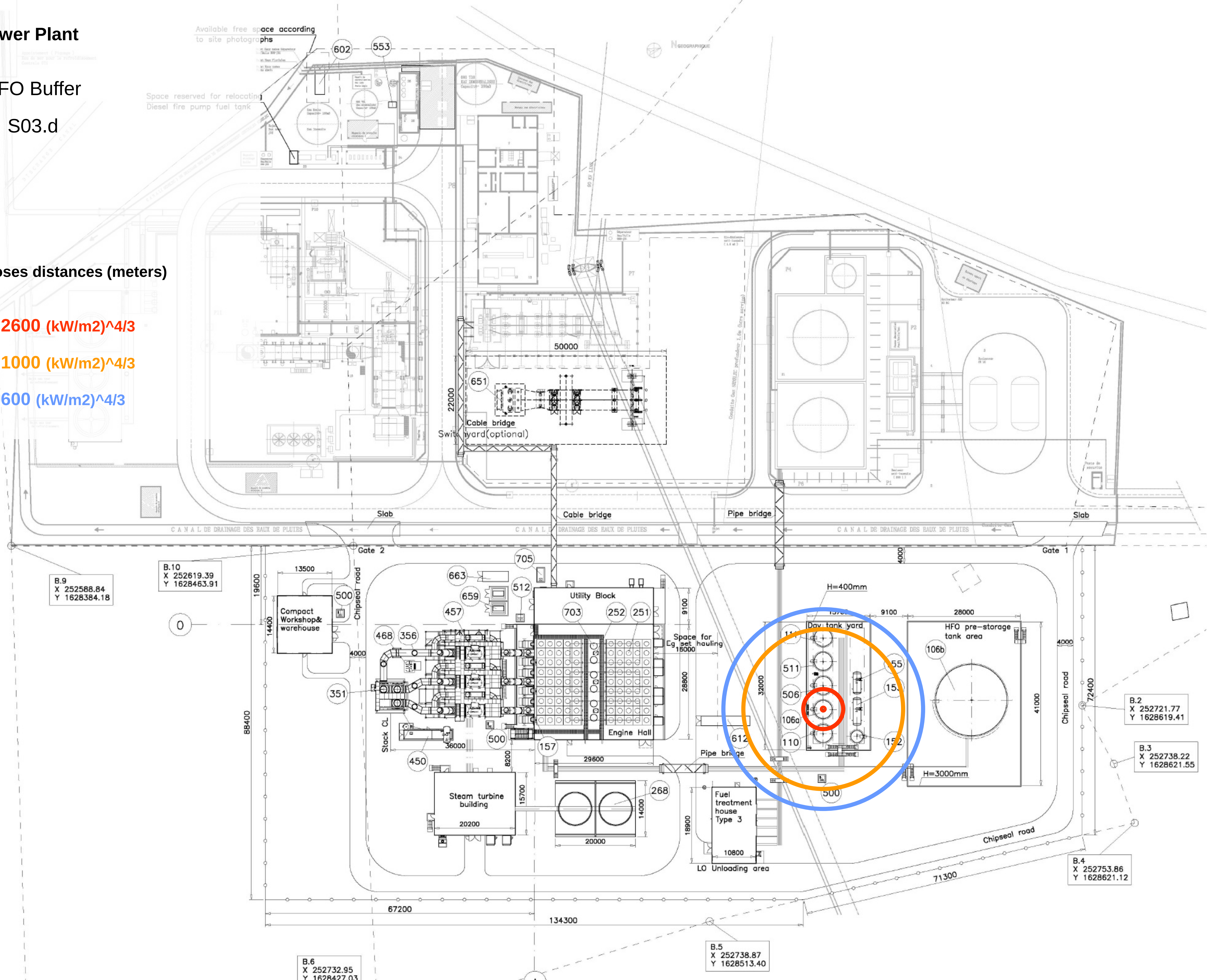
Scenario S03.d

Hazard

Fireball

Thermal doses distances (meters)

5	2600 (kW/m2)^4/3
20	1000 (kW/m2)^4/3
25	600 (kW/m2)^4/3



Dakar Power Plant

Unit HFO Day tank

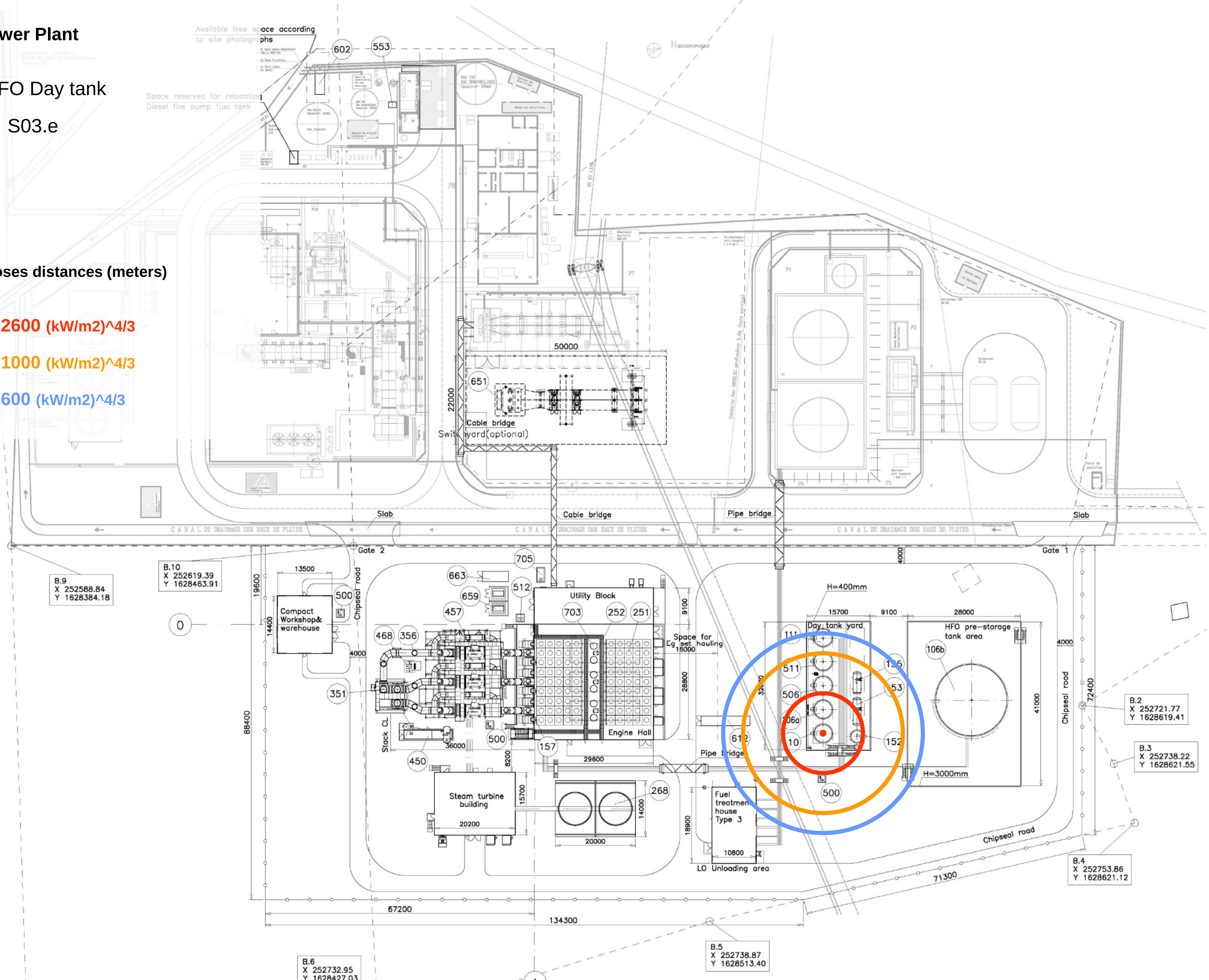
Scenario S03.e

Hazard

Fireball

Thermal doses distances (meters)

10	2600 $(kW/m2)^{4/3}$
20	1000 $(kW/m2)^{4/3}$
25	600 $(kW/m2)^{4/3}$



Dakar Power Plant

Unit LFO Storage

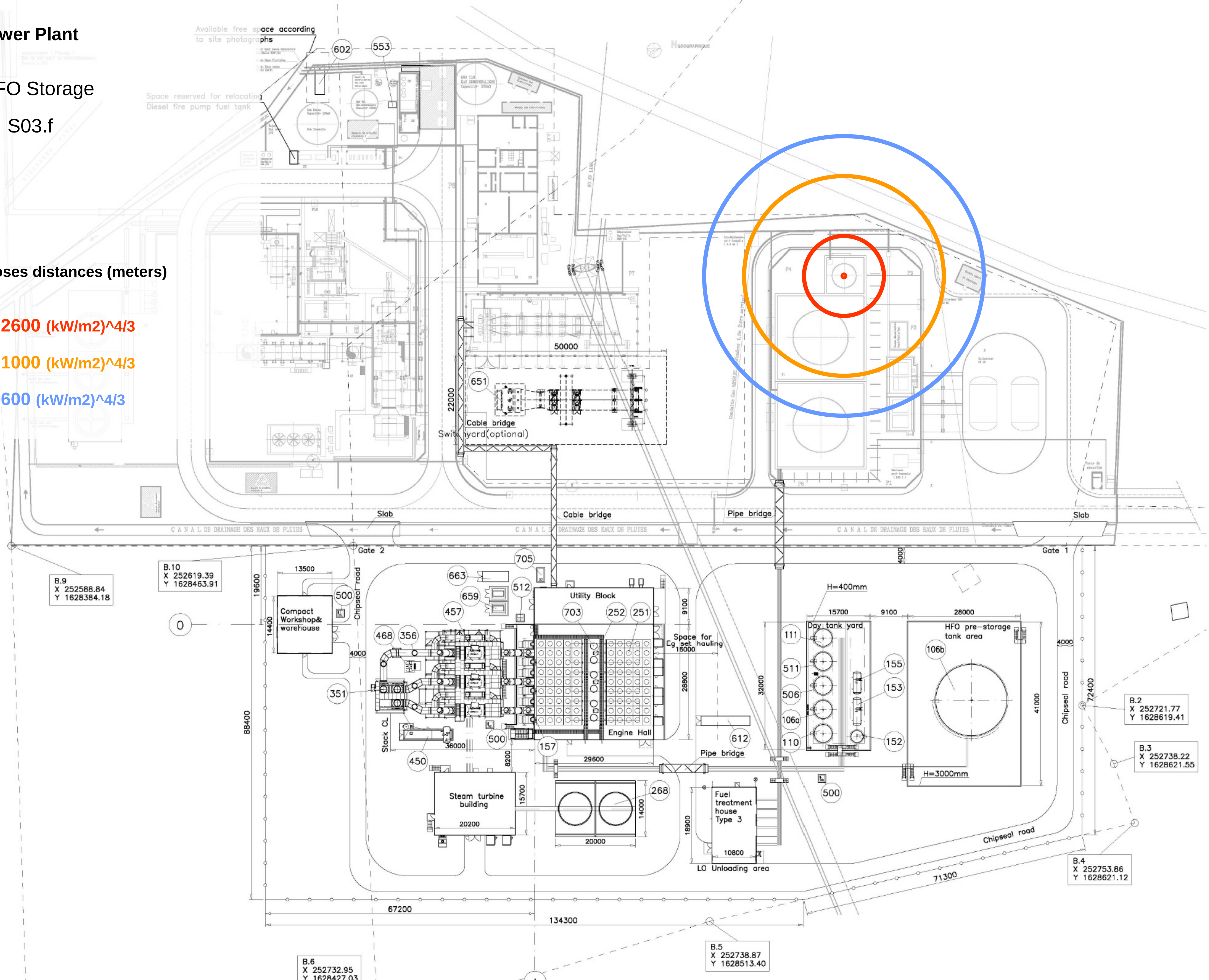
Scenario S03.f

Hazard

Fireball

Thermal doses distances (meters)

10	2600 (kW/m2)^4/3
25	1000 (kW/m2)^4/3
35	600 (kW/m2)^4/3



Dakar Power Plant

Unit LFO Day tank

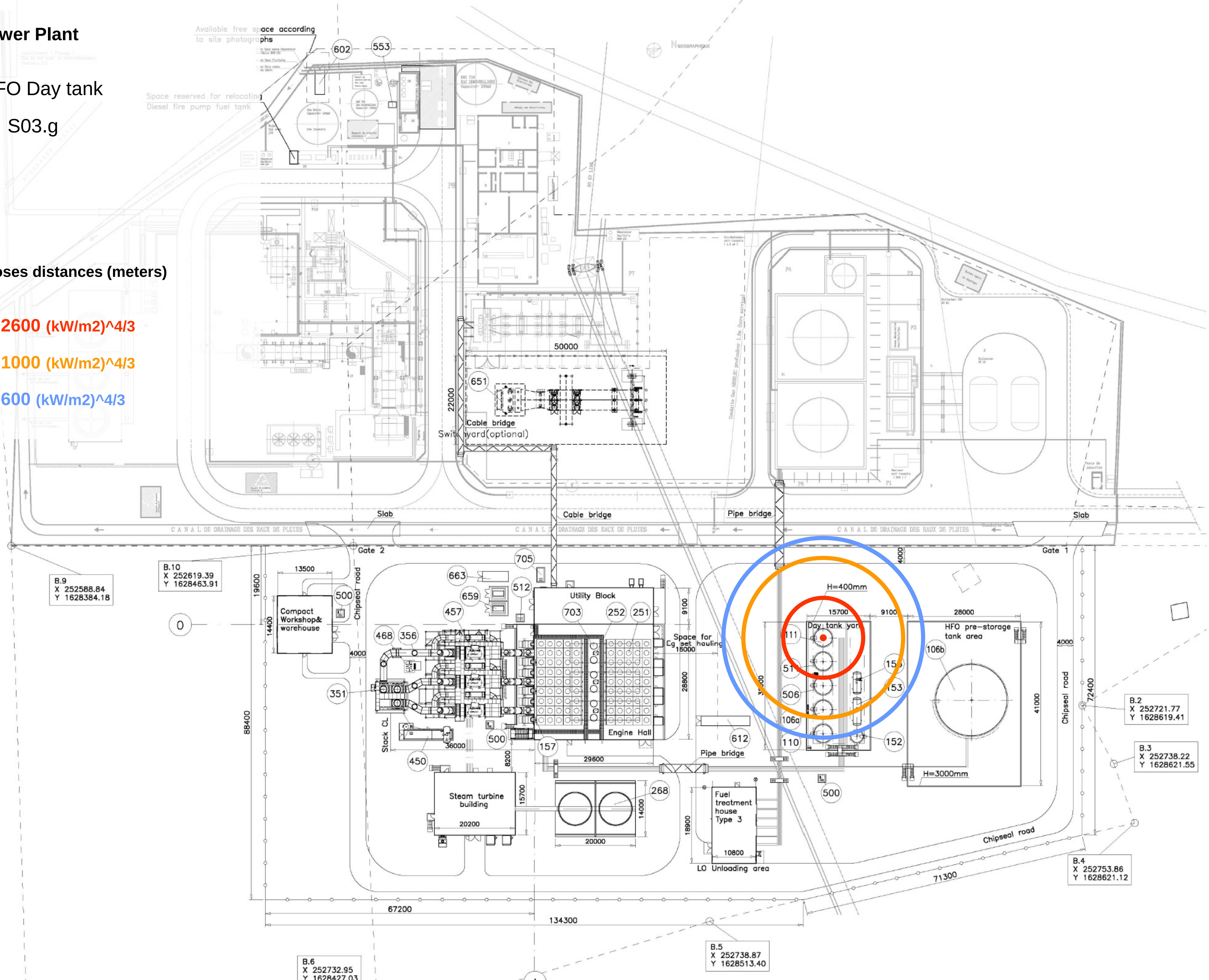
Scenario S03.g

Hazard

Fireball

Thermal doses distances (meters)

10	2600 (kW/m2)^4/3
20	1000 (kW/m2)^4/3
25	600 (kW/m2)^4/3



Dakar Power Plant

Unit HFO pre-storage

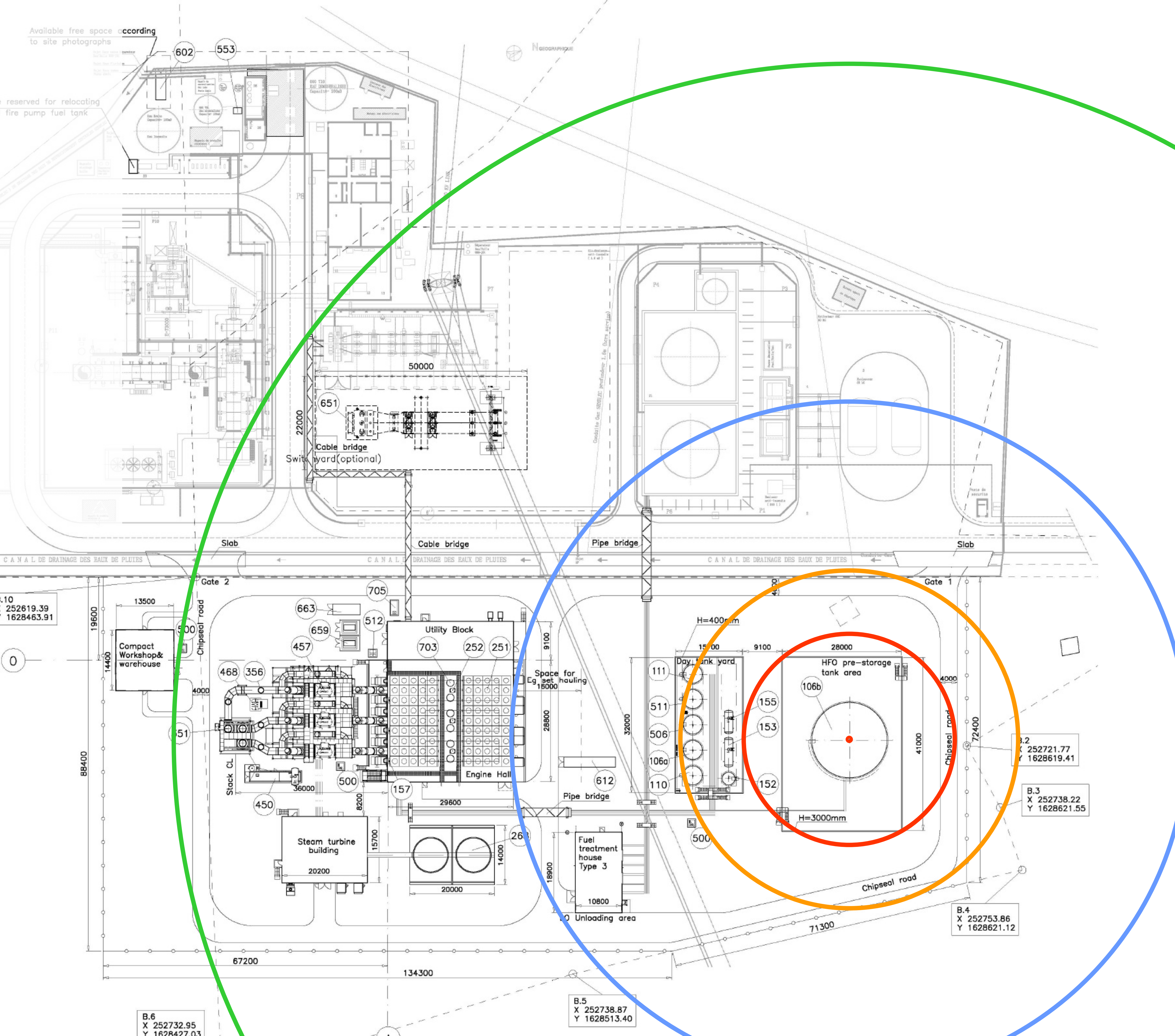
Scenario S04.a

Hazard

Internal Tank Explosion

Overpressure Distances (meters)

25	350 mbar
40	140 mbar
80	50 mbar
160	20 mbar



Dakar Power Plant

Unit HFO Storage 1

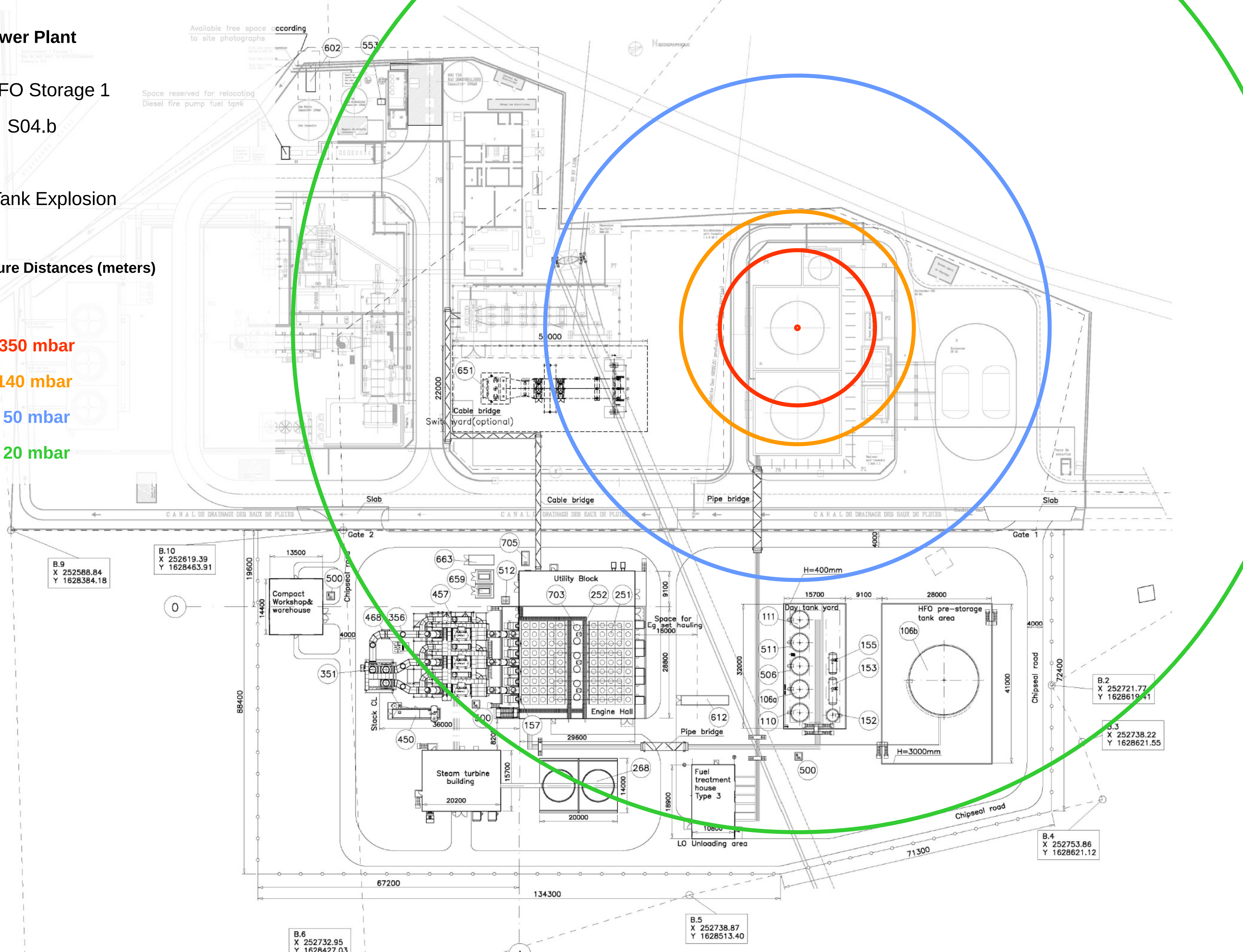
Scenario S04.b

Hazard

Internal Tank Explosion

Overpressure Distances (meters)

20	350 mbar
30	140 mbar
65	50 mbar
130	20 mbar



Dakar Power Plant

Unit HFO Storage 2

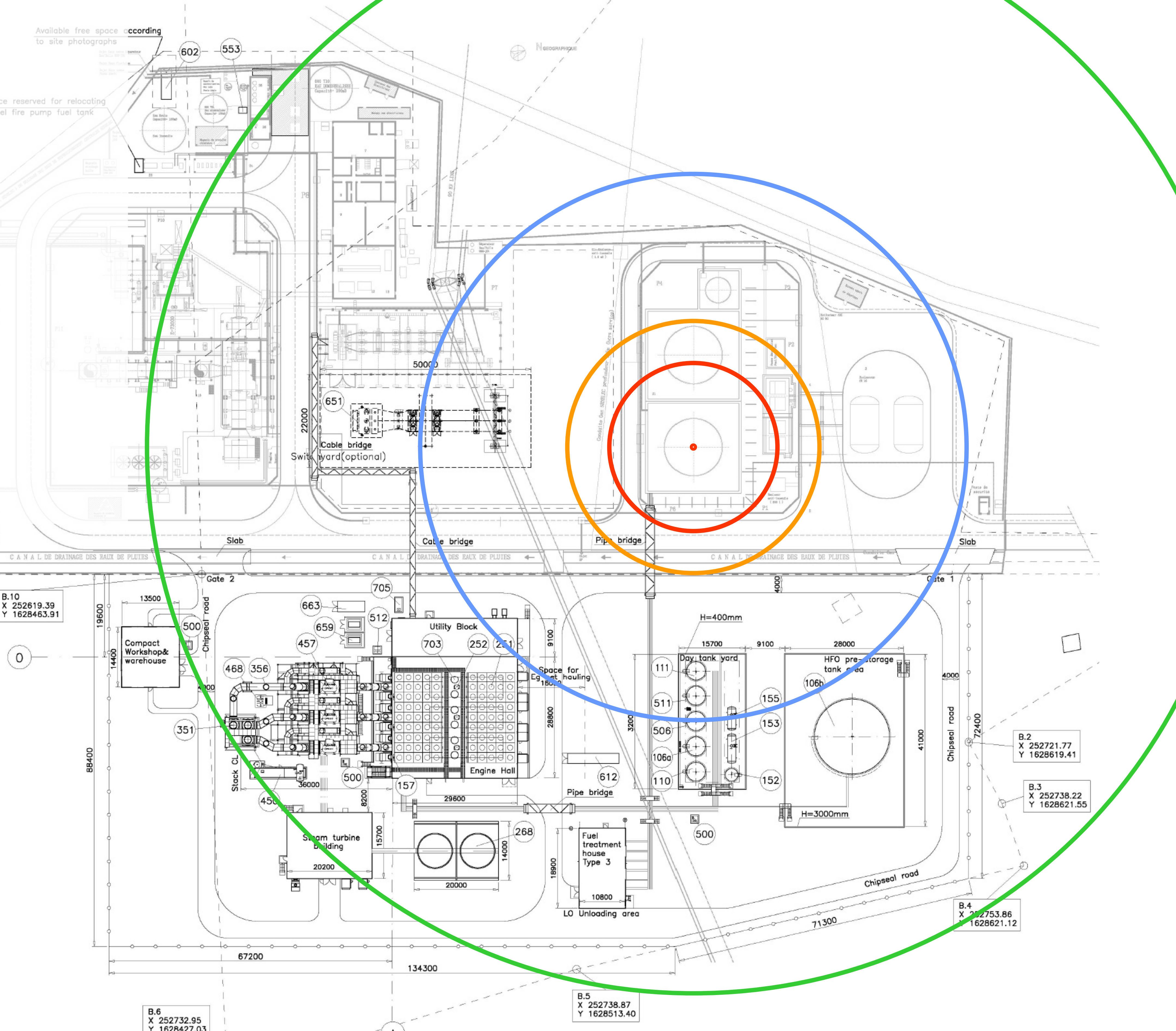
Scenario S04.c

Hazard

Internal Tank Explosion

Overpressure Distances (meters)

20	350 mbar
30	140 mbar
65	50 mbar
130	20 mbar



Dakar Power Plant

Unit HFO Buffer

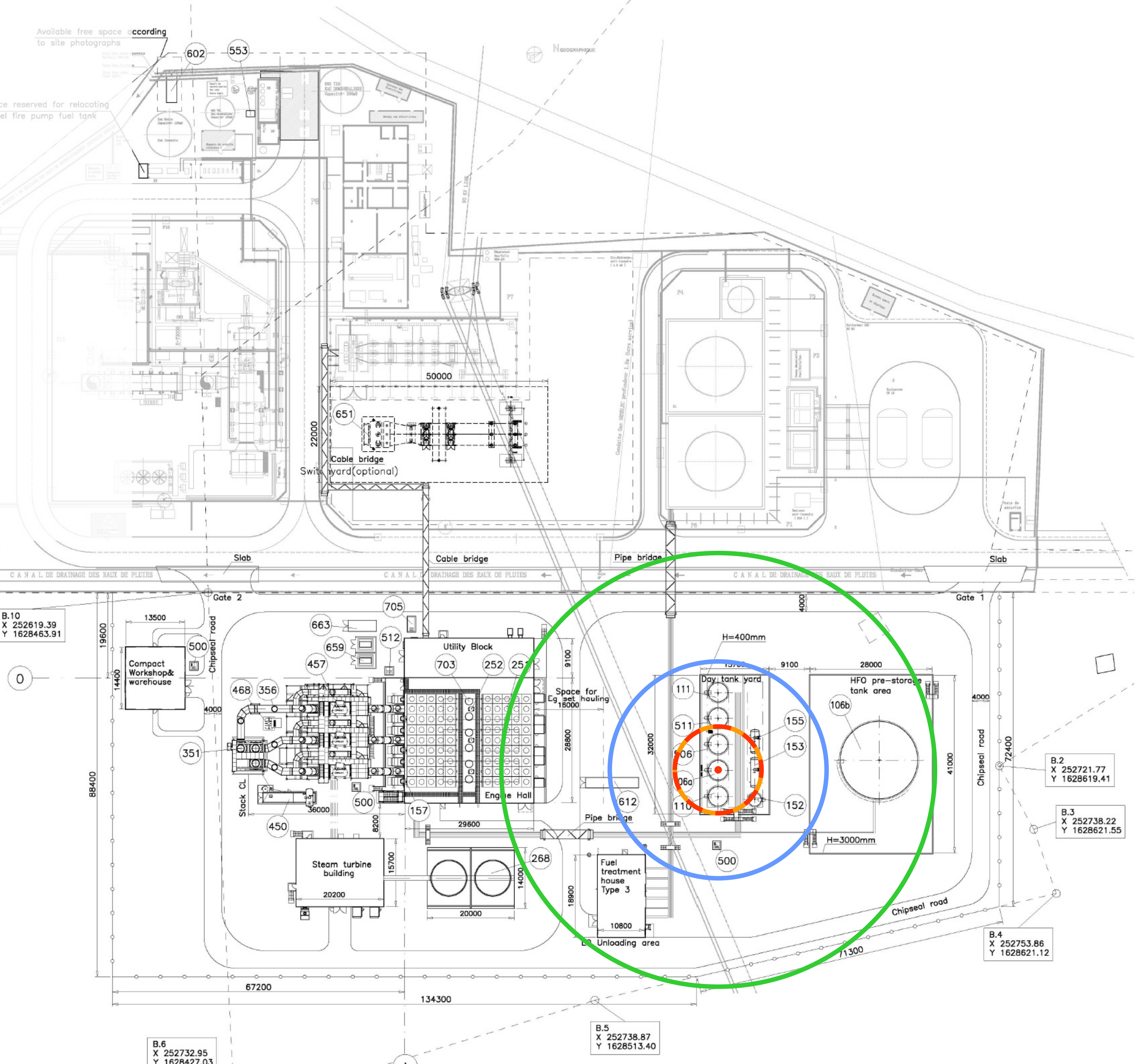
Scenario S04.d

Hazard

Internal Tank Explosion

Overpressure Distances (meters)

10	350 mbar
10	140 mbar
25	50 mbar
50	20 mbar



Dakar Power Plant

Unit HFO Day tank

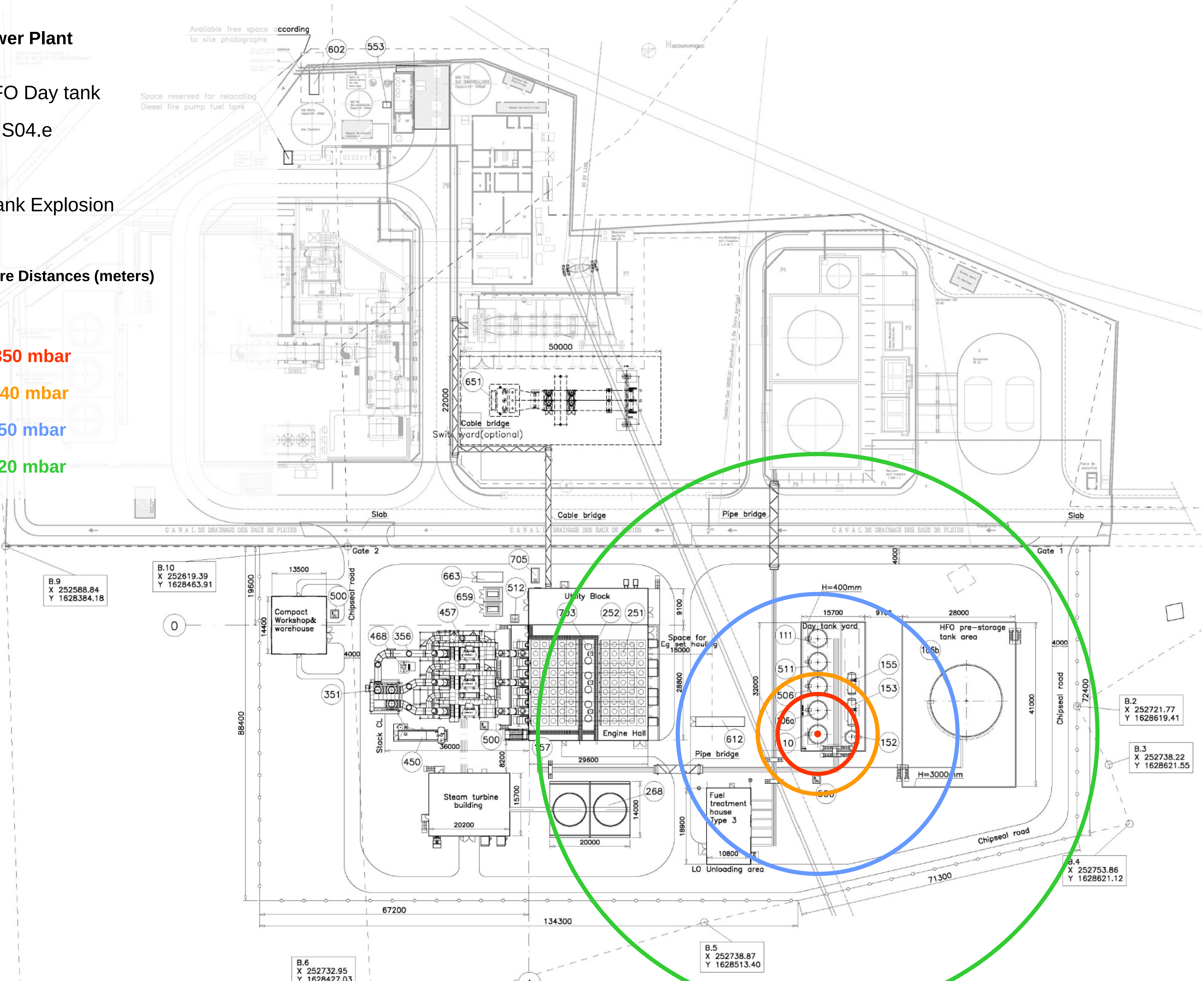
Scenario S04.e

Hazard

Internal Tank Explosion

Overpressure Distances (meters)

10	350 mbar
15	140 mbar
35	50 mbar
70	20 mbar



Dakar Power Plant

Unit LFO Storage

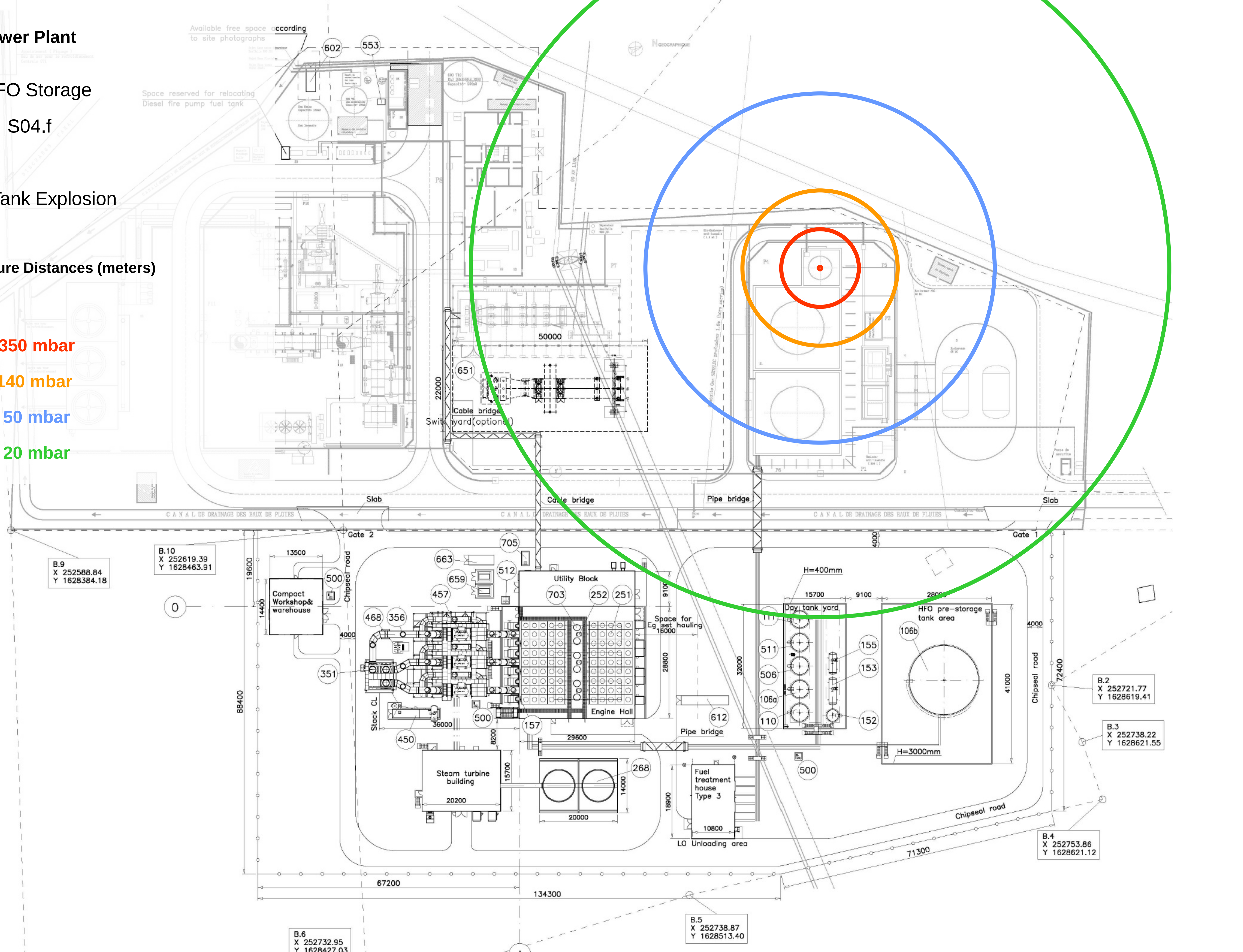
Scenario S04.f

Hazard

Internal Tank Explosion

Overpressure Distances (meters)

10	350 mbar
20	140 mbar
45	50 mbar
90	20 mbar



Dakar Power Plant

Unit LFO Day tank

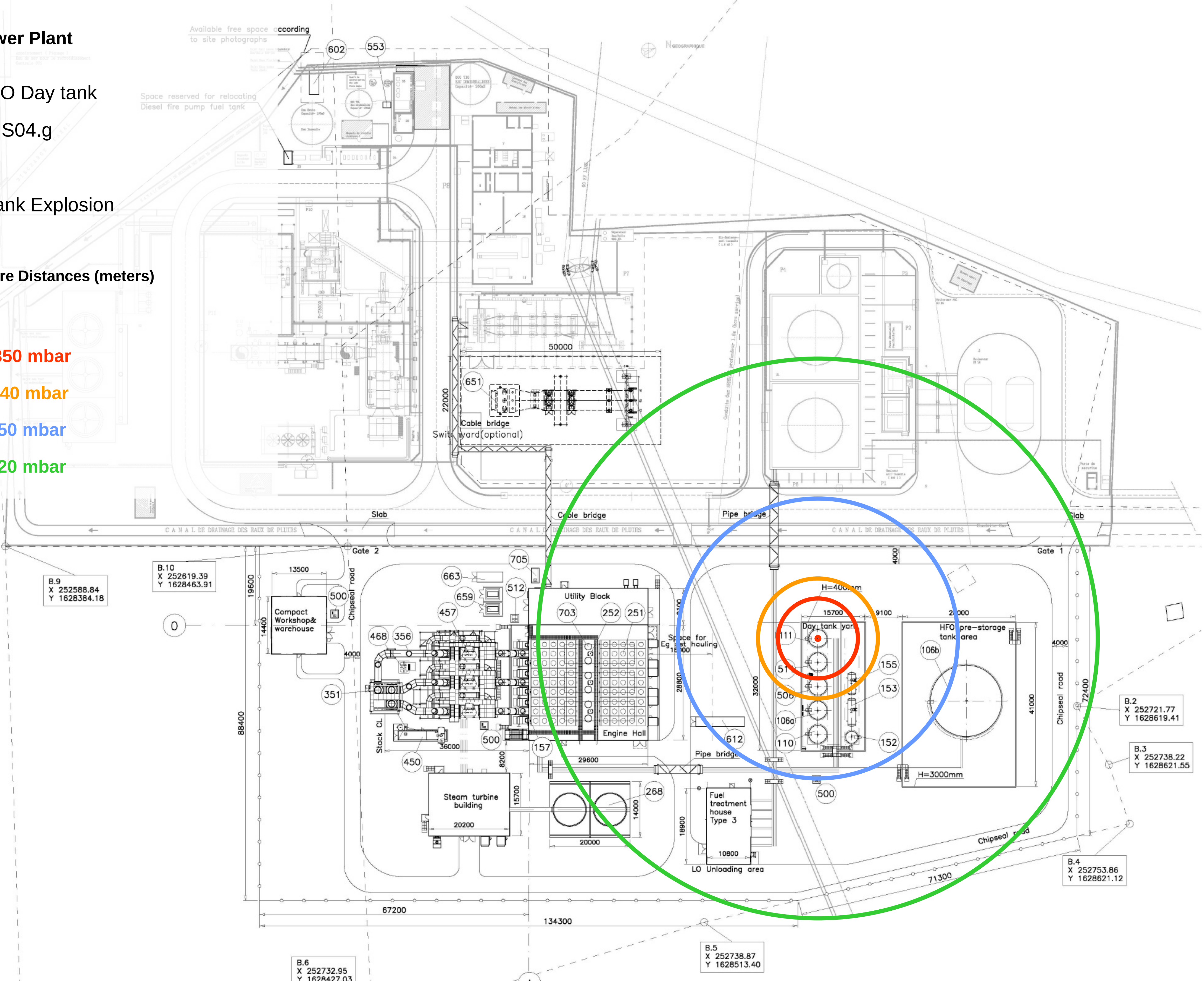
Scenario S04.g

Hazard

Internal Tank Explosion

Overpressure Distances (meters)

10	350 mbar
15	140 mbar
35	50 mbar
70	20 mbar



Dakar Power Plant

Unit HFO pre-storage bund

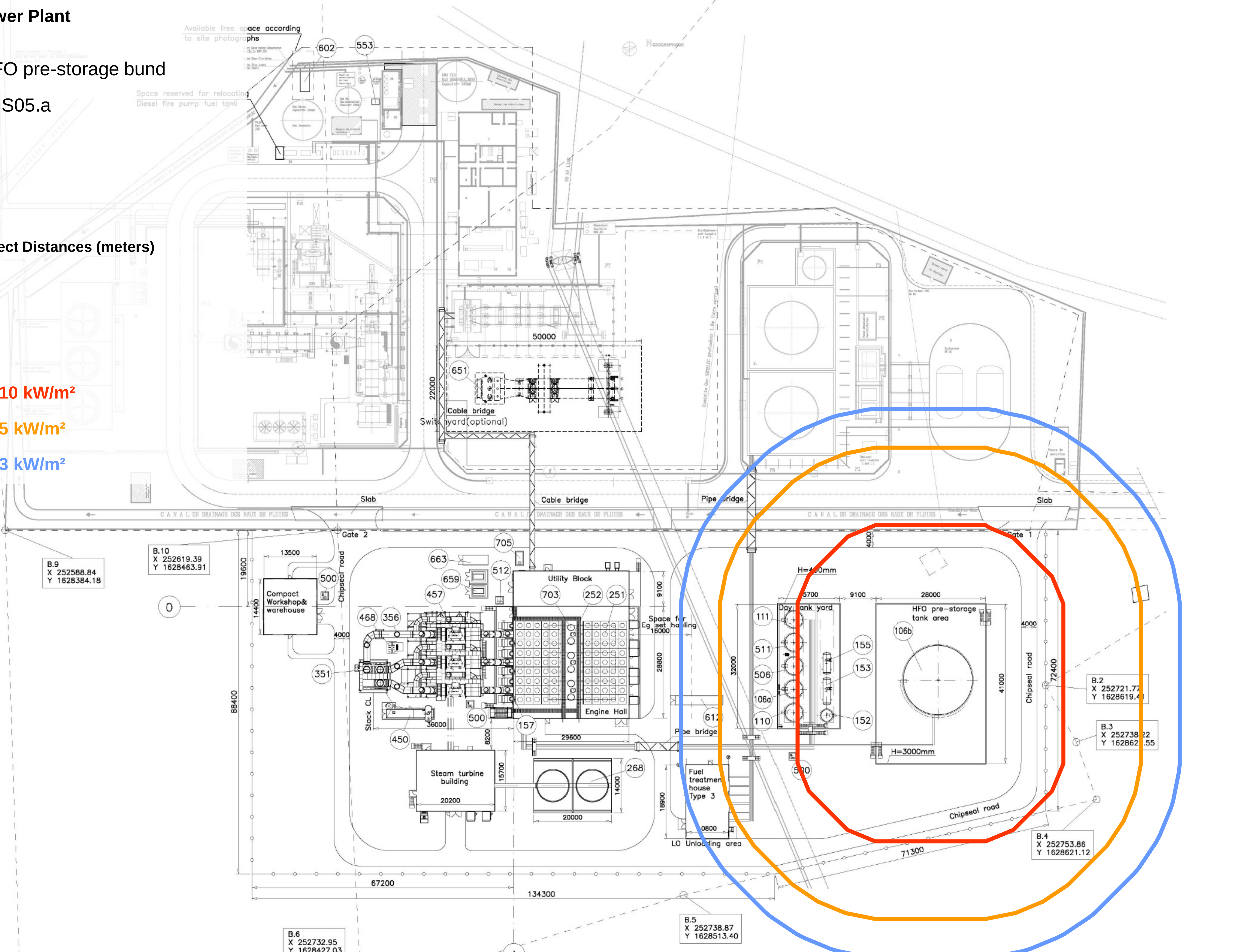
Scenario S05.a

Hazard

Bund Fire

Thermal effect Distances (meters)

20	10 kW/m²
40	5 kW/m²
50	3 kW/m²



Dakar Power Plant

Unit HFO Storage 1 Bund

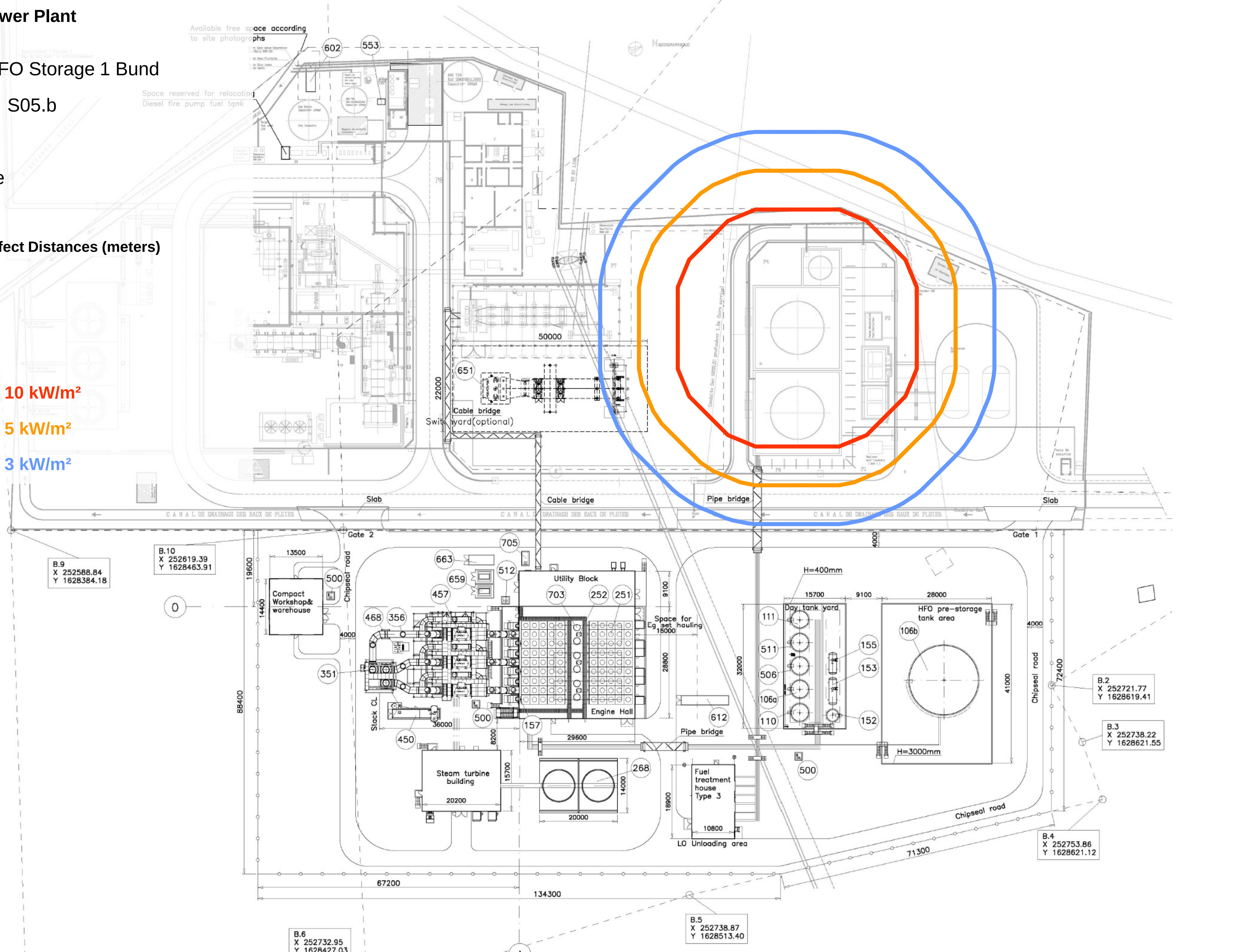
Scenario S05.b

Hazard

Bund Fire

Thermal effect Distances (meters)

20	10 kW/m²
30	5 kW/m²
40	3 kW/m²



Dakar Power Plant

Unit HFO Storage 2 Bund

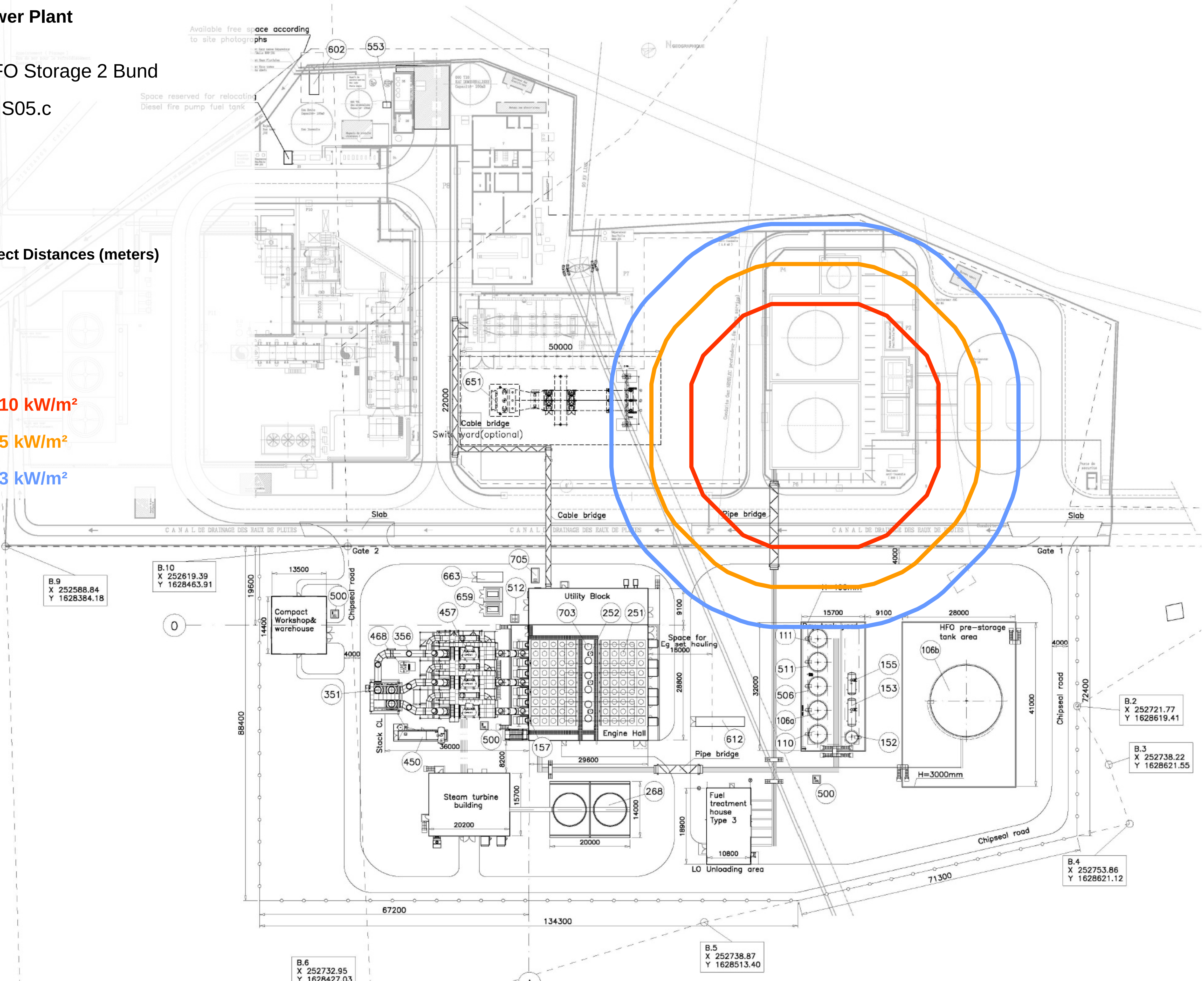
Scenario S05.c

Hazard

Bund Fire

Thermal effect Distances (meters)

20	10 kW/m²
30	5 kW/m²
40	3 kW/m²



Dakar Power Plant

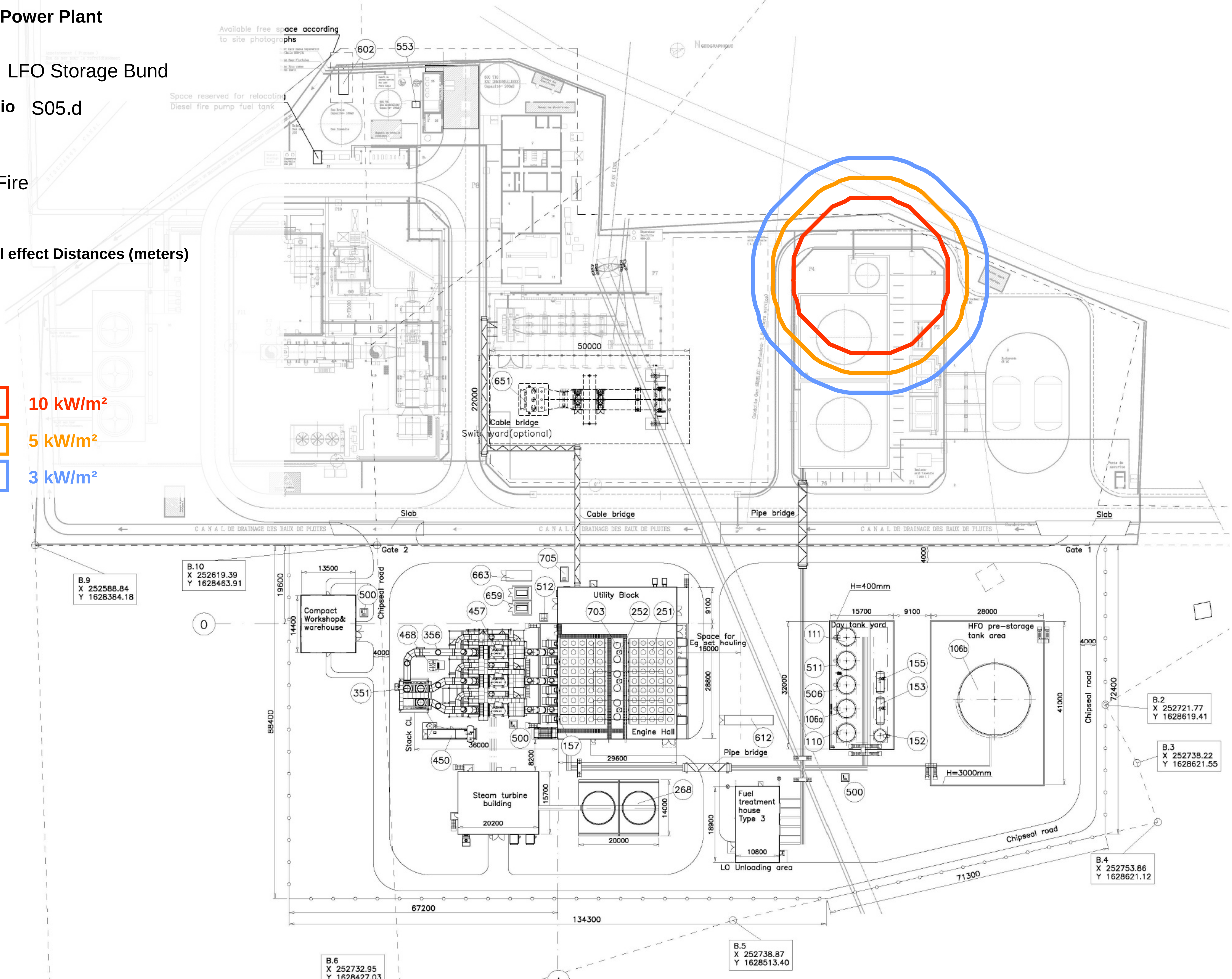
Unit LFO Storage Bund

Scenario S05.d

Hazard

Bund Fire

Thermal effect Distances (meters)



15	10 kW/m²
20	5 kW/m²
25	3 kW/m²

Dakar Power Plant

Unit Day tanks bund

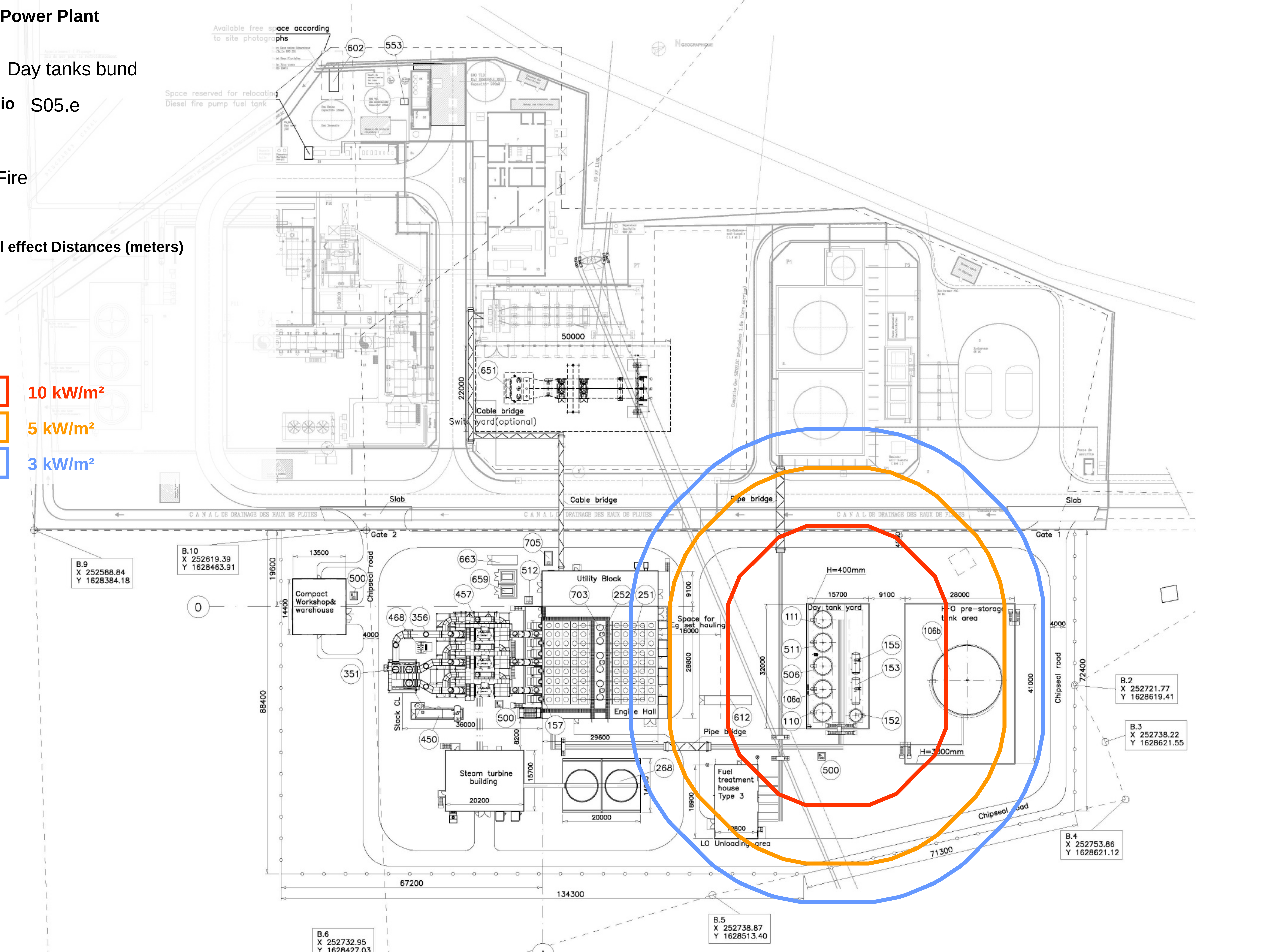
Scenario S05.e

Hazard

Bund Fire

Thermal effect Distances (meters)

20	10 kW/m²
35	5 kW/m²
45	3 kW/m²



Dakar Power Plant

Unit Unloading Pit

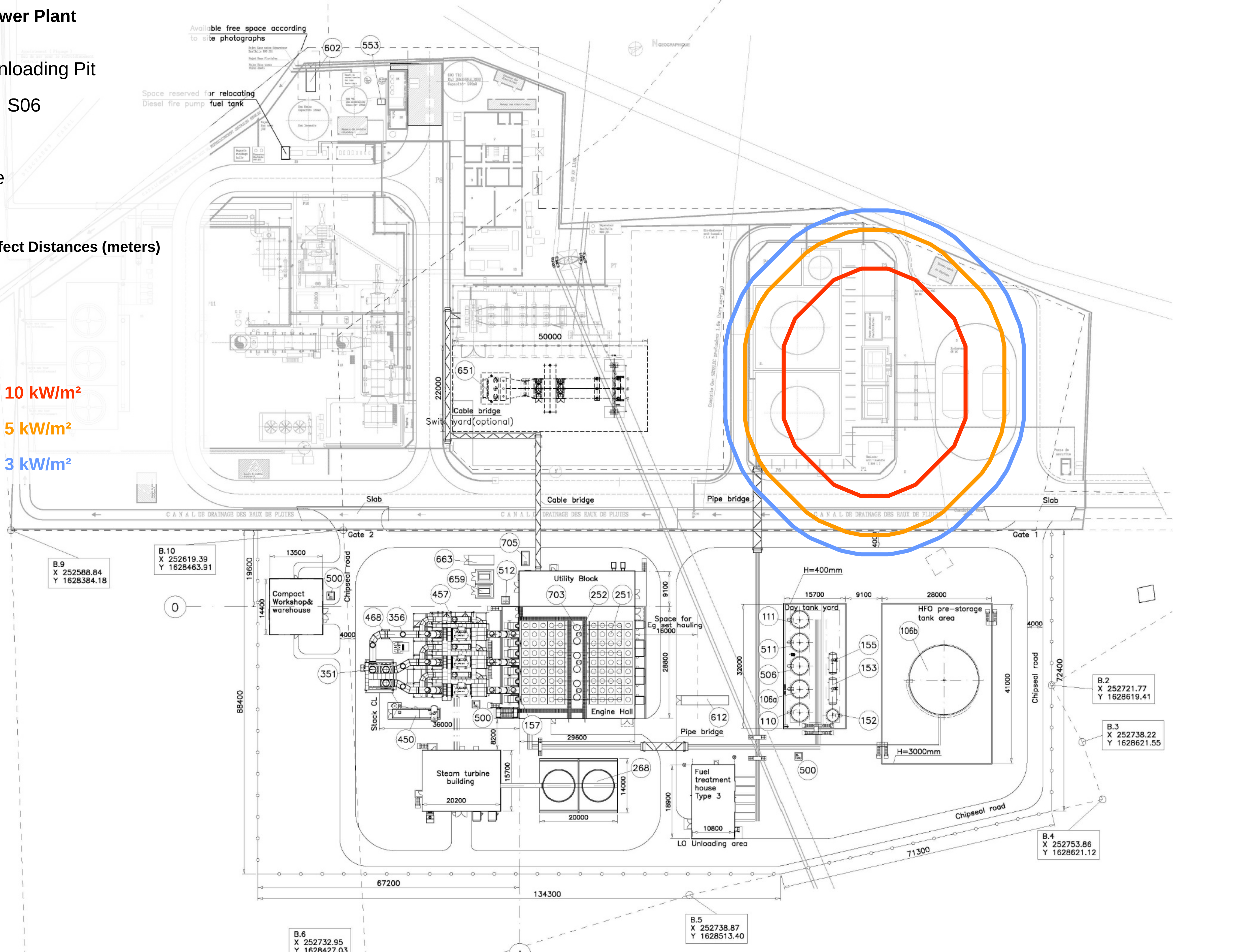
Scenario S06

Hazard

Bund Fire

Thermal effect Distances (meters)

20	10 kW/m²
30	5 kW/m²
35	3 kW/m²



Dakar Power Plant

Unit Pipework

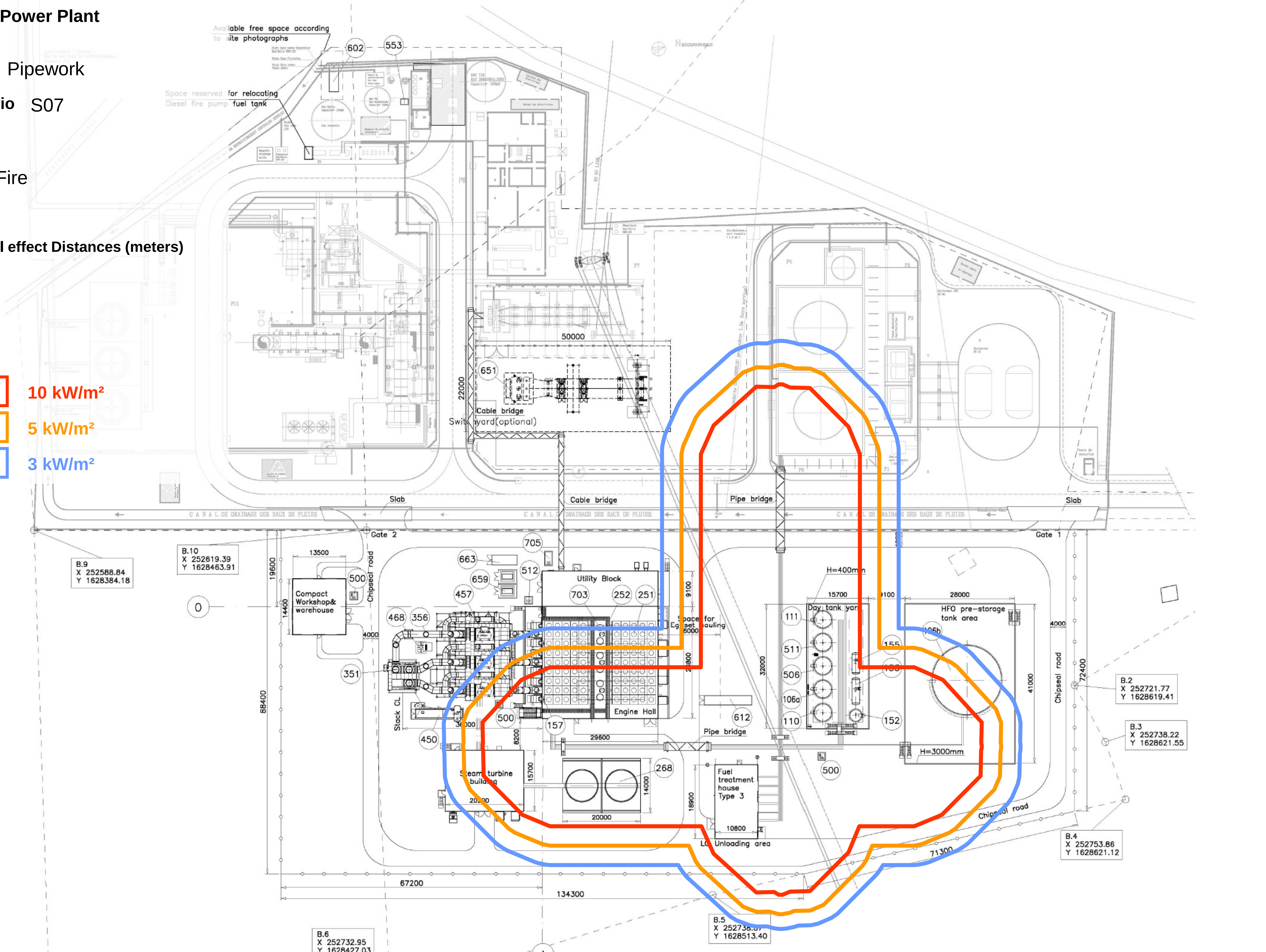
Scenario S07

Hazard

Bund Fire

Thermal effect Distances (meters)

20	10 kW/m²
25	5 kW/m²
30	3 kW/m²

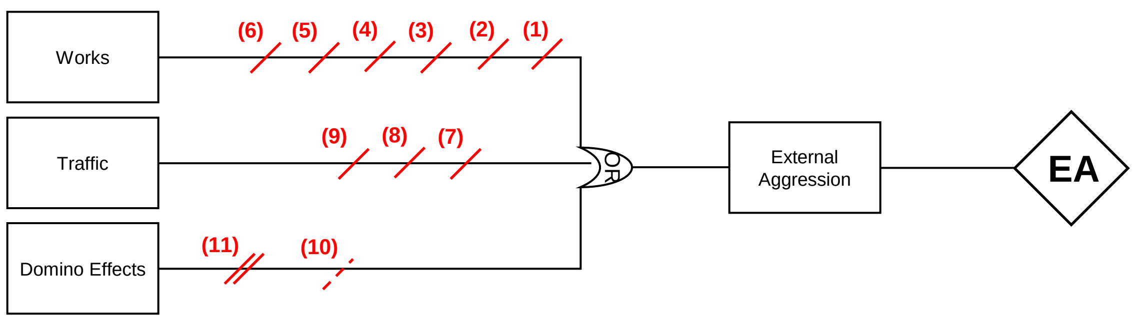


Box 9.2 Root cause analysis and consequences

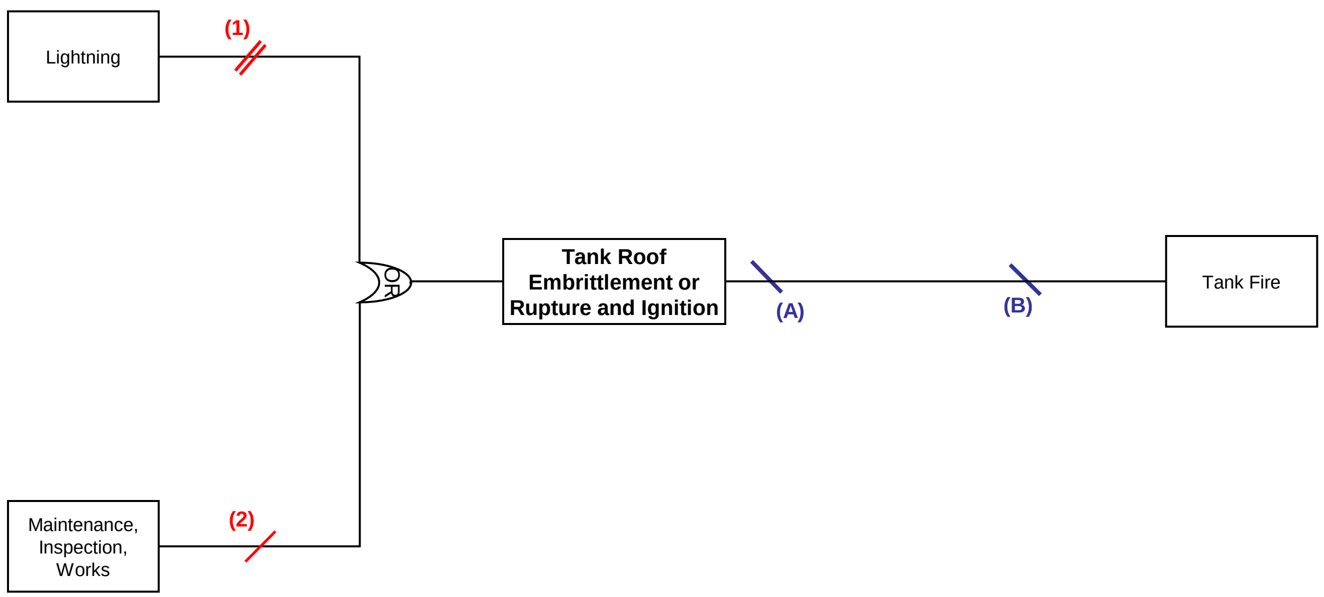
Risk Measures

Design Operation Intervention

(1) Authorised companies, Staff training
(2) Work Procedures
(3) Work Authorisation, Permit to Work
(4) Prevention Plan
(5) Provision Procedure
(6) Restricted Access Area near the storage areas
(7) Site Speed Limit
(8) Traffic Signs and Protective Measures
(9) Staff Patrols
(10) Fire Fighting measures
(11) Design: Area Separation: Storage / Control Room / Process Units



CAUSES — **Scenario :** S01 Tank Fire — *CONSEQUENCES*



Risk Measures — Design — Operation — Intervention

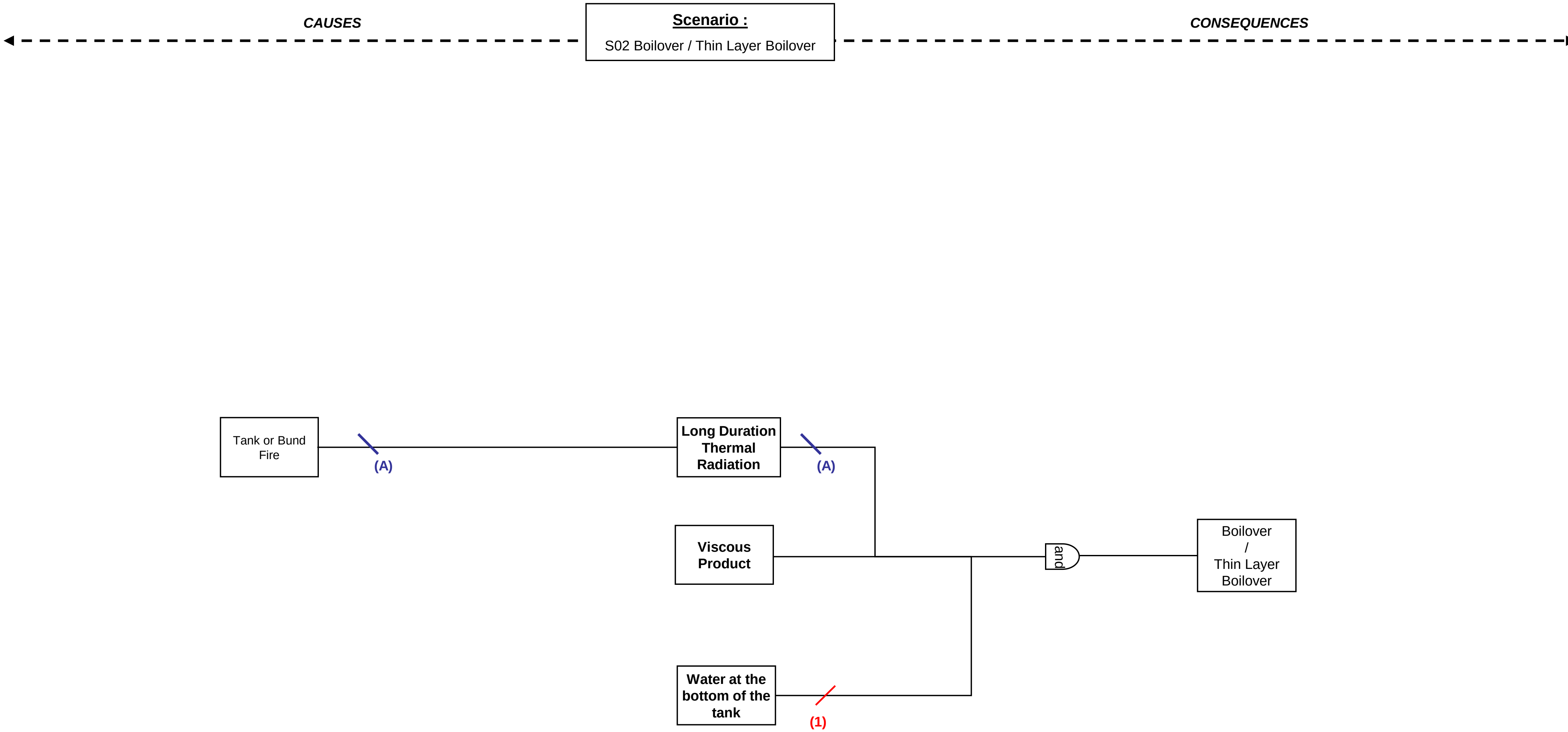
(1) Lightning Rod

(2) Maintenance Procedures, Permit to Work

Prevention/Protection/Mitigation Measures

(A) Ignition Prevention: Earthing, Classified Hazardous Areas, Security Rules

(B) Fire Fighting Measures



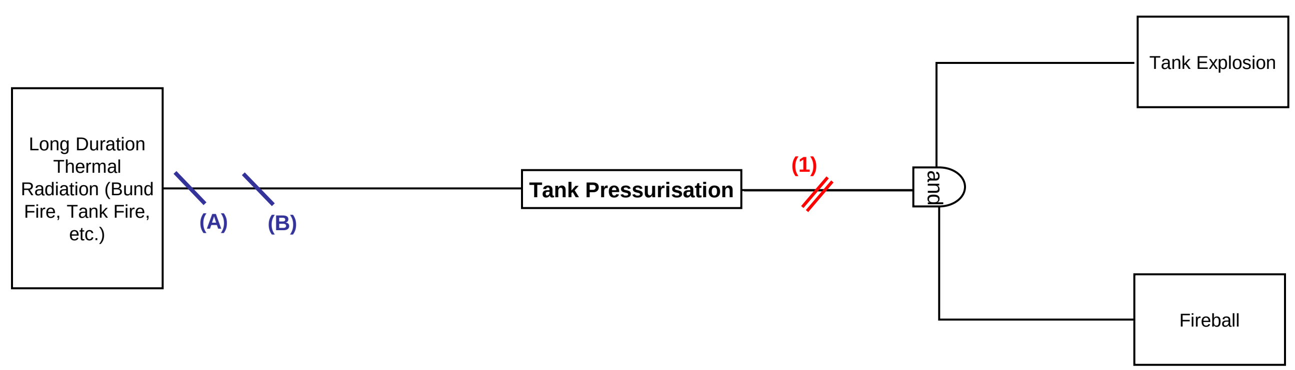
Risk Measures — Design — Operation — Intervention

(1) Periodic Tank Purge

Prevention/Protection/Mitigation Measures

(A) Fire Fighting Measures

CAUSES | **Scenario :** S03 Fireball Following Tank Pressurisation | *CONSEQUENCES*



Risk Measures — Design — Operation — Intervention

(1) Vents calculated for this scenario on the tanks

Prevention/Protection/Mitigation Measures

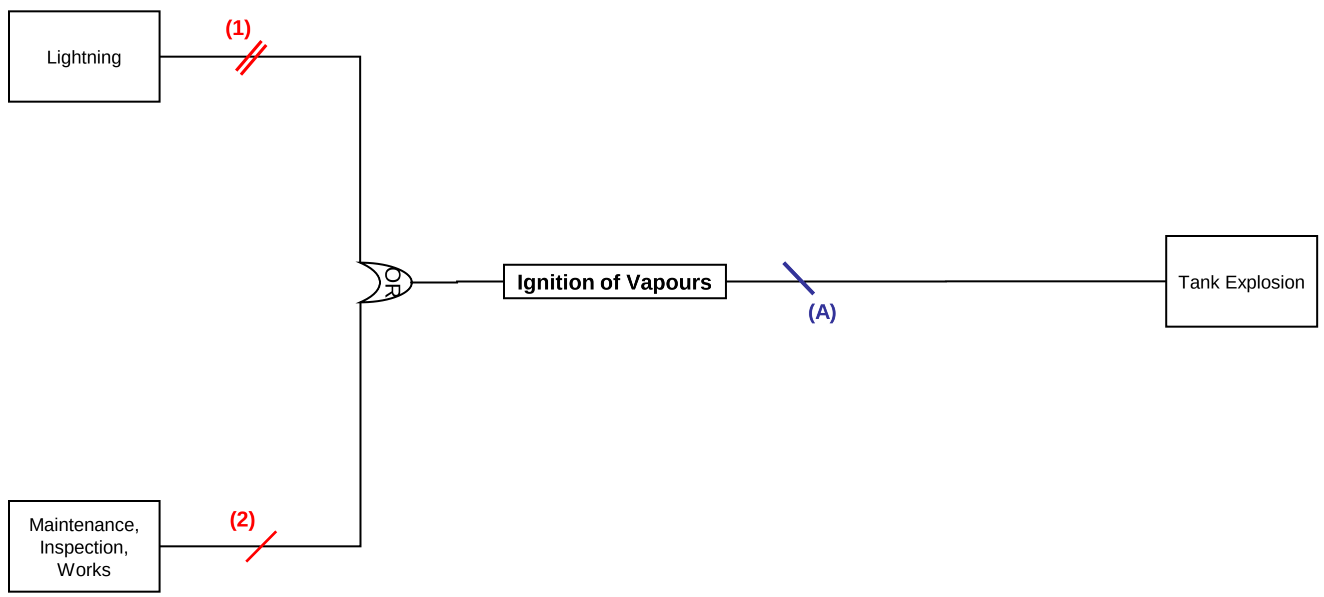
(A) Ignition Prevention: Earthing, Classified Hazardous Areas, Safety Rules

(B) Fire Fighting Measures

CAUSES

Scenario :
S04 Tank Internal Explosion

CONSEQUENCES

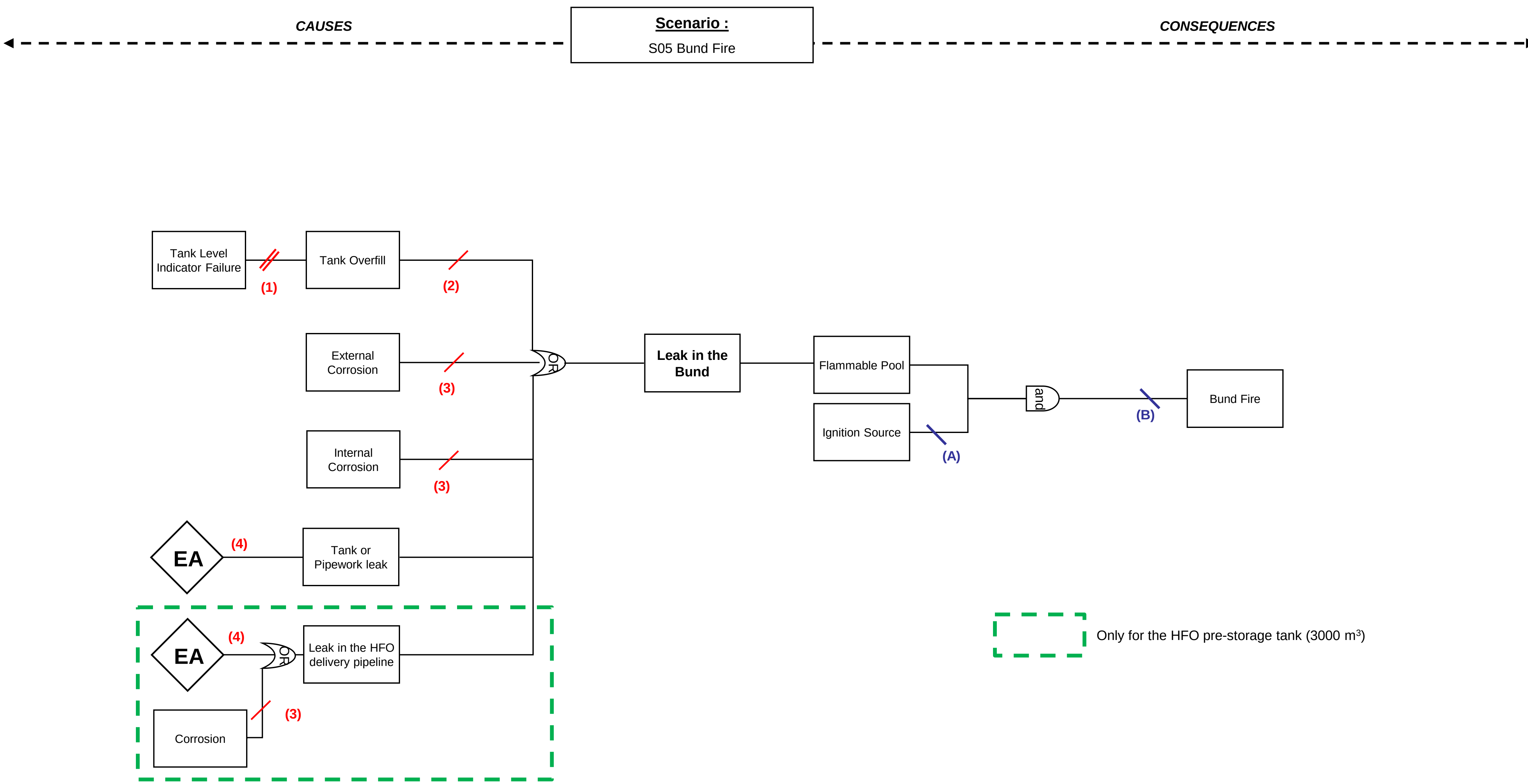


Risk Measures — Design — Operation — Intervention

(1) Lightning Rod
(2) Maintenance Procedures, Permit to Work...

Prevention/Protection/Mitigation Measures

(A) Tank venting



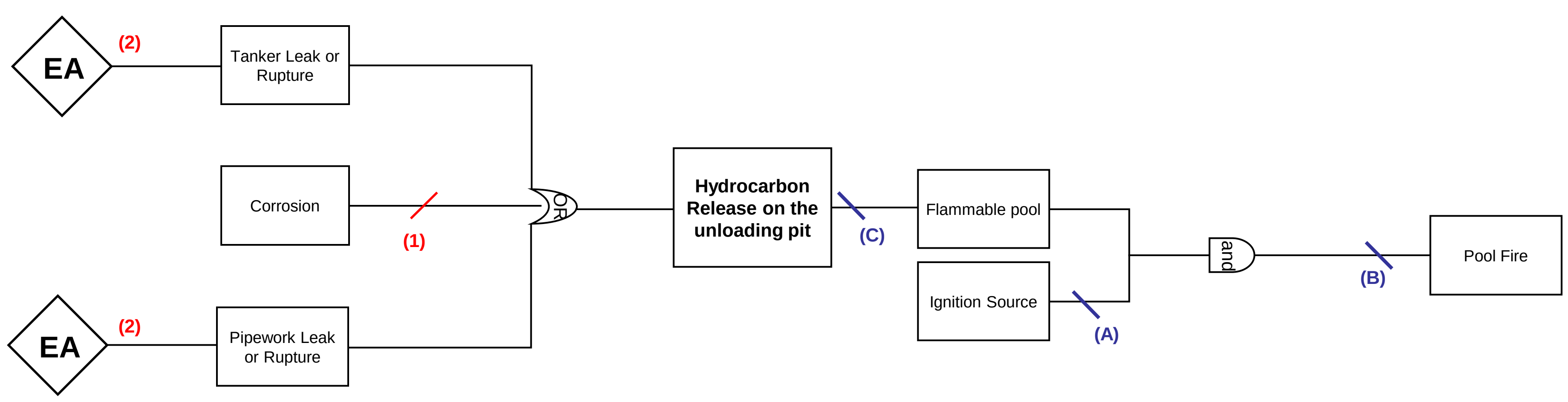
Risk Measures — Design — Operation — Intervention

(1) High Level independent alarm with possible operator action
(2) Safety Instructions
(3) Periodic Inspection of equipment
(4) See External Agression Tree

Prevention/Protection/Mitigation Measures

(A) Ignition Prevention: Earthing, Classified Hazardous Areas, Security Rules
(B) Fire Fighting Measures

CAUSES **Scenario :** S06 Pool Fire on the unloading pit *CONSEQUENCES*

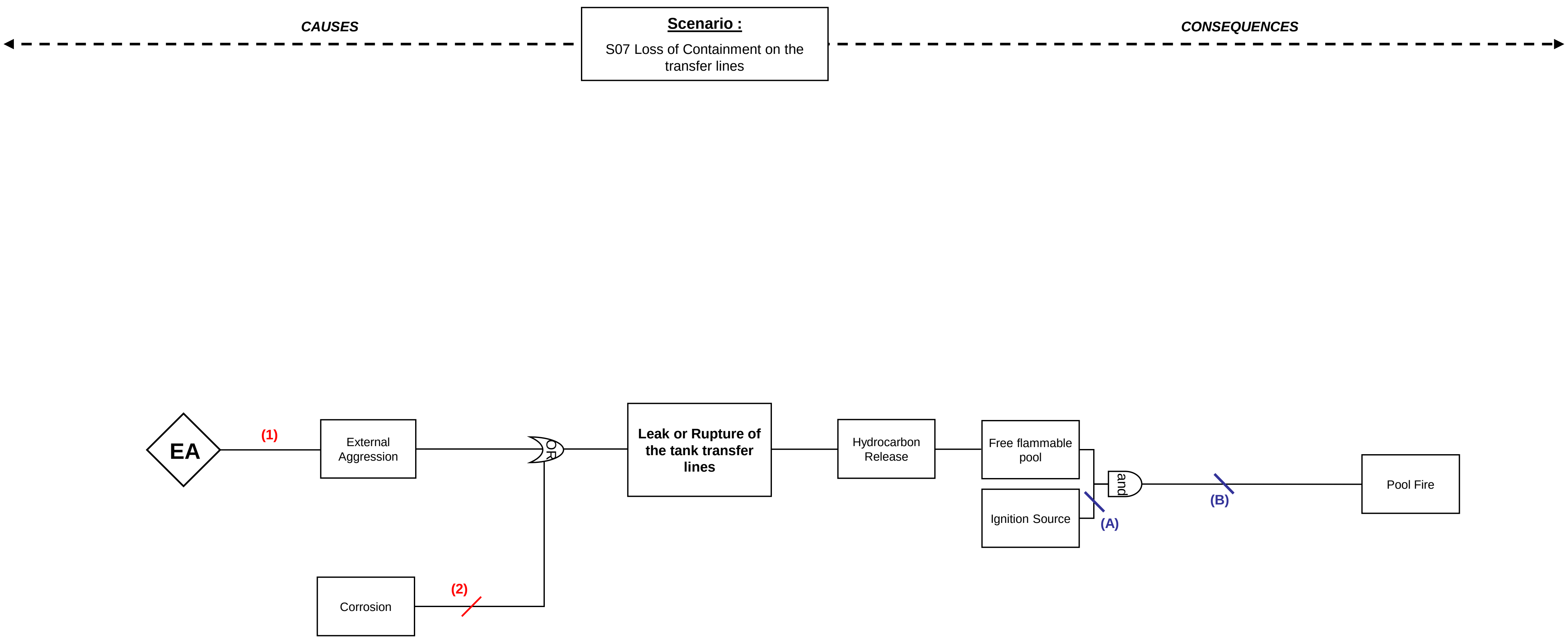


Risk Measures — Design — Operation — Intervention

(1) Equipment Maintenance and Inspection
(2) See External Agression Tree

Prevention/Protection/Mitigation Measures

(A) Ignition Prevention: Earthing, Classified Hazardous Areas, Security Rules
(B) Fire Fighting Measures
(C) Emergency Push Buttons in the unloading area



<u>Risk Measures</u> Design Operation Intervention

(1) See External Agression Tree

(2) Equipment Maintenance and Inspection

<u>Prevention/Protection/Mitigation Measures</u>

(A) Ignition Prevention: Earthing, Classified Hazardous Areas, Security Rules

(B) Fire Fighting Measures

10 ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN

10.1 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

This Environmental and Social Management Plan (ESMP) was prepared on the basis of the results of the ESIA on the ContourGlobal - Cap des Biches project.

Its aim is to meet the requirements of law N° 2001-01 of 15th January 2001 covering the Environment Code in Senegal. It has also been developed with the aim of complying with international good practices applicable to impact studies, meeting the requirements of IFC environmental Performance Standards.

The aim of the ESMP is to provide a framework for the environmental and social management of the Project, translating the mitigation measures specified in the ESIA into a plan for implementation of the Project. Thus the ESMP:

- Lists mitigation measures to be implemented by the Project for every phase in its implementation, with the aim of complying with Senegalese regulations and international standards and good practices
- Provides a framework for monitoring or even auditing project compliance with these standards and good practices.

The ESMP is supplemented by:

- A surveillance and monitoring plan
- A capacity reinforcement plan
- An implementation plan.

10.2 GENERAL PRINCIPLES OF ENVIRONMENTAL SURVEILLANCE AND MONITORING

Internal environmental monitoring (the aim of the ESMP) carried out within the context of the Project will ensure efficient implementation of the measures. This monitoring will be carried out using monitoring indicators defined by means of verification of associated sources of control.

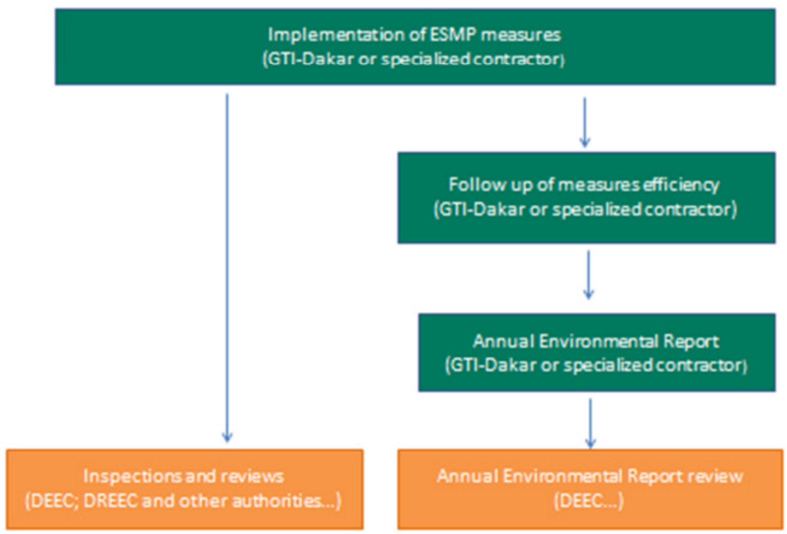
Internal monitoring will be carried out by an HSE manager who is a member of ContourGlobal - Cap des Biches staff or is working for one of ContourGlobal - Cap des Biches's service providers (insofar as ContourGlobal - Cap des Biches delegates surveillance responsibility contractually). In all cases, the HSE manager will perform regular inspections and checks on the installations during the construction and operational phases. His role will be to remind operators of good practices and management measures to be applied for every activity in the Project; any deviation observed will be recorded in a written report.

An annual environmental report will set out the various monitoring indicators defined in the ESMP and any deviations from them that have been observed.

The environmental report drawn up by the HSE manager will be a basis for environmental surveillance carried out by the Senegalese authorities. The authorities will also carry out checks on site, of variable frequency depending on the issue (see *Section 10.4*).

This organisation is presented in *Figure 10.1*.

Figure 10.1 Organisation of environmental surveillance and monitoring



10.3 *APPLICABLE STANDARDS AND PROCEDURES*

The environmental and social standards and procedures applicable to the Project are those described in *Chapter 6* of the ESIA report. The impacts reduction plan below sets out which management measures will have to be undertaken in order to ensure that the Project complies with Senegalese environmental standards.

10.4 *IMPACT REDUCTION PLAN AND MONITORING & SURVEILLANCE PLAN*

The impact reduction plan is a compilation of the mitigation measures identified in *Chapter 8, Evaluation of Impacts and Mitigation Measures* of the ESIA report.

For each measure, objectively verifiable monitoring indicators (OVI), means of verification (MV), the person in charge of implementing the measure and the budget involved are suggested.

The responsibilities and costs of the internal surveillance that will be implemented by ContourGlobal - Cap des Biches are also specified (see *Section 10.2*).

The budget given for each management measures is an estimate, calculated on the basis of an average cost of 65 000 CFA francs/man-day. It also takes into account the material costs of implementing measures, wherever possible. For mitigation measures that are integrated into Project design, the budget required for their implementation is included in investment expenditure (CAPEX) and operational expenditure (OPEX). The amounts of OPEX and CAPEX intended for implementation of the ESMP have not been included in this analysis, such that the detailed budget is a low estimate of the expenditure that will actually be incurred for the Project.

Note that measures for managing environmental issues were already included in the Wartsila technical instructions book, which will supervise the construction phase. These instructions are presented in *Box 10.2*.

Table 10.1 Impact reduction plan – construction phase

Activity/ Source	Potential impact	Impact receptors	Mitigation measures	OVI	MV	Timetable for implementation	Implementation		Internal monitoring		External monitoring	
							Manager	Costs	Frequency manager	Costs	Frequency manager	Costs
Impacts on air quality												
Site machinery, transport vehicles	Impact on air quality from combustion engine emissions	Local people Workers	Regular maintenance and inspection by the contractor in charge of the works	100% of vehicles that have been the object of annual maintenance over the past 12 months.	Maintenance report.	Throughout the construction phase	Contractor	Included in the budget of the company in charge	Service provider's HSE manager 1/ month	260 000 CFA F (2h/month i.e. 4 days over 12 months)	Technical committee and/or DEEC "Pollution and Disturbance" Division Every 2 months	250 000 CFA F / 2 months
			Reduction of atmospheric emissions from vehicles by limiting the number of journeys as much as possible	Vehicle fuel consumption	Monthly report from the worksite HSE manager	Throughout the construction phase	Contractor	Same	Service provider's HSE manager 1/ month	1 040 000 CFA F (1 day/month) i.e. 16 days over 12 months)		
Storage and transport of excavated earth	Impact on air quality due to dust emissions	Local people Workers	Covers over dust generating storage areas to minimise dust flight	Visual observation	Monthly report from the HSE manager	Throughout the construction phase	Contractor	Same	Service provider's HSE manager Daily	520 000 CFA F (0.5 day / month i.e. 8 days over 12 months)		
			Cover loads that generate dust.	Visual observation	Monthly report from the HSE manager	Throughout the construction phase	Contractor	Same	Service provider's HSE manager 1/ month	260 000 CFA F (2h/month i.e. 4 days over 12 months)		

Activity/ Source	Potential impact	Impact receptors	Mitigation measures	OVI	MV	Timetable for implementation	Implementation		Internal monitoring		External monitoring	
							Manager	Costs	Frequency manager	Costs	Frequency manager	Costs
			Spray site access tracks if they are not asphalted.	Visual observation	Monthly report from the HSE manager	Throughout the construction phase	Contractor	Same	Service provider's HSE manager Daily	520 000 CFA F 0.5 day / month i.e. 8 days over 12 months		
Transport	Impact on air quality due to dust emission	[illegible] Workers	Speed limits of 30km/h on non-asphalted site access tracks.	Visual observation	Monthly report from the HSE manager	Throughout the construction phase	Contractor	Same	Service provider's HSE manager 1/ month	650 000 CFA F (2 days then 0.5 day / month i.e. 10 days over 12 months)		
Transport	Impact on air quality due to dust emission	Local people Workers	Wheels rinsed on vehicles leaving the site.	Visual observation	Monthly report from the HSE manager	Throughout the construction phase	Contractor	Same	Service provider's HSE manager 1/ month	520 000 CFA F (0.5 day / month i.e. 8 days over 12 months)		
Impacts on ambient noise levels												
Machinery, vehicles and all sources of noise	Ambient noise	Local people	Avoid night work as much as possible.	Number of nights worked less than 20% of the total number of days worked	Worksite register	Throughout the construction phase	ContourGlobal - Cap des Biches	No specific implementation cost	E&S manager, ContourGlobal - Cap des Biches	-	Technical committee and/or DEEC "Pollution and Disturbance" Division Every 2 months	- *(included in the cost of bimonthly visits presented in terms of monitoring of air quality)*
Impacts on water resources												

Activity/ Source	Potential impact	Impact receptors	Mitigation measures	OVI	MV	Timetable for implementation	Implementation		Internal monitoring		External monitoring	
							Manager	Costs	Frequency manager	Costs	Frequency manager	Costs
Water requirements	Quantitative impact on water resource	Water resource	Optimise water consumption and minimise wastage Check absence of leak Supervise water consumption to identify any over-consumption and provide a basis from which to improve efficiency.	Volume of water consumed per day	Monthly report from the HSE manager Analysis of water volumes will identify any over-consumption which must be justified.	Throughout the construction phase	Contractor	Included in the budget of the contractor in charge	Service provider's HSE manager 1/ month	1 040 000 CFA F 1 day/month i.e. 16 days over 12 months	Technical committee and/or DEEC "Pollution and Disturbance" Division Every 2 months	- *(included in the cost of bimonthly visits presented in terms of monitoring of air quality)*
Accidental spillages or leaks from the chemical product or fuel oil storage tanks or from the worksite machinery used at the site.	Impacts on water quality	Groundwater	Retentions on storage tanks for hydrocarbons or hazardous products and on unloading areas. Unloading and storage management procedure which minimises risks of leakage. Provision of cleaning equipment in case of spillage. In case of accidental spillage, a "spillage" incident will be opened; this incident will be closed when the area has been cleaned up.	Visual observation during bimonthly audits or ad hoc statements Number of incidents involving leakages or spillage	Monthly report from the HSE manager End of worksite report (in the case of monitoring "spillage" incidents).	Throughout the construction phase	Contractor	Same	Service provider's HSE manager 1/ month An audit of the way in which products are stored must be carried out once a month.	520 000 CFA F 0.5 day / month i.e. 8 days over 12 months		

Activity/ Source	Potential impact	Impact receptors	Mitigation measures	OVI	MV	Timetable for implementation	Implementation		Internal monitoring		External monitoring	
							Manager	Costs	Frequency manager	Costs	Frequency manager	Costs
Discharge of sanitation effluent	Impacts on water quality	Surface water and groundwater	Check and regular maintenance of the waste water evacuation system (temporary and permanent septic tanks)	Volumes of effluent emptied	Daily reports from the HSE manager	Throughout the construction phase	Contractor	Idem	Service provider's HSE manager	520 000 CFA F 0.5 day / month i.e.8 days over 12 months		
Discharge of rain water	Impacts on water quality	Surface water and groundwater	Check and regular maintenance of the drainage system. The drainage system for non-contaminated water will be separate from the contaminated water collection system.	Visual check on management means after every major rainfall episode.	Daily reports from the HSE manager	Throughout the construction phase	Contractor	No implementation cost Usual worksite practices	Service provider's HSE manager 1/ month	520 000 CFA F 0.5 day / month i.e.8 days over 12 months		
Impacts on biodiversity												
Construction work	Impacts on biodiversity Modification of natural habitats on site	Natural habitats, Fauna, Flora	Avoid or minimise clearance of vegetation anywhere other than in the power plant's construction area.	Visual observation	Daily reports from the HSE manager	Throughout the construction phase	Contractor	No implementation cost	Site HSE manager	520 000 CFA F 0.5 day / month i.e.8 days over 12 months	Technical committee and/or DEEC "Pollution and Disturbance" Division Every 2 months	- *(included in the cost of bimonthly visits presented in terms of monitoring of air quality)*

Activity/ Source	Potential impact	Impact receptors	Mitigation measures	OVI	MV	Timetable for implementation	Implementation		Internal monitoring		External monitoring	
							Manager	Costs	Frequency manager	Costs	Frequency manager	Costs
Landscape and visual impacts												
Worksite installation, machinery, presence of the worksite	Landscape and visual impacts	Local people	Machines and materials will be stored in an orderly manner during the works. High machinery, including cranes, will not be left on site for any longer than is necessary for the construction work.	Visual observation	Daily reports from the HSE manager	Throughout the construction phase	Contractor	Included in the budget of the contractor in charge	Service provider's HSE manager	See measures relating to impacts on air quality: dust particles.	Technical committee and/or DEEC "Pollution and Disturbance" Division Every 2 months	- *(included in the cost of bimonthly visits presented in terms of monitoring of air quality)*
Lighting required for the worksite	Landscape and visual impacts	Local people	External safety lighting directed downwards.	Visual observation	Daily reports from the HSE manager	Throughout the construction phase	Contractor	Same	Service provider's HSE manager	-		
Social impacts												
Preparation of land, change in land use	Impacts on land use of the parcel concerned by the works	Local people and employees	The Project Promoter will ensure that the land acquisition procedure implemented by SENELEC and validated by the Municipality of West Rufisque and the Domains Administration has been properly complied with.	Compensation reports of the beneficiaries (available at SENELEC)	Management committee meeting reports	Prior to start-up of the construction works	ContourGlobal – Cap des Biches	Costs already covered by SENELEC	Site manager	2 000 000 CFA F	Technical committee and/or DEEC "Pollution and Disturbance" Division Every 2	- *(included in the cost of bimonthly visits presented in terms of monitoring of air quality)*

Activity/ Source	Potential impact	Impact receptors	Mitigation measures	OVI	MV	Timetable for implementation	Implementation		Internal monitoring		External monitoring	
							Manager	Costs	Frequency manager	Costs	Frequency manager	Costs
	Impacts on the agricultural income of the family growing crops on part of the parcel.	Local people and employees	If possible plan to clear the land after the last harvest. Inform the people concerned of the planned work start date as soon as possible and at least three weeks in advance to enable former users to cut down the trees and collect the wood to use for heating.	Date of announcement of start of works	Report from the information meeting / information notice Ensure that land clearance work has been previously announced at least 1 month before the start of works.	Prior to start-up of the construction works	GTI Dakar and Contractor	No specific implementation cost	Site manager	No specific monitoring cost	months Technical committee and/or DEEC "Pollution and Disturbance" Division	- *(included in the cost of bimonthly visits presented in terms of monitoring of air quality)*
Employment of local labour	Local employment (positive impact).	Local people and employees	Ensure that the recruitment policy is well defined and advertised and that job offers and published at local level. This local procedure for jobs will be established in agreement with the authorities.	Monitoring of the number of local employees of the Project	Recruitment plan / policy. Recruitment policy. Before the start of the works and checks during the construction work.	Prior to start-up of the construction works	ContourGlobal - Cap des Biches	No specific implementation cost	Promoter's human relations manager	No specific monitoring cost		

Activity/ Source	Potential impact	Impact receptors	Mitigation measures	OVI	MV	Timetable for implementation	Implementation		Internal monitoring		External monitoring	
							Manager	Costs	Frequency manager	Costs	Frequency manager	Costs
Employment of local labour	Local employment (positive impact).	Local people and employees	As far as possible jobs requiring no qualifications will be given in priority to candidates from the neighbouring urban community. ContourGlobal - Cap des Biches and the various contractors working on the project will estimate the number of jobs requiring few or no qualifications according to the different stages in the worksite, in order to draw up a provisions timetable for recruitment.	Monitoring of the number of local people hired.	Before the start of the works and intermittent checks during the construction work	Prior to start-up of the construction works	ContourGlobal - Cap des Biches	No specific implementation cost	Promoter's human relations manager	520 000 CFA F 0.5 day / month i.e. 8 days over 12 months		
Employment of labour	Propagation of contagious diseases, notably HIV/AIDS	Local people and employees	HIV/AIDS and contagious diseases prevention policy, with training sessions of the workers The Project promoter will establish a "code of conduct" right from the construction phase to ensure that employees behave in such a way as to limit the increase in contagious diseases and discourage prostitution.	Frequency of implementation of the awareness programme	Awareness programme communicated at the site and amongst surrounding communities	Prior to and during construction works	ContourGlobal - Cap des Biches	10 000 000 CFA F	Site manager responsible for HSE	1 040 000 CFA F 1 day / month i.e. 16 days over 12 month		

Activity/ Source	Potential impact	Impact receptors	Mitigation measures	OVI	MV	Timetable for implementation	Implementation		Internal monitoring		External monitoring	
							Manager	Costs	Frequency manager	Costs	Frequency manager	Costs
Impacts on health and safety												
Transport	Road safety risk	Local people and employees	Prepare a traffic plan comprising notably the establishment of speed limits for trucks around the power plant area. Installation of adequate signs in the Project's surroundings. Plan a timetable for traffic caused by the Project to avoid, if possible, peak traffic times in Rufisque.	Number of deviations observed	Daily reports from the HSE manager	Right from start-up of the construction works	ContourGlobal - Cap des Biches	Included in the budget of the contractor in charge	Site manager	See measures on air quality impacts: dust particles	Technical committee and/or DEEC "Pollution and Disturbance" Division Every 2 months	- *(included in the cost of bimonthly visits presented in terms of monitoring of air quality)*
			Awareness of drivers and populations exposed to the road risk in the plant's surroundings.	100% of drivers who have attended training	Monthly reports from the HSE manager	Prior to and during construction works	GTI - Dakar	5 000 000 F CFA	Site manager	260 000 CFA F 2h /month i.e. 4 days over 12 months		
Impacts linked to waste management												
Waste management	Risk of pollution if badly managed	Local people and employees	Waste Management Plan (WMP) to be developed prior to the start-up of construction work.	WMP approved prior to the start of works	WMP	Before start-up of the works and implemented throughout the construction phase	Contractor or service provider responsible for waste	5 000 000 CFA F	Site HSE manager	65 000 CFA F 1 day over 12 months	Technical committee and/or DEEC "Pollution and Disturbance"	- *(included in the cost of bimonthly visits presented*

Activity/ Source	Potential impact	Impact receptors	Mitigation measures	OVI	MV	Timetable for implementation	Implementation		Internal monitoring		External monitoring	
							Manager	Costs	Frequency manager	Costs	Frequency manager	Costs
		Local people and employees	Collection, storage, transport and disposal of waste by a specialist service provider, in compliance with Senegalese regulations. Traceability of removal and treatment of waste will be guaranteed by systematic recording of transport forms detailing the type of waste and the quantity and indicating the carrier's identity. Develop and maintain an inventory of stocks to reduce the amount of waste caused by materials out of date, materials that do not meet specifications, materials that are damaged or are in excess of requirements.	Report on waste produced and quantities removed for treatment by service providers.	Approval of the service provider. Waste dispatch form: Volume Type Destination	Right from start-up of the construction works. Throughout the construction phase.	Contractor in collaboration with GTI Dakar	Included in the contractor's budget	Site manager + HSE manager	1 560 000 CFA F i.e. 2 days/ month	Division Every 2 months	*in terms of monitoring of air quality)*

Table 10.1 Impact reduction plan – operational phase

Activity/ Source	Potential impact	Impact receptors	Mitigation measures	OVI	MV	Timetable for implementation	Implementation		Internal monitoring		External monitoring	
							Manager	Costs	Frequency manager	Annual costs	Frequency manager	Annual costs
Administrative procedures and applicable regulations												
Operation of the plant	Non compliance with applicable Senegalese regulations	NA	ContourGlobal –Cap des Biches will follow the administrative procedures required within the frame of this project (cf. Section 4.4 of this report), in particular those related to the ICPE regulations.	Absence of regulatory non-compliance	Obtained authorizations	Before the operational phase	COntourGlobal - Cap des Biches	Included	HSE Manager	-	Technical Committee	250 000 CFA per year
Impact on air quality												
Engines running on heavy fuel oil	Gas emissions (NO_x, SO_2, CO) and impacts on air quality	Local people Employees	Sulphur concentration in the fuel oil delivered will not exceed 2%.	100% of fuel oil will have a concentration <2%	Monitoring and recording of fuel oil quality used by means of delivery slips validating the quality requested.	Prior to start-up of the power plant, on signature of the supply contract. On every delivery during the operational period.	ContourGlobal - Cap des Biches Fuel supplier	1 200 000 CFA F	Site operational team. Monitoring terms included in the fuel supplier contract.	780 000 CFA F 1 day / month	Energy Office, DEEC, within the context of the annual report review	No direct cost involved

Activity/ Source	Potential impact	Impact receptors	Mitigation measures	OVI	MV	Timetable for implementation	Implementation		Internal monitoring		External monitoring	
							Manager	Costs	Frequency manager	Annual costs	Frequency manager	Annual costs
		Local people Employees	Delivery vehicles will be the object of regular inspections and maintenance. The number of journeys made by transport vehicles will be optimised.	Percentage of vehicles that have been the object of maintenance over the past 12 months. Objective of 100%	Vehicle inspection certificates	Operational phase.	Fuel delivery service provider	Included in the contractor's budget	Service provider's manager (regular maintenance of vehicles). Site operational team 1/month	200 000 CFA F 2h/month i.e. 3 days per year	DEEC Once / year	Travel cost paid: 200 000 CFA F
		Local people Employees	Air quality monitoring to confirm baseline conditions and monitor the quality of ambient air over the long term. See *Table 10.7* related to the monitoring plan	Results of measurements	Monitoring report	Monthly report	Service provider specialising in air quality measurements	150 000 CFA F / month of labour 600 000 CFA F / month of analyses i.e. 9 000 000 CFA F / year	Site HSE manager 1/ month	1 560 000 CFA F i.e. 2 days/month	DEEC Twice / year	
		Local people Employees	Monitoring of atmospheric emissions at output from the stack : 1/ month	Results of measurements	Monitoring report	Every 6 month	Service provider specialising in air quality measurements	250 000 CFA F / month of labour i.e. 3 000 000 CFA F / year	Site HSE manager 1/ month	1 560 000 CFA F i.e. 2 days/ month	Energy Office DEEC, with the context of the annual report review	No direct cost involved
Impacts of noise emissions on ambient noise levels												

Activity/ Source	Potential impact	Impact receptors	Mitigation measures	OVI	MV	Timetable for implementation	Implementation		Internal monitoring		External monitoring	
							Manager	Costs	Frequency manager	Annual costs	Frequency manager	Annual costs
Power plant design	Ambient noise	Local people Employees	Use of silencers on exhaust stacks, air inlets and ventilation output ventilators. The installation of anti-noise panels for generators and the steam turbine has been planned. See *Table 10.7* related to the monitoring plan.	Results of measurements	Environmental monitoring report (section on noise)	During design of the power plant and then prior to start-up. Throughout the duration of power plant operations.	ContourGlobal - Cap des Biches Measurement already taken into account during the power plant design phase Specialised service provider	Annual cost of 1 000 000 CFA F (of which cost of analyses 130 000 CFA F	Site HSE manager	195 000 CFA F i.e. 2h/month	Energy Office DEEC, with the context of the annual report review	No direct cost involved
Vehicles and machinery	Ambient noise	Local people Employees	Equip diesel engine vehicles and compression equipment with silencers Locate mobile equipment as far away from receptors as possible s As far as possible, plan to perform the various noisy activities all at the same time, in view of the fact that combined noise levels will probably not be much higher than the level produced if the	Sale	Environmental monitoring report (section on noise)	During design of the power plant and then prior to start-up. Throughout the duration of power plant operations.	ContourGlobal - Cap des Biches Measurement already taken into account during the power plant design phase Specialised service provider	Annual cost: 1 000 000 CFA F (of which cost of analyses 130 000 CFA F i.e. 2 days / year	Site HSE manager	195 000 CFA F i.e. 2h/month	Energy Office DEEC, within the context of the annual report review	No direct cost involved

Activity/ Source	Potential impact	Impact receptors	Mitigation measures	OVI	MV	Timetable for implementation	Implementation		Internal monitoring		External monitoring	
							Manager	Costs	Frequency manager	Annual costs	Frequency manager	Annual costs
			operations had been carried out separately.									
Impacts on water resources												
Water consumption	Impacts on water resources	Populations (pressure on the resource)	Optimisation of water consumption and minimisation of wastage Monitoring of water consumption to identify any over-consumption	Volume of water consumed.	Check and analysis of the HSE manager's reports on water consumption to detect any abnormality. Evolution of consumption over time. Number of unexplained consumption peaks.	Right from start-up of the power plant and throughout operations	Site HSE manager	390 000 CFA F/year i.e. 4h/month	Site HSE manager twice / week twice / month once / day	390 000 CFA F i.e. 4 h / month	DEEC once / year	Travel cost paid: 300 000 CFA F
Accidental spillage	Impacts on water quality	Groundwater	Regular check on installations to prevent any leakage or accidental spillage Installation of piezometers at the fuel oil storage tanks in order to monitor groundwater quality (see *Table 10.7* related to the monitoring plan).	Number of problems observed Results of groundwater monitoring campaigns	Installation control sheets Environmental monitoring report (section related to groundwater quality monitoring)	The piezometers will be installed before the operational phase, in parallel of the construction phase. Contro measures will be undertaken from commissioning of the plant and during all operation duration.	Maintenance manager	Control of the installations: 130 000 CFA F i.e. 2 days/month i.e. 1 560 000 / year Installation of the piezometers: 90 000 000 CFA	Site HSE manager	195 000 CFA F i.e. 2h/ month 3 000 000F CFA / month (analyses)	DEEC once / year	

Activity/ Source	Potential impact	Impact receptors	Mitigation measures	OVI	MV	Timetable for implementation	Implementation		Internal monitoring		External monitoring	
							Manager	Costs	Frequency manager	Annual costs	Frequency manager	Annual costs
Effluent management	Impacts on water quality	Groundwater	Treat oily water in a deoiler before discharging it into the SENELEC canal provided	Daily water volume discharged	Environmental monitoring report (section relating to liquid effluent)	Same	ContourGlobal - Cap des Biches	Included in the functioning budget	Site HSE manager	2 340 000 CFA F i.e. 1h/day	DEEC once / year	
Effluent management	Impacts on water quality	Groundwater	Analyse effluent once a month	Results of analyses (hydrocarbons and pH)	Environmental monitoring report (section relating to liquid effluent)	Same	ContourGlobal - Cap des Biches	Included in the functioning budget	Site manager Monthly analyses	200 000 CFA F/ month	DEEC once / year	
Effluent management	Impacts on water quality	Groundwater	Storage of waste sanitation water in septic tank and emptying by an approved service provider	Volumes emptied	Service provider's tank emptying data sheets	Same	Specialised service provider	Included in the functioning budget	Site HSE manager	780 000 CFA F i.e. 1 day / month	DEEC, within the context of the annual report review	No direct cost involved

Activity/ Source	Potential impact	Impact receptors	Mitigation measures	OVI	MV	Timetable for implementation	Implementation		Internal monitoring		External monitoring	
							Manager	Costs	Frequency manager	Annual costs	Frequency manager	Annual costs
Landscape and visual impacts												
Functioning of the power plant	Landscape and visual impacts linked to the presence of the infrastructures and the effects of the lights at night	Local people	The design, orientation and materials will be suitably and reasonably developed to fit in with the characteristics of the existing site and with the characteristics of the landscape. Appropriate usage of non-reflecting surfaces and coloured surfaces External lighting as discreet as possible and directed downwards to prevent lateral lighting	Not applicable.	Adequate design and implementation	Same	Site HSE manager	Included in the functioning budget	Site HSE manager	130 000 CFA F i.e. 1 h / month	DEEC Once / year	150 000 CFA F
Social impacts												
Employment of local labour	Local employment (positive impact)	Local people and employees	Ensure that the recruitment policy is well defined and advertised and that job offers and published at local level. This local procedure for jobs will be established in agreement with the authorities.	Number of local workers	Recruitment plan / policy. Recruitment policy.	Throughout the operational phase	ContourGlobal – Cap des Biches	No specific implementation cost	Promoter's human relations manager	No specific monitoring cost	-	-

Activity/ Source	Potential impact	Impact receptors	Mitigation measures	OVI	MV	Timetable for implementation	Implementation		Internal monitoring		External monitoring	
							Manager	Costs	Frequency manager	Annual costs	Frequency manager	Annual costs
Employment of local labour	Local employment (positive impact)	Local people and employees	As far as possible jobs requiring no qualifications will be given in priority to candidates from the neighbouring urban community. ContourGlobal - Cap des Biches and the various contractors working on the project will estimate the number of jobs requiring few or no qualifications according to the different stages in the worksite, in order to draw up a provisions timetable for recruitment.	Number of people hired locally.	Same	Same	ContourGlobal - Cap des Biches	No specific implementation cost	Promoter's human relations manager	520 000 CFA F 0.5 day / month i.e. 8 days over 12 months		
Employment of labour	Propagation of contagious diseases, notably HIV/AIDS	Local people and employees	HIV/AIDS and contagious diseases prevention policy, with training sessions of the workers. The Project promoter will establish a "code of conduct" right from the construction phase to ensure that employees behave in such a way as to limit the increase in contagious diseases and discourage prostitution.	Frequency of implementation of the awareness programme	Awareness programme distributed around the worksite and amongst surrounding communities	Same	ContourGlobal - Cap des Biches	10 000 000 CFA F	Site manager /HSE manager	1 040 000 CFA F 1 day / month i.e. 16 days over 12 months		

Activity/ Source	Potential impact	Impact receptors	Mitigation measures	OVI	MV	Timetable for implementation	Implementation		Internal monitoring		External monitoring	
							Manager	Costs	Frequency manager	Annual costs	Frequency manager	Annual costs
Impacts on health and safety												
Transport	Road safety risk	Local people and employees	Prepare a traffic plan comprising notably the establishment of speed limits for trucks around the power plant area. Installation of adequate signs in the Project's surroundings. Plan a timetable for traffic caused by the Project to avoid, if possible, peak traffic times in Rufisque.	Number of deviations observed	Daily reports from the HSE manager	Same	ContourGlobal – Cap des Biches	Included in the functioning budget	Site manager	See measures on air quality impacts: dust particles	DEEC, within the context of the annual report review	No direct cost involved
			Awareness of drivers and populations exposed to the road risk in the plant's surroundings.	100% of drivers who have attended training	Monthly reports from the HSE manager	Same	ContourGlobal – Cap des Biches	5 000 000 CFA F	Site manager	260 000 CFA F 2h / month i.e. 4 days over 12 months		
Impacts liked to waste management												
Waste management	Risk of pollution if badly managed	Local people and employees	Waste Management Plan (WMP) to be developed prior to the start-up of construction work.	WMP approved prior to the operational phase	WMP	Before commissioning of the plant (using and adapting the WMP implemented throughout the construction phase).	Contractor or service provider in charge of waste	5 000 000 CFA F	Site HSE manager	65 000 CFA F 1 day over 12 months	DEEC Once at the start of the operational phase	150 000 CFA F

Activity/ Source	Potential impact	Impact receptors	Mitigation measures	OVI	MV	Timetable for implementation	Implementation		Internal monitoring		External monitoring	
							Manager	Costs	Frequency manager	Annual costs	Frequency manager	Annual costs
		Local people and employees	Collection, storage, transport and disposal of waste by a specialist service provider, in compliance with Senegalese regulations. Traceability of removal and treatment of waste will be guaranteed by systematic recording of transport forms detailing the type of waste and the quantity and indicating the carrier's identity. Develop and maintain an inventory of stocks to reduce the amount of waste caused by materials out of date, materials that do not meet specifications, materials that are damaged or are in excess of requirements.	Report on waste produced and quantities removed for treatment by service providers.	Approval of the service provider. Waste dispatch form: Volume Type Destination	Same	Contractor in collaboration with ContourGlobal – Cap des Biches	Included in the contractor's budget	Site manager + HSE manager	1 560 000 CFA F i.e. 2 days/month		

Activity/ Source	Potential impact	Impact receptors	Mitigation measures	OVI	MV	Timetable for implementation	Implementation		Internal monitoring		External monitoring	
							Manager	Costs	Frequency manager	Annual costs	Frequency manager	Annual costs
Power plant operation	Risks linked to installations	ContourGlobal - Cap des Biches staff, sub-contractors, surrounding populations	Establishment of an Internal Operation Plan (IOP) by ContourGlobal - Cap des Biches before the power plant's operational phase Staff training in IOP procedures Performance of exercises to train in procedures	IOP Number of staff trained Number of internal exercise for training in procedures Number of external exercises organised with firefighters and the Civil Protection Office	Validation of the IOP List of staff trained Reports on internal and external exercises Participation by the Civil Protection Office in the exercises (in collaboration with Rufisque firefighters)	Drafted prior to start-up of the power plant (implemented during the whole of the construction phase) Regular staff training sessions (at least once a year during the operational phase) Bi-monthly internal exercises Annual external exercises	ContourGlobal - Cap des Biches	Creation : 13 000 000 CFA F Inclusion of protection mechanisms into the design: included in CAPEX Maintenance of protection mechanisms : included in OPEX Staff training and performance of exercises: 400 000 CFA F /year	Site HSE manager	6 days a year i.e. 390 000 CFA F	Civil Protection Office Once /year	250 000 CFA F

10.5 ENVIRONMENTAL MANAGEMENT SYSTEM: MAIN THEMED PROCEDURES

In addition to the mitigation plan presented above, the following themed environmental management procedures are to be planned:

- Water resource management
- Waste management
- Transport management
- Environmental emergency response plan in case of spillage
- Periodic for audit and review of the ESMP.

The essential principles of these procedures are defined in the following sections.

These procedures must be integrated into the power plant's environmental management system. They will be designed to be adaptable to the various Project phases, in order to remain relevant to the specific issues arising in each phase.

Other procedures relating to the safety of installations and associated industrial risks will also be implemented through the Power Plant's IIP (Internal Intervention Plan) and IOP (Internal Operation Plan). Specific procedures relating to worker health and safety will also be planned; the study of occupational risks presented in *Chapters 8 and 9* of the ESIA report will act as a basis for this procedure.

10.5.1 *Water resources management procedure*

The aim of this procedure is to integrate into the ESMP the water resource conservation demands that are part of Senegalese national policy and inherent to development of the Project. It concerns:

- Water consumption by the power plant
- The protection of soils, groundwater and seawater, notably by the prevention of discharge of pollutant products into the environment and the prevention of pollutant migration from the power plant into groundwater and onto the coast.

It is noted that the Project is located in a generally arid region, with very few surface water resources. The water resources conservation procedures will include, however, provisions aimed at limiting the risks of soil contamination notably in areas of temporary accumulation of rain water on the surface.

The water resources conservation procedure will include the following elements in particular:

- An inventory of water consumption stations planned for each phase in the Project

- A description of water consumption monitoring and reduction measures to be implemented for each phase in the Project
- Details of planned water storages
- Details of liquid effluent treatment and discharge mechanisms, for effluent from each phase in the Project (notably: origin, design of networks and collection ditches, design and performance of treatment units and surveillance of the quality of treated water prior to discharge).

The environmental management manager at the power plant will ensure that water resource management reports are drawn up regularly, including results from the periodic monitoring of resource quality and availability, the results of environmental audits concerned with water resource management and the corrective measures implemented where necessary.

Table 10.2 Principles applicable to the water resource management procedure

Aspect	Management principle
Reduction of water consumption	• Collection and recycling of rain water and non-contaminated water used to wash equipment and surfaces, with the aim of reducing dust. • Monitoring of water consumption and identification of abnormally high consumption episodes, to detect any possible leakages and define corrective action.
Implementation of management measures for hazardous products, effluent and waste products in order to prevent any infiltration of pollutants into groundwater / the coast	• Systematically implement a substitution principle: replace any hazardous products with its less hazardous equivalent. • Storage and handling of products: use of retentions with recuperation of drips and spillages for the storage and unloading of hazardous products as well as for washing and maintenance activities. • No buried tank will be installed for the storage of hydrocarbons or other hazardous products. • Storages of hazardous products will be designed and built so as to allow adequate confinement and protection with regard to any leakages, in order to prevent any impact on the environment. Each tank will be located on a retention fitted with a leakage detection system. • Storages and networks of hazardous products, i.e. tanks, pipelines and connecting pipes will be regularly inspected by qualified staff and an inspection report will be drawn up. • Staff will be trained in good practice in terms of the storage and handling of products and in maintenance, to prevent any risks linked to hazardous products.

10.5.2 Waste management procedure

This sub-section describes the principles applicable to the development of a management procedure for waste at the power plant. These principles are defined on the basis of the requirements of Senegalese regulations applicable to waste and current good practice relating to waste management.

The optimisation of waste management is a continuous process and ContourGlobal - Cap des Biches will periodically review this procedure with a view to continual improvement. This revision should not be restricted to the evaluation of waste treatment and disposal facilities, but should also focus on the use of technical solutions with a view to the reduction of waste at source.

Table 10.3 Principles applicable to the waste management procedure

Aspect	Management principle
Purchasing department – selection of materials and products that generate the least possible waste	• In its supplies policy, ContourGlobal - Cap des Biches will take waste generation potential into account in order to selection options that generate the least waste, wherever possible.
Inventory management	• Inventory management system will be kept up to date with a view to identifying product consumption, ensuring the traceability of waste and identifying any wastage and over-consumption. • An inventory will be kept of all waste generated and eliminated (type and volumes). • ContourGlobal - Cap des Biches will develop objectives for reductions in the amounts of waste generated, year on year, based on a periodic review of inventories.
Staff training	• Waste will be handled and stored according to its type and risk classification, in compliance with health and safety rules. • An area for central accumulation of waste (ACAW) will be used to store waste. Compatible waste materials will be stored together. • Areas of the ACAW used to store hazardous waste will be covered and the ground will be waterproofed. Liquid and hazardous waste storage units will be fitted with retention systems. • The ACAW will be fenced and only authorised staff will be allowed access to the site. • The ACAW will be maintained in good order, clean and with waste products separated by type and risk classification, in order to minimise risks of pollution, fire and explosion, and the proliferation of vermin.
Final disposal of waste	• Recyclable waste will be regularly collected for recycling by local recycling companies. Contracts for the collection of waste by these companies will be confirmed after verification of acceptability of their practices from an environmental, health and safety management point of view. • All hazardous and non-combustible waste will be processed appropriately in the country or exported abroad for processing and final discharge. Any export of waste for elimination outside the borders of Senegal will meet the demands of the Basel Convention on the control of transborder movements of waste and other hazardous materials. • Potentially infectious waste will be place in dedicated, labelled recipients, for evacuation to a specialized centre for incineration in a dedicated incinerator. • No waste will be burned in the open air.
Transport of waste off site	• When waste materials are sent off site, suitable transport vehicles will be used (if needed by means of use of a service provider) in order to comply with the rules on ensuring that loads are safe, properly labelled and traceable. • The transport vehicles used will be fitted with means with which to take action in case of any accidental spillage.

Aspect	Management principle
Cumulative impact	• Monitoring of what happens to waste in order to anticipate any saturation of the facility. • The waste management plan will describe possible alternatives to the local facility, in anticipation of any saturation.

10.5.3 Transport management procedure

This section describes the principles to follow for the development of a Transport Management Procedure (TMP), notably associated with the following phases of the Project:

- Construction:
  - transport of construction equipment and machinery
  - transport of products and materials purchased or extracted locally, in the periphery of the Project area, to the construction site

- Operation:
  - transport to the Project area of technical supplies: chemicals, spare parts, equipment/tools for work on installations
  - fuel
  - maintenance equipment
  - workers transport

Table 10.4 Transport management principles

Aspect	Management principle
Condition of public roads used by vehicles for the Project	• A review will be carried out of regulations applicable to the transport of staff and goods on public roads, in order to provide a basis for regulatory conformity of transport activities, notably in terms of maximum axle loads authorised depending on the type of road taken. • Public road preservation measures specific to the Project will be implemented, notably: o Compliance with regulatory limits on vehicle axle loads o Compliance with Project speed limits on road and tracks o Transport of site machinery using flatbed trucks o Creating driver awareness of road driving that respects the state of roads and highways. • It may be necessary to improve certain sections of road or track, in agreement with local highway authorities.
Atmospheric emissions linked to car and truck traffic	• Vehicles used for the Project's construction phase must comply with the emission limit specifications identified by regulations and by international best practice. • The vehicles will be duly maintained by ContourGlobal - Cap des Biches and its sub-contractors, in order to ensure correct functioning of their engines and their exhaust fume filtering systems. • Measures to reduce fuel consumption and atmospheric emissions will be studied.

Aspect	Management principle
Site machinery traffic	• Safety measures will be implemented to ensure road user safety, notably: o The signalling of heavy vehicles using public roads (use of flashing lights and signs) o Escort of wide loads by escort vehicles, (leader cars and cars bringing up the rear) o Limitation of the weight and volume of loads to ensure good road stability o Coordination with local authorities to agree on routes to be taken, times and road safety measures to be implemented and intervention and coordination measures to be implemented in case of incident. • Where possible, ContourGlobal - Cap des Biches and its sub-contractors will ensure that vehicle loads are optimised, if necessary by means of loads shared between different Project operators in order to limit the number of vehicles to be mobilised.
Waste transport	• Any transport of waste, whether hazardous or not, will be undertaken in compliance with the waste management procedure, taking into account applicable regulations and international good practice relating to the packaging, packing, labelling and transportation of waste.
Parking on public roads	• Vehicles, particularly HGVs, which are stopped on public roads or in populated areas, must ensure that they are safely parked and do not obstruct the public highway.
Training	• Driving training will be provided to ContourGlobal - Cap des Biches and sub-contractor staff, to ensure that the drivers of vehicles and machinery working on the Project apply good road driving rules, in order to guarantee the safety of staff and third parties. • ContourGlobal - Cap des Biches and its sub-contractors will ensure that only staff who have taken road safety training and have reached the levels of competence required are authorised to drive the Project's vehicles and machinery. • In addition, all drivers must receive (at least): o Training that is specific to their type of vehicle o Defensive driving training o Driver training in driving rules to ensure the safety of off-site road users (for example pedestrians, farmers using the road to move their farm machinery, herdsmen moving their animals across the road).
Measures in case of accident	• In case of a traffic accident involving one of the Project's vehicles, the ContourGlobal - Cap des Biches manager in charge of activity supervision will inform emergency services as quickly as possible. These emergency services will be on the one hand the ContourGlobal - Cap des Biches emergency crew (working immediately, off the public highway) and on the other hand (on the public highway) public emergency services. Details of the incident or accident will be recorded in an accident report.

10.5.4 *Environmental emergency response plan in case of spillage*

Accidental events may result in various environmental impacts, such as, for example, uncontrolled spillages of hydrocarbons, chemicals or other hazardous waste, notably in case of:

- A leak or crack of the fuel oil supply pipe, a tank, vat or container
- A leak from a collection network
- An accident situation in the processing installations, during the operational phase, leading to the spillage of hydrocarbons, sludge or potentially contaminated water into the environment
- A traffic accident involving damage to a diesel tank or a fuel oil tank.

An emergency response plan in case of spillage will be implemented by ContourGlobal - Cap des Biches organising a systematic, quick and efficient response to any kind of emergency, accident situation or spillage of water contaminated by hydrocarbons, or of any other hazardous chemical product, in order to reduce/remedy potential damage to the environment and property. This plan must plan for immediate confinement of any spillage and rapid cleaning of any deteriorated area.

This procedure will define the roles and responsibilities of ContourGlobal - Cap des Biches staff and sub-contractors in the response process in case of accidental spillage. The location of intervention equipment and the contact details of trained staff must be clearly displayed.

The emergency response plan in case of spillage will include training and awareness, and will notably specify requirements terms of continuous staff training and the performance of periodic training exercises. It will also include provisions for the correct periodic verification and maintenance of intervention resources.

This procedure will be periodically audited and revised in order to ensure it remains relevant and operational throughout the Project's lifespan.

10.5.5 *Periodic audit and update of the ESMP*

Audit and review levels

The ESMP will be periodically audited and updated to ensure sustainability and continuous improvement throughout the Project, from detailed design phase to operational phase.

At corporate level, the ESMP will be reviewed within the context of ContourGlobal - Cap des Biches Project audits, focussing on risk identification, the ESMP, specific HSE standards and objectives and the reporting process for environmental indicators related to the Project. To ensure audit integrity it is preferable for audits to be carried out by staff members who do not work directly on the Project, or by specialised sub-contractors.

At operational level, a periodic audit programme will be drawn up and implemented aiming to check that the environmental management procedures specified in the ESMP are included in operational procedures, effectively implemented and that their results in terms of improving the environmental efficiency of activities are monitored over time. These audits will be scheduled and accompanied by the Project's environmental management team.

Within this context ContourGlobal - Cap des Biches will establish an audit schedule for the environmental management procedures used by sub-contractors involved with the Project, and their environmental performance. To this end all sub-contractors must draw up an internal verification programme, permitting continuous improvement of the ESMP at their level, between each audit.

Integration and use of results

The integration of audit and monitoring results will permit periodic evaluation of the relevance and adequate nature of the Project's ESMP. Any change to or adaptation of the ESMP will be the object of written tracking and an update of the checked version of the ESMP. Changes to the ESMP will be communicated to the Project team and their results will be evaluated during the next audits, in a continuous improvement cycle.

10.6 CLOSURE AND RESTORATION OF THE SITE AFTER OPERATIONS

The contract signed between ContourGlobal - Cap des Biches and SENELEC provides for operation of the power plant for 20 years. This duration could be extended depending on local electricity generation requirements and according to the national production strategy defined by SENELEC. The power plant will be subject to a Closure and Restoration Management Plan (CRMP). In compliance with the CRMP, ContourGlobal - Cap des Biches will implement the measures required to restore all sites at the end of the Project, and to ensure that environmental and social impacts associated with closure of the site are kept under control, in accordance with regulations and good practice.

In this respect, ContourGlobal - Cap des Biches will implement measures throughout operation of the power plant to ensure the absence of any deterioration of the site. If such an event, impacting the condition of the site, were to take place during the operational period, ContourGlobal - Cap des Biches would record it and the necessary investigations and remediation would be undertaken. In order to prevent any contamination of the soil and groundwater, various measures in terms of the storage and use of chemicals, lubricants and hydrocarbons, will be implemented.

10.6.1 *Integration of issues linked to closure – design phase*

The power plant has been designed for continuous operation whilst guaranteeing a relevant safety level. All the design studies for the power plant have included the good practices currently recognised in the industry. With the aim of minimising impacts linked to site closure, design of the power plant has taken into account and included the following aspects (this list is not exhaustive:

- Choice and use of materials
- Ease of replacement and dismantling
- Location of equipment
- Limitation of pollution accumulation, in waste water networks, for example
- Installation of secondary containment around tanks and storage areas
- Ease of operation
- Ease of cleaning

Pipelines carrying hydrocarbons will be either over ground or buried and fitted with a double skin or easy access, in accordance with international good practice, in order to allow any leak to be detected.

10.6.2 *Integration of issues linked to closure – operational phase*

ContourGlobal - Cap des Biches will adopt a series of measures during the operational phase in order to minimise site restoration requirements after operations are finished. The following measures in particular will be adopted:

- Confinement and appropriate management of chemicals, lubricants and hydrocarbons in order to minimise the risk of accidental leakage
- Development and maintenance of a drainage system in order to avoid, in the product spreading, in case of leakage, and contaminating surface water (including seawater) and groundwater
- Storage of anti-spillage kits in the storage areas and employees trained to use them.
- Management of sub-contractors during deliveries of chemicals, fuel oil and lubricants as well as during waste product collection
- Regular review of measures implemented for the storage, control and cleaning of chemicals, hydrocarbons and lubricants
- Adequate staff training.

10.6.3 *Site closure and restoration*

The CRMP will be established in agreement with SENELEC and the competent authorities, after a closure audit carried out according to national regulations or international good practice. This plan will be reviewed regularly throughout the project's various phases and updated in case of modification of operating conditions (change in fuel oil delivery method, …). Implementation of the measures described in the preceding paragraph will minimise any contamination of the environment. The management plan will detail the following:

- replacement or cleaning of pipelines and equipment if necessary and evacuation of any hazardous materials that they might contain
- plans of buried cables, pipelines and equipment
- site protection and surveillance programme, including soil sample analyses if necessary.

Content of the CRMP will be organised as follows:

- summary of scenarios envisaged in terms of site closure and restoration
- summary of applicable environmental recommendations (Senegalese and international)
- description of standards and criteria applicable to the site, after dismantling
- initial description of planned dismantling measures for the various site installations
- surveillance of the site after closure and requirements in terms of maintenance
- planned timetable for the dismantling of installations
- responsibilities it terms of dismantling and maintenance
- supervision of costs.

The CRMP will include the following appendices:

- cleaning, restoration and remediation methods
- erosion control
- treatment facilities for waste generated by site dismantling.

A report on cessation of activity will also be drafted after operations are ended, reporting on the condition of the site. This report will be communicated to the Environment Minister and to the ICPE supervisory Minister.

Before commencing dismantling operations, an evaluation of risks linked to these operations will be undertaken. This evaluation will address activities, risks and control measures, as well as the following points:

- consumables, chemicals, oils, lubricants …
- exposure to noise and control
- staff management
- handling and storage
- burns, cuts
- cleaning

- demolition
- site dismantling and cleaning
- evaluation of the presence of hazardous materials
- accidents and near-accidents
- loading and unloading
- elimination of waste and materials
- contaminated soils and materials
- health and safety.

Dismantling of the power plant will be carried out in compliance with good practice in force at the time of these operations. Operations to dismantle the power plant and its associated installations may lead to a risk of exposure to dust and hazardous and inflammable products. Infrastructures likely to present the greatest risks during their dismantling are as follows:

- fuel oil unloading area
- heavy fuel oil storage and service tanks
- oil storage tanks
- fire water tank
- pumping station
- sludge treatment area
- sludge tanks
- machines and engines room
- pipelines
- stacks

Exposure to the various hazards identified must be prevented by the implementation of suitable good practice, such as:

- staff training in the removal of potentially hazardous waste from tanks, equipment or contaminated soil
- staff training in the treatment and removal of potentially hazardous equipment (for example electrical or insulation equipment containing mercury)
- use of personal protection equipment (PPE) adapted and selected after risk evaluation such as, for example, gloves, eyewear and insulating respiratory apparatus
- implementation of a work permit system for work by hotspot or operations performed close to or on electrical equipment.

During the dismantling phase, all collections or removal of materials and waste will be recorded to ensure the traceability of these movements.

10.7 ENVIRONMENTAL SURVEILLANCE AND MONITORING PLAN

10.7.1 *Environmental surveillance*

The environmental report drawn up by the ContourGlobal - Cap des Biches HSE manager will act as the basis for environmental surveillance by the DEEC (particularly the "Pollution and Disturbance" division and the air quality management centre) and the DREEC, through the Environmental Monitoring Committee.

These Offices will also check on the installations, by means of regular visits to the worksite area (construction phase) and the power plant (operational phase) in order to ensure that the measures set forth in the ESMP are being properly complied with, and that annual reports are a good reflection of the actual situation at the site. Other regional offices, in particular the DEFCCS (Office for Water, Forests, Hunting and the Conservation of Soils), the Office for Civil Protection or the Stock Rearing Office will also be involved in surveillance of the power plant.

With the context of environmental surveillance, it is planned that the actions presented in *Table 10.5* will be carried out. The exact terms may be adapted however, depending on specific issues inherent to the various different Project phases (see *Section 10.4*).

Table 10.5 Environmental surveillance methods

	Construction phase	Operational phase
Report review	1 report at the end of the construction phase.	1 annual environmental monitoring report
Site visit	Up to one monthly visit involving the various Offices concerned with surveillance by turn (depending on the issues of the moment).	• Unannounced inspections. • About 1 visit per year to supplement/fine-tune the information presented in the annual report.

Requirements for institutional reinforcement of the Senegalese authorities in order to be able to carry out the surveillance action are identified in *Section 10.8.2* on the plan to reinforce capacities.

10.7.2 *Environmental monitoring*

The environmental and social management plan presented in *Section 10.4* comprises:

- Corrective measures intended to suppress or reduce potential impacts
- Monitoring measures aimed at ensuring the efficiency of corrective measures.

This environmental monitoring concerns the issues for which the Project's potential impacts, prior to mitigation, were relatively large. It aims to evaluate the efficiency of certain environmental measures and possibly to identify impacts whose scope is different to that anticipated.

An environmental monitoring plan will thus be implemented to enable regular monitoring of the Project's potential impacts, notably of ambient air quality, noise levels, quality of water discharged, groundwater and soils. The results of these specific measures will be integrated into the environmental annual report that will be reviewed by the Senegalese authorities. This plan is summarised in *Table 10.6* below.

Table 10.6 Environmental monitoring plan

Aspect	Type of monitoring / location	Method / indicators to follow	Periodicity	Implementation date
Air quality	Monitoring of the power plant's atmospheric emissions.	• Air quality monitoring (SO_2 and NO_2) will be taken by laying passive tubes. These tubes will be installed at the edge of the power plant and at the sensitive receptors identified as being vulnerable to possible impacts by the Project on air quality.	Monthly measurements: the tubes will be left for 4 weeks at each site identified, and then replaced.	Campaign to consolidate data from the baseline, prior to the operational phase (concomitant with the power plant's construction phase). Monitoring campaign during operations in "normal" mode as from start-up of the power plant.
Quality of water discharged	Sampling of effluent and laboratory analysis	• An analysis of effluent prior to discharge will be performed once a month. In case of discharge thought to be abnormal, the water will be recycled to the treatment plant and specific analyses will be performed. • Results of analyses performed after treatment will be recorded and measures will be taken in case of any excessive readings.	Sampling, and monthly analyses.	As from start-up of the power plant.

Groundwater quality	Monthly sampling via the network of piezometers. Monthly analysis of the quality of groundwater.	• An analysis of the quality of groundwater will be conducted once a month in order to detect potential contamination related to abnormal functioning of the facility. • The analysis results will be recorded and measures will be put in place only if exceedances are shown. • In the event of detection of a groundwater pollution, the Senegalese authorities will be informed.	Monthly sampling and analysis	As from start-up of the power plant.
Water consumption	Monitoring of water consumption to identify any over-consumption.	• Check and analysis of the HSE manger's reports on water consumption, in order to detect any abnormality.	Monthly check.	As from start-up of the power plant.
Acoustic environment	Noise levels monitoring in the environment.	Noise measurements: • At the site boundary • At the closest sensitive receptors (see points used in the baseline).	Every 6 months Additional measurements will be achieved in case of a complaint from a neighbour	As from start-up of the power plant.

Environmental monitoring will be carried out either by a specialised external company or internally by ContourGlobal - Cap des Biches technicians (measurement of air quality at stack output, for example). Roles and responsibilities will be specified at the same time as the monitoring and surveillance methods.

10.7.3 *Air quality measurements: proposal for monitoring areas*

Based on the preliminary results of the modelling of atmospheric emission impacts (Section 8.5), a monitoring campaign of air quality was achieved (NOx, NO_2 et SO_2) was undertaken by ContourGlobal - Cap des Biches at the end of the mon t of November 2014.

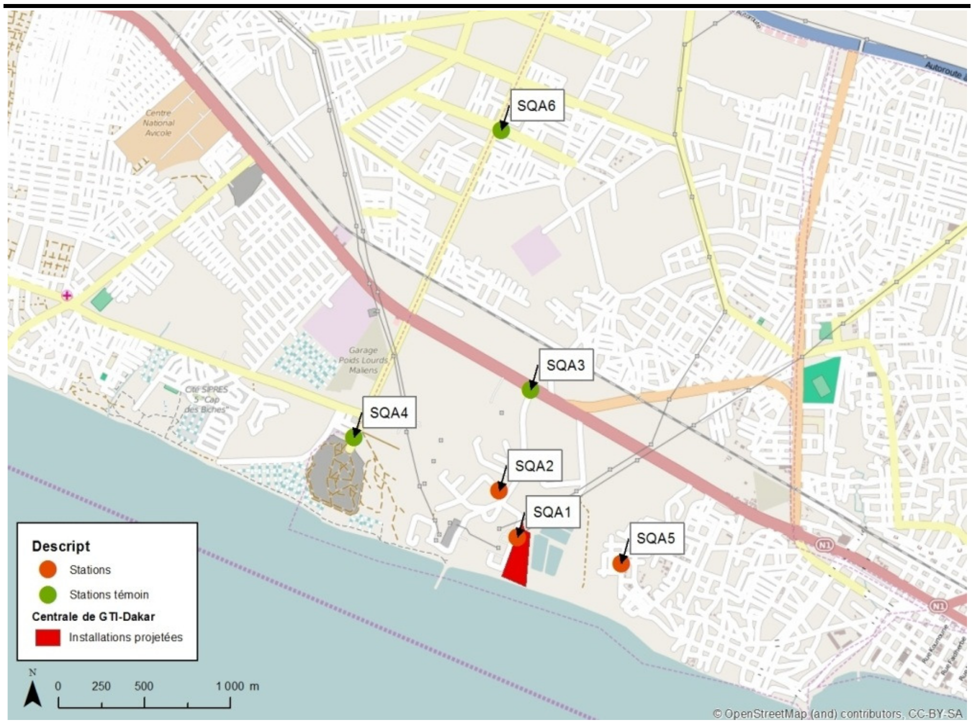
This campaign was conducted with diffusion tubes (passive sampling), left on the field during 4 weeks. Six sites were identified, with the support of technical services of the DEEC:

- 1 site (SQA1) at the boundaries of the Project implementation area and not related to the presence of a sensitive receptor;
- 2 sites (SQA2 and SQA5) located at sensitive receptors in the potential direct influence area of the Project with regards to air quality (distance less than 500m); and

- 3 sites (SQA3, SQA4 and SQA6) at sensitive receptors located more than 1 km from the project area (outside the potential area of influence).

The precise location of monitoring sites is shown on *Figure 10.2.*

Figure 10.2 ***Air quality monitoring proposition***



Source: *ERM, 2014*

Points SQA3, SQA4 and SQA6 will help to know the background concentrations of NO_2 and SO_2 in these inhabited areas that are not influenced by the existing facilities of SENELEC nor by tge future ContourGlobal - Cap des Biches plant (due to atmospheric dispersion conditions - see Section 5.3.7).

In case of exceedance of air quality standards, the Senegalese authorities will be informed in order to define an appropriate response, taking into account all sources of emissions in the area (especially SENELEC facilities). The monitoring approach and information will be coordinated by the authorities

10.8 ENVIRONMENTAL AWARENESS AND INSTITUTIONAL CAPACITIES REINFORCEMENT PLAN

10.8.1 *ContourGlobal - Cap des Biches staff awareness*

Staff training in issues relating to environmental management, industrial hygiene and work station safety is an important element on which the Project's ability to meet the relevant HSE standards depends.

Training is required at ContourGlobal - Cap des Biches in order to maintain a high level of knowledge of HSE procedures and standards, commensurate with the environmental management objectives and plan.

Recommended training modules could cover:

- The understanding of environmental sensitivities and risks associated with the Project

- The understanding of mitigation measures in the design and creation of the Project

- The understanding of adequate procedures for the use and handling of chemicals and of waste management procedures

- Awareness of individual responsibilities and the team's responsibility when the environmental management plan is implemented, and training in application of its procedures

- Knowledge of, and training in, emergency procedures.

Other subjects could be defined depending on staff competencies at various work stations and their hierarchical levels.

In parallel to this internal training policy for ContourGlobal - Cap des Biches staff and sub-contractors, there will also be some communication actions with village communities around the site. These awareness actions, which are measures to accompany the Project's residual impacts, were presented in *Section 10.4*. The main topics that will be addressed may concern the following elements:

- HIV/AIDS prevention
- Road safety prevention
- Awareness in case of incident (in relation with the power plant's IPP and IOP).

10.8.2 Possible reinforcement of the capacities of authorities responsible for environmental surveillance

As indicated in *Sections 10.4* and *10.7.1*, several Senegalese administrative entities (particularly the DEEC and the DREEC) will be involved in the Project's environmental surveillance.

Similar environmental surveillance is already being undertaken by the DEEC at the Kounoune power plant and at other power plants in the country.

In the Project's case, it should be noted that DEEC staff, particularly from the "Pollution and Disturbance" Division (which will coordinate the majority of action linked to environmental surveillance) and from the Air Quality

Management Centre (CGQA), are relatively used to monitoring thermal electricity generation plants, in view of the existence of several installations of this type (particularly in the Cap des Biches area).

However, a need to reinforce the capacities of the DEEC ("Pollution and Disturbance" Division and CGQA) in terms of atmospheric discharge and noise surveillance has been identified. If it takes place, this reinforcement must take into account complementarity between national and regional levels, by also involving the DREEC. ContourGlobal - Cap des Biches and DEEC can work together in order to specify the details of these requirements and make them official (training sessions and supply of equipment) and to define implementation responsibilities.

In this respect ContourGlobal - Cap des Biches could contribute to the acquisition of measurement equipment (sonometer, hydrocarbon analysis kit, etc.) up to an amount of 15 000 000 CFA francs.

Alongside this support, support linked to actual implementation of external monitoring could be provided. This support could involve:

- Review of reports: help with the interpretation of environmental monitoring results with intervention by a specialised service provider during the first two years of plant operation, to give enough time for the Senegalese authorities to increase their skills.
- Visit to the site:
    - Help with the performance of control measurements with intervention by a specialised service provider (cost already included in external monitoring – see *Chapter 10.4*)
    - Provision of logistic requirements for these visits (cost already included in external monitoring – see *Chapter 10.4*)

Costs associated with support for the authorities within the context of external monitoring are estimated at:
- Intervention by a specialised service provider (help with report review): 10 days' work per year, i.e. 5 000 000 CFA F per year, for a period of 2 years.
- Intervention by a specialised service provider (help with the performance of measurements on site): 4 000 000 CFA F / year an (cost already included in external monitoring – see *Chapter 10.4*).
- Provision of logistic requirements (cost already included in external monitoring – see *Chapter 10.4*).

These elements must be taken into account if a protocol of cooperation is defined with a view to institutional support for the Senegalese authorities in charge of the project, if this protocol is defined between the Promoter and the DEEC.

10.9 ESMP IMPLEMENTATION PLAN

10.9.1 Responsibilities

Aim

This section describes the organisation of environmental and social management for application of the ESMP during the various phase of the Project.

Project Promoter

As Project promoter and owner, ContourGlobal - Cap des Biches will take general responsibility for correct application of the ESMP. ContourGlobal - Cap des Biches will mandate an environmental and social manager, with a sufficient level of authority and resources to supervise correct application of the ESMP.

The ContourGlobal - Cap des Biches HSE manager will be notably responsible for:

- Implementing and monitoring the Project's environmental and social management measures
- Coordinating sub-contractors of second and third levels with regard to ESMP requirements
- Reacting to the results of site inspections
- Supervising the reception, registration and processing of any complaint brought by external parties.

Alongside these internal monitoring activities the HSE manager will draw up an annual environmental report presenting the various monitoring indicators defined in the ESMP as well as any deviations observed. This environmental report will act as a basis for the environmental surveillance that will be carried out by the Senegalese authorities during installation inspections.

Contractors and sub-contractors working on the Project

During the construction phase, ContourGlobal - Cap des Biches will hire contractors to provide services of a technical nature and to carry out construction work at the power plant. They will be responsible for the implementation of all the mitigation measures specified in the ESMP.

They will also be responsible for continuous management of potential environmental and social impacts associated with their activities within the context of their mandate from ContourGlobal - Cap des Biches, whether these activities are carried out by them or by their sub-contractors.

10.9.2 *Implementation deadlines*

Some measures described in the ESMP will be implemented right from the start of the construction phase, whilst others will only be implemented once the operational phase has begun. Implementation details are given in the impacts reduction plan in *Section 10.4.*

10.9.3 *Budget*

The budget for each management measure presented in *Section 10.4* includes the costs of implementing the measure and those of internal monitoring. Costs associated with environmental surveillance (external monitoring) are also estimated, for information. These estimates are still to be fine-tuned, they are based on the costs of equipment and salaries at the time of writing this ESIA.

Some of these mitigation measures have been implemented during the project conception phase. For those measures, the associated costs are included in the investment costs (CAPEX) and in the operational costs (OPEX). Costs relating to the ESMP implementation within CAPEX and OPEX budgets have not been integrated in this study. Consequently, the estimated budget detailed in this ESIA underestimates the real cost of the measures that will be implemented at the site for the Project.

Estimated budget for the implementation of mitigation measures that have not been taken into account during the conception phase is presented in the *Table 10.7*. Estimated costs for external monitoring correspond both to logistic support with travel by authorities and to the sub-contracting of certain monitoring activities to specialised experts as well as technical support (acquisition of equipment and training).

Table 10.7 Budget for ESMP implementation

<table>
<tr><th colspan="2">Project phase</th><th>Measure implementation</th><th>Internal follow up</th><th>External folllow up</th></tr>
<tr><td colspan="2">Construction</td><td>20 000 000 F CFA</td><td>12 270 000 F CFA</td><td>250 000 F CFA every two months ie 1 375 000 F CFA (duration 11 month)</td></tr>
<tr><td rowspan="3">Operation</td><td>Total cost</td><td>34 200 000 F CFA</td><td>-</td><td>15 000 000 F CFA</td></tr>
<tr><td rowspan="2">Annual cost</td><td rowspan="2">16 610 000 F CFA</td><td rowspan="2">12 360 000 F CFA</td><td>10 050 000 F CFA /year for the two first years, including support for annual reports drafting</td></tr>
<tr><td>then 5 050 000 F CFA the following years, including support from a specialized subcontractor</td></tr>
</table>

11 GENERAL CONCLUSION

This report presents the conclusions of an Environmental and Social Impact Assessment study undertaken for the ContourGlobal - Cap des Biches's Project to revamp and modify a thermal power plant located at Cap des Biches. The power production process of the new facility will implement a recent technology, different from the one initially implemented between 2000 and 2013. This new technology will allow limiting the project interactions with environment in particular with the marine environment. In addition, some existing equipment will be refurbished and reused in the new facility.

Data sources that were used for this study include:

- secondary sources, notably technical documents linked to the project and drawn up by ContourGlobal - Cap des Biches, studies undertaken for other projects in the region, statistics issued by Senegalese ministries, publications of international organizations or research centers ;
- examination of the legislation, of international policies and standards connected to the Project implementation;
- two visits in the Project area to validate and complete available data related to environmental and social aspects of the Project ; and
- outputs of public in-depth information and consultation process. During this process, stakeholders had the opportunities to ask questions and to share their concerns related to the Project and to the ESIA implementation.

Based on the data collected and the Project characteristics, potential impacts associated with the power plant construction and operation have been identified, and in particular for air quality, ambient noise, wastewater discharge and waste disposal. To limit these impacts, mitigations measures to eliminate or reduce them have been defined. These measures have been integrated in an Environmental and Social Management Plan (ESMP). This plan will be implemented and followed up during the construction and operation phases of the Project. Regular monitoring of the results of the ESMP implementation will be undertaken and these results will be compared to the Senegalese legislation and international standards requirements. The monitoring plan will be implemented by both ContourGlobal - Cap des Biches and Senegalese authorities within the framework of their environmental surveillance activities.

Based on the conclusions of this ESIA study, international experts in charge of the ESIA implementation consider that the ContourGlobal - Cap des Biches Project, as described in the ESIA report, follow the best international practices and is acceptable with regards to the environmental and social Senegalese legislation requirements.

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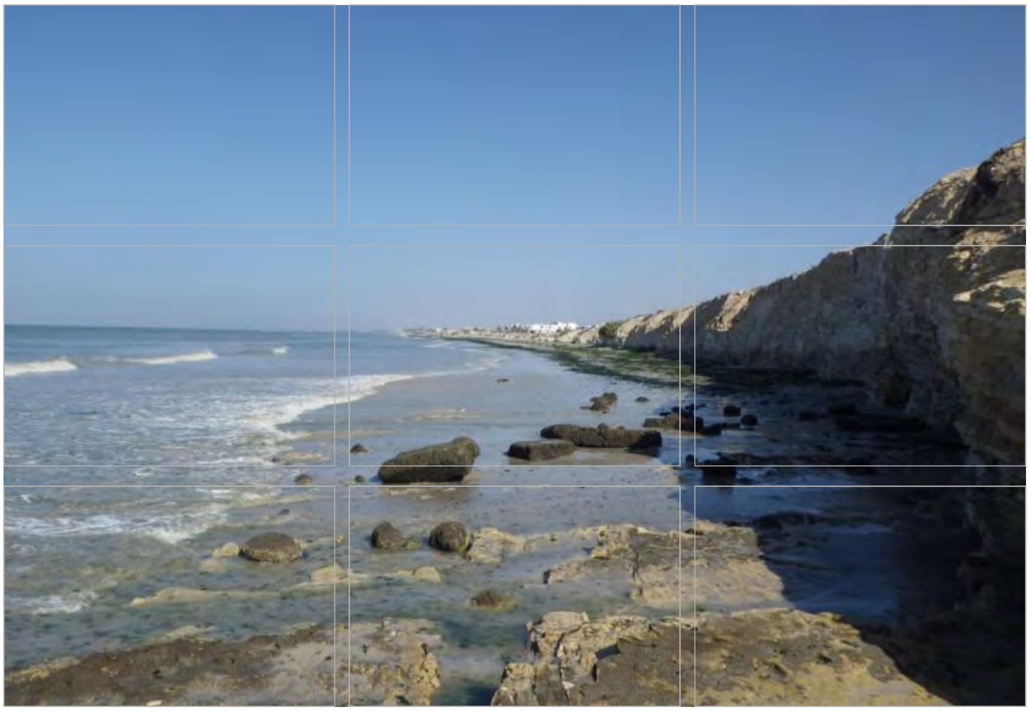
ANNEXE 1: ESIA TERMS OF REFERENCE



GTI DAKAR PRODUCTEUR INDEPENDANT D'ELECTRICITE

Termes de Référence de l'étude d'impact environnemental et social –

Réhabilitation et modification de la centrale thermique de GTI-Dakar à Cap des Biches, Rufisque

Septembre 2014

ERM

Delivering sustainable solutions in a more competitive world

GTI-Dakar

Termes de Référence de l'étude d'impact environnemental et social du projet de réhabilitation et modification de la centrale thermique de GTI-Dakar à Cap des Biches, Rufisque

Réalisé en collaboration avec le bureau d'études 2iEC, Dakar

Septembre 2014

Référence ERM : GMS 0251196

Pour Environmental Resources Management

Approuvé par : Camille Maclet, Associé

Signature: 

Date: 02 Septembre 2014

TABLE DES MATIERES

1 INTRODUCTION

Ce document présente les termes de référence (TdR) de l'étude d'impact environnemental et social (EIES) du projet de modification de la centrale électrique de Gti Dakar à Cap des Biches (ci-après 'le Projet '), conformément à l'arrêté ministériel n° 9471 MJEHP – DEEC du 28 novembre 2001 portant contenu des termes de références des études d'impact. Ces TdR représentent la première phase de la procédure de demande de renouvellement de l'autorisation d'exploiter les installations de production d'électricité. Ils précisent la portée et le contenu de l'EIES devant être réalisée pour le Projet, et devront être validés par la Direction de l'Environnement et des Etablissements Classés (DEEC) qui est sous l'autorité du Ministère de l'Environnement et de la Protection de la Nature.

1.1 PRESENTATION GENERALE DU PROJET

La société GTI-Dakar possède une centrale thermique de production d'électricité de 52 MW située à Cap des Biches, Rufisque. L'autorisation d'exploiter la centrale électrique a été accordée à GTI-Dakar par l'arrêté ministériel n°006562/MEPN/MEMI/DEEC du 19 août 1998, et la production d'électricité a débuté en décembre 2000. L'installation est inscrite sous le numéro 4221 du Registre Spécial des Installations Classées.

Le Projet développé par GTI-Dakar consiste en la réhabilitation et modification de la centrale existante, arrêtée depuis juillet 2013. Ce projet a été défini en accord avec la SENELEC, en fonction des projections de production au niveau régional et national, et à moyen et long terme.

Les modifications envisagées comprennent d'une part le remplacement des équipements principaux de production d'électricité (turbines, chaudières, système de refroidissement) par d'autres équipements récents et de technologie différentes (moteurs diesels associés à un cycle combiné) et d'autre part la réhabilitation d'équipements existants, notamment des réservoirs de stockage des combustibles, etc.

La nouvelle technologie repose sur la mise en œuvre de trois moteurs diesel de 16,5 MW qui, associés à une chaudière de récupération de chaleur débitant sur une turbine à vapeur de 3,5 MW, peuvent fonctionner en cycle combiné (puissance totale de la centrale : 53 MW). A noter que cette modification du procédé de production d'électricité permet une réduction très significative des prélèvements et rejets dans le milieu marin associés à la configuration actuelle de la centrale.

Le descriptif précis de la situation actuelle de la centrale et des améliorations envisagées est présenté au *Chapitre 4.2.1*.

1.2 *BUREAUX D'ETUDE EN CHARGE DE L'EIES*

GTI-Dakar a mandaté Environmental Resources Management (''ERM'') qui s'est associé à 2iEC, pour travailler en partenariat à la réalisation l'EIES du Projet. M. Oumar Karamoko Ndiaye, Directeur de 2iEC, est agréé par les autorités sénégalaises pour la réalisation des études d'impact sur l'environnement conformément à l'arrêté ministériel n°9470 MJEHP/DEEC du 28 novembre 2001.

2 OBJECTIFS DE L'EIES

2.1 PRINCIPE

La procédure d'EIES est réglementée par les Articles L48 à L54 du Chapitre V de la loi N° 2001 - 01 du 15 Janvier 2001 portant code de l'environnement.

Tout projet, quel qu'il soit, implique une modification de l'état initial de sa zone d'implantation. L'objectif principal d'une EIES est d'évaluer quels seront les impacts induits par les modifications liées à ce projet, et de déterminer si ces impacts sont acceptables d'un point de vue environnemental et social.

L'objectif de la procédure EIES est donc d'évaluer les impacts potentiels d'un projet susceptibles d'affecter l'environnement biophysique, humain et socioéconomique. Les mesures d'atténuation appropriées identifiées dans le cadre de la procédure EIES sont destinées à supprimer, réduire voire compenser les impacts négatifs du projet. La pertinence de ces mesures sera évaluée au regard de leur capacité à limiter les impacts négatifs et à maximiser les impacts positifs du projet proposé.

2.2 DEMARCHE D'ELABORATION DE L'EIES

La démarche d'élaboration de l'EIES doit permettre d'apporter les éléments de réponses aux thématiques listées ci-dessous :

- description du milieu récepteur, avec une attention particulière portée à la sensibilité environnementale et sociale de la zone d'étude ;
- identification de toutes les installations classées prévues dans le cadre des phases de préparation et d'exploitation du Projet, et description des enjeux environnementaux liés à ces aménagements/installations ;
- identification des impacts potentiels liés au projet et évaluation quantitative et/ou qualitative de leur incidence supposée ;
- élaboration d'un plan de gestion environnementale afin de supprimer, réduire voire compenser les impacts négatifs mis en évidence et d'optimiser les impacts positifs en prenant en compte l'avis des parties intéressées ;
- définition des grandes lignes de la surveillance environnementale et des indicateurs de suivi environnemental à mettre en œuvre suite à l'implantation du projet ; et
- identification des obligations réglementaires à respecter pendant les phases de l'exploitation.

3 ZONE DU PROJET ET PERIMETRE D'ETUDE

Zone du Projet

La zone d'implantation du Projet est localisée au sein de la zone industrielle de Cap des Biches, dans la ville de Rufisque, dans le département du même nom (cf. *Figure 3.1*). La nouvelle centrale sera installée sur un terrain de 2,99 ha adjacent au site initial d'implantation (d'une surface de 2,5 ha) et représenté sur la *Figure 3.2*. Ce site est composé de deux parcelles ayant des statuts cadastraux différents :

- un Titre Non-Immatriculé (TNI) sous la compétence de la commune de Rufisque (surface : environ 1,84 ha) ; ce terrain a été attribué à la SENELEC qui le transfèrera à GTI-Dakar en amont de la phase de travaux au travers d'un bail emphytéotique ;
- un terrain de 1,15 ha environ, faisant partie du Domaine Public Maritime (DPM) ; les démarches visant à octroyer ce terrain à la SENELEC sont en cours auprès du Ministère de l'Economie et des Finances.

Figure 3.1 Localisation de la zone du Projet : vue large

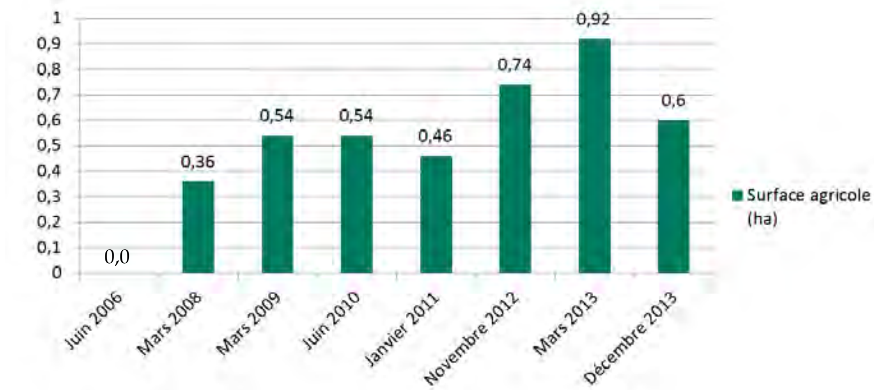
Figure 3.2 *Site d'implantation des nouveaux équipements*

Rouge : site des installations existantes / bleu : nouveau site

La partie nord du TNI est utilisée à des fins agricoles (maraîchage) sur une surface variable (0,3 à 0,9 ha environ selon les années - cf. *Figure 3.3*). La SENELEC et GTI-Dakar ont mené des discussions avec le cultivateur qui exploite ce terrain, sous le contrôle des autorités locales, afin de mettre en place une procédure de compensation comme requis par la réglementation sénégalaise et préconisé par les bonnes pratiques internationales. Ces discussions ont abouti à la signature par l'ensemble des parties d'un rapport d'estimation des impenses, entérinant ainsi l'attribution du TNI à la SENELEC.

On peut également noter que le terrain situé à l'est du nouveau site est un bassin faisant partie de la Station d'Epuration des Eaux de la commune de Rufisque.

Figure 3.3 Evolution de la surface agricole sur le nouveau site



Source : ERM d'après une analyse d'images satellites

Périmètre d'étude

Une description précise du périmètre d'étude sera incluse dans le rapport d'EIES et présentera en détail les impacts potentiels du Projet qui ont pu être identifiés ainsi que les études connexes menées dans le but d'atténuer les impacts.

Le périmètre d'étude correspond aux zones d'influence potentielles des travaux et des activités de la future centrale. L'EIES portera sur les zones d'influence directe et indirecte du projet et celles où des enjeux environnementaux et sociaux potentiels importants auront été identifiés. Les activités développées dans l'environnement direct et aux alentours de la centrale seront également pris en compte. Les zones d'influence marine et terrestre potentielles sont détaillées ci-après.

A noter que ce périmètre d'étude pourra être adapté en fonction des thématiques étudiées lors de l'EIES, en particulier dans les cas suivants :

- Etude de l'émergence sonore et de la qualité de l'air : étude au niveau des récepteurs humains les plus proches et les plus sensibles, afin de prendre en compte les conditions les plus pénalisantes dans l'évaluation de l'impact.
- Etude du milieu physique (pédologie, géologie, climat) : zone d'étude élargie couvrant les variations normales de chaque paramètre, et en fonction des données disponibles au plus proche de la zone du Projet.
- Environnement humain : les données socio-économiques primaires et secondaires seront récoltées autant que possible au niveau local, afin de disposer de données spécifiques au contexte de la zone d'étude ; ces données seront mises en lumière avec des données régionales et nationales le cas échéant.
- Consultations des parties prenantes : des réunions d'information et d'échange seront organisées à l'échelle locale (Communautés urbaines et

quartiers), régionale (Préfecture, Directions départementales et régionales, etc.) et nationale (Ministère et Directions nationales).

Le retour d'expérience de l'exploitation de la centrale dans sa configuration initiale a permis de déterminer deux types de zones d'influence : terrestre et marine.

Zone d'influence marine

L'influence potentielle du Projet sur le milieu marin sera principalement liée aux rejets d'eau de mer réchauffée après le refroidissement de la turbine de 3,5MW. Ceux-ci seront très limités, en comparaison avec les volumes utilisés pour un fonctionnement en cycle combiné dans la configuration actuelle.

La dispersion des rejets en milieu marin est principalement liée aux courants côtiers au niveau de la zone de Cap des Biches, qui varient en fonction des saisons :

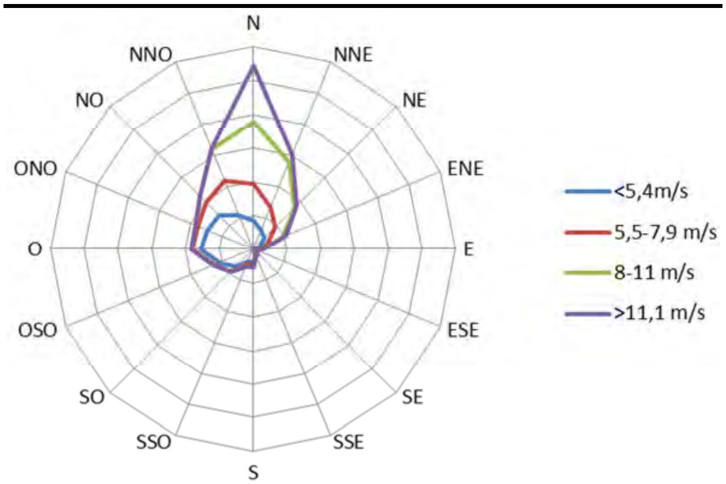
- de décembre à avril : courant parallèle à la côte, majoritairement vers le sud, principalement influencé par les alizés soufflant à cette période ; et
- de mai à novembre : courant parallèle à la côte, majoritairement vers le nord, principalement influencé par le vent de mousson.

Afin de prendre en compte ces phénomènes saisonniers influençant directement la dispersion des rejets liquides en milieu marin, il est proposé de considérer une zone côtière de 1 km de part et d'autre de la zone du Projet, jusqu'à une distance de 1 km vers le large. Cette zone d'étude du milieu marin est considérée comme enveloppe de la zone d'influence du Projet.

Zone d'influence terrestre

La zone d'influence terrestre potentielle du Projet est principalement liée aux rejets gazeux. D'après la rose des vents au niveau de la zone de Dakar, présentée à la *Figure 3.4*, les vents soufflent majoritairement depuis le nord, si bien que la dispersion atmosphérique se fait principalement en direction du sud.

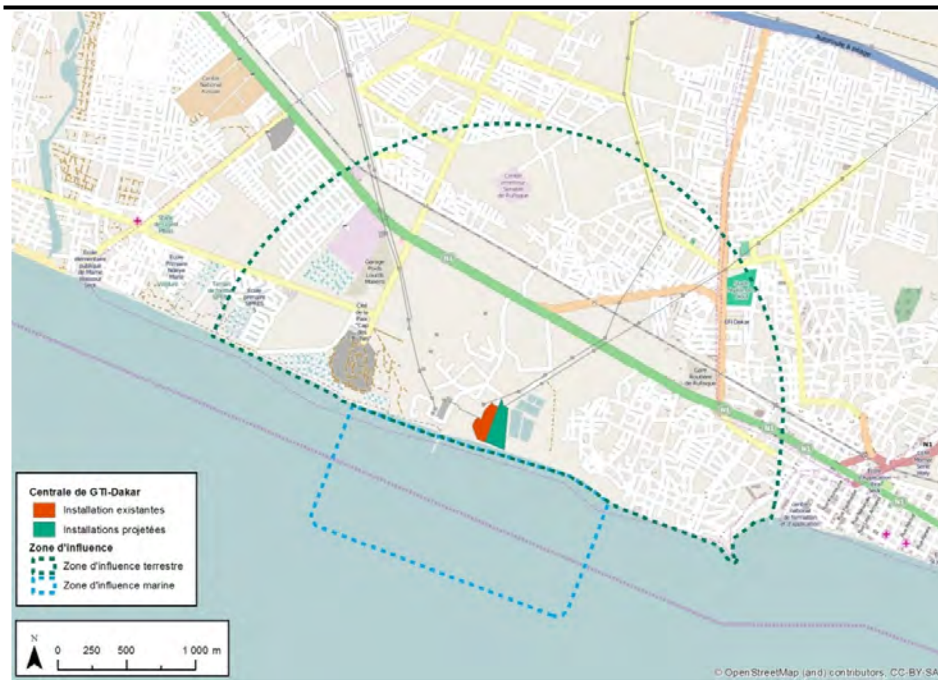
Figure 3.4 Rose des vents au niveau de l'aéroport de Dakar



D'après les résultats de la modélisation initialement réalisée en amont de la construction de la centrale actuelle (*ERM, 1997*), la zone d'impact potentiel sur la qualité de l'air est inférieure à 2 km. Il est proposé de conserver une zone identique, dans le cadre du Projet. Les nouvelles modélisations qui seront réalisées dans le cadre de la réalisation de l'EIES permettront d'affiner cette zone d'influence potentielle.

Les zones d'influence marine et terrestre potentielles sont présentées à la *Figure 3.5*.

Figure 3.5 Zones d'influence potentielle du Projet (évaluation préliminaire)



4 *CONTENU DE L'ETUDE PROPOSEE ET PREMIERS ELEMENTS DE CADRAGE*

4.1 *CONTENU DE L'ETUDE PROPOSEE*

Organisation du rapport

L'organisation du rapport final de l'EIES sera fondée sur l'organisation définie dans la législation environnementale et sociale sénégalaise. Les sections et chapitres suivants seront intégrés dans le rapport :

- résumé non technique ;
- introduction ;
- description et justification du projet ;
- analyse du cadre réglementaire et institutionnel de l'étude ;
- analyse de l'état initial du site et de son environnement ;
- description et analyse des variantes du projet ;
- consultation publique ;
- identification et évaluation des impacts probables liés au projet ;
- étude de danger et évaluation des risques professionnels ;
- plan de gestion et de suivi environnemental et social ; et
- conclusions générale.

Plusieurs annexes seront également intégrées au rapport, parmi lesquelles :
- une liste des abréviations utilisées dans le rapport ;
- la liste des experts ayant participé à l'élaboration de l'EIES ;
- les références bibliographiques ;
- le détail des personnes et entités consultées ;
- les présents TdR, ainsi que le courrier d'observations de la DEEC ; et
- des plans de situation.

Etudes techniques

Plusieurs études techniques, focalisées sur les principales nuisances potentielles associées à ce type d'installation, seront réalisées dans le cadre de la démarche d'EIES : une modélisation de la qualité de l'air et de la dispersion atmosphérique, une modélisation des nuisances sonores ainsi qu'une étude de danger et une évaluation des risques professionnels. Les résultats de ces études seront intégrés au rapport d'EIES.

Chapitres additionnels inclus dans le rapport de l'EIES

Les chapitres suivants seront également intégrés au rapport d'EIES :

- liste d'abréviations et d'acronymes ;
- résultats complets des études techniques (modélisation de la dispersion atmosphérique et modélisation des niveaux de bruits induits par le Projet) ;

- liste des consultants impliqués dans l'étude d'EIES ;
- bibliographie et références ; et
- liste des personnes rencontrées pendant la procédure EIES.

Dépôt du rapport d'EIES

Le rapport provisoire de l'EIES sera déposé en trente-cinq exemplaires à la Direction de l'Environnement et des Etablissements Classés (DEEC), qui convoquera les membres du Comité Technique Régional à une réunion de pré-validation.

Suite à la pré-validation, GTI-Dakar organisera une séance d'audience publique, avec l'appui de la DEEC et en conformité avec les directives du Code de l'Environnement du Sénégal en la matière.

Le rapport final de l'étude, après intégration des observations, sera déposé en cinq exemplaires à la Direction de l'Environnement et des Etablissements Classés en plus d'une copie électronique.

4.2 *ELEMENTS DE CADRAGE RELATIFS AU PROJET*

4.2.1 *Description du projet*

Contexte actuel des installations

La société GTI-Dakar est propriétaire d'une centrale thermique de 52 MW située à Cap des Biches sur la commune de Rufisque. L'autorisation d'exploiter la centrale a été accordée à GTI-Dakar par l'arrêté ministériel n°006562/MEPN/MEMI/DEEC du 19 août 1998 (cf. *Annexe 1*), et la production d'électricité a débuté en décembre 2000. Cette centrale a été mise à l'arrêt en 2013. L'installation est inscrite sous le numéro 4221 du Registre Spécial des Installations Classées.

Il s'agit d'une centrale thermique à cycle combiné pouvant fonctionner au diesel ou au naphta. Elle est composée d'une turbine à combustion (TAC) associée à une turbine à vapeur (TAV) pouvant fonctionner soit en cycle simple (uniquement la TAC) avec une capacité de 35 MW, soit en cycle combiné (TAC + TAV) avec une capacité maximale de 52 MW. Le site couvre une surface de 2,5 ha et regroupe les installations suivantes :

- Ouvrages amont : déchargement et stockage du combustible, réservoir d'eau brute, station de pompage eau de mer ;
- Ouvrages de production : turbine à combustion (TAC), couplée à un alternateur, turbine à vapeur (TAV), couplée à un alternateur, chaudière de récupération de la chaleur des gaz d'échappement de la TAC permettant la production de vapeur, système de refroidissement de la TAV utilisant de l'eau de mer, système de refroidissement de la TAC par l'air, cheminées

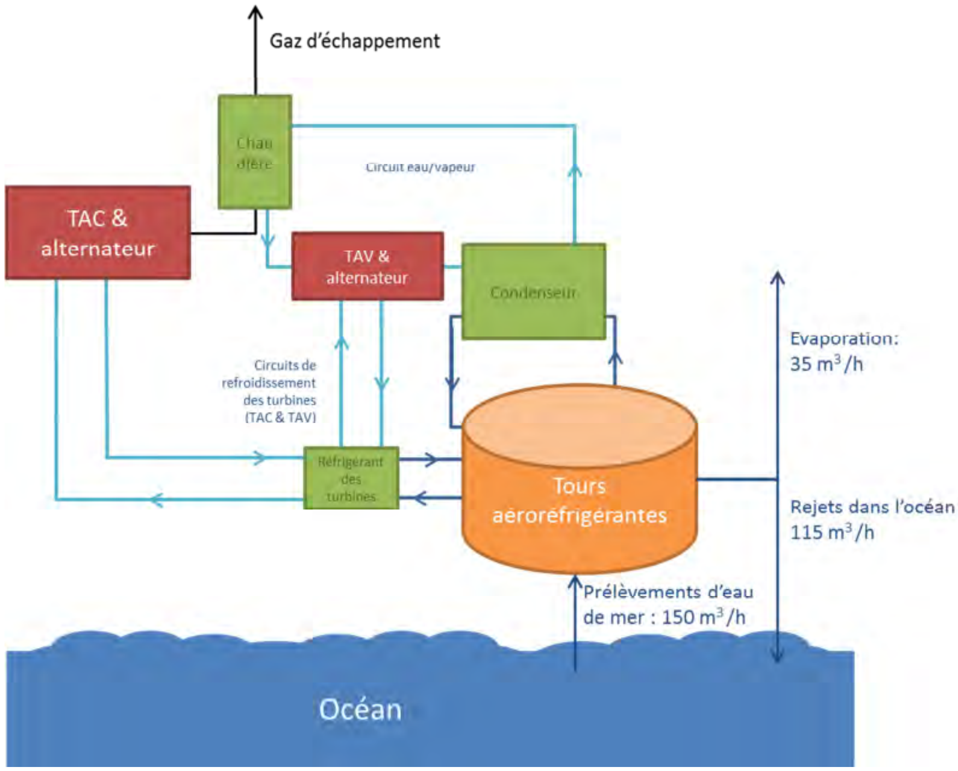
d'évacuation des gaz de combustion (une pour le fonctionnement en cycle combiné et l'autre pour le fonctionnement en cycle simple) ;

- Systèmes auxiliaires : unité de déminéralisation de l'eau et de stockage d'eau déminéralisée, unité de production d'air comprimé, système de protection incendie, générateur électrique de secours, système de séparation eau / huile avant rejet en mer ;
- Ouvrages aval : transformateur 11/90 kV et poste électrique haute tension, pour l'évacuation de l'énergie sur le réseau de la SENELEC ; et
- Bâtiments, comprenant en particulier : la salle de commande, la salle des auxiliaires électriques, la salle des protections, les bureaux d'exploitation, les ateliers, magasins, entrepôts de produits chimiques.

L'eau de mer nécessaire au refroidissement de la TAV est prélevée via le canal d'amenée des centrales existantes de la SENELEC et est rejetée par un canal de rejet commun avec les centrales de la SENELEC. La localisation de ces différentes installations est présentée à la *Figure 4.1* ; la *Figure 4.2* présente le principe de refroidissement de la centrale actuelle lors des phases de fonctionnement en cycle combiné.

Figure 4.1 Principales installations de la centrale thermique existante

Figure 4.2 *Schéma de principe du système de refroidissement du cycle combiné – centrale actuelle*



La proximité avec l'océan, induisant une atmosphère salée corrosive, ainsi que certains retards dans le gros entretien des installations ont entrainé une détérioration rapide de celles-ci. C'est ainsi que la chaudière de récupération de chaleur et la TAV ont dû être mises hors-service en mars 2011 et que la TAG n'a pu être maintenue en fonctionnement qu'avec de sévères limitations. En juillet 2013, la TAG a été complètement arrêtée pour des raisons de sécurité, le diagnostic ayant révélé une détérioration importante de plusieurs des composantes en rotation de la turbine. GTI-Dakar a alors décidé de ne pas redémarrer la production mais de procéder à une remise à niveau complète des installations, en coordination avec la SENELEC.

Conformité des installations existantes vis-à-vis de la réglementation sénégalaise

Le rapport d'EIES présentera un état des lieux de la conformité des équipements existants par rapport à la réglementation sénégalaise. Un focus sera fait sur les équipements qui seront réutilisés dans le cadre de la réhabilitation.

Réhabilitation envisagée

Une réhabilitation intégrale de la centrale a initialement été envisagée. Toutefois, le coût lié à la réhabilitation, associé au surcoût induit par l'utilisation d'un combustible particulièrement onéreux, le diesel, ont conduit à abandonner cette solution. SENELEC et GTI-Dakar ont donc recherché des solutions alternatives et celle qui s'est très vite imposée a été de mettre en œuvre des moteurs diesel permettant un fonctionnement au fioul lourd et facilement convertibles pour un fonctionnement au gaz, lorsque le gaz sera disponible en quantités et qualité suffisantes.

Trois nouveaux moteurs seront donc installés, d'une capacité unitaire de 16,5 MW. Ils seront associés à un système dénommé « flexicycle » permettant d'augmenter notablement la puissance maximale disponible et le rendement de l'installation. Ce système consiste à installer, sur chaque cheminée d'échappement des moteurs, une petite chaudière de récupération de chaleur débitant sur une turbine à vapeur. Le « cycle combiné » ainsi constitué augmente de 3,5 MW la puissance maximale de la centrale, la portant à 53 MW soit l'équivalent de la puissance de l'ancienne centrale mise à l'arrêt.

Cette nouvelle installation réutilisera une partie des équipements de la centrale existante, en particulier :

- le transformateur et la connexion au réseau électrique ;
- les bureaux ;
- certains systèmes auxiliaires tels que le système de production d'eau déminéralisée et les compresseurs pour la production d'air comprimé ; et
- les équipements de stockage : stockage de carburant, stockage d'eau brute, d'eau déminéralisée et d'eau du système incendie.

Principales modifications par rapport à la situation initiale

Les principales modifications entre la situation future, constituant le projet, et la configuration initiale et actuelle sont liées au procédé de production d'électricité. Elles sont présentées dans la *Table 4.1* ci-après.

Table 4.1 Principales évolutions des intrants et sortants

Caractéristiques	Configuration initiale	De 2011 à 2013	Configuration future proposée
Capacité de production	52 MWe	35 MWe	53 MWe
Combustible utilisé	Diesel et naphta	Diesel	Fioul lourd
Système de refroidissement	Tours aéroréfrigérantes (eau de mer)	Air ou tours aéroréfrigérantes (eau de mer)	Air
Utilisation d'eau déminéralisée	Circuits fermés de réfrigération	Circuits fermés de réfrigération	Autre (quantité limitée)
Provenance et utilisation d'eau brute	SDE ; Réfrigération	SDE ; Réfrigération	SDE ; Autre (quantité limitée)
Utilisation d'eau de mer	Système de refroidissement	Système de refroidissement	Aucune
Effluents	• Gazeux • Liquides (en mer) : eau de refroidissement, eaux pluviales, eaux des séparateurs des rejets huileux	• Gazeux • Liquides (en mer) : eau de refroidissement, eaux pluviales, eaux des séparateurs des rejets huileux	• Gazeux • Liquides (en mer) : eaux pluviales, eaux des séparateurs des rejets huileux

Caractéristiques	Configuration initiale	De 2011 à 2013	Configuration future proposée
Déchets spéciaux	Déchets huileux	Déchets huileux	Déchets huileux et boues du fioul lourd

Installations existantes non-réutilisées dans le cadre du Projet

Comme précisé précédemment, une partie des installations existantes seront réutilisées dans le cadre du Projet, après mise en conformité. Les équipements actuels restants seront cédés à la SENELEC en décembre 2015, conformément à l'accord initial entre GTI-Dakar et la SENELEC entré en vigueur en décembre 2000.

Le devenir de ces installations (démantèlement, mise en sécurité) sera donc décidé par la SENELEC.

Contenu du chapitre de description du Projet

Le rapport d'EIES présentera les éléments suivants :
- Installations liées au Projet.
- Infrastructures auxiliaires.
- Technologie proposée, en particulier les besoins en intrants et sortants associés au process de production d'électricité.
- Besoin de main d'œuvre et gestion du personnel.

Les informations présentées concerneront à la fois les phases de construction et d'exploitation, pour lesquelles un calendrier prévisionnel sera présenté. Un plan de situation sera annexé au rapport.

4.2.2 *Revue du cadre législatif et réglementaire*

Politique environnementale au Sénégal

Le nouveau Code de l'Environnement a été instauré par la loi N° 2001 - 01 du 15 Janvier 2001, en remplacement du Code de 1983. Ce Code constitue l'aboutissement d'un long processus de codification et d'une démarche intégrée entreprise par le gouvernement sénégalais en faveur de l'environnement.

Les principales innovations du nouveau Code sont les suivantes :

- la consécration du droit à un environnement sain ;
- une réglementation des études d'impact sur l'environnement ;
- le transfert des compétences environnementales aux collectivités locales ;
- la prise en compte des instruments de planification environnementale et des principes du développement durable ; et
- le renforcement des normes de protection de l'environnement.

Cadre réglementaire et législatif applicable

Conformément à l'Article L-13 de la Loi N° 2001 - 01 du 15 Janvier 2001 portant code de l'environnement, GTI-Dakar devra obtenir un renouvellement de l'autorisation d'exploiter de l'installation, du fait des modifications substantielles qui seront apportées au projet initial. A ce tire, une EIES doit être réalisée. Cette procédure a été confirmée par la DEEC, suite à une réunion de cadrage de l'étude organisée le 25 juin 2014 dans les locaux de la DEEC (cf. compte-rendu en Annexe 2).

La prise en compte de l'incidence potentielle que pourrait avoir la mise en place du Projet est régie par la réglementation environnementale. L'EIES sera conduite dans une optique de conformité avec la législation sénégalaise applicable, en particulier :

- Loi n°2001-01 du 15 janvier 2001portant Code de l'Environnement (Titre II, Chapitre I) ;
- Décret n°2001-282 du 12 avril 2001 portant application du Code de l'Environnement ;
- Arrêté n°9468 du 28 novembre 2001 portant réglementation de la participation du public à l'EIES ;
- Arrêté n°9472 du 28 novembre 2001 portant contenu du rapport de l'EIES ;
- Ainsi que tous les autres textes réglementaires applicables.

Analyse des procédures administratives exigibles

L'EIES présentera les différentes procédures que devra suivre GTI-Dakar dans le cadre de la mise en œuvre du Projet.

4.2.3 Analyse de l'état initial du site et de son environnement

L'étude de l'état initial de l'environnement correspond à une analyse descriptive de la zone d'implantation du Projet et de ses alentours. Cet état initial décrit les environnements physiques, biologiques et socioéconomiques pouvant être affectés par le Projet, tout en prenant en compte les spécificités géographiques du site, les sources existantes d'impacts ainsi que le niveau à partir duquel ces impacts auront une influence significative sur le milieu.

Dans le cas du présent projet, la description de l'état initial reposera sur différentes études bibliographiques et de terrain :

- Environnement physique : étude des données climatiques, physiques, hydrologiques, géologiques et hydrogéologiques disponibles au niveau de la zone d'étude. Une étude de l'environnement sonore sera également réalisée dans le cadre de l'état initial, afin de déterminer le niveau de bruit avant implantation de la centrale. Enfin, les centrales électriques existantes au niveau de la zone du Projet (appartenant à la SENELEC) seront prises en compte dans le cadre de la modélisation de la dispersion atmosphérique ; la modélisation ainsi réalisée correspondra à un état initial de la qualité de l'air avant mise en œuvre du Projet.

- Environnement biologique : étude des données bibliographiques disponibles, et validation via une visite de terrain. Une cartographie de l'occupation des sols et des habitats naturels sera également réalisée, grâce à la photo-interprétation d'images satellitaires et à une validation sur le terrain.

- Environnement humain : comparaison entre les données socio-économiques récoltées au niveau local et les données bibliographiques disponibles au niveau national et/ou régional ; description des infrastructures socio-économiques, équipements et autres installations implantées au niveau de la zone d'étude. Un focus particulier sur les modes d'occupation des sols sera fait dans un rayon de 500 m autour des limites du site du Projet, en lien avec l'article L 13 du code de l'environnement.

L'analyse des conditions environnementale de base ciblera en particulier les thématiques en lien avec les rejets atmosphériques et liquides, ainsi que les émissions sonores et la gestion des déchets.

4.2.4 Analyse des alternatives

Le rapport d'EIES présentera une analyse des alternatives au Projet en identifiant les variantes à la solution de base (dont une variante sans projet) et en évaluant les différentes solutions technologiques réalistes en termes d'avantages et d'inconvénients. Ces solutions seront également comparées à un scenario de réhabilitation intégrale des installations existantes.

L'analyse mettra en lumière les avantages et inconvénients associés à chaque variante, afin de démontrer que l'alternative retenue se justifie sur la base de critères environnementaux, sécuritaires et économiques.

4.2.5 Plan de participation publique et de communication

La participation du public est un élément essentiel du processus d'évaluation environnementale et un moyen de s'assurer que le projet intègre les préoccupations des populations concernées. Dans le cadre de l'étude d'impact, des séances d'information seront organisées avec les autorités locales et les populations riveraines afin de leur présenter le projet dans un résumé simple et de recueillir leur avis et suggestions, afin de les analyser et de les prendre en compte au besoin.

La consultation des parties prenantes devra permettre d'évaluer l'acceptabilité sociale du projet par les populations riveraines, et préparer (si nécessaire) la mise en œuvre d'un plan de communication pour éviter d'éventuels conflits sociaux et faciliter cette acceptation ; à ce titre, un accent particulier devra être mis sur le volet information/sensibilisation.

La consultation sera réalisée à 2 échelles différentes ; le niveau local concernera principalement les populations riveraines à la zone du Projet, tandis que les consultations au niveau régional et national permettront de consulter les institutions nationales concernées (Direction de l'environnement et des établissements Classés (DEEC), SENELEC, etc.). La liste des personnes et entités consultées sera présentée en annexe du rapport.

Les informations qui figureront dans le rapport seront essentiellement :

- des informations sur les personnes consultées (les différentes parties prenantes) ;
- le niveau d'influence par rapport au Projet ;
- la preuve que la consultation a été réalisée ;
- une copie du formulaire-type de commentaire présenté aux parties prenantes ; et
- les réponses au dispositif de consultation.

4.2.6 *Identification et évaluation des impacts probables liés au Projet*

Identification et évaluation des impacts

Une identification préalable des impacts potentiels liés au Projet sera faite sur la base de la description du Projet fournie par son promoteur. Ces impacts potentiels pourront être directs ou indirects, permanents ou temporaires, en fonction des différentes phases de réalisation et d'exploitation du Projet. Une pré-identification des impacts environnementaux et sociaux potentiels associés à la mise en œuvre du Projet est présentée à la *Table 4.2*.

Chaque impact potentiel identifié sera évalué et décrit selon sa nature, sa durée, son ampleur et son intensité. Il sera ensuite évalué au regard de la sensibilité des différents récepteurs, mise en évidence dans le cadre de la description de l'état initial.

Cette première évaluation permettra par ailleurs d'établir une base de proposition de mesures d'atténuation et de réduction des impacts.

Impacts positifs

Une identification et une évaluation des impacts positifs relatifs à la mise en œuvre du Projet devront être faites en termes de bénéfices environnementaux, d'amélioration des conditions de vie et des conditions économiques et financières des populations locales.

Impacts négatifs

Une identification des impacts négatifs potentiels d'ordre physique, biologique, économique et socioculturel sera effectuée. Une première mission de cadrage a permis d'évaluer les sensibilités environnementales et sociales du site d'implantation ; d'un point de vue environnemental, la sensibilité de la faune, la flore et les habitats naturels paraît faible, et aucun enjeu majeur n'a été décelé. Les premières réunions publiques organisées n'ont pas non plus mis en évidence de préoccupations importantes pour les populations alentours, le Projet paraissant a priori bien accueilli. Ces éléments seront développés et précisés dans le cadre de l'EIES.

Les impacts potentiels du Projet correspondront donc principalement aux enjeux « classiques » propres aux centrales thermiques, à savoir le bruit et la qualité de l'air. Des modélisations de dispersion atmosphérique et de propagation du bruit seront réalisées dans le cadre de l'EIES afin d'évaluer l'impact a priori. Si ces modélisation révèlent des impacts significatifs, certains points de conception technique de la centrale pourront être revus en collaboration avec GTI-Dakar, afin d'obtenir une conception du Projet dont les impacts sont acceptables.

Les impacts du Projet sur les autres récepteurs environnementaux (faune, flore, hydrogéologie, etc.) et sociaux (emploi, santé, utilisation des ressources, etc.) seront également analysés, pour les phases de construction et d'exploitation.

Les principales incidences potentielles du Projet sont présentées au travers de la matrice de pré-identification des impacts présentée à la Table 4.2 ci-dessous.

Impacts cumulés

L'analyse des impacts prendra également en compte les projets industriels déjà validés mais non débutés à ce jour, puisque leurs effets et impacts sur l'environnement n'auront pas été pris en considération dans le cadre de l'état initial du Projet (à l'inverse des infrastructures existantes qui interagissent déjà avec l'environnement et dont les effets seront pris en compte lors de l'étude de l'état initial).

A noter qu'aucun projet en cours de mise en œuvre n'a été mis en évidence lors de la phase de cadrage.

Table 4.2 Matrice de pré-identification des impacts potentiels du Projet

Activités / Type d'impacts	Qualité de l'air	Bruit	Qualité et ressources en l'eau	Erosion des sols	Biodiversité (habitats terrestres, faune et flore)	Paysage	Occupation foncière	Agriculture locale et moyens de subsistance	Contexte local économique & social	Santé et sécurité des communautés et des travailleurs	Déchets
Construction											
Défrichement et modification de l'occupation des sols		X		X	X	X	X	X	X		
Travaux de construction	X	X	X		X				X	X	X
Exploitation											
Approvisionnement (eau, fioul lourd, etc.)			X						X	X	
Fonctionnement de la centrale	X	X	X		X	X			X	X	X

4.2.7 *Etude de danger et évaluation des risques professionnels*

Conformément à l'article R-5 de la Loi N° 2001-01 du 15 janvier 2001 portant code de l'environnement, l'EIES comportera une évaluation des dangers inhérents à la mise en place du Projet. L'objectif est d'identifier et d'évaluer les incidences des évènements accidentels pouvant survenir dans le cadre des activités de construction et d'exploitation et de présenter les mesures de prévention adaptées permettant d'assurer la sécurité des infrastructures, des installations et de l'environnement à un niveau acceptable. Cette étude sera réalisée dans une optique de conformité avec le guide d'étude de danger établi par la Direction de l'environnement et des établissements classés du ministère de l'environnement et de la protection de la nature (1). Pour chaque scenario identifié, une description des causes et conséquences (incluant une évaluation de l'occurrence, de la gravité et du risque) ainsi que des barrières de prévention sera réalisée. Les effets associés à chaque scenario seront modélisés, afin d'identifier les zones susceptibles d'être touchées.

Une évaluation des risques professionnels sera également réalisée, conformément à l'article 6 du décret 2006-1256 relatif aux « obligations des employeurs en Santé Sécurité au Travail » stipulant qu'un employeur doit prendre les mesures nécessaires pour assurer la promotion de la sécurité et de la santé des travailleurs. Cette évaluation consistera à identifier les risques puis à les hiérarchiser et à planifier les actions de prévention appropriées pour chacun des risques identifiés.

4.2.8 *Plan de Gestion et de Suivi Environnemental et Social*

Le Plan de Gestion et de Suivi Environnemental et Social (PGSES) devra proposer une description des mesures d'atténuation et de réduction des impacts potentiels proposées.

Il fournira également des informations sur les responsabilités qui incombent à l'entreprise dans la mise en œuvre des mesures d'atténuation et des actions correctives proposées. Il présentera également les coûts de mise en œuvre et de suivi associés à chaque mesure, et identifiera les entités responsables de la mise en œuvre, du suivi et du contrôle des mesures d'atténuation.

Toutes ces informations seront présentées dans un tableau, qui détaillera les éléments suivants :

- Activité/Source.
- Impact potentiel.
- Récepteurs d'impact.
- Mesures d'atténuation.
- Indicateurs de suivi Objectivement Vérifiables (IOV).
- Moyens ou sources de Vérification (MV).
- Calendrier de la mise en œuvre.

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(1) Guide d'étude de danger, DEEC - Ministère de l'environnement et de la protection de la nature ; version octobre 2005.

- Mise en œuvre :
  - Responsable ; et
  - Coûts.
- Suivi interne :
  - Responsable ;
  - Fréquence ; et
  - Coûts.
- Suivi externe :
  - Responsable ;
  - Fréquence ; et
  - Coûts.

Le chapitre comprendra également un plan de surveillance et de suivi de l'environnement, en fonction des impacts résiduels mis en évidence dans le cadre de l'étude. Ce plan sera destiné à s'assurer que les mesures proposées sont mises en œuvre et efficaces.

Un focus sur le dispositif institutionnel associé à la mise en œuvre de la surveillance et du suivi environnemental sera également réalisé, afin de déterminer les rôles et responsabilité de chaque institution impliquée. Cette analyse permettra de prévoir les besoins éventuels de renforcement technique et matériel des institutions qui seront sollicitées.

Enfin, les mesures de gestion environnementale liées à la phase travaux seront traduites en recommandations à l'attention des entreprises, afin d'être insérées dans les cahiers des prescriptions techniques à respecter en terme de protection de l'environnement pendant l'exécution du chantier.

5 PROFIL DES COMPETENCES DES CONSULTANTS

L'EIES sera menée par Environmental Resources Management ('ERM'). ERM est l'un des leaders mondiaux du conseil en environnement. ERM emploie près de 4000 personnes dans 140 bureaux de par le monde. ERM opère sur le continent africain depuis plusieurs dizaines d'années, à partir de la France, du Royaume Uni, et de ses trois bureaux en Afrique du Sud.

Les consultants d'ERM s'appuieront sur l'expertise du cabinet 2iEC, en particulier en ce qui concerne les données et analyses relatives à l'environnement biologique et à l'environnement humain. Avec plus de 15 experts sénégalais dans ses rangs et de nombreuses EIES à son actif, le cabinet 2iEC possède l'expertise indispensable à une telle étude.

L'équipe de consultants présentera les compétences suivantes :

- un environnementaliste spécialisé sur les projets énergétiques ;
- un écologue ;
- un sociologue ;
- un expert du milieu marin ;
- des experts en modélisation de la dispersion des émissions atmosphériques et de la propagation sonore ;
- un spécialiste de la réglementation environnementale ;
- un cartographe ; et
- un expert en analyse des risques industriels et des risques professionnels associés.

Les études menées par les différents consultants et experts de l'équipe ERM / 2iEC seront coordonnées par plusieurs experts en planification et exécution de projets disposant d'une expérience satisfaisante dans la réalisation d'études environnementales et sociales ; ils agiront en tant que directeur de Projet et/ou chef de Projet.

ANNEXE 1 : ARRETER D'AUTORISATION D'EXPLOITER

ADmb.nd
République du Sénégal

19.08.1998-006562

N°______/MEPN/MEMI/DEEC

MINISTERE DE L'ENVIRONNEMENT
ET DE LA PROTECTION DE LA NATURE

Direction de l'Environnement et des *Etablissements Classés*
Rue Leblanc X Emile Zola
: 22-38-48

EC N°4221

ANALYSE : Arrêté interministériel autorisant l'ouverture et l'exploitation d'un établissement dangereux, insalubre ou incommode rangé dans la 1ère classe.

LE MINISTRE DE L'ENVIRONNEMENT ET DE LA PROTECTION DE LA NATURE,

LE MINISTRE DE L'ENERGIE, DES MINES ET DE L'INDUSTRIE,

VU la Constitution ;

VU la loi n°83-05 du 28 janvier 1983 portant Code de l'Environnement ;

VU la loi n°86-15 du 14 avril 1986 portant fixation des taxes relatives à la prospection, la recherche et l'exploitation des mines et carrières, au contrôle des bijoux en or, des appareils à vapeur et à pression de gaz et des établissements classés ;

VU le décret n°98-603 du 4 juillet 1998 portant nomination des Ministres ;

VU le décret n°98-604 du 4 juillet 1998 portant répartition des services de l'Etat, du contrôle des établissements publics, des sociétés nationales et des sociétés à participation publique entre la Présidence de la République, la Primature et les Ministères ;

VU la nomenclature annexée au décret du 21 septembre 1977 portant classement des établissements dangereux, insalubres ou incommodes ;

VU le PV de l'enquête de commodo et incommodo prescrite par l'arrêté ministériel n°15-026 du 6 octobre 1965 concernant la Société Dakaroise et d'Entreposage au Cap des Biches;

VU la demande de la Société GTI Dakar S/C du Cabinet Racine ;

SUR la proposition du Directeur de l'Environnement et des Etablissements Classés, du Directeur des Mines et de la Géologie et après l'avis du Directeur de la Protection Civile,

ARRETENT

ARTICLE PREMIER .- La Société GTI DAKAR, S/C du Cabinet RACINE au 22 Rue Ramez BOURGI BP 545 à Dakar, est autorisée à ouvrir et à exploiter une Centrale Electrique d'une puissance de 50 Mégawatts sise au Cap des Biches Km 22 Route de Rufisque dans la région de Dakar.

.../...

ARTICLE 2. - L'installation projetée appartient à la 1ère classe des établissements dangereux, insalubres ou incommodes. Elle figure sous le N° 153 bis de la nomenclature annexée au décret du 21 septembre 1977 portant Classement desdits établissements.

ARTICLE 3. - La construction et les dimensions du foyer devront être prévues en fonction de la puissance calorifique nécessaire et du régime de marche prévisible de façon à rendre possible une conduite rationnelle de la combustion et réduire au minimum les dégagements de gaz poussières ou vésicules indésirables.

ARTICLE 4 . - La collecte et l'évacuation des cendres et mâchefers se feront sans qu'il puisse en résulter d'émission de poussières ou de bruits gênants pour le voisinage.

ARTICLE 5 . - La structure des conduits d'évacuation sera coupe-feu de degré de 2 heures lorsqu'ils traverseront des locaux habités ou occupés par des tiers. Leurs matériaux seront suffisamment isolants pour que le voisinage ne soit pas incommodé par la chaleur. On veillera particulièrement à l'étanchéité et à la résistance des joints. En outre, leur construction et leurs dimensions devront assurer un tirage convenable permettant une bonne combustion.

ARTICLE 6 . - La construction des cheminées doit être faite de façon à permettre une dispersion correcte des fumées.

ARTICLE 7 : - Pour permettre le contrôle des émissions de gaz et de poussières et faciliter la mise en place des appareils nécessaires à ce contrôle, les cheminées ou conduits d'évacuation devront être pourvus de dispositifs obturables commodément accessibles, à un emplacement permettant des mesures représentatives des émissions à l'atmosphère.

ARTICLE 8 . - Lorsque la localisation exceptionnelle, les conditions météorologiques, le mode de combustion ou la nature du combustible la rendent nécessaire, peut être exigée la mise en place, entre le foyer et la sortie des gaz de combustion, de toutes installations efficaces pour la rétention des particules et vésicules ou des gaz nocifs.

ARTICLE 9 . - Dans la mesure où les appareils utiliseront de l'eau, celle-ci devra être évacuée conformément aux presriptions en vigueur concernant les rejets d'effluents des installations classées.

ARTICLE 10 . - Les combustibles à employer devront correspondre aux caractéristiques préconisées par le constructeur de l'installation. La conduite de la combustion devra être effectuée et contrôlée de façon à éviter toutes évacuations de gaz ou de poussières et de vésicules susceptibles de créer un danger ou une incommodité pour le voisinage.

<u>ARTICLE 11</u> . - L'installation sera construite, équipée et exploitée de façon que son fonctionnement ne puisse être à l'origine de bruits aériens ou vibrations mécaniques susceptibles de compromettre la santé ou la sécurité du voisinage ou constituer une gêne pour sa tranquilité.

L'usage de tous appareils de communication par voie acoustique (sirènes, avertisseurs, haut-parleurs, etc...) gênants pour le voisinage est interdit, sauf si leur emploi est exceptionnel et réservé à la prévention ou au signalement d'incidents graves ou d'accidents.

<u>ARTICLE 12</u> . - L'entretien de l'installation de combustion se fera soigneusement et aussi fréquemment que nécessaire, afin d'assurer un fonctionnement ne présentant pas d'inconvénients pour le voisinage. Cette opération portera sur le foyer, la chambre de combustion et l'ensemble des conduits d'évacuation des gaz de combustion et, le cas échéant, sur les appareils de filtration et d'épuration.

<u>ARTICLE 13</u> . - Les déchets et résidus produits par les installations seront stockés dans des conditions ne présentant pas de risques de pollution (prévention des envols, infiltrations dans le sol, odeurs) pour les populations avoisinantes et l'environnement.

<u>ARTICLE 14</u> . - Toutes dispositions seront prises pour qu'il ne puisse y avoir en cas d'accident, tel que rupture de récipient, déversement direct de matières dangereuses ou insalubres vers les égouts ou les milieux naturels.

<u>ARTICLE 15</u> . - Tous les appareils à pression doivent être déclarés avant leur mise en service. Les prises de terre doivent être bien réparties autour des installations.

<u>ARTICLE 16</u> . - L'installation électrique sera entretenue en bon état : elle sera périodiquement contrôlée par un technicien compétent. Les rapports de contrôle seront tenus à la disposition de la Direction de l'Environnement et des Etablissements Classés.

<u>ARTICLE 17</u> - Il est interdit de pénétrer avec du feu ou de fumer dans le dépôt. Cette interdiction doit être signalée par tout moyen approprié permettant d'avertir toute personne se dirigeant vers le dépôt.

<u>ARTICLE 18</u> .- Les systèmes d'extinction appropriés suivant les types de feux (feux d'hydrocarbures, feux de secs, feux d'origine électrique, etc...) doivent être mis en place.

<u>ARTICLE 19</u> .- La réalisation d'un Plan d'Opération Interne (P.O.I.) à la charge de l'exploitant est obligatoire.

<u>ARTICLE 20</u>. - La mise à jour du registre de sécurité, sur lequel sont reportés les renseignements indispensables à la bonne marche du service de sécurité, est obligatoire.

<u>ARTICLE 21</u>. - L'exploitant est tenu d'informer le Bureau des Etablissements Classés de tout accident ou incident dans les 72 heures.

Le non respect de ces prescription peut entraîner l'annulation de l'autorisation d'exploitation.

.../...

ARTICLE 22. - Indépendamment des prescriptions spéciales prévues ci-dessus, l'installation sera soumise aux dispositions réglementaires concernant l'urbanisme, l'hygiène et la sécurité des travailleurs.

ARTICLE 23. - L'installation est inscrite sous le numéro **4221** du Registre Spécial des Etablissements classés.

Elle donnera lieu chaque année à la perception des taxes afférentes aux établissements dangereux, insalubres ou incommodes. Ces taxes calculées sur une surface occupée et équipée de **25 000 m2** seront acquises pour l'année quelle que soit la durée de fonctionnement ou d'utilisation de l'installation.

ARTICLE 24. - Le Gouverneur de la Région de **Dakar**, le Directeur de l'Environnement et des Etablissements classés, le Directeur des Mines et de la Géologie et le Directeur de la Protection Civile sont chargés, chacun en ce qui le concerne, de l'exécution du présent arrêté qui sera publié et communiqué partout où besoin sera./-

LE MINISTRE DE L'ENVIRONNEMENT ET DE LA PROTECTION DE LA NATURE

Souty TOURE

LE MINISTRE DE L'ENERGIE DES MINES ET DE L'INDUSTRIE

Magued DIOUF

AMPLIATIONS:

1 - Présidence
1 - SGG
1 - MEPN
1 - MEMI
1 - MINT
1 - Gouverneur de **DAKAR**
1 - Président du Conseil Régional de **DAKAR**
6 - DEEC

ANNEXE 2 : COMPTE-RENDU DE LA REUNION DE CADRAGE DE L'ETUDE ORGANISEE LE 25 JUIN 2014 DANS LES LOCAUX DE LA DEEC

COMPTE RENDU DE LA RENCONTRE RELATIVE AU LANCEMENT DES DEMARCHES ENVIRONNEMENTALES ET SOCIALES EN LIEN AVEC LE PROJET DE REHABILITATION ET MODIFICATION DE LA CENTRALE DE GTI-DAKAR, CAP DES BICHES, RUFISQUE

Introduction

Le mercredi 25 juin 2014, s'est tenue dans les bureaux de la Division des évaluations environnementales de la Direction de l'Environnement et des Etablissements Classés (DEEC) une rencontre d'échange sur le lancement de l'étude d'impact environnemental et social du projet de réhabilitation et modification de la centrale de GTI-Dakar, Cap des Biches, Rufisque.

Les participants à cette rencontre étaient :

- M. SOW, chef de la Division des Evaluations d'Impact sur l'Environnement de la DEEC
- M. MIOSSEC, Directeur Général de GTI-Dakar
- M. GUEYE, représentant la SENELEC
- M. BRIAND, consultant pour la société ERM, chargée par GTI-Dakar de la réalisation de l'évaluation environnementale et sociale
- M. GLENAT, consultant pour la société ERM
- M.NDIAYE, consultant agréé pour la réalisation d'évaluations environnementales et Directeur du Cabinet 2iEC, partenaire d'ERM pour la réalisation de l'évaluation environnementale et sociale du Projet de GTI-Dakar
- M. DIAGNE, expert environnementaliste du Cabinet 2iEC

Déroulement de la rencontre :

A l'entame de la réunion après les présentations d'usage, Monsieur Miossec a fait une présentation succincte du projet de réhabilitation et de modification de la centrale de GTI-Dakar. Un document de présentation est fourni en annexe du présent compte-rendu.

Suite à cet exposé, M. Sow, Chef de la Division des évaluations environnementales, a convenu qu'un audit des installations existantes n'était pas approprié, et qu'il était nécessaire de réaliser une étude d'impact approfondie intégrant l'ensemble des installations de GTI. Cette étude d'impact devra faire le point sur l'existant en termes de conformité avant de se projeter sur la réhabilitation et l'extension de la centrale.

Cette démarche permettra, au-delà de prise en compte des aspects techniques, de prendre en charge les préoccupations sociales avec la consultation et l'audience publique qui sont des parties intégrantes de la procédure d'étude d'impact.

M. Sow a annoncé que la Division des évaluations environnementales apportera toute la diligence nécessaire à cette démarche, afin d'optimiser au mieux les délais de réalisation des études environnementales et sociales.

Observations

Il est demandé à la société GTI-Dakar de déposer par courrier un Avis de Projet accompagné d'un projet de Termes de Référence de l'étude d'impact approfondie afin de permettre le démarrage de la procédure d'instruction du dossier.

ANNEXE : PRESENTATION DU PROJET DE REHABILITATION ET DE MODIFICATION DE LA CENTRALE DE PRODUCTION D'ELECTRICITE DE GTI-DAKAR

Présentation du Projet de réhabilitation et modernisation de centrale thermique de GTI-Dakar à Cap des Biches, Rufisque

GTi DAKAR

PRODUCTEUR INDEPENDANT D'ELECTRICITE

ERM

The world's leading sustainability consultancy

Localisation du Projet

The world's leading sustainability consultancy

ERM

Contexte actuel des installations existantes

- Centrale à cycle combiné (diesel ou naphta) de Cap des Biches exploité de décembre 2000 à juillet 2013
- Turbine à combustion (TAC) associée à une turbine à vapeur (TAV)
  - Cycle simple (TAC) : 35 MW
  - Cycle combiné (TAC + TAV) : 52 MW
- TAC refroidie à l'air / TAV refroidie à l'eau de mer (aéroréfrigérant en cycle semi-fermé)
- Problème de maintenance entre 2000 et 2013:
  - Cycle combiné ne fonctionne plus depuis 2011
  - Centrale arrêtée définitivement depuis juillet 2013

Projet de réhabilitation

Projet de réhabilitation mené en coordination avec la SENELEC :

- Critères économiques: utilisation de HFO au lieu de diesel
- Impossibilité de restaurer la totalité des installations à un coût compatible avec le prix de revente de l'électricité
- ➔ Modification des installations, et changement du procédé de production d'électricité

Réhabilitation envisagée :

- Installation de moteurs diesel fonctionnant au fioul lourd et convertibles pour un fonctionnement au gaz
- 3 moteurs d'une capacité unitaire de 16,5 MW
- Cycle combiné : chaudière de récupération de chaleur des gaz d'échappement associée à une turbine à vapeur ➔ augmentation de 3,5 MW la puissance maximale de la centrale
- Total: 53 MW soit l'équivalent de la puissance de l'ancienne centrale mise à l'arrêt
- Réutilisation d'une partie des installations :
  - Transformateur et la connexion au réseau électrique
  - Certains systèmes auxiliaires tels que le système de production d'eau déminéralisée et les compresseurs pour la production d'air comprimé
  - Equipements de stockage : stockage de carburant, stockage d'eau brute, d'eau déminéralisée et d'eau du système incendie
  - Bureaux

Projet de réhabilitation

- Principales modifications

Caractéristiques	Configuration initiale	De 2011 à 2013	Configuration future proposée
Capacité de production	52 MWe	35 MWe	53 MWe
Combustible utilisé	Diesel et naphta	Diesel	Fioul lourd
Système de refroidissement	Tours aéroréfrigérantes (eau de mer)	Air ou tours aéroréfrigérantes (eau de mer)	Air
Utilisation d'eau déminéralisée	Circuits fermés de réfrigération	Circuits fermés de réfrigération	Autre (quantité limitée)
Provenance et utilisation d'eau brute	SDE ; Réfrigération	SDE ; Réfrigération	SDE ; Autre (quantité limitée)
Utilisation d'eau de mer	Système de refroidissement	Système de refroidissement	Aucune
Effluents	• Gazeux • Liquides (en mer) : eau de refroidissement, eaux pluviales, eaux des séparateurs des rejets huileux	• Gazeux • Liquides (en mer) : eau de refroidissement, eaux pluviales, eaux des séparateurs des rejets huileux	• Gazeux • Liquides (en mer) : eaux pluviales, eaux des séparateurs des rejets huileux
Déchets spéciaux	Déchets huileux	Déchets huileux	Déchets huileux et boues du fioul lourd

Réduction très significative des prélèvements et rejets dans le milieu marin associés à la configuration actuelle de la centrale

Localisation de la zone d'extension

- Terrain de 2,99 ha adjacent au site initial d'implantation (d'une surface de 2,5 ha) divisé en deux parcelles:
  - un Titre Non-Immatriculé (TNI) sous la compétence de la commune de Rufisque (surface : environ 1,84 ha) ; ce terrain a été attribué à la SENELEC qui le transfèrera à GTI-Dakar au travers d'un bail emphytéotique ;
  - un terrain de 1,15 ha environ, faisant partie du Domaine Public Maritime (DPM) ; les démarches visant à octroyer ce terrain à la SENELEC sont en cours auprès du Ministère de l'Economie et des Finances.
- Terrain en cours d'acquisition par la SENELEC

ANNEXE 2: DEEC COMMENTS ABOUT TERMS OF REFERENCES

République du Sénégal
Un Peuple - Un But - Une Foi

MINISTERE DE L'ENVIRONNEMENT
EU DU DEVELOPPEMENT DURABLE

DIRECTION DE L'ENVIRONNEMENT
ET DES ETABLISSEMENTS CLASSES

N° 2 720 ..../MEDD/DEEC

Dakar le, 30 OCT. 2014.

LA DIRECTRICE

A
Monsieur le Directeur Général
GTI – Dakar

DAKAR

Objet : ***Projet de termes de référence (TDR) relatifs à la réhabilitation et modification de la centrale thermique de GTI- Dakar à Cap des Biches (Rufisque).***

Monsieur le Directeur Général,

J'accuse bonne réception de votre correspondance relative à l'objet susmentionné.

Veuillez trouver ci-joint, les observations de la Direction de l'Environnement et des Etablissements Classés (DEEC) sur lesdits TDR.

La DEEC donne son accord pour le démarrage de l'étude sous réserve de l'intégration de ces points aux termes de référence. A cet effet, veuillez nous faire parvenir une copie des TDR finalisés.

Je vous rappelle que les TDR amendés, devront être annexés au rapport d'étude d'impact sur l'environnement.

Je vous prie d'agréer, **Monsieur Directeur Général,** l'assurance de ma considération distinguée.

PJ : Observations de la DEEC

Direction de l'Environnement et des Etablissements Classés
La Directrice

Mariline DIARA

Ampliation :

- *DIC*
- *DCPN*
- *DREEC/DKR*

République du Sénégal
Un Peuple – Un But – Une Foi
....
MINISTERE DE L'ENVIRONNEMENT
ET DU DEVELOPPEMENT DURABLE
....
Direction de l'Environnement
et des Etablissements Classés

F 0

N° 2 7 2 0 ....MEDD/DEEC/DEIE

Dakar, le 30 OCT. 2014

Observations de la Direction de l'Environnement et des Etablissements Classés sur les Termes de Référence de l'Etude d'Impact Environnemental du projet de réhabilitation et de modification de la centrale thermique de GTI – Dakar à Cap des Biches

1. Description du projet

L'étude devra décrire l'ensemble des composantes du projet :

- les éléments constitutifs du projet et de ses aménagements connexes, en se servant de cartes et en donnant les renseignements suivants : emplacement, délimitation, plan d'ensemble, taille ;
- les activités d'installation et d'exploitation ;
- les investissements hors site nécessaires etc.

Cette description devra également couvrir l'ensemble du processus avec notamment :

- des informations relatives aux modalités d'exploitation et identification des émissions ;
- la capacité de la centrale et ses paramètres caractéristiques ;
- les différentes étapes de développement incluant, l'implantation, les essais de commissionning, l'exploitation ;
- etc.

1.1. Description de la technologie :

- les composantes ;
- les différents inputs et outputs du process ;
- combustibles et conditions de stockages ;
- produits chimiques et conditions de stockage ;
- bacs d'épuration et de neutralisation ;
- besoin en combustible, vapeur, eau de refroidissement ;
- diagramme des flots et des processus ;
- utilisation et partage d'installations déjà existantes dans la zone d'implantation ;
- processus d'émission de polluants dans l'air, eaux usées, et autres rejets.

1.2. Services auxiliaires pour le projet :

- décrire et schématiser comment la centrale est alimentée en gaz, vapeur, eau, etc.
- décrire et schématiser les différents effluents du projet : eaux usées, etc.

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- discuter tous les accords avec les parties prenantes durant les différentes phases et la connexion avec la gestion optimale des aspects environnementaux, sociaux et sécuritaires ;
- discuter les différents plans d'utilisation et de gestion du personnel pendant les différentes phases de développement du projet et démontrer comment au niveau de chaque phase sont pris en compte les aspects HSE.

2. Description des conditions environnementales de base et détermination des incidences environnementales :

Il sera procédé à :

- l'analyse de l'état initial de l'environnement sur les plans naturel, socio-économiques et humains ;
- l'analyse des effets économiques et sociaux liés au choix du site du projet ;
- l'analyse des incidences directes ou indirectes des installations sur l'environnement en particulier sur les milieux naturels, sur les commodités du voisinage (effluents gazeux et aqueux, bruits, vibration, déchets et odeurs) ou sur l'agriculture, l'hygiène, la santé et la protection des biens matériels ;
- l'analyse de la sensibilité environnementale et sociale du projet et de son milieu d'accueil.

Les composantes environnementales à cibler sont :

➢ ***Air :***

- identifier les composantes du projet qui affecteront la qualité de l'air ;
- identifier les sources d'émission ;
- évaluer les quantités de polluants dans les conditions normales d'exploitation et hors normes d'exploitation ;
- discuter l'effet potentiel de ces émissions sur la qualité de l'air. Pour cela, procéder à une modélisation de la dispersion des émissions générées par la centrale de manière à évaluer les effets sur la santé, etc.

➢ ***Eau :***

- identifier les activités du projet qui peuvent affecter les eaux de surface et souterraines, aussi bien en phase d'exploitation que construction ;
- déterminer les besoins en eau et leur source ;
- donner les estimations des besoins en eau et décrire les moyens pour minimiser la consommation ;
- décrire la méthode de refroidissement de la centrale ;
- donner les débits d'eau requis ainsi que les débits maxima ;
- décrire et quantifier les eaux usées à rejeter ;
- effets de ces rejets sur les différents milieux ;
- etc.

✓ *Gestion des eaux usées*

- quantité et sources ;
- système de traitement des eaux usées ;
- etc.

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Milieu aquatique

- état des cours d'eau proches du site ;
- impacts générés par les eaux de refroidissement sur le milieu aquatique et les courants marins ;
- etc.

➢ ***Bruit :***

- identifier les activités qui vont affecter le niveau actuel du bruit, durant les phases de construction et d'exploitation ;
- niveau sonore prévisible des installations ;
- commenter et discuter l'impact du bruit sur site et en limite de propriété en phase construction et exploitation.

➢ ***Gestion des déchets :***

- production des déchets à chaque étape de la production et de l'entretien ;
- pour chaque type de déchets : désignation, quantité, volume, mode d'élimination ou de valorisation interne ou externe, mode de conditionnement ;
- mesures prises pour le traitement.

➢ ***Faune et Flore :***

Une description floristique et faunistique du milieu naturel sur le site sera réalisée.

3. Etude de dangers

L'étude devra comporter un volet Etude de dangers. Cette étude de danger devra être faite conformément au guide méthodologique d'Etude de Danger du Ministère en charge de l'Environnement. Par ailleurs, dans cette Etude de Danger, le consultant devra donner pour chaque scénario les défaillances, les causes et conséquences de chaque phénomène ainsi que l'occurrence initiale, la gravité initiale, le risque initial, les barrières de prévention, l'occurrence finale, les barrières de protection, la gravité finale, le risque final et enfin le scénario résiduel et la cinétique. Il devra procéder à une modélisation, sur fond cartographique, de la propagation des effets desdits scénarii à une échelle permettant d'identifier clairement les zones susceptibles d'être touchées. Par ailleurs, prendre en charge l'environnement du site comme source externe de danger pour les installations de GTI. En conclusion, le consultant renseignera sur l'acceptabilité du projet dans la zone du point de vue des différents risques en tenant compte des mesures de mitigation identifiées.

De même, procéder à une analyse exhaustive des risques professionnels.

4. Plan de Gestion Environnementale et sociale

Il devra présenter l'ensemble des mesures d'atténuation durant les différentes phases du projet (installation, exploitation) pour éliminer les impacts négatifs ou les ramener à un niveau acceptable. Le cas échéant, l'étude décrira les mesures envisagées pour optimiser les impacts positifs ; pour les impacts résiduels, elle présentera les mesures de compensation.

Elle présentera une évaluation de l'efficacité des mesures d'atténuation, de compensation et d'optimisation des impacts identifiés ainsi que les coûts et modalités de mise en œuvre de ces mesures. En définitive, le PGES sera présenté sous la forme d'un tableau récapitulatif avec les

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principaux résultats et recommandations du PGES, les impacts et mesures d'atténuation, les coûts afférents à chaque mesure d'atténuation de même que les responsabilités de mise en œuvre.

5. Plan de Surveillance et de Suivi Environnemental :

Il devra indiquer les liens entre les impacts identifiés et les indicateurs à mesurer, les méthodes à employer, la fréquence des mesures et la définition des seuils déclenchant les modalités de correction. Le plan de suivi doit identifier les paramètres de suivi ainsi que les coûts relatifs aux activités de suivi. Ce plan devra être présenté sous forme de tableau avec tous les aspects des modalités de surveillance et de suivi évaluées en termes de coûts et les responsabilités clairement définies. Ce programme de suivi vise à s'assurer que les mesures d'atténuation sont effectivement mises en œuvre, qu'elles génèrent les résultats escomptés et qu'elles sont soit modifiées ou annulées si elles ne produisent pas de résultats satisfaisants. A cet effet, des indicateurs chiffrés et mesurables devront être dans la mesure du possible proposés. Par ailleurs pour chaque indicateur, le lieu de monitoring (suivi) devra être défini de manière précise ainsi que le protocole de suivi.

Des rapports de surveillance et de suivi environnemental devront être planifiés à toutes les phases du projet pour vérifier le niveau d'exécution des mesures d'atténuation et évaluer les effets des travaux sur l'environnement.

6. Dispositif institutionnel :

L'étude devra établir, de façon claire, précise et opérationnelle, le dispositif de mise en œuvre des mesures de mitigation et de suivi. Il devra déterminer les rôles et responsabilités de chaque institution /organisation interpellée ou impliquée dans l'exécution et l'exploitation du projet.

7. Renforcement des capacités :

Le consultant devra évaluer les capacités des institutions impliquées dans le suivi et les besoins de renforcement technique et matériel de ces dernières pour une mise en œuvre correcte du PGES. A cet effet, préparer un budget récapitulatif de toutes les actions et activités de renforcement des capacités proposées.

8. Participation Publique :

La participation du public est un élément essentiel du processus d'évaluation environnementale et un moyen de s'assurer que le projet intègre les préoccupations du public. Aussi, le Consultant devra respecter les directives du Sénégal en matière de consultation et de participation des communautés impliquées et des services étatiques concernées. Pour cette raison, des séances d'information seront organisées avec les parties concernées afin de leur présenter le projet dans un résumé simple et de recueillir leur avis et suggestions afin de les prendre en compte si possibles.

La liste des personnes consultées devra être annexée au rapport d'EIE.

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9. Elaboration de clauses environnementales à insérer dans les DAO des entreprises :

Le Consultant devra proposer des recommandations spécifiques à l'attention des entreprises de réalisation des travaux pour la protection de l'environnement, lesquelles directives devront être insérées au niveau du cahier des prescriptions techniques permettant le respect et la protection de l'environnement pendant l'exécution du chantier.

10. Bilan Environnemental du Projet :

L'étude doit présenter une conclusion de l'étude d'impact dégageant les risques majeurs du projet sur l'environnement, l'efficacité des mesures proposées et les avantages que procure la réalisation de ce projet. En définitive, le consultant renseignera sur l'acceptabilité du projet sur site.

11. Structuration du rapport

L'étude d'impact environnemental devra être succincte, documentée sur le plan cartographique et devra comprendre les parties suivantes :

- Sommaire ;
- Résumé non technique ;
- Introduction ;
- Description et justification du projet ;
- Cadre légal et institutionnel ;
- Description du milieu récepteur ;
- Analyse des variantes et description du Projet retenu ;
- Consultations Publiques ;
- Identification et analyse des impacts (situation sans projet comprise) ;
- Etude de dangers et analyse des risques professionnels ;
- Plan de Gestion Environnementale et Sociale ;
- Plan de Suivi et de Surveillance ;
- Conclusion ;
- Annexes :
    - Abréviations
    - Liste des Experts ayant participé à l'élaboration du rapport
    - Bibliographie et référence
    - Personnes consultées
    - TDR de l'étude
    - Plans (situation etc.) ;
    - Etc.

Produits attendus : le Consultant fournira au promoteur, le rapport provisoire de l'étude d'impact environnemental en trente cinq (35) exemplaires pour son dépôt à la Direction de l'Environnement et des Etablissements Classés (DEEC), qui convoquera les membres du Comité Technique à une réunion de pré-validation.

Le rapport final de l'étude, après intégration des observations, sera déposé en cinq (05) exemplaires à la Direction de l'Environnement et des Etablissements Classés en plus d'une copie électronique.

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NB :

1. relativement aux installations existantes sur le site, l'étude devra déterminer lesquelles seront capitalisées dans ce projet et leur niveau de conformité et définir au besoin, les éléments complémentaires à mettre en place pour les rendre opérationnelles et conformes à la réglementation.

2. Pour le reste des équipements / installations, un plan de démantèlement ou de mise en sécurité et conformité devra être élaboré et soumis avant la finalisation de la procédure d'étude d'impact sur l'environnement.

3. Dans la partie « analyse des impacts » : suivant l'importance des impacts, le recours à des modélisations est recommandé afin de déterminer l'étendue spatiale de l'impact.

4. les modèles de dispersion des émissions et de propagation des phénomènes dangereux utilisés devront être justifiés.

106, rue Carnot, 1er étage - BP 6557 Dakar- Étoile - Tél : (+221) 33 821 07 25 - Fax : (+221) 33 822 62 12
Site Web: http://www.denv.gouv.sn

ANNEXE 3: ALLOCATION OF THE PROJECT'S LAND

Senelec

Direction de l'Administration du Patrimoine et des Approvisionnements
Département Administration Générale

Dakar, le

A

Monsieur le Maire de la
Ville de Rufisque

<u>Réf.</u> : DAPA/DAGE/SA/UGPBT/ds
<u>Objet</u> : Demande d'attribution de terrain

Monsieur le Maire,

Dans le cadre de la réalisation de notre programme de renforcement en capacité de production d'énergie électrique, nous envisageons l'extension de la centrale de GTI sise au Cap des Biches.

Cette extension nécessite la mise en place de trois (03) groupes d'une puissance totale de 50 MW environ et la construction de tanks de stockage d'hydrocarbures sur le même site.

Le terrain de **2 ha 99 a 23 ca**, nécessaire pour l'implantation de ces groupes est constitué comme l'indique l'extrait du plan cadastral ci-joint, du Domaine National (TNI) sur **1 ha 84 a 37 ca** et du Domaine Public Maritime (DPM) sur **1 ha 14 a 86 ca**.

Dans le contrat qui nous lie avec l'exploitant, nous avons la charge de mettre à sa disposition le terrain nécessaire pour l'implantation des différentes installations.

A cet effet, nous venons par la présente, solliciter auprès de votre haute autorité, l'attribution de la partie du terrain de **1 ha 84 a 37 ca** située sur le Domaine National.

Elle est limitée à l'Est par la station d'épuration de l'ONAS à l'Ouest par l'actuelle centrale de GTI, au Nord par le TF798/R de Senelec et au Sud par le Domaine Public Maritime.

Aussi nous pouvons déjà vous assurer de l'intérêt de ce projet pour l'économie du pays en général et en particulier pour le renforcement de la satisfaction de la demande en énergie électrique.

En vous remerciant par avance de toute l'attention et la diligence que vous voudrez bien porter au traitement de ce dossier, nous vous prions de croire, **Monsieur le Maire,** à l'assurance de notre considération distinguée.

Veuillez agréer, **Monsieur le Maire**, l'assurance de notre considération distinguée.

REPUBLIQUE DU SENEGAL
VILLE DE RUFISQUE
Courrier Arrivée 13 FEV. 2014
N° 398

Le Directeur Général

<u>P.J</u> : copie extrait du plan cadastral

28, rue Vincens • BP 93 Dakar (Sénégal) Tél. : 221) 839 30 30 • Fax : (221) 823 12 67

REPUBLIQUE DU SENEGAL
Peuple - Un But - Une Foi

VILLE DE RUFISQUE

No 0.0236
N° ....VR/SGV/DAU/sp./mnn

Rufisque, le 21 FEV. 2014

Le Maire,

Objet : demande d'attribution de terrain

V/Réf : V/L référencée DAPA/DAGE/SA/UGPBT/ds du 13 fév. 2014
N/Réf : courrier arrivé n° 398 VR/BC du 13 fév. 2014

Monsieur le Directeur Général,

Nous accusons réception de votre lettre sus référencée, relative à une demande d'attribution de terrain d'un hectare quatre vingt quatre ares et trente sept centiare (1ha 84a 37ca) situé dans le Domaine National de Rufisque.

Nous notons avec intérêt l'importance de ce projet pour le développement économique et social de notre pays.

Après examen du dossier suivi d'une visite des lieux par nos services techniques, nous réservons une suite favorable à votre requête.

Toutefois, pour nous permettre d'établir l'acte d'attribution, nous vous prions de bien vouloir procéder au règlement des frais de bornage estimés à Dix Millions (10 000 000) de francs CFA à l'ordre du Receveur, Percepteur Municipale de Rufisque.

En outre, nous vous invitons à vous rapprocher de nos services pour nous accorder sur les mesures d'accompagnement (redevances annuelles, emploi des jeunes locaux, ...). Les conclusions de ces travaux feront l'objet d'une convention qui sera signée conjointement entre l'exploitant de la centrale et la Mairie de Rufisque.

Recevez ***Monsieur le Directeur Général****, l'assurance de ma considération distinguée.*

Pj: Ordre de recette.

A
Monsieur le Directeur Général
de la SENELEC.
DAKAR

SENELEC
ARRIVEE
le 11 MARS 2014
BUREAU DU COURRIER
28, RUE VINCENS Tel.: 33 839 30 30

République du Sénégal
Ville de Rufisque

Badara SENE

Hôtel de Ville BD. Maurice GUEYE BP 30 RUFISQUE SENEGAL
(221) 33 839 86 20 / fax : (221) 33 839 04 59

VILLE DE RUFISQUE

Rufisque, le 14 AVR. 2014

Le Maire

Objet : Attribution d'un terrain du Domaine National sis à la Cap des Biches
Pour l'extension de la centrale de «GTI ».

Réf : V/L du 13 Février 2013
N/L n° 00236 / VR /SGV/DAU/sp./mn

Monsieur le Directeur Général,

Suite à votre lettre visée en référence, je vous informe que la **SENELEC** est attributaire du **terrain d'1ha 84a 37ca dépendant du Domaine National, compris entre les TF 798/R, 2936/R, et 283/R sis dans la zone industrielle du Cap des Biches à Rufisque.**

Le terrain attribué est destiné à l'extension de la Centrale de GTI pour la construction de tanks de stockages d'hydrocarbure, et pour la réalisation d'équipements divers.

La SENELEC déclare avoir pris connaissance des dispositions relatives aux conditions d'affectation de terrain compris dans les zones industrielles et les terres relevant du Domaine Nationale.

Ainsi, elle est priée de se rapprocher du **Chef du Bureau des Domaines de Rufisque** pour les formalités de régularisation du terrain.

Recevez, **Monsieur le Directeur Général**, l'assurance de ma considération distinguée.

A
Monsieur le Directeur Générale
de la SENELEC - 28, rue Vincens BP : 93
Tél : 33 839 30 30 / Fax : 33 823 12 67
DAKAR

République du Sénégal — Ville de Rufisque

Badara SENE

Hôtel de Ville BD. Maurice GUEYE BP 30 RUFISQUE SENEGAL
(221)33 839 86 20/ fax. (221) 33 839 86 20

Département Administration Générale

Dakar le, 19 mars 2014

Accord 25/03/14

A

Monsieur le Directeur Général

Papa DIENG

Société d'Électricité — Le Directeur Général — SENELEC

Réf : DAPA/DAGE/SA/UGP/ds

Objet : Attribution terrain pour Contour Global au Cap des Biches

Monsieur le Directeur Général,

Par lettre n° 00236 en date du 21 février 2014, Monsieur le Maire de la commune de Rufisque nous notifie l'avis favorable qu'il a réservé à notre demande d'un terrain du Domaine National d'une superficie d'**1 ha 84 a 30 ca** situé à Rufisque dans la zone du cap des Biches.

Pour lui permettre d'établir l'acte d'attribution, il nous a demandé de verser au titre des frais de bornage, le montant de **Dix Millions (10 000 000) francs CFA** au Receveur percepteur Municipal de Rufisque.

En outre, il nous invite à nous rapprocher de ses Services pour discuter et nous accorder sur des mesures sociales d'accompagnement. Sur ce sujet, le promoteur semblait disposé à rencontrer les Autorités municipales et promettait même d'accompagner la famille qui exploite présentement un maraîchage sur le site.

C'est pourquoi nous sollicitons votre accord pour le règlement des frais de bornage et répondre à l'invitation du Maire de Rufisque en compagnie du Promoteur tout en restant dans les limites de l'offre de ce dernier.

Dans l'attente de vos instructions,

Nous vous prions d'agréer, **Monsieur le Directeur Général,** l'expression de nos sentiments dévoués.

Le Directeur de l'Administration, du Patrimoine et des Approvisionnements

SENELEC — Direction de l'Administration du Patrimoine et des Approvisionnements — Le Directeur

Abdoulaye DIAGNE

P.J : 02

REPUBLIQUE DU SENEGAL

GESTION
2014

COMMUNE DE RUFISQUE

…………

……………………………………

Enregistré aux Finances
Municipales sous le
N°179/14………
Du registre des Recettes
Rufisque, le …24 FEV. 2014
Bordereau N°23/2014

SERVICE COMMUNAL

ORDRE DE RECETTE
BUDGET MUNICIPAL

Chap …. **70** ….. Art … **705** Paragr ……..
Frais de Bornages
ETAT des sommes dues par ………………………………..
POUR LES MOTIFS CI-APRES
SAVOIR

DETAIL ET NOMBRE des pièces justificatives (quand i y a lieu)	**LIBELLES**	**Montant**
ci-joint photocopie d'identité	Ordre de recette relatif aux Frais de Bornages **Directeur general de la Senelec rue Vincent Dakar Du TNI sis à la zone du cap des Biches** (1 ha 84 a 37 ca) **Soit :**	**10 000 000 frs**

Vu, certifie le présent état à la somme de : **Dix millions (1000000) Francs CFA,** par l'Ordonnateur qui invite le Receveur Municipal de la Commune à recevoir **dix millions de Francs CFA** pour les motifs énoncés d'autre part, et à porter dans ses écritures au compte désigné en tête du présent ordre de versement.
Vu et rendu exécutive conformément aux prescriptions de l'article 345 du 20 décembre.

Rufisque,……24 FEV. 2014
Le Maire
Badara Sene

SENELEC
ARRIVEE
le 11 MARS 2014
BUREAU DU COURRIER
28, RUE VINCENS Tel.: 33 839 30 30

REPUBLIQUE DU SENEGAL

MINISTERE DE L'ECONOMIE ET DES FINANCES
DIRECTION GENERALE DE LA COMPTABILITE
PUBLIQUE ET DU TRESOR

N° 0088616

DGCPT

QUITTANCE DE VERSEMENT BANCAIRE

N° : 12 14 000179

ORIGINAL

Poste comptable : 12 PERCEPTION DE RUFISQUE / BDIAW

Date de versement: 01 Avril 2014

Partie Versante : cheq 4189101 cbao P/C SENELEC

Montant du versement : 10.000.000 FCFA dix millions Francs CFA

Compte débité : 515.2

Compte(s) crédité(s)	Nature	Montant	Compte auxiliaire
433.0.12	BORNAGE 179/14 1ha 84 a 37ca p/c rufisque	10.000.000	COMMUNE DE RUFISQUE

28, RUE VINCENS

EXPLOITATIONS
DAKAR - PIKINE - GUEDIAWAYE - RUFISQUE
THIES - TIVAOUANE - LOUGA - SAINT-LOUIS
M'BOUR - TOUBA - DIOURBEL - KAOLACK
TAMBACOUNDA - MATAM - ZIGUINCHOR
KOLDA - FATICK - RICHARD TOLL

Régistre de Com. : DAKAR N° 84.B.30
NINEA : N° 0014001/ 2 G 3
Tél : 33 839 30 30 - Fax : 33 823 82 46
Télex : (906) 21 845

A rappeler dans la réponse

Annexe

OBJET :

RECEVEUR PERCEPTEUR MUNICIPAL DE
.RUFISQUE

Dakar, le 31 MARS 2014

MESSIEURS

Nous vous prions de trouver ci dessous un chèque N° 4189101

de francs CFA . **10.000.000** sur la

CBAO Groupe Attijariwafa bank

à DAKAR en règlement de : . ATTRIBUTION TERRAIN POUR CONTOUR

. GLOBAL CAP DES BICHES

Paierie de Rufisque
Arrivée
N° : 51
Date : 01/04/14

Veuillez agréer, MESSIEURS nos salutations distinguées

CHEQUE À DÉTACHER
SAPIN - Tél : 849 49 49

Série Chèque N° 4189101

B.P.F. CFA *10.000.000*

CBAO
Groupe Attijariwafa bank

PAYEZ CONTRE CE CHÈQUE DIX MILLIONS DE FRANCS CFA
somme en toutes lettres

A L'ORDRE DE RECEVEUR PERCEPTEUR MUNICIPAL DE RUFISQUE

TRESORERIE
31 MARS 2014

LE 31 MARS 2014 20

PAYABLE A
2, Place de l'Indépendance
Tél. : (221) 33 839 96 96
B.P. 129 DAKAR

Code banque	Code Guichet	N° de Compte	RIB
SN012	01201	020136015435	26

SOCIETE D'ELECTRICITE SENELEC
28, Rue Vincens - Dakar

ANNEXE 4: OPERATING PERMIT

AD/mb.nd
République du Sénégal

MINISTERE DE L'ENVIRONNEMENT
ET DE LA PROTECTION DE LA NATURE

Direction de l'Environnement et des *Etablissements Classés*
Rue Leblanc X Emile Zola
: 22-38-48

19.08.1998-006562

N°______/MEPN/MEMI/DEEC

EC N°4221

ANALYSE : Arrêté interministériel autorisant l'ouverture et l'exploitation d'un établissement dangereux, insalubre ou incommode rangé dans la 1ère classe.

LE MINISTRE DE L'ENVIRONNEMENT ET DE LA PROTECTION DE LA NATURE,

LE MINISTRE DE L'ENERGIE, DES MINES ET DE L'INDUSTRIE,

VU la Constitution ;

VU la loi n°83-05 du 28 janvier 1983 portant Code de l'Environnement ;

VU la loi n°86-15 du 14 avril 1986 portant fixation des taxes relatives à la prospection, la recherche et l'exploitation des mines et carrières, au contrôle des bijoux en or, des appareils à vapeur et à pression de gaz et des établissements classés ;

VU le décret n°98-603 du 4 juillet 1998 portant nomination des Ministres ;

VU le décret n°98-604 du 4 juillet 1998 portant répartition des services de l'Etat, du contrôle des établissements publics, des sociétés nationales et des sociétés à participation publique entre la Présidence de la République, la Primature et les Ministères ;

VU la nomenclature annexée au décret du 21 septembre 1977 portant classement des établissements dangereux, insalubres ou incommodes ;

VU le PV de l'enquête de commodo et incommodo prescrite par l'arrêté ministériel n°15-026 du 6 octobre 1965 concernant la Société Dakaroise et d'Entreposage au Cap des Biches;

VU la demande de la Société GTI Dakar S/C du Cabinet Racine ;

SUR la proposition du Directeur de l'Environnement et des Etablissements Classés, du Directeur des Mines et de la Géologie et après l'avis du Directeur de la Protection Civile,

ARRETENT

ARTICLE PREMIER .- La Société GTI DAKAR, S/C du Cabinet RACINE au 22 Rue Ramez BOURGI BP 545 à Dakar, est autorisée à ouvrir et à exploiter une Centrale Electrique d'une puissance de 50 Mégawatts sise au Cap des Biches Km 22 Route de Rufisque dans la région de Dakar.

.../...

ARTICLE 2. - L'installation projetée appartient à la 1ère classe des établissements dangereux, insalubres ou incommodes. Elle figure sous le N° 153 bis de la nomenclature annexée au décret du 21 septembre 1977 portant Classement desdits établissements.

ARTICLE 3. - La construction et les dimensions du foyer devront être prévues en fonction de la puissance calorifique nécessaire et du régime de marche prévisible de façon à rendre possible une conduite rationnelle de la combustion et réduire au minimum les dégagements de gaz poussières ou vésicules indésirables.

ARTICLE 4. - La collecte et l'évacuation des cendres et mâchefers se feront sans qu'il puisse en résulter d'émission de poussières ou de bruits gênants pour le voisinage.

ARTICLE 5. - La structure des conduits d'évacuation sera coupe-feu de degré de 2 heures lorsqu'ils traverseront des locaux habités ou occupés par des tiers. Leurs matériaux seront suffisamment isolants pour que le voisinage ne soit pas incommodé par la chaleur. On veillera particulièrement à l'étanchéité et à la résistance des joints. En outre, leur construction et leurs dimensions devront assurer un tirage convenable permettant une bonne combustion.

ARTICLE 6. - La construction des cheminées doit être faite de façon à permettre une dispersion correcte des fumées.

ARTICLE 7 : - Pour permettre le contrôle des émissions de gaz et de poussières et faciliter la mise en place des appareils nécessaires à ce contrôle, les cheminées ou conduits d'évacuation devront être pourvus de dispositifs obturables commodément accessibles, à un emplacement permettant des mesures représentatives des émissions à l'atmosphère.

ARTICLE 8. - Lorsque la localisation exceptionnelle, les conditions météorologiques, le mode de combustion ou la nature du combustible la rendent nécessaire, peut être exigée la mise en place, entre le foyer et la sortie des gaz de combustion, de toutes installations efficaces pour la rétention des particules et vésicules ou des gaz nocifs.

ARTICLE 9. - Dans la mesure où les appareils utiliseront de l'eau, celle-ci devra être évacuée conformément aux presriptions en vigueur concernant les rejets d'effluents des installations classées.

ARTICLE 10. - Les combustibles à employer devront correspondre aux caractéristiques préconisées par le constructeur de l'installation. La conduite de la combustion devra être effectuée et contrôlée de façon à éviter toutes évacuations de gaz ou de poussières et de vésicules susceptibles de créer un danger ou une incommodité pour le voisinage.

ARTICLE 11 . - L'installation sera construite, équipée et exploitée de façon que son fonctionnement ne puisse être à l'origine de bruits aériens ou vibrations mécaniques susceptibles de compromettre la santé ou la sécurité du voisinage ou constituer une gêne pour sa tranquilité.

L'usage de tous appareils de communication par voie acoustique (sirènes, avertisseurs, haut-parleurs, etc...) gênants pour le voisinage est interdit, sauf si leur emploi est exceptionnel et réservé à la prévention ou au signalement d'incidents graves ou d'accidents.

ARTICLE 12 . - L'entretien de l'installation de combustion se fera soigneusement et aussi fréquemment que nécessaire, afin d'assurer un fonctionnement ne présentant pas d'inconvénients pour le voisinage. Cette opération portera sur le foyer, la chambre de combustion et l'ensemble des conduits d'évacuation des gaz de combustion et, le cas échéant, sur les appareils de filtration et d'épuration.

ARTICLE 13 . - Les déchets et résidus produits par les installations seront stockés dans des conditions ne présentant pas de risques de pollution (prévention des envols, infiltrations dans le sol, odeurs) pour les populations avoisinantes et l'environnement.

ARTICLE 14 . - Toutes dispositions seront prises pour qu'il ne puisse y avoir en cas d'accident, tel que rupture de récipient, déversement direct de matières dangereuses ou insalubres vers les égouts ou les milieux naturels.

ARTICLE 15 . - Tous les appareils à pression doivent être déclarés avant leur mise en service. Les prises de terre doivent être bien réparties autour des installations.

ARTICLE 16 . - L'installation électrique sera entretenue en bon état : elle sera périodiquement contrôlée par un technicien compétent. Les rapports de contrôle seront tenus à la disposition de la Direction de l'Environnement et des Etablissements Classés.

ARTICLE 17 - Il est interdit de pénétrer avec du feu ou de fumer dans le dépôt. Cette interdiction doit être signalée par tout moyen approprié permettant d'avertir toute personne se dirigeant vers le dépôt.

ARTICLE 18 .- Les systèmes d'extinction appropriés suivant les types de feux (feux d'hydrocarbures, feux de secs, feux d'origine électrique, etc...) doivent être mis en place.

ARTICLE 19 .- La réalisation d'un Plan d'Opération Interne (P.O.I.) à la charge de l'exploitant est obligatoire.

ARTICLE 20. - La mise à jour du registre de sécurité, sur lequel sont reportés les renseignements indispensables à la bonne marche du service de sécurité, est obligatoire.

ARTICLE 21. - L'exploitant est tenu d'informer le Bureau des Etablissements Classés de tout accident ou incident dans les 72 heures.

Le non respect de ces prescription peut entraîner l'annulation de l'autorisation d'exploitation.

.../...

ARTICLE 22. - Indépendamment des prescriptions spéciales prévues ci-dessus, l'installation sera soumise aux dispositions réglementaires concernant l'urbanisme, l'hygiène et la sécurité des travailleurs.

ARTICLE 23. - L'installation est inscrite sous le **numéro 4221** du Registre Spécial des Etablissements classés.

Elle donnera lieu chaque année à la perception des taxes afférentes aux établissements dangereux, insalubres ou incommodes. Ces taxes calculées sur une surface occupée et équipée de **25 000 m2** seront acquises pour l'année quelle que soit la durée de fonctionnement ou d'utilisation de l'installation.

ARTICLE 24. - Le Gouverneur de la Région de **Dakar**, le Directeur de l'Environnement et des Etablissements classés, le Directeur des Mines et de la Géologie et le Directeur de la Protection Civile sont chargés, chacun en ce qui le concerne, de l'exécution du présent arrêté qui sera publié et communiqué partout où besoin sera./-

LE MINISTRE DE L'ENVIRONNEMENT ET DE LA PROTECTION DE LA NATURE

Souty TOURE

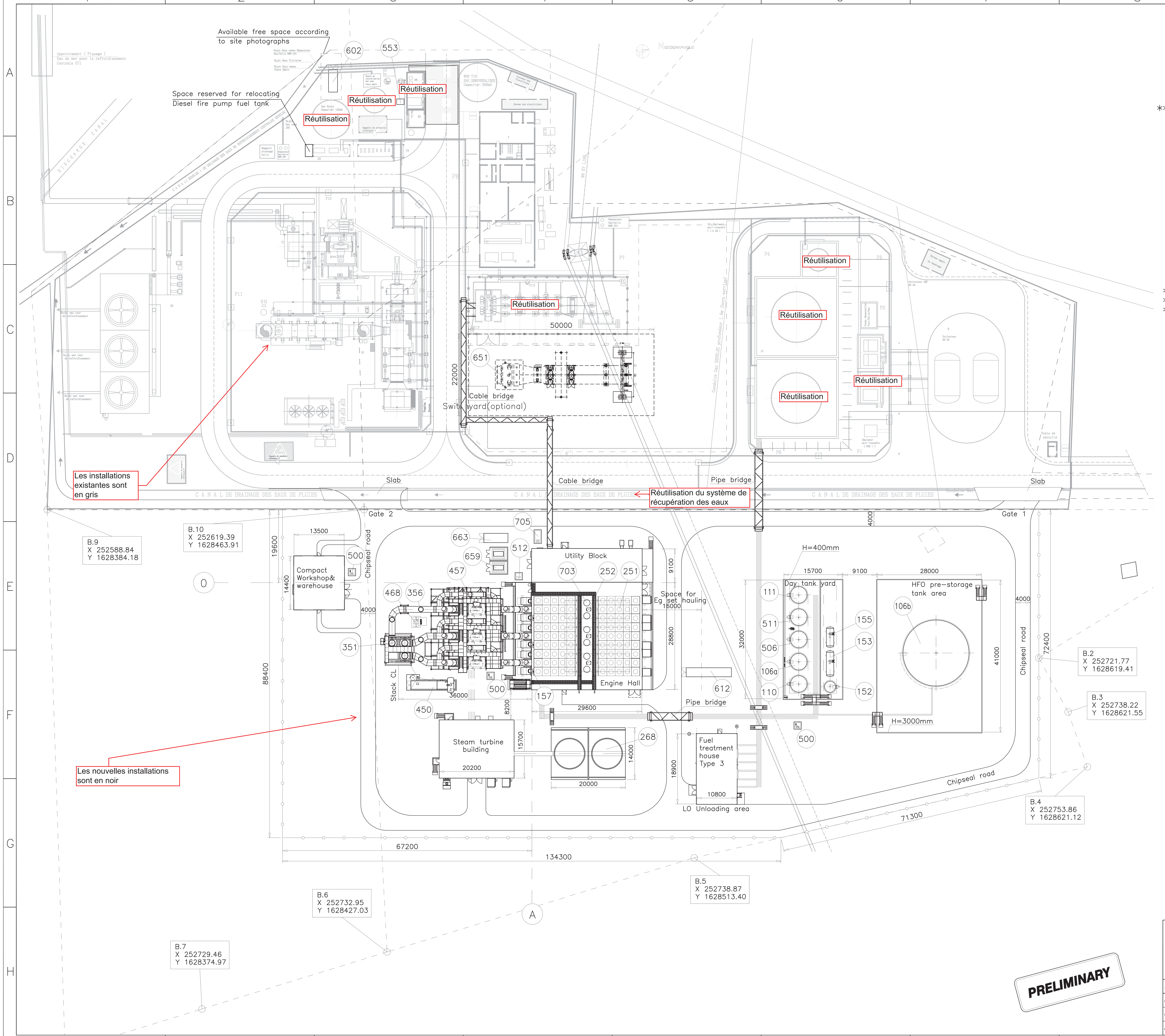
LE MINISTRE DE L'ENERGIE DES MINES ET DE L'INDUSTRIE

Magued DIOUF

AMPLIATIONS:

1 - Présidence
1 - SGG
1 - MEPN
1 - MEMI
1 - MINT
1 - Gouverneur de **DAKAR**
1 - Président du Conseil Régional de **DAKAR**
6 - DEEC

ANNEXE 5: PROJECT LAY OUT AND SECTION MAPS



SITE AREA

Item No.	Pcs.	Code	Description	Volume [m³]	Weight [kg] Incl. liquids	Mounting level (Floor level)
157	3	–	Oil mist separator unit		250	+10.300
251	18	VCA	Radiator		4445	+15.340
252	3	VEA	Expansion vessel	1,2	1450	+16.300
268	–	–	Air cooled condenser			
351	3	NHA	Exhaust gas silencer		7200	+8.850
** 356	16	–	Rupture disk		365	
450	1	RBA	Heat recovery container		34000	
457	3	RCC	Full heat recovery boiler		22300	
468	1	DAD	Boiler washing water tank	5		
500	3	DAD	Oily water collecting pit	2,5		
512	1	DAA	Control pit			
553	1	VBD	Treated water booster unit			
602	1	VFC	Fire pump station		7000	
612	1	–	Water spray & foam container			
651	1	AET	Step–up transformer (optional)			
659	2	BFB	Station transformer			
663	1	BLM	Black starting unit		5500	
703	6	EAB	Ventilation unit 27 m³/s		2000	+11.400
705	1	–	Septic tank			

DAY / STORAGE TANK / UNLOADING AREA

Item No.	Pcs.	Code	Description	Volume [m³]	Weight [kg] Operative	Mounting level (Floor level)
* 100	2	PAA	HFO unloading pump			–
* 102a	1	PAC	HFO Transfer Pump Unit			
* 105	1	PAF	LFO Transfer Pump Unit			
106a	1	PBA	HFO Buffer Tank	50	56250	–
106b	1	PBA	HFO Pre–storage tank (Frangible roof joint)	3000	3089500	–
110	1	PBC	HFO Day Tank	100	109800	–
111	1	PBF	LFO Day Tank	100	109600	
152	1	QAC	Clean Lube Oil Tank	35	39600	–
153	1	QAD	Used Lube Oil Tank	20	22590	–
155	1	QAM	Lube Oil Service Tank	16	18160	–
506	1	DDB	Sludge tank	80	87200	–
511	1	DAB	Oily water buffer tank	50	56000	–

FUEL TREATMENT HOUSE & PUMP SHELTER

Item No.	Pcs.	Code	Description	Volume [m³]	Weight [kg] Operative	Mounting level (Floor level)
102b	1	PAC	HFO Transfer Pump Unit	–	1026	–
107	1	PBB	HFO Separator Unit		8550	–
112	1	PCA	HFO Feeder Pump Unit		–	–
113	1	PCA	LFO Feeder Pump Unit		1065	–
150	1	QAA	LO Unloading Pump Unit (clean)		230	–
151	1	QAB	LO Loading pump unit (used)		–	–
154	1	QAE	LO Transfer Pump Unit		470	–
201	1	TCC	Instrument Air Bottle	0,27	–	–
502	1	DAD	Oily water feed pump		–	–
504	1	DBB	Oily water treatment unit		–	–
507	1	DDC	Sludge transfer pump unit		–	–
657	1	BFA	LV Switchgear		–	–
660	1	BJG	HFO Tank Contr Panel + Remote Commo		–	–
661	1	BLI	Lighting Panel		–	–
670	3	–	Frequency Converters for Feeder Pumps		–	–

* Units need to be located in the existing plant facility.

** Note:– Engines will be converted later to use gas fuel; the rupture disks are planned considering the gas fuel.

SITE INFORMATION

SITE AREA		17 510 m2
Gross floor area	Powerhouse footprint	1 135 m2
	Engine hall	864 m2
	Utility Block	271 m2
	Steam turbine building	317 m2
	Workshop & warehouse	200 m2
	Day tank yard pool	522 m2
	Fuel treatment house Type 3	210 m2
OUTSIDE PERIMETER OF DAY TANK YARD		97 m
HFO PRE–STORAGE TANK AREA		1 176 m2
OUTSIDE PERIMETER OF HFO PRE–STORAGE TANK AREA		140 m
AIR COOLED CONDENSER AREA		280 m2
ROAD AREA		2 830 m2
GRAVEL SPACE		8 330 m2
GREEN SPACE/GRASS		2 250 m2

WÄRTSILÄ

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Master layout

Power Plant, Site

Alt.4

GTI Dakar

3xW18V46

Product: W18V46

MADE 20–Mar–2014 Krishna Shinde

CHKD 16–May–2014 Iiris Korhonen

APPD

Units: mm/kg

Scale: 1:500

Size: A1

DBAC984595 XX

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ENGINE HALL

	Item No.	Pcs.	Code	Description	Volume [m³]	Weight [kg] Incl. liquids	Mounting level (Floor level)
	1	3	SQA	Engine generator set W18V46		371780	+0.000
	5	3	MOD	Engine auxiliary module		7094	+0.000
	7	3	PFC	Engine fuel booster		1800	+0.000
	156	3	QBB	Lube oil separator unit		1520	+1.335
	203	2	TSB	Starting air bottle	4,8	2023	+0.000
	250	1	VBA	Maintenance water tank	10	11500	+0.000
	256	3	VCH	Condensate preheater			+0.000
	300	6	NGA	Intake air filter		2788	+1.840
	350	3	NHA	Exhaust gas module		6000	+4.490
**	355	3	NHA	Exhaust gas ventilation unit		200	+3.450
	613	1	–	Foam bladder			±0.000
	653	3	BAN	Neutral point cubicle			+0.000
	668	3	CFE	Local control panel			+0.000
	701	3	EAA	Ventilation unit, aux. area 18 m³/s		2100	+1.336
	702	6	EAA	Ventilation unit, engine hall 18 m³/s		2600	–0.200

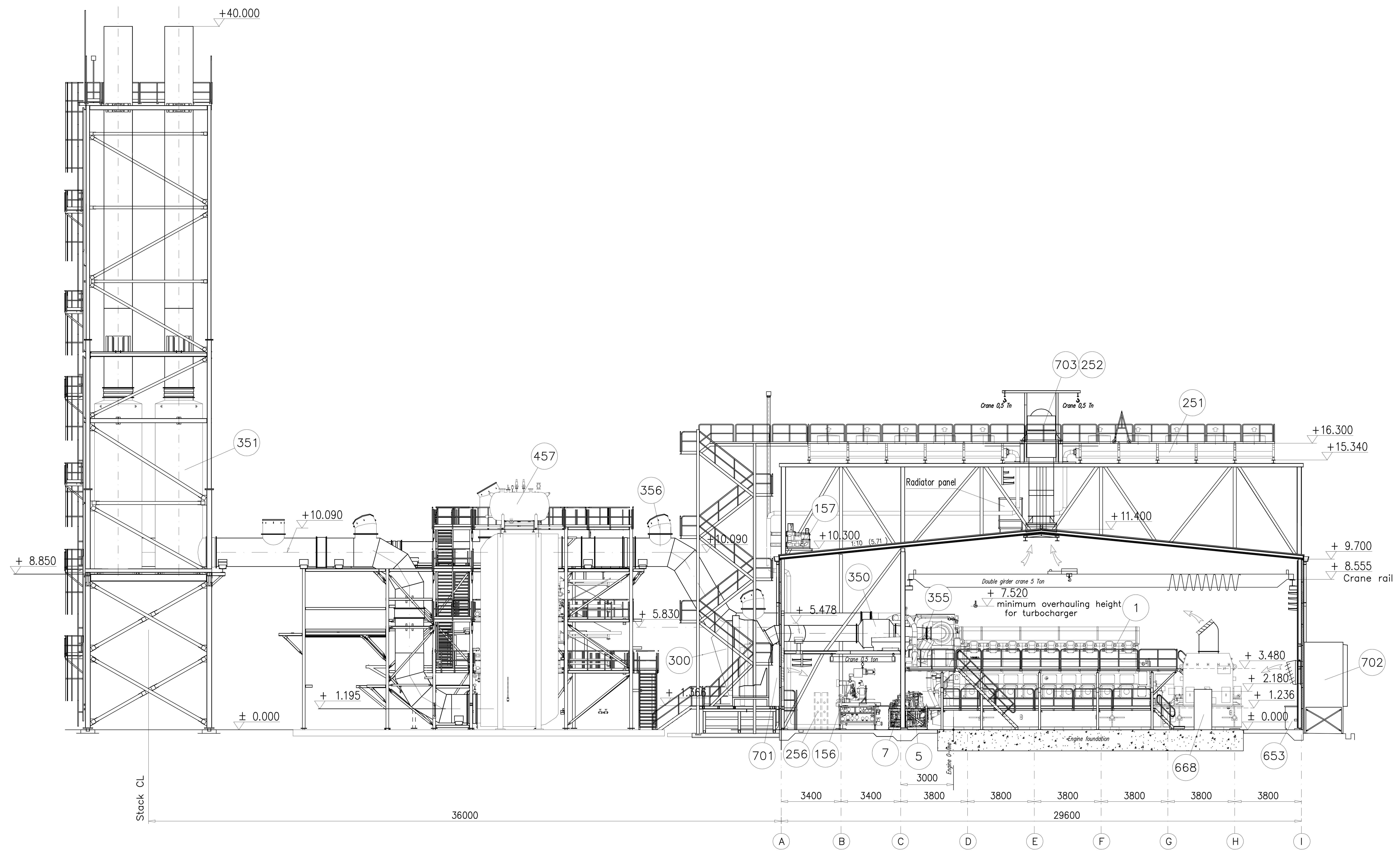
UTILITY BLOCK

Item No.	Pcs.	Code	Description	Volume [m³]	Weight [kg] Incl. liquids	Mounting level (Floor level)
200	2	TCA	Instrument and working air unit			+0.000
202	1	TSA	Starting air unit			+0.000
650	1	AEE	Substation control panel			+2.000
652	1	BAC	MV Switchgear			+2.000
655	1	BEY	DC–system			+2.000
656	1	BFA	LV Switchgear			+2.000
661	1	BLI	Lighting panel			+2.000
664	1	BLN	Fire detection panel			+2.000
666	1	CFA	Control panel, common			+2.000
667	3	CFC	Control panel, engine wise			+2.000
670	3	BLP	Frequency converter for radiator			+2.000
680	3	–	Frequency converter for roof fan			+2.000
713	3	–	Ventilation outlet fan	2.5		–

SITE AREA

	Item No.	Pcs.	Code	Description	Volume [m³]	Weight [kg] Incl. liquids	Mounting level (Floor level)
	157	3	–	Oil mist separator unit		250	+10.300
	251	18	VCA	Radiator		4445	+15.340
	252	3	VEA	Expansion vessel	1,2	1450	+16.300
	268	–	–	Air cooled condenser			
	351	3	NHA	Exhaust gas silencer		7200	+8.850
**	356	16	–	Rupture disk		365	
	450	1	RBA	Heat recovery container		34000	
	457	3	RCC	Full heat recovery boiler		22300	
	468	1	DAD	Boiler washing water tank	5		
	500	3	DAD	Oily water collecting pit	2,5		
	512	1	DAA	Control pit			
	553	1	VBD	Treated water booster unit			
	602	1	VFC	Fire pump station		7000	
	612	1	–	Water spray & foam container			
	651	1	AET	Step–up transformer (optional)			
	659	3	BFB	Station transformer			
	663	1	BLM	Black starting unit		5500	
	703	6	EAB	Ventilation unit 27 m³/s		2000	+11.400
	705	1	–	Septic tank			

** Note:– Engines will be converted later to use gas fuel; the rupture disks and exhaust gas ventilation unit are planned considering the gas fuel.



Section A–A

PRELIMINARY

WÄRTSILÄ	© Wärtsilä Finland Oy Power Plants
Master layout	Engine hall, Section
Alt.4	GTI Dakar 3xW18V46
Product: W18V46	Units: mm/kg
MADE 20–Mar–2014 Krishna Shinde	Scale: 1:150
CHKD 15–May–2014 Iiris Korhonen	Size: A1
APPD	Doc. ID: DBAC984596 Rev. XX

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ANNEXE 6: COMPLIANCE AUDIT REPORT, 2012

PRODUCTEUR INDEPENDANT D'ELECTRICITE

AUDIT ENVIRONNEMENT, HYGIENE ET SECURITE

CENTRALE DE PRODUCTION ELECTRIQUE DE GTI

RAPPORT FINAL

MARS 2012

QUARTZ- Afrique

Liberté 6 extension, n° 8

BP : 10427 – TEL/FAX : 33 827 92 77

EMAIL : quartz.afrique@orange.sn

Site web: www.quartzafrique.com

TABLE DES MATIERES

LISTE DES ABREVIATIONS

AT	Accident de Travail
ATEX	Atmosphère explosive
CBP	Code de Bonne pratique
CHS	Comité d'Hygiène et de Sécurité
DPC	Direction de la Protection Civile
DBO5	Demande biochimique en oxygène pour 5 jours
DCO	Demande chimique en oxygène
DEEC	Direction de l'Environnement et des Etablissements classés
ESP	Equipement sous pression
EPI	Equipement de Protection Individuelle
HSE/EHS	Hygiène Sécurité et Environnement
ICPE	Installations Classées pour la Protection de l'Environnement
MES	Matière en suspension
MP	Maladie Professionnelle
NC	Non Conformité
POI	Plan d'Opération Interne
PMC	Plan de mise en conformité
RAS	Rien à signaler
REG	Réglementation
RIA	Robinet Incendie Armé
SDE	Société Dakaroise d'Entreposage
SENELEC	Société Nation de l'Electricité du Sénégal
STD	Standard

LISTE DE TABLEAUX ET FIGURES

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CHAPITRE I :. INTRODUCTION

I.1 CONTEXTE DE LA MISSION

La société QUARTZ-Afrique a été mandatée par GTI pour la réalisation d'un audit Hygiène, Sécurité et Environnement en vue de la mise en conformité de son site de production, par rapport à la nouvelle réglementation nationale en vigueur depuis 2001 en matière de sécurité et d'environnement, et répondre ainsi aux exigences des ses partenaires.

I.2 OBJECTIFS DE L'AUDIT

L'objectif général visé dans cette étude est d'établir un état des lieux sur la situation environnementale et la gestion des risques du site de GTI et de proposer des recommandations pour sa mise à niveau en matière d'environnement d'hygiène et de sécurité.
Les objectifs spécifiques de cet audit sont de:

a. permettre au site de GTI de disposer d'un système organisationnel HSE performant;
b. renforcer le système documentaire de l'établissement pour mieux rendre compte du niveau de gestion des risques sur le site ;
c. avoir une situation du site en matière de respect des normes environnementales et de sécurité ;
d. dégager les grandes lignes d'un Plan de mise en conformité réglementaire en matière de Sécurité-Environnement du site.

I.3 DEROULEMENT DE LA MISSION

Une réunion de cadrage de la mission s'est tenue le mardi 11 janvier 2011 à la salle de réunion de la centrale électrique sise à cap des biches.
Lors de cette réunion, il a été présenté le chronogramme des activités ainsi que la démarche méthodologique de l'audit qui repose essentiellement sur trois phases d'intervention :

- Phase 1 : Préparation de l'audit
- Phase 2 : Réalisation de l'audit
- Phase 3 : Rédaction d'un rapport de synthèse

- **Phase 1 : Préparation de l'audit**

Cette phase s'est réalisée dans les locaux du cabinet QUARTZ-Afrique. Elle a consisté à élaborer les outils de collecte de données et le référentiel d'audit.

- **Phase 2 : Réalisation de l'audit**

Cette phase s'est déroulée en deux étapes :
Étape 1 : audit du système de gestion HSE.
Etape 2 : audit terrain

Étape 1 : audit du système de gestion HSE:

Elle a consisté à des échanges entre les experts de Quartz-Afrique et le l'équipe de management de GTI. La démarche utilisée a consisté à des séances de questions réponses en s'appuyant sur un questionnaire d'audit.
Cette étape a consisté à analyser et évaluer l'ensemble du système documentaire de référence. Cette phase est très importante dans la démarche d'audit parce qu'elle permet d'identifier les écarts et les éléments de dysfonctionnement du système de gestion, de la santé, de la sécurité du personnel et de l'environnement du site au regard des codes de bonne pratique HSE applicables.

Étape 2 : audit terrain

Cette étape a consisté à visiter l'ensemble du site de GTI afin de procéder à des constats d'audit de manière à identifier les écarts par rapport aux référentiels HSE.

❖ **Phase 3 : Exploitation des données et rédaction d'un rapport de synthèse**

- Analyse des informations obtenues, examen de conformité par rapport aux exigences du référentiel et évaluation des risques (technologiques et professionnels) ;

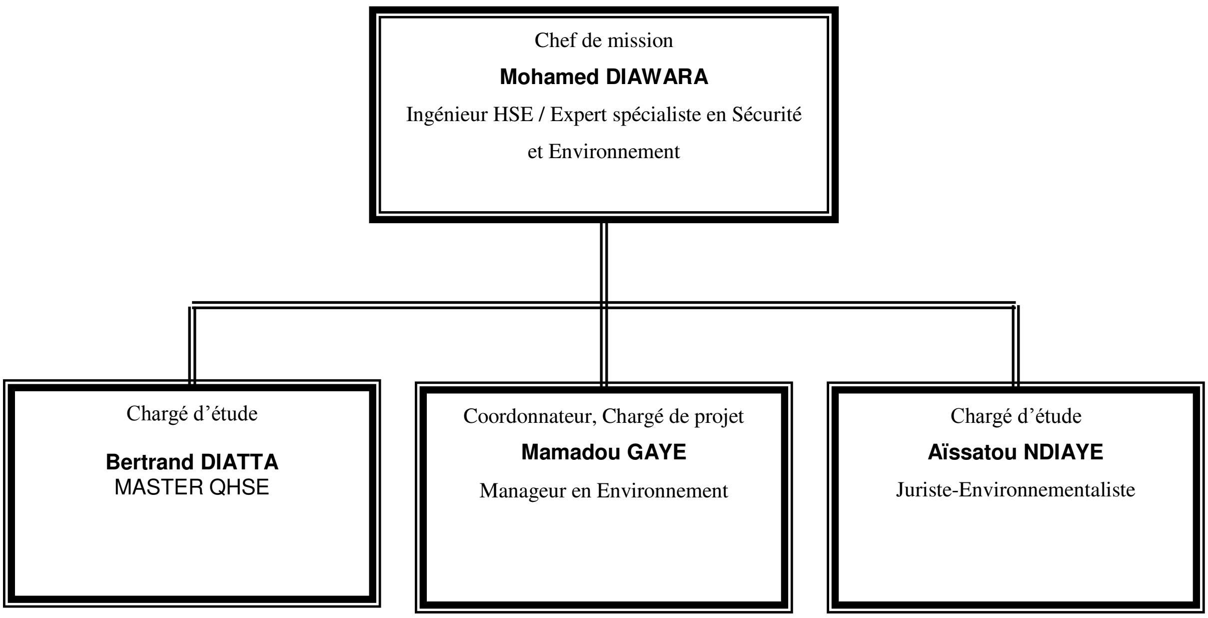
Rédaction d'un rapport présentant les résultats détaillés de l'audit avec propositions d'actions correctives.

I.5 CHAMP DE L'AUDIT

Le domaine couvert par cet audit Hygiène-Sécurité-Environnement concerne la totalité du site d'exploitations de GTI

I.6 EQUIPE D'INTERVENTION

Cet audit est réalisé par le cabinet QUARTZ-Afrique.
QUARTZ-Afrique est un bureau d'études sénégalais basé à Dakar dont l'activité concerne la sécurité et l'environnement. Il a une large expérience dans les audits de conformité réglementaire aussi bien en environnement qu'en santé, sécurité au travail. Il est aussi spécialiste en évaluation des risques dans les établissements classés pour avoir mené plusieurs études de risques en milieu industriel au Sénégal. QUARTZ-Afrique a à son actif plusieurs audits environnementaux, étude d'impact environnemental et études de dangers, pour le compte des industriels en vue du respect de la législation sur les installations classées pour la protection de l'environnement (ICPE). QUARTZ-Afrique a aussi réalisé des études de risques pour l'administration basées sur des scénarios d'accidents majeurs afin de constituer une cartographie de risques.
L'organigramme de l'équipe de projet est présenté ci-après :



I.7 STRUCTURE DU RAPPORT

Les différentes parties du rapport sont:

- Chapitre I Introduction
- Chapitre II Description du site et des activités ;
- Chapitre III Description de l'environnement du site ;
- Chapitre IV Résultats de l'audit
- Chapitre V Plan de mise en conformité règlementaire

CHAPITRE II :. DESCRIPTION DU SITE ET DES ACTIVITES

II.1 PRESENTATION DE LA CENTRALE ELECTRIQUE DE GTI

La Centrale électrique de Gti-Dakar est du type à cycle combiné de 54 MW, comprenant une turbine à gaz General Electric ayant une puissance nominale en base environ 36 MW, tandis que la section vapeur associé a une puissance nominale de l'ordre de 16 MW.
La centrale utilise comme combustible de base du Diesel Oil et exceptionnellement du Naphta quand ce combustible est produit par la SAR. La centrale fonctionne à feu continu, 24/24 , sauf pendant les période de visite ou de révision pour maintenance programmée .

La centrale participe à hauteur de 10 % sur la production d'énergie sur le réseau national interconnecté. Sa production annuelle se situe entre 300 et 360 GWH

Les installations principales sont :

- La Turbine à gaz proprement dite (TAG)
- La chaudière de récupération de la chaleur des fumées (HRSG).
- Le transformateur principal HT de 90 KV au secondaire
- La tour de refroidissement qui est la source froide
- Le poste de dépotage des combustibles liquides
- Le parc de stockage des combustibles
- Les réservoirs d'eau brute SDE,
- La station de traitement de l'eau déminéralisé par Osmose inverse et les réservoirs d'eau déminéralisée.
- La sous station électrique HT
- Les bâtiments administratifs
- Une petite station de pompage de pompage d'eau de mer

II.2 RENSEIGNEMENTS GENERAUX SUR LE SITE

Le tableau ci-dessous fournit les informations générales sur la centrale électrique de GTI

Tableau 2.1 Fiche Signalétique de GTI

Identification :		
Dénomination sociale		Centrale Electrique de GTI-DAKAR
Adresse		Direction : Gti Dakar 2 Place de l4indépendance Dakar –Immeuble SDIH Centrale : Km 26 route de Rufisque
Téléphone		Gti Dakar : 33 889 14 13 Centrale : 33 839 87 39
Situation foncière :		
Statut du terrain : Titre foncier		
Emprise foncière globale		**2,5 Ha**
Activité :		
Activités principales		Production d'énergie électrique
Année de démarrage des activités de l'entreprise		1998
Autorisations antérieures		
N° autorisation		4221
Organisation :		
Effectifs	**Nombre d'employés permanents**	GTI Dakar (5) _MEGS SUARL : **(41)**
	Nombre d'employés temporaires	variable suivant les plannings de maintenance de 5 à 30 personnes
Horaire de travail pour la production		de 7H 30 à 16 H 30
Chef de l'établissement		Directeur Technique : Serigne DIOP Chef de centrale : KEVIN Hagan

II.3 LOCALISATION DE LA CENTRALE DE GTI

Situé à 23 km à l'Est de Dakar en bordure de l'atlantique, la centrale électrique de GTI est accessible par la voie terrestre qui part de l'angle du complexe touristique de RIO (hôtel coumba lamba) et qui croise la route nationale RN°1. Elle est également accessible par voir maritime (cf fig 2.1)

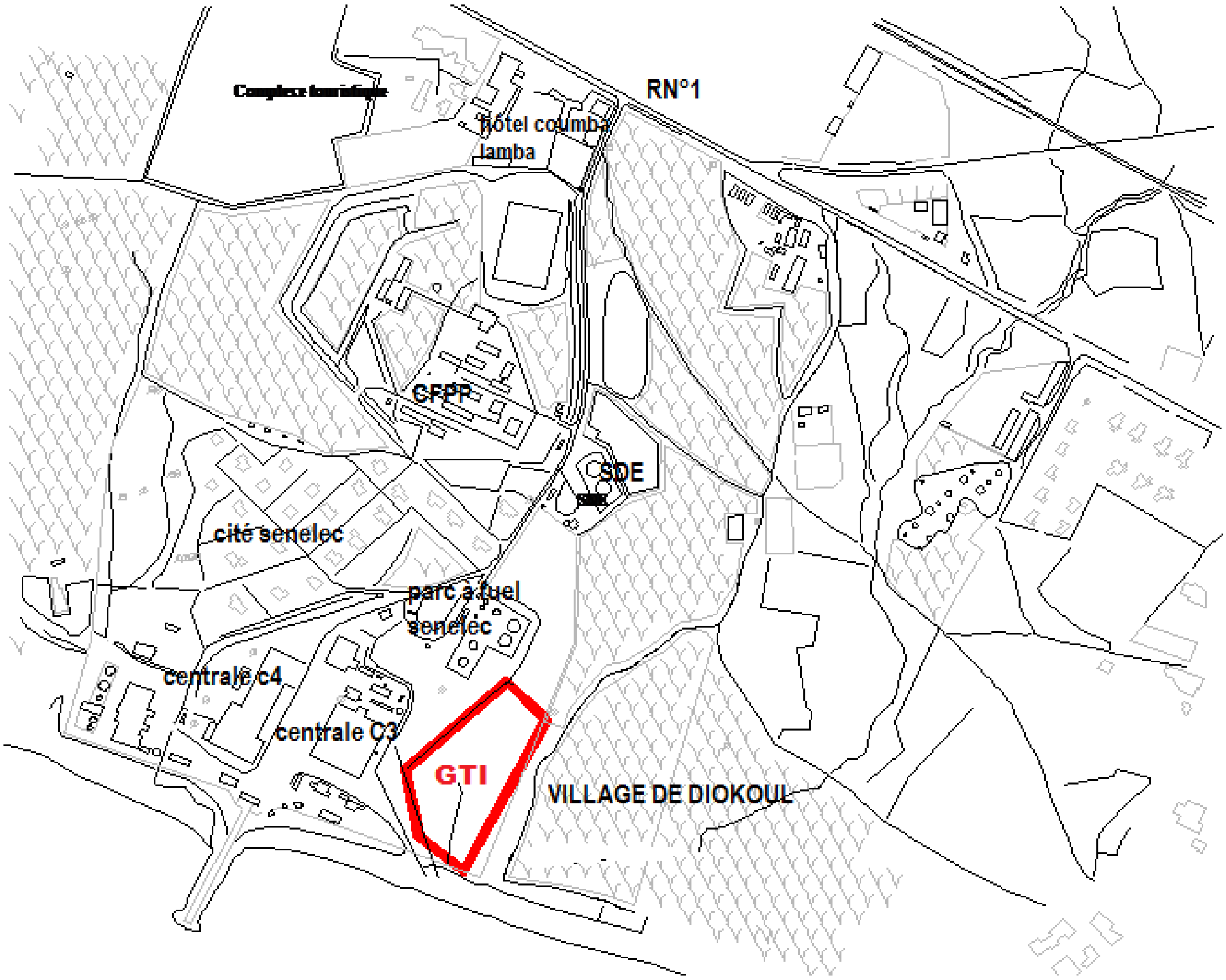


Figure 2.1 localisation de la centrale de GTI en limite rouge

Figure2.2 : vue aérienne de la centrale de GTI

II.4 DESCRIPTION DES ACTIVITES DU SITE

Le domaine d'activité des centrales de GTI est la production d'électricité. La mise en œuvre de cette activité fait intervenir des opérations :

- de réception et stockage des matières premières constituées principalement de combustibles et produits chimiques tels que soude caustique, acide chlorhydrique, …...;
- de production d'électricité par cycle simple et combiné;
- d'élévation de tension via des transformateurs pour le transport de l'énergie électrique ;

II.4.1 Réception et stockage des matières premières

II.4.1.1 Combustibles

L'alimentation en combustible constitue la première phase des étapes aboutissant à la production de l'électricité au niveau de la centrale électrique de GTI. Celle-ci se fait par pompage à partir de camions dans lieu de dépotage prévu à cet effet.

Le dépôt principal d'hydrocarbure renferme :
(Réservoir, contenance, volumes)

- un réservoir de stockage de distillat (185T01A) d'une capacité de 1450 m^3
- un réservoir de stockage de distillat (185T01A) d'une capacité de 1450 m^3
- un réservoir de stockage de distillat (185T02) d'une capacité de 120 m^3

Tous ces réservoirs sont disposés dans des rétentions sous forme de mûr.

II.4.1.2 Produits chimiques

Des produits chimiques sont transportés par camions ou conteneurs dans des fûts de 1000, 200 ou de 30 litres pour la plupart des produits et sont entreposés dans des magasins ou aires de stockage. Ces produits sont utilisés pour :

- la déminéralisation de l'eau brute, au traitement de l'eau de chaudière (exemple le phosphate pour le relèvement du pH) ou pour parfaire la qualité de l'eau (exemple de l'hydrazine utilisé comme dégazage chimique pour éliminer l'oxygène dans les bâches alimentaires) ;
- l'inhibition de la corrosion dans les unités de production.

L'ensemble des produits chimiques stockés et manipulés au sein de la centrale est présenté dans les tableaux ci-dessous.

Tableau 2.2 : liste des produits chimiques

DESCRIPTION	SEUIL MAX	CONDITIONNEMENT	EMPLACEMENT
Optisperse P5494		Fût de 1000 ou 200l	Magasin prod. Chimiques
Steamate NA0540E		Fût de 1000 ou 200l	Magasin prod. Chimiques
Cortrol OS 7780		Fût de 1000 ou 200l	Magasin prod. Chimiques
Sodium hypochlorite (30%)		Fût de 200l	Magasin prod. Chimiques
Spectrus NX1100		Fût de 200l	Magasin prod. Chimiques
Corshield MD4154		Fût de 200l	Magasin prod. Chimiques
Depositrol BL5310		Fût de 1000 ou 200l	Magasin prod. Chimiques
Spectrus CT1300		Fût de 200l	Magasin prod. Chimiques
Hypersperse MDC220		Fût de 200l	Magasin prod. Chimiques
W3000 CFL		Fût de 30l	Magasin prod. Chimiques
Cleanblade		Fût de 200l	Magasin prod. Chimiques
Hypersperse MSI 310		Fût de 200l	Magasin prod. Chimiques
Chemm 3000		Fût de 30l	Magasin prod. Chimiques
Hypochlorite de sodium 12,5% (Eau de Javel)		Fût de 200l	Magasin prod. Chimiques
Acide chlohydrique 33%		Fût de 200l	Magasin principal / Labo
Soude 30 % (Lessive de soude)		Fût de 200l	Magasin principal / Labo
Phosphate trisodique		Sac de 25kg	Magasin principal / Labo
AMBERJET ™ 4200 CL Resin (anion resin)		Sachet de 25ml	Magasin principal / Labo
AMBERJET ™ 1200 H Resin (cation resin)		Sachet de 25ml	Magasin principal / Labo
Molyver 1 reagent for 25ml sample		Sachet de 25ml	Magasin principal / Labo
Molyver 2 reagent for 25ml sample		Sachet de 25ml	Magasin principal / Labo
Molyver 3 reagent for 25ml sample		Sachet de 25ml	Magasin principal / Labo
Phosver 3 phosphate reagent for 25 ml sample		Sachet de 25ml	Magasin principal / Labo
Ferrover iron reagent powder pillows for 25ml sample		Sachet de 25ml	Magasin principal / Labo
Amino acid F reagent powder		Flacon de 1 litres	Magasin principal / Labo
Reagent3 di molibdato per silicio for 100ml sample		Flacon de 100 ml	Magasin principal / Labo
Reagent di acido citrico for 100ml sample		Flacon de 100 ml	Magasin principal / Labo
DPD free chlorine reagent for 25ml sample		Sachet de 25ml	Magasin principal / Labo
Oxygen scavanger 1 reagent for 25ml sample		Flacon de 1 litres	Magasin principal / Labo
Oxygen scavenger 2 reagent 500ml		Flacon de 1 litres	Magasin principal / Labo
Oxygen scavenger 2 reagent 100ml		Sachet de 25ml	Magasin principal / Labo
Reagente II precipitatore dell' ossigeno		Flacon de 1 litres	Magasin principal / Labo
Solution standard acide sulfurique		Flacon de 1 litres	Magasin principal / Labo
Potassium persulfate		Flacon de 1 litres	Magasin principal / Labo
DEHA1 Reagent set		Sachet de 25ml + lacon de 100	Magasin principal / Labo
Free chlorine set		Sachet de 25ml + lacon de 100	Magasin principal / Labo
Reagent citric acide 500ml		Flacon de 500 ml	Magasin principal / Labo
Citric acid F reagent 500ml		Flacon de 500 ml	Magasin principal / Labo
Solution tampon PH4 1000ml rouge		Flacon de 1 litres	Magasin principal / Labo
Solution tampon PH7 1000ml vert		Flacon de 1 litres	Magasin principal / Labo
Solution tampon PH10 1000ml		Flacon de 1 litres	Magasin principal / Labo
Solution tampon PH11 1000ml		Flacon de 1 litres	Magasin principal / Labo
Potassium chloride solution 500ml		Flacon de 500 ml	Magasin principal / Labo
Reagent Molybdate3 for SILICA 100ml		Flacon de 100 ml	Magasin principal / Labo
Amino acid F for 100ml sample (liquid)		Flacon de 100 ml	Magasin principal / Labo
Solution Etalon KCL 500ml		Flacon de 500 ml	Magasin principal / Labo
Solvant REXYL SID		Fût de 30l	Magasin principal
Shell Rimula D40 (huile)		Fût de 200l	Magasin huile
Shell Rimula D50 (huile)		Fût de 200l	Magasin huile
Shell Turbo oil T46 (huile)		Fût de 200l	Magasin huile
Shell Turbo oil T32 (huile)		Fût de 200l	Magasin huile
Carter EP 150 (huile)		Fût de 200l	Magasin huile
Carter EP 220 (huile)		Fût de 200l	Magasin huile
Preslia 32 (huile)		Fût de 200l	Magasin huile
Preslia 46 (huile)		Fût de 200l	Magasin huile
Graisse SKF LGM2		Pôt de 1kg	Magasin huile

II.4.2 Description du Procédé de production

- **Cycle simple**

Un mélange de distillat et d'air comprimé est brûlé dans les 10 chambres de combustion, à une température d'environ 1300 degrés. En augmentant de volume, les gaz chauds issus de la combustion actionnent une turbine (T1) qui, reliée à un alternateur (A1), permet de produire de l'électricité. Le rendement de cette turbine à gaz simple n'est pas très élevé, entre 35 et 38%, car une grande partie de l'énergie est perdue sous forme de chaleur dans les gaz d'échappement. Ce rendement peut être légèrement augmenté en élevant la température de la chambre à combustion. On se heurte toutefois rapidement à un problème de tenue des matériaux. Une meilleure solution consiste à récupérer la chaleur des gaz d'échappement, pour le chauffage ou la production de vapeur

- **Cycle combiné**

Au sortir de la première turbine, les gaz d'échappement sont encore suffisamment chauds (575°C) pour produire de la vapeur. Dans une centrale à cycle combiné, cette vapeur sert à actionner une deuxième turbine (T2) qui, reliée à un deuxième alternateur (A2), permet également de produire du courant électrique. Le rendement global pour la production électrique d'une centrale à cycle combiné au distillat oscille actuellement entre 58 et 60%.

- **Transformateurs pour le transport de l'énergie électrique**

L'énergie produite par les deux unités de production est transférée à la SENELEC par l'intermédiaire d'un transformateur connecté à leur réseau.
Les deux alternateurs du cycle combiné produisent de l'énergie à une tension de 11,5kV. Pour être compatible avec le réseau interconnecté de la SENELEC, cette tension est élevée à 90kV par le transformateur principal de puissance 67MVA

II.4.3 DESCRIPTION DES UTILITES

Les utilités nécessaires au fonctionnement des centrales sont : l'eau de refroidissement, l'air comprimé, et l'électricité.

- **L'eau de refroidissement :**

La centrale GTi utilise l'eau déminéralisée et l'eau de mer pour le refroidissement des différents circuits.

- Le circuit fermé de refroidissement utilise 80m^3 d'eau déminéralisée pour refroidir
    - les parties chaudes de la turbine à gaz (réfrigérant huile, réfrigérant alternateur, pieds turbine et réfrigérant air atomisation),
    - les parties chaudes de la turbine à vapeur (réfrigérant huile et réfrigérant alternateur),
    - les paliers des pompes alimentaires
    - le réfrigérant cabine échantillonnage

Deux produits chimiques sont utilisés pour le traitement de l'eau du circuit fermé : le SPECTRUS, pour lutter contre la prolifération des bactéries et la CORSHIELD pour la passivation.

- L'eau de mer est utilisée pour le refroidissement de l'eau du circuit fermé (par un réfrigérant eau/eau) et le condenseur de la turbine à vapeur.

- **L'air comburant**

L'air comburant utilisé par la turbine à gaz est tiré directement de l'air ambiant au voisinage immédiat de la turbine par la force de succion du compresseur axial qui l'envoi au niveau des chambres de combustion à une pression de 10 bars et à la température de 350°C. L'air comburant traverse préalablement un système de filtration composé d'un jeu de filtres coalescents, d'un jeu de pré filtres et d'un jeu de filtres efficients

- **L'électricité**

Lorsque la centrale fonctionne en plein régime en cycle combiné, l'énergie unihoraire utilisée par les auxiliaires peut atteindre 1,875 MW et provient de la production des deux alternateurs.
A l'arrêt et au démarrage l'énergie consommée par les auxiliaires provient du réseau de la SENELEC.
La puissance consommée, dans ce cas, est variable.

II.5 CLASSEMENT ADMINISTRATIF DU SITE

Au titre de la législation sur les installations classées pour la protection de l'environnement ICPE (cf. code de l'environnement), ***la centrale électrique de GTI,*** à travers ses activités de production d'énergie électrique, ses équipements, et ses substances dangereuses mises en œuvre, est un *« établissement classé ».* A ce titre, elle constitue un établissement soumis à cette présente réglementation. Les installations soumises (voir liste ci-dessous) font référence à la nomenclature sénégalaise des Installations Classées pour la Protection de l'Environnement (ICPE).

Tableau 2.3 : Classement administratif de GTI

N° de la rubrique	Intitulé de la rubrique	Valeur actuelle sur le site	Régime
A1401	***Production et distribution d'électricité*** *(procédé par générateur de vapeur et de turbine)* *Quelque soit la capacité*	GTI produit 50 MW	**A**
A 1406	**Réfrigération ou Compression** (installation) La puissance absorbée étant : puissance totale absorbée Supérieure à 200KW Supérieure à 20KW inférieure à 200KW	Puissance totale des compresseurs de GTI 110KW	D
S 302	**Acide** (emploi ou stockage) La quantité maximale susceptible d'être stockée dans l'installation étant Supérieure à 500m3 Supérieure à 50 m3 et inférieure à 5000m3 Supérieure à 5m3 et inférieure à 50 m3	La quantité totale stockée sur le site est 20m3	D
S703	**Liquides inflammables**	Qeq totale = 3000m3	A

Conformément à la nomenclature des ICPE, GTI est un établissement de première classe ; elle est donc soumise à autorisation.

CHAPITRE III. : DESCRIPTION DE L'ENVIRONNEMENT DU SITE

III.1. ENVIRONNEMENT NAUREL DU SITE

III.1.1. Contexte géographique

La centrale électrique de GTI située au niveau du cap des Biches se trouve administrativement dans la commune d'arrondissement de Rufisque ouest plus précisément dans le département de Rufisque, région de Dakar.

La commune d'arrondissement de Rufisque ouest est limitée :

- A l'est par les quartiers de Kheury Souf,
- Au Nord par les quartiers de Guendel, de Ndar Gounaw et de SantaYalla,
- A l'Ouest par le département de Pikine
- Au Sud par l'océan Atlantique.

Elle couvre une superficie de 2,5 Km2.

III.1.2 Météorologie

A) NATURE DU CLIMAT

La Commune d'Arrondissement de Rufisque ouest appartient à la zone sahélienne. Elle est marquée par deux (2) saisons principales :

- une longue saison sèche de neuf (9) mois (octobre à juillet) marquée par les alizés maritimes ;
- une courte saison pluvieuse de trois (3) mois (juillet à octobre) dominée par le flux de mousson issu de l'Anticyclone de Sainte-Hélène.

Le climat est soumis à des influences géographiques (présence de la façade maritime) et atmosphérique par l'intermédiaire de l'alizé maritime qui est un vent relativement humide et frais qui intervient surtout en saison sèche.

B) FACTEURS CLIMATIQUES

Les données climatiques présentées ci-aprés ont été obtenues au niveau de la Station Météorologique de Dakar-Yoff (station de référence).

- **Les températures**

Les températures sont dans l'ensemble relativement basses avec une moyenne annuelle de l'ordre de 24°C. La période de juin à octobre reste globalement la plus chaude. Les températures les plus basses sont enregistrées durant le période janvier-février.

Tableau 3.1 : Températures maximales et minimales en °C à Dakar (période 1951-2007)

Source : Direction Météorologie Nationale

	Janv	Fév.	Mars	Avr	Mai	Jui	Jut	Aoû	Sep	Oct	Nov	Déc	Moy.
TX	24.9	24.7	24.9	24.9	25.9	28.5	29.8	30	30.4	30.6	29.3	26.8	27.5
TM	21.2	21	21.3	21.7	23	25.8	27.2	25.8	27.5	27.6	25.9	23.3	24.3
TN	17.5	17.2	17.7	18.6	20.2	23.1	24.6	24.8	24.7	24.6	22.6	19.9	21.3

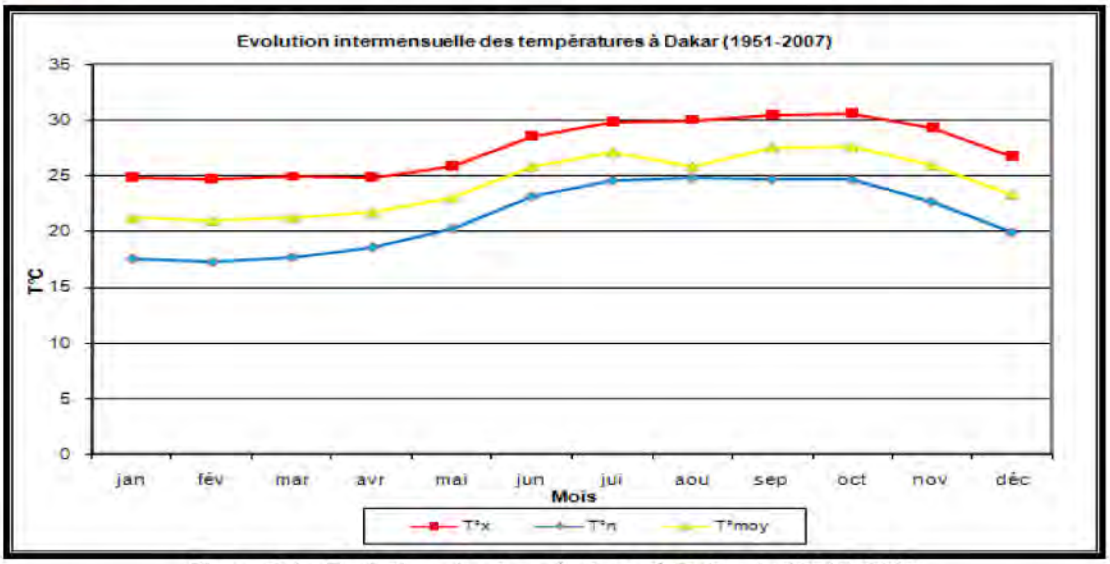


Figure 3.1 : Evolution des températures à Dakar de 1951 à 2007

❖ <u>**Les précipitations**</u>

La période pluvieuse s'étend de juin à octobre. Le mois d'août est le plus pluvieux avec une moyenne de 209 mm.

Ces précipitations sont peu abondantes et dépassent rarement 500 mm/an. Toutefois compte tenu des caractéristiques topographiques de la région de Dakar, elles provoquent souvent d'importantes inondations dans la zone des dépressions.

Tableau 3.2 : Pluviométrie moyenne mensuelle et cumul à Dakar (période 1898-2007)

Source : Direction Météorologie Nationale

Mois	Janv	Fév.	Mars	Avr	Mai	Jui	Jut	Aoû	Sep	Oct	Nov	Déc	Cumul
Moyenne	1	1	0.1	0.1	0.7	13.1	74.7	209.5	141.6	39.4	1.8	2,9	485.9

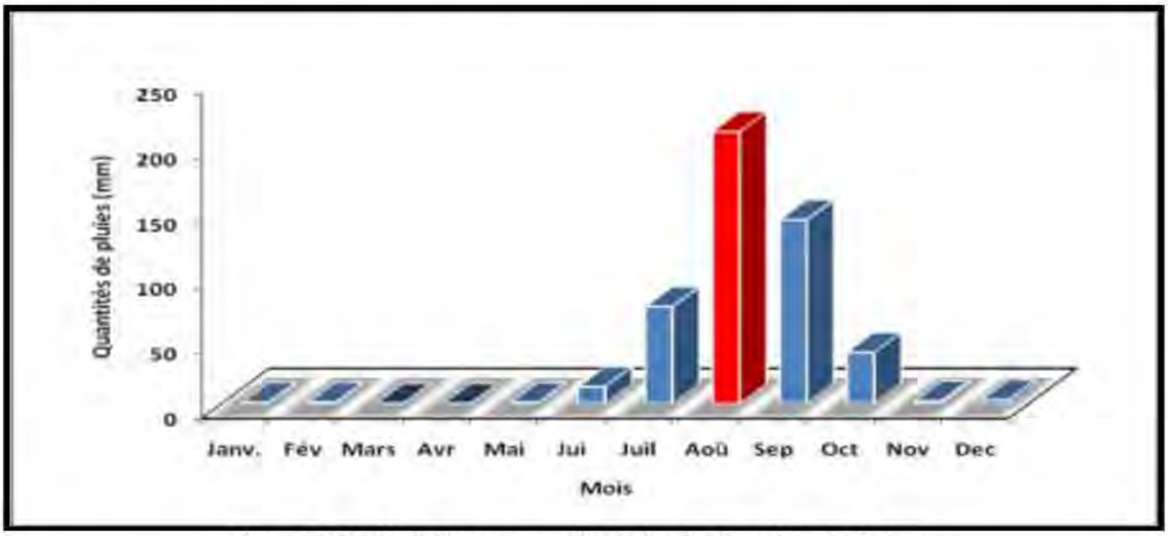
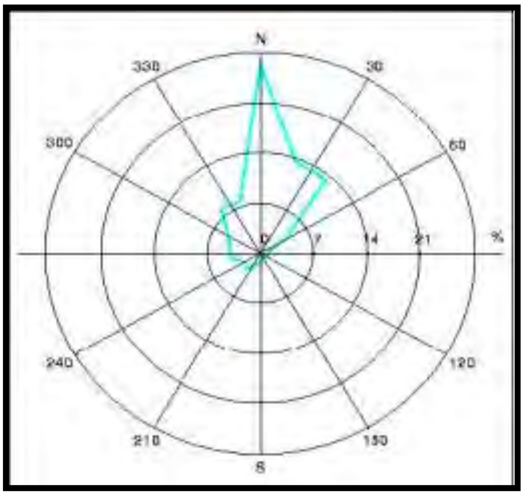


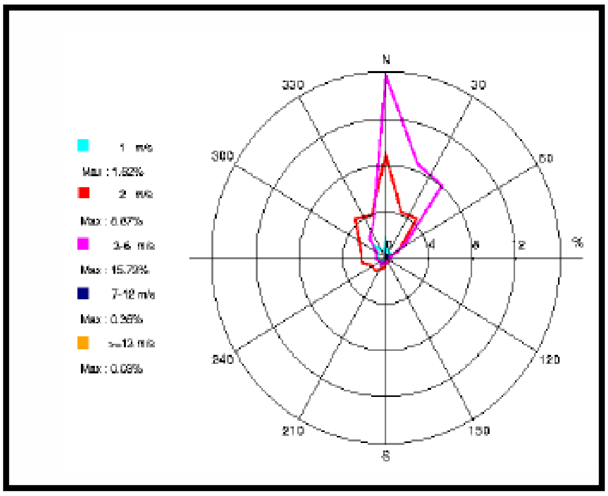
Figure 3.2 : Variation mensuelle de la pluviométrie de Dakar

❖ Les vents

La figure a) présentent la rose des vents générale avec toutes les classes de vitesse confondues pour la station de l'aéroport de Dakar, sur la période du 01/01/1999 au 31/12/2003, tandis que la figure b) présente la rose des vents générale par classe de vitesse.



a) Rose des vents toute classe de vitesse sur la période du 01/01/1999 au 31/12/2003



b) Rose des vents par classe de vitesse

Figure 3.3 : Rose des vents de la station de l'aéroport de Dakar (ERM, 2007)

L'analyse de ces deux figures nous permet de faire les observations suivantes :

- les vents les plus fréquents sont les vents de vitesse comprise entre 3 m/s et 6 m/s soit respectivement 10,8 km/h et 21,6 km/h ;
- les roses des vents montrent une direction privilégiée : vents du secteur nord : 74 % des observations ont des directions de vents comprises entre 300 (Nord Ouest) et 40 (Nord Nord-Est) ;
- sur l'ensemble des directions, les vents ont une vitesse moyenne de 3,1 m/s (9,7 km/h) ;
- les vents faibles (de vitesse inférieure ou égale à 2 m/s) représentent 50,2 % des observations dont 2,6 % de vents calmes (vents inférieurs à 1 m/s) ;
- les vents forts (de vitesse supérieure à 7 m/s) représentent 2,6 % des observations.

La région est donc soumise à des vents d'origine et de directions variables selon les saisons :

- de novembre à juin, les vents sont en général des vents du nord alizés issus de l'anticyclone des azores ou des dorsales maghrébines et sahariennes ;
- l'alizé maritime vent frais et humide de direction NW et NNE ;
- l'alizé continental ou harmattan, vent chaud et sec de direction NE et SE. Ce vent ne souffle sur la côte qu'à la faveur d'un arrêt de l'alizé maritime y provoquant une élévation brusque de la température et une baisse de l'hygrométrie ;
- de juin à octobre les vents dominants sont de direction SSW et SE qui caractérise les flux de mousson issus de l'anticyclone austral Sainte Hélène.

❖ Humidité relative

C'est le rapport de la pression effective de la vapeur d'eau dans l'atmosphère sur la pression maximale. Dans la région de Dakar, elle est en moyenne 75,6%. Les valeurs les plus élevées sont obtenues pendant l'hivernage, période pendant laquelle l'évaporation est importante.

Tableau 3.3 : Humidité relative maximales et minimales en % à Dakar durant la période 1951-2007
Source : Direction Météorologie Nationale

	Janv	Fév.	Mars	Avr	Mai	Jui	Jut	Aoû	Sep	Oct	Nov	Déc	Moy.
HR max	89.4	91.8	92.5	92.7	91.9	89.5	87.5	90.3	92.4	91.9	90.2	87.5	90.6
HR moy	68.6	72.8	75.3	78.4	79.2	78	77	79.9	81.1	78.4	71.8	66.4	75.6
HR min	47.8	53.9	58.1	64.1	66.6	66.5	66.5	69.4	69.8	65	53.4	45.3	60.5

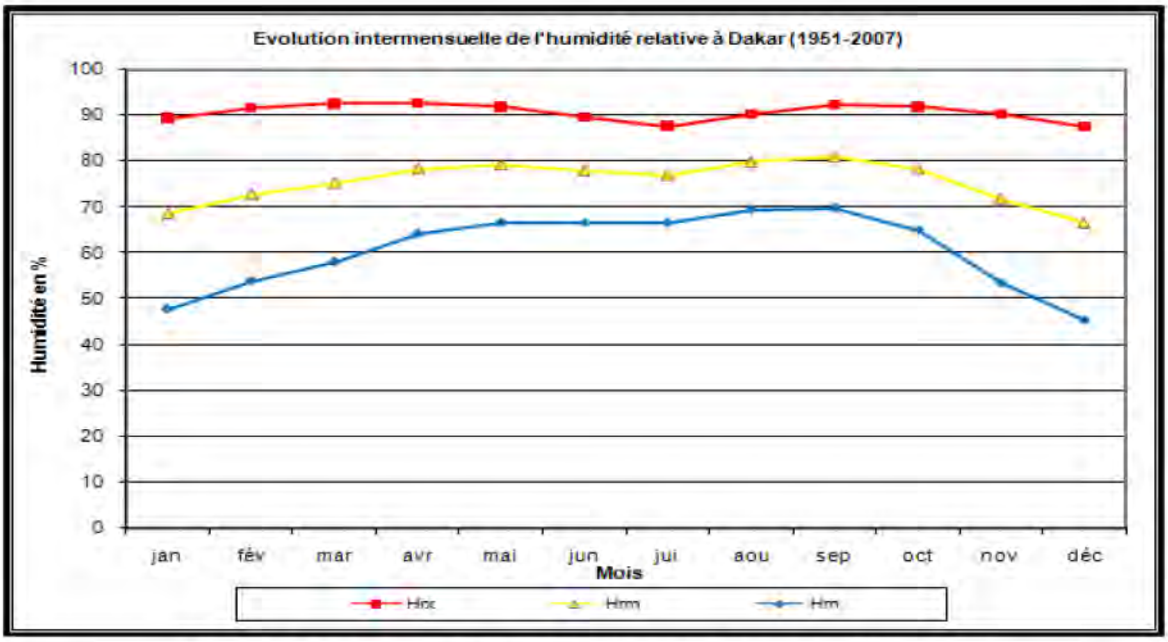


Figure 3.4 : Evolution de l'humidité relative à Dakar entre 1951 et 2007

❖ **Insolation**

Les valeurs moyennes journalières les plus élevées de l'insolation à Dakar sont obtenues pendant les mois d'avril et de mai avec plus de 9 heures/ jour. Les mois d'août et de septembre présentent les valeurs les plus faibles.

Tableau 3.4 : Valeurs moyennes journalières en heures de l'insolation à Dakar de 1951 à 2007
Source : Direction Météorologie Nationale

Mois	Janv	Fév.	Mars	Avr	Mai	Jui	Jut	Aoû	Sep	Oct	Nov	Déc
Valeurs	7.9	8.4	9.1	9.6	9.2	8.1	7.3	6.9	7.2	8.2	8.2	7.5

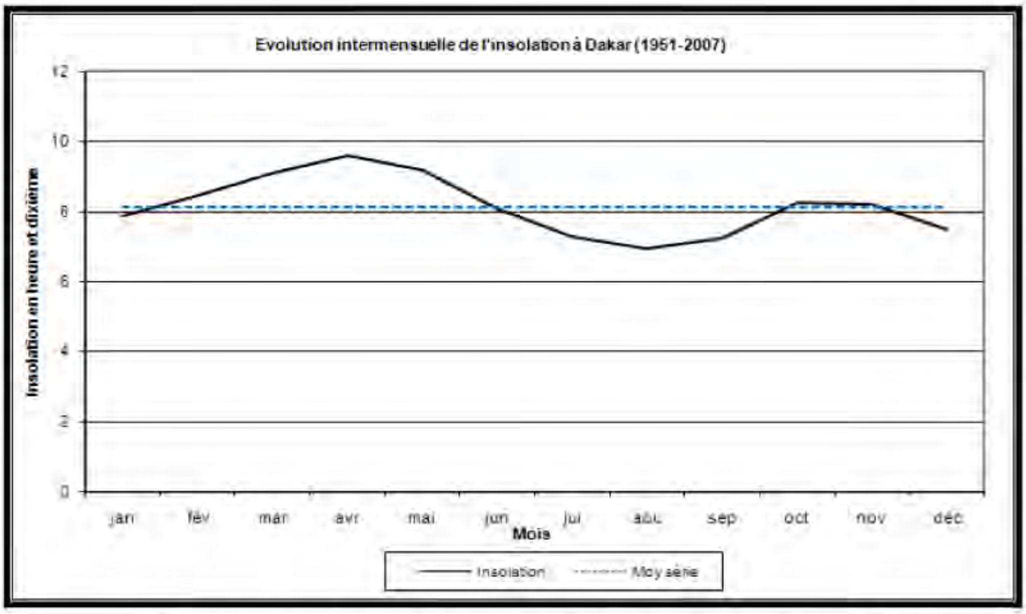


Figure 3.5: Evolution de l'insolation à Dakar entre 1951 et 2007

❖ **Récapitulatif des paramètres météorologiques**

Les données climatiques de base de la région de Dakar sont résumées dans le tableau 2.5.

Tableau 3.5 : Paramètres météorologiques de la région de Dakar

Paramètres	Valeurs
Température moyenne	24,28 °C
Pluviométrie moyenne	≤ 500 mm / an
Humidité relative moyenne annuelle	75 %
Insolation moyenne journalière	8,13 heures
Vitesse moyenne du vent	4,5 m/s

III.1.3 Eaux de surface

La zone de Rufisque ouest, précisément le site de la centrale de GTI est caractérisé par sa proximité avec la mer. Cette dernière est utilisée pour le refroidissement.

III.1.4 Géologie et hydrogéologie

La géologie de la région de Dakar est constituée par des dépôts de nature variée. Le site de Rufisque se caractérise par la présence d'un puissant horizon marno-calcaire. On y distingue les marno-calcaires altérés caractérisés par une couleur jaune, des marno-calcaire beiges compacts, des marnes grises à noires. Ces formations sont attribuées à l'éocène inférieur (Figure 3.6)

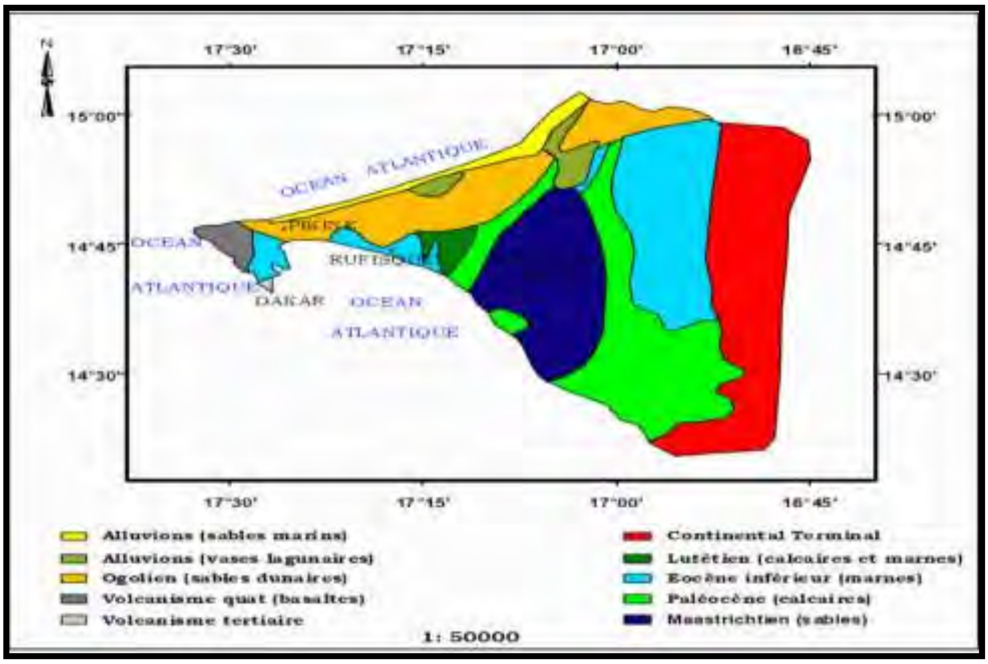


Figure 3.6 : Carte géologique de la région de Dakar

Concernant l'hydrogéologie, la zone de Dakar renferme un système de formations aquifères constitué essentiellement par la nappe des sables quaternaires allongée le long de la côte Nord, assez décalée du site de l'usine. A l'ouest, cet aquifère est en contact latéral avec la nappe des sables infra basaltiques située sous Dakar, dont l'exploitation intense entraîne l'avancement du biseau salé. Cette nappe dite nappe des sables infra basaltiques a son mur en forme de plan incliné vers le Nord-ouest, passant de 20 m au Sud à plus de 75 m vers Yoff, alors que le toit de la nappe présente une forme plus irrégulière. A cap des biches, une nappe de 2 à 2,5m de profondeur a été observée.

III.1.5 Urbanisation des zones sensibles

III.1.5.1 Occupation des sols

La centrale électrique de GTI est localisée dans une zone où la pêche occupe une place importante. Cette activité est surtout exercée par les habitants du village de Diokhoul situé à environ 1Km au sud est du site

III.1.5.2 Activités industrielles adjacentes

Au niveau du site de cap des biches nous notons la présence quelques industries qui se développent. Il s'agit en effet de :

- **LA CENTRALE ELECTRIQUE DE CAP DES BICHES DE SENEEC**

La centrale du cap de biches, propriété de Senelec, est spécialisée dans la production de l'électricité. Celle- ci dispose en effet de deux grandes centrales de production (C_3 et C_4) avec des puissances assignées de 82 MW et 84 MW.

- **SDE**

La société Dakaroise d'entreposage est située à quelques mètres du dépôt d'hydrocarbure principal. Elle a pour principale activité le stockage et la distribution d'hydrocarbure. Compte tenu de la quantité de fioul stockée, la SDE présente des risques pour le voisinage en cas d'accident. Les principaux produits stockés sont :

- Du fuel lourd (6000 m3) ;
- Un réservoir à toit fixe contenant du diesel (3825 m3).

III.1.5.3 Voies de communication

Les seules voies d'accès au site de cap des Biches sont constituées par :

- La route nationale n°1 : elle est située à environ 650 m du site de cap des Biches. C'est une voie qui est très fréquentée par la circulation automobile,
- La route secondaire : c'est la seule voie terrestre qui mène directement au site de la centrale de GTI
- La voie de navigation sud, empruntée le plus souvent par les pêcheurs du village de DIOKOUL et des piroguiers clandestins.

III.1.5.4 Zones et équipements vulnérables à protéger

Les zones et équipements vulnérables à protéger dans les environs immédiats de centrale sont :

- La cité Senelec
- La Société D'entreposage du Sénégal (SDE)
- Le centre de formation professionnelle et de perfectionnement
- L'océan atlantique.

CHAPITRE IV : RESULTATS DE L'AUDIT EHS

IV.1 METHODOLOGIE D'EVALUATION DU NIVEAU DE NON-CONFORMITE

Les non-conformités[1] décelées dans cet audit sont hiérarchisées selon des paramètres : le type et le niveau.

TYPE DE NON-CONFORMITE (NC) :

Réglementation (REG) : Ce type de NC concerne la non application des lois, et règlements nationaux en vigueur au Sénégal.

NIVEAU DE NON-CONFORMITE :

Les non-conformités (NC) décelées en matière de gestion des aspects environnementaux, de l'hygiène et de la sécurité sur le site de sont classées en trois groupes **(A, B, C)** suivant le niveau de risque et l'urgence d'action à entreprendre. On distingue :

Niveau de non-conformité	Signification	Classement des actions correctives selon leur priorité
Groupe A	Ce groupe de NC présente des conditions ou des circonstances : ➢ qui seraient violation flagrante par rapport à la réglementation et qui pourrait engendrer une amende importante, des poursuites judiciaires ou une publicité pouvant porter atteinte à l'image de marque de l'établissement, ou ➢ qui pourraient causer un accident grave pour les employés, le public ou l'environnement même s'ils ne sont pas en violation des lois et règlements en vigueur au Sénégal.	Actions correctives à mettre en œuvre dans l'immédiat
Groupe B	Ce groupe de NC présente des conditions ou des circonstances qui ne conduisent pas forcément à des poursuites ou causer des accidents graves mais résulteraient d'une non application des procédures et recommandations en matière d'hygiène, de sécurité et d'environnement.	Actions correctives à mettre en œuvre dans le moyen ou long terme

[1] **Non-conformités :** écarts entre ce que GTI «doit faire» (exigence du référentiel d'audit) et ce qu'il «fait» (la réalité du terrain)

IV.2 RESULTATS DE L'AUDIT

Cette partie présente les résultats de l'audit de conformité réglementaire EHS. Ces résultats sont donnés pour chaque domaine audité, à savoir :

- → Conformité du Système de Management EHS ;
- → Conformité environnementale ;
- → Conformité en Hygiène, Sécurité et Santé au Travail ;
- → Conformité en gestion des risques majeurs.

IV.2.1 Examen de conformité du Système de Management EHS

IV.2.1.1 Engagements et politique EHS

Description :

GTI existe depuis 1998 et est propriétaire du site. IL a en effet confié à la société MEGS l'exploitation des installations, le maintien et l'entretien des équipements. A ce titre MEGS s'occupe des aspects HSE sur le site. Ceci montre l'engagement et la volonté de la Direction Générale à mieux prendre en charge les questions HSE. MEGS élabore son budget annuel qu'il soumet à GTI. Ils ont plein pouvoir pour agir au nom de GTI sur tous les aspects HSE.

La déclaration d'engagement est écrite, affichée, communiquée à tous les employés et commentés.
Recommandations :
RAS

IV.2.1.2 Organisation de la veille réglementaire

Description :

- MEGS a mis en place une procédure qui porte sur le HSE. A cet effet, MEGS a collecté tous les textes juridiques relatifs à l'environnement.
- Un document de veille réglementaire est en cours de production sur base de lien avec un audit consacré.

Recommandations :

RAS

IV.2.1.3 Objectifs, cibles, Plan ou programme d'action EHS

Description :

- Les objectifs et cibles sont connus au regard des exigences groupe qui a défini ses objectifs stratégiques en matière de HSE.
- Ces objectifs sont partagés au début de chaque année avec l'ensemble du personnel à la première réunion du comité.

Recommandations :

RAS

IV.2.1.4 Ressources, rôles et responsabilités / Structures de management

Description

Un Responsable HSE existe et on a défini ses rôles et responsabilités. Les missions de chaque membre de la ligne hiérarchique, du personnel et de la direction générale sont définies.

- Il existe des objectifs HSE assignés à chaque agent du site y compris la ligne hiérarchique.
- Des responsabilités HSE sont intégrées dans les fiches de poste de chaque agent

Recommandations :

- RAS

IV.2.1.5 Formation, sensibilisation, communication et consultation

Description :

Beaucoup d'efforts ont été faits en matière de formation du personnel sur les aspects HSE.

- Il existe des formations en ligne et en présentiel destinées aux travailleurs. Les besoins de formation sont prédéfinis par le groupe et les filiales adaptent certains modules en fonction du contexte local. Un programme de formation est défini au début de chaque année.
- Concernant les prestataires extérieurs, une formation d'imprégnation avec système d'évaluation niveau 1 et niveau 2 existe.

Recommandations :

RAS

IV.2.1.6 Comité HSE

Description :

Un nouveau CHS existe, il est fonctionnel et se réunit régulièrement.

- Le CHS se réunit tous les mois pour passer en revue les objectifs HSE. Des propositions d'amélioration sont faites
- Une formation du CHS sur les rôles et responsabilités est régulièrement effectuée.

- Le bilan annuel et le rapport de projection ne sont pas systématiquement envoyés à l'inspection du travail.
- Les PV ne sont pas envoyés à l'inspection du travail :
- Les procès verbaux (PV) de réunion du CHS sont communiqués au personnel du site.

Recommandations :

- Le bilan annuel doit être systématiquement envoyé à l'inspection du travail du ressort
- Conformément à l'article 13 du décret 94-244 du 7 mars 1994 qui fixe les modalités de fonctionnement du CHS, ce dernier doit être impliqué dans tout programme d'action, ainsi que le bilan annuel en matière de HSE.

Source : REG, HSST.1.9 / Décret N° 94-244 du 07 mars 1994 fixant les modalités d'organisation et de fonctionnement des CHST/Groupe A

IV.2.1.7 Documentation

Description :

- Le site dispose d'un ensemble de documents de prescription (procédures, consignes d'exploitation, les flow-sheet, plans, etc.)
- Il existe un système de référencement de cette documentation intégré « Gensuite » permettant aux opérateurs d'y avoir accès au besoin mais le système mérite d'être amélioré avec une meilleure traçabilité.

Recommandations:

- Toute la documentation HSE doit être codifiée et archivée physiquement. Elle doit aussi être mise à la disposition du personnel.
- GTI doit renforcer son système d'archivage, de suivi et de traçabilité des actions HSE, y compris le suivi des procédures

REG,HSST.1.9/ Décret N° 2006-1256 et **MEHS.2.5 bis/ Décret** N° 94-244 du 07 mars 1994 fixant les modalités d'organisation et de fonctionnement des CHS/**Groupe B**

IV.2.2 Examen de conformité environnementale

IV.2.2.1 Situation administrative (dossier ICPE)

Description :

- GTI dispose d'un permis avec une autorisation d'exploiter avec un numéro
- L'inventaire de toutes les ICPE n'a pas été réalisé sur le site : Même si GTI s'acquitte des taxes superficiaires sur les établissements classés pour le site depuis son début d'exploitation, le dossier ICPE n'est pas actualisé par respect au code de l'environnement de 2001.
- Par ailleurs, les nouvelles installations (3 nouveaux magasins produits chimiques, système de réfrigérant d'air n'ont pas fait l'objet d'une nouvelle demande d'autorisation d'exploiter conformément à la réglementation en vigueur.

Recommandations :

- La liste des installations doit être dressée avec désignation des rubriques et des valeurs seuil de référence ;
- L'établissement doit déposer un dossier ICPE actualisé auprès de la DEEC ;
- Les plans qui accompagnent les dossiers doivent être repris en tenant compte des dernières modifications apportées sur le site et respectant les échelles

  Source : REG, ENV.1.1 / ENV.1.2 / ENV.1.3 / ENV.1.4 / Loi N°2001 – 01 du 15 janvier 2001 portant code de l'environnement et son décret d'application/**Groupe A**

IV.2.2.2 Equipements sous pressions (ESP)

Description :

- Le site exploite des équipements sous pression de gaz et de vapeur mais ces équipements ne sont pas déclarés auprès de la DEEC.

Recommandations :

- ☞ GTI doit procéder à l'inventaire de tous les ESP exploités sur le site. Un registre doit être établi à cet effet reprenant la désignation de l'ESP, date de mise service, volume, pression de service, pression d'épreuves, les plans et schémas de l'appareil et les PV d'inspection et de maintenance.
- ☞ Tous les ESP doivent être déclarés auprès de la DEEC (récipients, générateurs de flamme ou d'eau chaude, tuyauteries, soupapes,) avec mention de l'année de fabrication, description générale de l'équipement, plans et schémas des composants, sous ensembles, circuits, etc., résultats des calculs de conception éventuels, des contrôles effectués,…, les rapports d'essais.

Source : REG/ ENV.1.3/ Loi n°2001 – 01 du 15 janvier 2001 portant code de l'environnement/ *Titre II / Chapitre I :* *installations classées pour la protection de l'environnement/art L27***Groupe A**

IV.2.2.3 Gestion des eaux usées

Description :

Le fonctionnement des centrales est associé à des rejets d'eaux usées industrielles (eaux de lavage, refroidissement, procédé, eaux de lessivage des dépôts d'hydrocarbures).

- ☞ GTI dispose de 4 points de rejets :

1. Eaux de refroidissement (tour de refroidissement en circuit fermé (7000 m3 d'eau de mer)). Les pertes et les évaporations sont compensées par 280 m3.
2. Eaux de lavage, purges drainées par un réseau de collecteurs et envoyées dans un décanteur.
3. Eaux de lavage en zone de dépôt (eaux chargées d'huile) envoyées vers 3 séparateurs successifs pour finir vers un 2ème point de rejet
4. Poste déminé : une partie acide est neutralisé par de la soude (NaOH) avant rejet.

- Les eaux usées issues de la décantation sont analysés par un laboratoire de la place
- Il est arrivé que les analyses soient effectuées par un autre labo que celui de l'ESP (Labo TEREAU) qui n'est cependant pas agréé à notre connaissance. Le labo de l'ESP n'étant pas toujours opérationnel
- Les résultats d'analyse des échantillons prélevés (mensuellement) ne sont pas envoyés trimestriellement à la DEEC.
- Au niveau des décanteurs, lorsqu'on atteint le niveau haut, les pompes automatiques se déclenchent et permettent un rejet du trop plein sans attendre les résultats d'analyse. Ce qui fait qu'on n'a aucune garantie sur les niveaux de charge rejetés.
- Les eaux de pluie sont bien séparées des eaux usées et sont rejetées en mer via un canal d'évacuation

Il existe un programme formalisé de suivi des effluents rejetés par la centrale. Ce programme comprend :

- des prélèvements et analyses périodiques des effluents de l'usine avant rejet, même après décantation :

Il existe un suivi périodique des indices de pollution tels que pH, T°, MES, DCO, DBO5, azote total, phosphore total, hydrocarbure …. afin de détecter des écarts par rapport à la norme NS 05-061 et de mettre en œuvre des actions immédiates de réduction

Recommandations :

☞ Penser à mesurer la température à une distance suffisamment éloignée pour ne pas être influencée par les eaux de rejets SENELEC.

☞ le trop plein après décanteurs devrait être stocké dans un réservoir tampon, analysé pour vérifier la charge avant rejet dans le milieu.

☞ Les résultats des analyses devront être transmis à la DEEC

Sources :

REG, ENV.4.11 / Norme NS 05-061 sur la pollution des eaux adoptée en juillet 2001/**Groupe A**

REG, ENV.4.4 / loi N°2001 – 01 du 15 janvier 2001 portant code de l'environnement **et ENV.3.6 /** Loi n° 2009-24 portant code de l'Assainissement/**Groupe A**

REG, ENV.4.12 / ENV.3.14 / ENV.4.15 / ENV.4.16 / Norme NS 05-061/**Groupe A**

REG, ENV.4.2 / ENV.4.3 / Loi N°81-13 du 4 mars 1981 portant le code de l'eau/**Groupe A**

IV.2.2.4 Gestion des émissions atmosphériques

Description :

Les émissions atmosphériques identifiées sur le site sont liés principalement au fonctionnement des différentes installations de combustion. Ces émissions gazeuses sont rejetées actuellement dans l'atmosphère par l'intermédiaire de 2 cheminées.

Ces émissions sont composées principalement d'oxyde d'azote et de soufre, de dioxyde de carbone et de turbine à gaz. Les gaz brulés vont directement en cheminée au cas où la déviateur ou diverteur (porte) est fermée. C'est le cycle simple.

En cycle combiné, la porte est ouverte, elle ferme l'ouverture de la cheminée1, tous les gaz sont envoyés au niveau de la chaudière pour chauffer l'eau déminée qui la transforme en vapeur pour alimenter les turbines. Les gaz sont déviés au niveau de la cheminée2. Ces émissions sont composées principalement de SO2, NOx et de particules fines (PM10).

Pour la gestion de ces émissions, un système de mesure en discontinu est effectué par l'exploitant avec un TESTO 350 .Les mesures sont effectuées en un seul point de la cheminée. La valeur 5xD n'est pas respectée pour le nombre de plate forme de mesure à prévoir. De même, les mesures d'émissions en sortie de cheminée ne sont pas effectuées.

- VERITAS effectue périodiquement des mesures mais déplore autant le nombre de trous que la forme de trou inadapté pour le jointage de la sonde.
- Les rapports de mesure trimestriels ne sont pas produits.
- Il existe un rapport annuel de mesure des émissions mais non envoyés à l'environnement.

☞ Il existe un système de mesures en continu des immissions via un analyseur en continu. Toutefois, depuis juin 2008 GTI ne procède plus à des mesures d'ambiance Il n'existe plus de programme de surveillance des polluants rejetés aussi bien en émission qu'en immissions.

Recommandations :

☞ GTI doit réaménager la cheminée de manière à respecter la règle des 5D et du nombre de points de mesures.

☞ L'établissement devra mettre en œuvre un programme de surveillance des polluants rejetés par la centrale. Ce programme pourrait intégrer :

- L'envoi des mesures effectuées par VERITAS à la DEEC.
- Le suivi de la qualité de l'air par la remise en marche de l'analyseur en continu ;

Source :

REG, ENV.5.9/ ENV.5.10/ ENV.5.11/ ENV.5.12/ ENV.5.13/ Norme NS 05-062 et **ENV.4.2/**Loi N°2001 – 01 du 15 janvier 2001 portant code de l'environnement/**Groupe B**

IV.2.2.5 Pollution du sol et sous-sol

Description :

☞ Tous les stockages disposent de rétentions

☞ GTI n'a pas connaissance de la pollution du sol dans cette zone. Le site ne dispose pas d'un réseau de piézomètre pour caractériser la qualité, le niveau de la nappe et le sens d'écoulement des eaux souterraines.

☞ Une étude de caractérisation du sol et sous-sol n'est pas effectuée

Recommandations :

- L'établissement doit impérativement respecter le programme de gestion et de suivi des liquides dangereux manipulés sur le site et tout particulièrement le gasoil. Ceci passe par : Le nettoyage et la dépollution au besoin de toutes les zones déjà contaminées par le gasoil, en particulier, la zone de déchargement, suite à une étude de caractérisation du sol et du sous sol ;
- L'Installation d'un réseau de piézomètres dans les zones de stockage d'hydrocarbures. A cet effet, des prélèvements de la nappe devraient être régulièrement effectués à des fins d'analyse.

Source : REG, ENV.6.1/ Loi N°2001-01 du 15 janvier 2001 portant code de l'environnement/**Groupe A**

IV.2.2.6 Bruit

Description :

☞ Les nuisances sonores générées par les moteurs sur le site sont plus d'ordre professionnel. Néanmoins, des mesures en limites de propriété ne sont pas effectuées pour vérifier le niveau d'intensité acoustique en ces endroits.

Recommandations :

☞ des mesures annuelles du bruit en limites de propriété doivent être effectuées en différents endroits.

Source : **REG**, **ENV.7.1/ Loi** N°2001 – 01 du 15 janvier 2001 portant code de l'environnement et **ENV.7.2/ Décret** N°2001-282 du 12 avril 2001 portant application portant code de l'environnement/**Groupe B**

IV.2.2.7 Gestion des déchets

Description :

L'établissement dispose d'une procédure de gestion des déchets produits sur le site mais dans la pratique, il se pose les problèmes suivants que nous énonçons :

- .les zones de stockage des déchets solides ne sont pas toujours appropriés car pourraient ne pas être étanche à l'infiltration et ne sont pas pourvus de système de drainage
- certains déchets solides ne sont pas mis aux endroits appropriés par le personnel, par exemple dans les poubelles existants ;

Recommandations :

- La zone devant être aménagée pour le stockage des déchets dangereux doit respecter les règles de stockages recommandées en la matière. (étanchéité et système de drainage)
- Le personnel doit être sensibilisé pour prendre l habitude de mettre les déchets dans les poubelles appropriées

Source : **REG**, **ENV.2.3/ Loi** N°2001 – 01 du 15 janvier 2001 portant code de l'environnement/**Groupe B**

IV.2.3 Examen de conformité en Hygiène, Sécurité et Santé au Travail

IV.2.3.1 Identification et évaluation des risques SST

Description :

GTI dispose d'un document d'analyse des risques « Tasks Hazards Analysis » qui rend compte de tous les risques qui existent à GTI avec (Common Activities, Job categories, Hazards, Associeted Risks, Control Measures for risks mitigation) En plus, une évaluation des risques se fait à chaque fois qu'il ya un nouveau travail qui s'effectue sur le site.

Recommandations :

- RAS

***Source** : **REG**,* **MEHS.2.1/ Loi** N° 97-17 du 1er décembre 1997 portant Code du travail/**Groupe B**

IV.2.3.2 Sécurité relative aux postes de travail et aux tâches

Description :

- Certains postes de travail exposent les agents à des risques et le plus souvent ils n'en sont pas conscients.
- En fonction du poste occupée, des formations sont effectuées pour chaque poste.
- L'analyse des postes de travail est effectuée avant toute occupation de poste ;Il existe un document « Restrictide Work Operazation » qui liste les employés, leurs compétences techniques et HSE et les formations avant occupation du poste.
- Chaque fiche de poste intègre la dimension santé, sécurité au travail.
- Un programme d'inspection des locaux de travail existe mais c'est le responsable des opérations qui s'en occupe. Cela se fait sur une base mensuelle. A cet effet, un document qui s'appelle revue des performances HSE est élaboré est déroulé 2 fois par an. Cette revue sera basée sur les activités suivantes :
    - surveillance active
    - Informations résultant de contrôles
    - Investigations sur les incidents

  Un 2ème document de revue et de gestion globale « Gensuite » existe et est mis en pratique chaque mois pour le suivi.

Recommandations :

- RAS

IV.2.3.4 Sécurité électrique

Description :

- Les installations électriques à GTI font l'objet d'une vérification annuelle effectuée par un bureau de contrôle agréé (VERITAS). La liste des armoires, coffrets électriques, etc. existe (Listé dans le rapport VERITAS)
- Une procédure de sécurité électrique existe : il s'agit d'une procédure de sécurité des systèmes d'isolement, d'isolations électriques, de travail avec du matériel électriques, d'énergie accumulée.
- A intervalles réguliers (mensuellement), un suivi et contrôle de l'application de ces procédures et consignes sont effectués.
- Un système d'habilitation électrique existe à GTI. Des personnes ont été formées et autorisées à intervenir sur des installations électriques. Une procédure définit les responsabilités des uns et des autres.

Recommandations :

- RAS

IV.2.3.5 Sécurité stockage gaz

Description :

Il y a une zone destinée à l'oxycoupage avec 2 bouteilles d'oxygène et d'acétylène. Les vides sont séparés des pleines.

Recommandations :

- RAS

IV.2.3.6 Sécurité manutention

Description :

- Un inventaire des équipements de manutention est élaboré ;
- Les équipements de manutention sont suivis périodiquement ;
- Les contrôles périodiques annuels sont effectués
- Seul le chariot dispose d'un registre de sécurité. Les autres équipements n'en disposent pas.

Recommandations :

- Disposer d'un registre de sécurité pour les autres appareils de levage

  Source : REG/ art L174 du code du travail

IV.2.3.7 Sécurité gestion des produits chimiques

Description :

- Une procédure pour la gestion des produits chimiques est écrite ;
- Tout le personnel est formé aux risques chimiques

Recommandations :

RAS

IV.2.3.8 Sécurité travaux en hauteur

Description

- Une procédure est écrite pour les travaux en hauteur.

Recommandations :

RAS

IV.2.3.9 Equipements de protection individuelle (EPI)

Description :

- Un programme de gestion des EPI est mis en place :
- Il existe une procédure écrite pour la gestion des EPI.

Recommandations :

- ☞ RAS

Source : REG, HS.1.8/ Décret n° 2006-1261 du 15 novembre 2006 ; **HS.2.1/ Loi** N° 97-17 du 1er décembre 1997 portant Code du travail ; **HS.2.2/ Décret** N° 2006-1251 du 15 novembre 2006 relatif aux équipements de travail ; **MEHS.2.3/ Décret** N° 2006-1256 du 15 novembre 2006 fixant les obligations des employeurs en matière de sécurité au travail/**Groupe A**

IV.2.3.10 Sécurité machines et des équipements

Description :

- ☞ L'établissement a développé une procédure HSE spécifiques aux isolations mécaniques.
- ☞ Il existe une procédure écrite concernant la commande de nouveaux équipements.

Recommandations :

- ☞ RAS

Source : REG, HS.3.7/ Décret N° 2006-1251 du 15 novembre 2006 relatif aux équipements de travail/**Groupe B**

STD, Directive 2006-42 CE/Groupe B

IV.2.3.11 Conformité du restaurant, des sanitaires, ordre et propreté

Description :

<u>Vestiaires et toilettes :</u>

- ☞ Les toilettes dans le local GTI sont contigües à une salle où il y a des bouteilles d'eau de boisson. Un réfrigérateur est installé à proximité du lavabo. Les toilettes dans le local GTI sont mal entretenues.

Recommandations :

- ☞ Les toilettes doivent être mieux entretenus et faire l'objet d'inspections régulières
- ☞ La réception des produits alimentaires, eau potable doit se faire dans une zone distincte du local GTI.

Source :REG, HS.1.1/ Loi N° 83-71 du 05 juillet 1983 portant Code de l'hygiène ; **HS.1.6** et **HS.1.7/** Décret n° 2006-1261 du 15 novembre 2006 fixant les mesures générales d'hygiène et de sécurité dans les établissements de toute nature ; **HS.2.2/** Décret N° 2006-1251 du 15 novembre 2006 relatif aux équipements de travail ; **HS.1.8/** Décret n° 2006-1261 du 15 novembre 2006 fixant les mesures générales d'hygiène et de sécurité dans les établissements de toute nature /**Groupe B**

IV.2.3.12 Système d'autorisation de travail

Description :

- Tous travaux susceptibles de générer des accidents de travail doivent au préalable être autorisés par un système de permis de travail à GTI. Le système d'autorisation de travail est pratiqué à GTI.
- Le personnel est formé sur les permis de travail.
- Cependant, lors de notre audit, le chef de quart n'était pas informé de la présence sur le site, d'un prestataire extérieur alors qu'il dispose de son autorisation de travail. Ce qui pose un problème de coordination interne sur la continuité du permis.

Recommandations :

- Reprendre le programme de sensibilisation et de formation de la ligne hiérarchique pour une meilleure efficacité dans la mise en œuvre du permis de travail

REG, **ENV.1.1/** Loi N°2001 – 01 du 15 janvier 2001 portant code de l'environnement/**Groupe A**

IV.2.3.13 Enquête et analyse des accidents de travail (AT) et maladies professionnelles (MP)

Description :

Lorsqu'un accident grave ou mortel survienne sur le site, une enquête est diligentée avec utilisation de l'outil d'analyse ***Five-Why's*** .

- Il existe une démarche de gestion globale des accidents de travail avec des procédures écrites.
- Les membres du CHS sont formés à l'analyse et enquêtes des accidents et incidents.

Recommandations

RAS

Source : REG, HS.6.1/ HS.6.2, Décret N° 2006-1250 du 15 novembre 2006 relatif à la circulation des véhicules et engins à l'intérieur des entreprises/ **Groupe B**

IV.2.3.14 Entreprises extérieures et sous-traitance

Description :

- Il existe une procédure spécifique HSE pour les entreprises extérieures. Avant le démarrage des travaux, le personnel des entreprises extérieures est formé par GTI.
- Les entreprises extérieures sont concernées par l'exigence d'un système d'autorisation de travail. Les cahiers de charges pour l'exécution de travaux confiés à des entreprises extérieures intègrent des exigences HSE.

Recommandations :

- RAS

IV.2.3.15 Suivi médical du personnel

Description :

- Le médecin du travail ne participe pas à l'évaluation et l'analyse des postes de travail
- Des visites d'embauche et annuelles sont effectuées. Cependant, certains travailleurs occupant des postes exposés de niveau A ne subissent pas de visites spécifiques au regard des risques liés à leur poste

Recommandations :

- Le médecin du travail devrait procéder à des visites périodiques et spécifiques chez certaines catégories de travailleurs avec un dossier médical de suivi.
- Le médecin du travail, en rapport avec le coordonnateur HSE et le CHS, doit procéder à l'identification et à l'évaluation de tous les postes de travail.
- Dégager suffisamment du temps au médecin du travail pour s'occuper de ses missions premières de prévention.
- Le médecin du travail devra à la fin de chaque année faire un rapport sur la santé au travail et dégager un plan d'action annuel en termes de surveillance des conditions de santé au travail et de surveillance médicale

Source : REG, HSST.1.20/ Décret n° 2006-1258 du 15 novembre 2006 fixant les missions et les règles d'organisation et de fonctionnement des services de Médecine du Travail /**Groupe B**

IV.2.4 Examen de conformité en gestion des risques majeurs

IV.2.4.1 Sécurité dans les parcs de stockage de combustibles

Description :

- Le stockage de combustibles utilisés comme principales matières premières pour le fonctionnement de la centrale est de type aérien (il n'existe pas de stockage souterrain). Le site comprend 1 dépôt de gas-oil qui est dans un état globalement satisfaisant.
- Il existe une procédure de gestion du dépôt. Cependant, le suivi du nettoyage n'est pas régulier.
- Les codes de couleur standard ne sont pas bien respectés au niveau des tuyauteries.

Recommandations :

- Le dépôt doit être constamment en état de propreté et être complètement débarrassés des objets non nécessaires (brindilles larguées par les oiseaux). Ceci pourra se faire à travers un suivi régulier.
- Harmoniser les codes de couleur en respectant les codes standards internationaux.

Source : REG, **ENV.2.3/ Loi** N°2001 – 01 du 15 janvier 2001 portant code de l'environnement/**Groupe B**

IV.2.4.2 Sécurité Incendie et Explosion

Description :

Prévention des incendies et explosions **:**

Le risque incendie-explosion est présent dans certaines zones visitées notamment dans le dépôt d'hydrocarbures, le magasin général, centrale, etc,

Prévention des incendies et explosions **:**

- ☞ Le personnel a bénéficié d'une formation sur les mesures de prévention destinées à réduire le risque incendie ou explosion présents sur le site.
- ☞ Il existe un programme de formation du personnel en matière de prévention incendie.

Moyens de lutte contre l'incendie **:**

Les moyens de lutte contre l'incendie (extincteurs, réseau d'incendie constitué de pompes, de réserves d'émulseur, de circuit d'eau conçu pour alimenter les couronnes de refroidissement des bacs et de RIA) sont disponibles. Le circuit d'eau du réseau incendie du dépôt principal de combustible fait l'objet de tests périodiques par le personnel sur place. Tous les extincteurs sont contrôlés périodiquement par un organisme agréé et les dates de vérification sont inscrites sur leurs plaques signalétiques. Cependant, quelques disfonctionnements ont été notés :

- ☞ Les réserves en émulseur sont insuffisantes (un seul kit mobile de 1500 litres).
- ☞ Les zones ATEX ne sont pas matérialisées

Recommandations :

Prévention des incendies et explosions **:**

- ☞ L'établissement doit renforcer ses moyens en émulseur
- ☞ Les couronnes de refroidissement doivent ceinturer entièrement les robes de tous les réservoirs
- ☞ Délimiter des zones à risque d'explosion sur le site (zones ATEX) et l'application des Mesures techniques et organisationnelles prévues par la réglementation ATEX (Directive 1999/92/CE du 16 décembre 1999).

Source : REG, arrêté interministériel n°4862 du 14 juillet 1999 rendant obligatoire l'établissement d'un POI dans certains établissement classés et d'un PPI dans les collectivités locale présentant à l'intérieur de leur périmètre territorial des installations classées soumise à l'élaboration d'un POI

IV.2.4.3 Gestion des situations d'urgence

Description

- Le site dispose d'un plan d'opération interne qui n'est pas mis à jour.

Recommandations :

- Le POI devra être mis à jour et être envoyé à la DEEC et la DPC pour validation.

Source : **REG**, **RT1.1./ Loi** N°2001 – 01 du 15 janvier 2001 portant code de l'environnement ; **RT.12./** Arrêté ministériel N°4862 du 14 juillet 1999 rendant obligatoire l'établissement du plan d'opération interne (POI) dans certains établissements classés/**Groupe A**

IV.2.5 Tableau de synthèse sur l'évaluation des non-conformités[2]

Niveau de non-conformité	Group A	Group B	TOTAL NC
Type de non-conformité	**REG**	**REG**	
SYSTÈME DE MANAGEMENT EHS			
Engagements et politique EHS			
Organisation de la veille réglementaire			
Objectifs, cibles, Plan ou programme d'action EHS			
Ressources, rôles et responsabilités / Structures de management			
Formation, sensibilisation, communication et consultation			
Comité HSE		2	2
Documentation		1	1
Total Système de management EHS		**3**	**3**
ENVIRONNEMENT			
Situation administrative (dossier ICPE)	2		2
Equipements sous pressions (ESP)	1		1
Gestion des eaux usées		1	1
Gestion des émissions atmosphériques		2	2
Pollution du sol et sous-sol	3		3
Bruit		1	1
Gestion des déchets		2	2
Total Environnement	**6**	**6**	**12**
HYGIÈNE, SÉCURITÉ ET SANTÉ AU TRAVAIL (HSST)			
Identification et évaluation des risques SST			
Sécurité relative aux postes de travail et aux tâches			
Sécurité dans les ateliers et magasins			
Sécurité électrique			
Sécurité stockage gaz			
Sécurité manutention		1	1
Sécurité gestion des produits chimiques			
Sécurité travaux en hauteur			
Equipements de protection individuelle (EPI)			
Sécurité machines et des équipements			
Conformité du restaurant, des sanitaires, ordre et propreté		1	1
Système d'autorisation de travail		1	1
Enquête et analyse des accidents de travail (AT) et maladies professionnelles (MP)			
Entreprises extérieures et sous-traitance			
Sûreté			
Suivi médical du personnel		1	1
Total HSST		**4**	**4**
GESTION DES RISQUES MAJEURS			
Sécurité dans les parcs de stockage de combustibles		1	1
Sécurité incendies et explosions	2		2
Gestion des situations d'urgence	1		1
Total Gestion des risques majeurs	**3**	**1**	**4**
Total Audit EHS	**9**	**14**	**23**

[2] 1 signifie : une non-conformité

V.PLAN DE MISE EN CONFORMITE REGLEMENTAIRE

Le Plan de mise en conformité (PMC) vise à assurer la réalisation correcte de toutes les recommandations sorties de l'audit. Il facilite la mise en conformité de l'établissement en fonction de toutes les dispositions réglementaires.

Ce PMC inclut deux parties :

- Le rappel des actions correctives proposées à la suite des non-conformités observées ;
- Les modalités de mise en œuvre et de suivi des actions correctives.

❖ SYSTEME DE MANAGEMENT HSE

Thème	Actions correctives	Responsabilités	Indicateurs de suivi	Coût	Délai de mise en œuvre/
Organisation de la veille réglementaire	• Mise en place d'un document spécifique de veille réglementaire spécifique à l'évolution des textes sénégalais.	Chef de Centrale Conseiller EHS	______	X	**2^{ième} semestre 2011**
Comité HSE	• Transmettre les pv et le bilan annuel du CHS à l'inspection du travail du ressort	Directeur technique Chef de Centrale	Bordereau de transmission		**À la fin de chaque année**

❖ ENVIRONNEMENT

Thème	Actions correctives	Responsabilités	Indicateurs de suivi	Coût	Délai de mise en œuvre/ A DISCUTER AVEC LE MEPN
Situation administrative (dossier ICPE)	☞ Dresser la liste des installations classées avec désignation des rubriques et des valeurs seuil de référence ; ☞ Déposer un dossier ICPE actualisé auprès de la DEEC ; ☞ Reprendre les plans en tenant compte des dernières modifications apportées sur le site en respectant les échelles.	Directeur technique Conseiller EHS	attestation de dépôt au prés de la DEEC .	x	**1er trimestre 2012**
Equipements sous pressions (ESP)	☞ procéder à l'inventaire de tous les ESP exploités sur le site ; ☞ établir Un registre reprenant la désignation de l'ESP, date de mise service, volume, pression de service, pression d'épreuve²1s, les plans et schémas de l'appareil et les PV d'inspection et de maintenance~~;~~	Chef de maintenance	Attestation de dépôt de dossier technique au prés de la DEEC	**x**	**1er trimestre 2012**
	☞ déclarer tous les ESP auprès de la DEEC avec mention de l'année de fabrication, description générale de l'équipement, plans et schémas des composants, sous ensembles, circuits, etc., résultats des calculs de conception éventuels, des contrôles effectués,…, les rapports d'essais.	Directeur technique Chef centrale	rapport de vérification par un bureau de contrôle agréé		
Gestion des eaux usées	☞ mesurer la température à une distance suffisamment éloignée pour ne pas être influencée par les eaux de rejets SENELEC. ☞ Pour chacun des décanteurs Stocker les eaux décantées dans un système de réservoir tampon (à mettre en place) et l'analyser pour en vérifier la charge avant rejet dans le milieu. ☞ Transmettre les résultats d'analyse à la DEEC	Chef d'exploitation Directeur technique Chef centrale	Rapport de mesures Bon de commande Rapport d'analyse de laboratoire agréé des eaux usées	**16.000.000**	**2ième semestre 2013**
Gestion des émissions atmosphériques	☞ transmettre le rapport d'analyse des mesures des émissions à la DEEC	Directeur technique Chef de centrale	PV de réception Rapport d'analyse	**x**	**2ième semestre 2012**
Pollution du sol et sous-sol	☞ Installer un réseau de piézomètres dans les zones de stockage d'hydrocarbures	Directeur technique Chef centrale	Présence d'un réseau de piézomètre dans les zones de stockage ou de manipulations des hydrocarbures Rapport de	**15.000.000**	**2ième semestre 2012**

Thème	Actions correctives	Responsabilités	Indicateurs de suivi	Coût	Délai de mise en œuvre/ A DISCUTER AVEC LE MEPN
			caractérisation du sol et sous sol		
Bruit	☛ Effectuer des mesures annuelles du bruit en limites de propriété et aux différents endroits.	Conseiller EHS Chef centrale	Registre de la cartographie du bruit	2.500.000	1er trimestre 2012
Gestion des déchets	☛ Aménager une zone de stockage compartimentée des déchets ☛ Renforcer la sensibilisation du personnel sur la nécessité de disposer les ordures dans les poubelles appropriées à cet effet et aux endroits stratégiques	Directeur technique Chef centrale Conseiller EHS Chef d'exploitation Chef de maintenance Chef centrale Conseiller EHS	Existence de poubelles dans l'enceinte de l'établissement Pv de réunion enregistrement dans gensuite des discussions et échanges avec les employés sur la propreté	22.500.000	1er trimestre 2012

❖ SECURITE

Thèmes	Actions correctives	Responsabilités	Indicateurs de suivi	Coûts	Délai de mis en œuvre/ A DISCUTER AVEC LE MEPN
PARTIE SECURITE ET SANTE DES TRAVAILLEURS (SST)					
Sécurité manutention	Disposer d'un registre de sécurité pour tous les appareils de levage.	Chef maintenance	Registre de sécurité à jour	x	**1er trimestre 2012**
Conformité des vestiaires et toilettes, ordre et propreté	Inspecter régulièrement les toilettes Spécifier les toilettes « dames » et « hommes » par une affiche Construire un restaurant d'entreprise dans une zone éloignée des toilettes de GTI et de MEGS	Conseiller EHS Directeur technique Conseiller EHS	Calendrier d'entretien Affiche sur les portes des toilettes Restaurant d'entreprise aménagée	x	**Immédiat** **2 ième trimestres 2012**
Système d'autorisation de travail	Mettre en place un système de suivi et de contrôle du statut (fermé/ouvert) des permis de travail	Conseiller EHS Chef des opérations	Registre de suivi du statut des permis de travail	x	**immédiat**
Suivi médical du personnel	procéder à des visites périodiques et spécifiques chez certaines catégories de travailleurs avec un dossier médical de suivi par le médecin.	Médecin du travail Conseiller EHS	Registre de consultation Dossier médical	x	**1er trimestre 2012**
Partie gestion des risques majeurs					
Sécurité dans les parcs de stockage de combustibles	Harmoniser les codes de couleur en respectant les codes standards internationaux	Conseiller EHS	Bon de commande	x	**1er trimestre 2012**
Prévention des incendies et explosions	• Renforcer le stock en émulseur (cf étude de danger) ; • Délimiter des zones à risque d'explosion sur le site (zones ATEX) et l'application des Mesures techniques et organisationnelles prévues par la réglementation ATEX (Directive 1999/92/CE du 16 décembre 1999). • Associer la DEEC, la DPC au exercice de simulation de lutte anti- incendie .	Directeur technique Chef centrale Conseiller EHS	Quantité émulseur existante Bon de commande Fiche de simulation et d'exercice de mis en œuvre	x	**2ième trimestre 2012**
Gestion des situations d'urgence	Mettre à jour le POI et l'envoyer à la DPC pour validation	Directeur technique Chef centrale Conseiller EHS	Rapport de réception Note de validation	x	**1er trimestre 2012**

ANNEXE 7: CONTOUR GLOBAL HSE POLICY

Standards internes ContourGlobal de santé et sécurité au travail

Standards SST CG

TABLE DES MATIÈRES

INTRODUCTION

Les standards SST CG contiennent des directives ayant pour but de préserver un environnement de travail sûr et efficace sur les sites de ContourGlobal.

Il ne vise pas à remplacer les exigences légales, lois ou réglementations locales, nationales ou internationales en matière de sécurité. S'il existe un conflit entre les standards SST de CG et d'autres standards ou codes locaux, nationaux ou internationaux, c'est l'exigence la plus rigoureuse qui s'applique.

Tout écart ou exception de la part d'un sous-traitant ou d'une entité ContourGlobal qui prévoit moins que les obligations minimales définies par ces standards nécessite un accord écrit préalable de la part du directeur de la Sécurité ContourGlobal mondial et/ou de la personne désignée.

Les standards SST CG sont applicables à la société, aux entités, aux filiales ContourGlobal et à toute personne qui exerce une activité pour ContourGlobal ou sur ses propriétés à travers le monde.

Chaque entité, filiale ou sous-traitant de ContourGlobal doit développer, mettre en place, maintenir et respecter les procédures sécurité et être responsable de la conformité de la part de ses employés et entrepreneurs.

Lorsque les projets de construction sont gérés par un responsable sous-traitant désigné, il ou elle doit développer, mettre en place, maintenir et respecter les procédures sécurité et être responsable de la conformité de la part de ses employés et autres co-contractants et sous-traitants.

Certains termes utilisés dans ces standards peuvent être différents de la terminologie locale utilisée par les entreprises à travers le globe. Lors du développement du programme spécifique de l'entité, lestermes les plus appropriés pour la région et/ou l'entreprise spécifique doivent être employés.

Les standards SST de CG traitent des éléments de santé et de sécurité d'un système de gestion et des tâches fonctionnelles pour un programme efficace. Il n'aborde pas les autres éléments d'un système de gestion de projet, tels que le respect de l'environnement, la gestion de projet et le contrôle qualité.

Les standards SST CG comprennent 12 sections principales comme suit **:**

1. Politique de santé et sécurité au travail (SST)
2. Formation sécurité
3. Conception générale et exploitation des installations
4. Risques physiques
5. Risques chimiques
6. Risques biologiques
7. Risques ergonomiques
8. Risques mécaniques
9. Risques et opérations spéciaux
10. Équipements de protection individuelle
11. Programme de contrôle de la santé au travail
12. Situation d'urgence et capacité à réagir

Aucune modification de ces standards n'est permise à titre individuel.

Les suggestions de mise à jour ou de modifications, le cas échéant, des standards SST CG doivent être adressées à l'équipe Santé et Sécurité.

REFERENCES

Les standards OHS CG respectent les obligations et dispositions en matière de sécurité des agences, associations, conseils, sociétés, etc. mentionnés ci-dessous, dans la mesure où elles s'appliquent au projet et à leur cadre de travail. Si un conflit venait à exister entre les diverses exigences, c'est l'exigence la plus rigoureuse qui s'applique.

Les références applicables sont :

- OHSAS 18002:2007 – Systèmes de gestion de la santé et sécurité au travail – Directives pour la mise en application de l'OHSAS 18001
- Organisation mondiale du travail : 2001 – Directives pour les systèmes de gestion de santé et sécurité au travail (OSH-MS)
- Loi de 1974 sur la Santé et sécurité au travail etc. - Archives nationales - Ministère de la justice – Royaume Uni
- National Institute for Occupational Safety and Health (NIOSH)
- American Society of Mechanical Engineers (ASME)
- American Conference of Governmental Industrial Hygienists - ACGIH®
- Organisation mondiale de la santé (OMS)
- Title 29, Code of Federal Regulations, Parts 1910 and 1926, Occupational Safety and Health Administration (OSHA), U.S. Department of Labor.
- Title NFPA51B, National Fire Codes, National Fire Protection Association Standard for Fire Prevention in Use of Cutting and Welding Procedures, Édition 1989.
- Association canadienne de normalisation (CSA)
- OSHA 3120 - Contrôle de l'énergie dangereuse – verrouillage / mise hors service
- ANSI Contrôle de l'énergie dangereuse – verrouillage / mise hors service et méthodes alternatives (ANSI Z244.1-2003)
- Programme consultatif OSHA sur les espaces confinés
- *Introduction to Fall Protection*, 3rd Edition, J. Nigel Ellis, Ph.D., CSP, P.E. Published by the American Society of Safety Engineers
- American Society of Mechanical Engineers – AMSE B56.1 - Safety Standard For High Lift And Low Lift Trucks
- Exigences de l'office suédois de l'environnement du travail
- Ministère brésilien du travail - Normes réglementaires en matière de santé au travail et de sécurité
- Organisation internationale de normalisation - ISO 509 - Équipement pour la manipulation des matériaux, y compris les chariots-élévateurs, les plateformes coulissantes, etc.
- National Weather Service, *National Oceanic and Atmospheric Administration*, Ministère américain du commerce.
- Norme IEEE386 pour les systèmes connecteurs isolés séparables pour des systèmes de distribution d'alimentation au-delà de 600V.
- Mine Safety and Health Administration (MSHA) - Federal Mine Safety and Health Act of 1977 (Mine Act)

1 POLITIQUE SANTE ET SECURITE AU TRAVAIL (SST)

1.1.1 La société ContourGlobal, ses entités, filiales et toutes les personnes qui exercent une activité pour ContourGlobal ou sur ses propriétés à travers le monde doivent suivre la politique SST interne de ContourGlobal, établie afin d'avoir une ligne directrice unique, pour traiter des risques locaux qui peuvent généralement être : l'électricité, les espaces confinés, l'incendie, les travaux à chaud, la manipulation et les fuites de produits chimiques, la chute d'outils, la noyade, les conditions météorologiques, les hautes températures pressions, les excavations, explosions et chutes au cours d'activités telles que : escalade, nettoyage et inspection.

1.1.2 La politique SST doit être signée par la principale autorité de l'entreprise (administration supérieure) et doit comprendre un engagement à la prévention des accidents et des maladies et une amélioration continue de la gestion et de la performance en matière de SST, respecter les exigences légales applicables et les autres exigences auxquelles l'organisation souscrit et qui sont liées à ses risques en matière de SST.

1.1.3 Elle doit être appropriée à la nature et à l'étendue des risques SST de l'organisation impliquant tous les sites en opération et les projets de construction.

1.1.4 Elle doit être documentée, mise en œuvre, maintenue et communiquée à toutes les personnes qui travaillent sous le contrôle de l'organisation avec l'intention qu'elle devienne leur obligation individuelle en matière de SST et également disponible aux parties intéressées.

1.1.5 Un audit externe cherchera les preuves démontrant que la politique SST a été mise en œuvre, ce qui signifie que chaque employé comprend quels sont ses engagements envers la compagnie et sait comment les mettre en œuvre dans ses activités quotidiennes.

1.1.6 La politique SST doit être revue tous les ans et le personnel formé à nouveau.

2 FORMATION SECURITE

2.1.1 Chaque entité, filiale ou sous-traitant de ContourGlobal doit établir, mettre en œuvre et maintenir une (des) procédure(s) pour faire en sorte que les personnes travaillant sous leur contrôle soient conscientes :

2.1.1.1 Des conséquences en matière de SST, réelles ou potentielles, de leurs activités professionnelles, leur comportement et les bénéfices en matière de SST d'une performance accrue du personnel ;

2.1.1.1.1 Des cours de spécialités doivent être fournis et renouvelés, si besoin est, pour permettre aux employés de réaliser toutes les tâches correspondantes en toute sécurité.

2.1.1.2 De leurs rôles et responsabilités et l'importance d'atteindre le niveau de conformité à la politique et aux procédures SST et aux exigences du système de gestion SST, y compris la préparation aux situations d'urgence et capacité à réagir ;

2.1.1.3 Des conséquences potentielles d'un écart aux procédures spécifiées.

2.1.2 Les procédures de formation doivent prendre en compte les différents niveaux de responsabilité, de capacité, de compétences linguistiques, du degré d'alphabétisation et de risque.

2.1.3 Un système pour évaluer l'efficacité de la formation ou de l'action prise doit être mis en œuvre (e.g. examens) et les résultats associés doivent être conservés.

2.1.4 Les comptes-rendus de formation doivent être documentés et tenus dans un fichier.

2.1.5 La formation doit être fournie aux managers, superviseurs, travailleurs et aux visiteurs occasionnels de zones de dangers et à risque.

2.1.6 À travers des spécifications contractuelles adéquates ContourGlobal doit s'assurer que les prestataires de services, ainsi que la main d'œuvre contractée ou sous-traitée sont formées de manière adéquate avant que le travail ne commence.

2.1.7 Chaque entité ContourGlobal doit contrôler, documenter et revoir de manière régulière la performance SST des prestataires de services tout au long de la période contractuelle et lors de la révision à l'issue du contrat.

3 CONCEPTION GENERALE ET EXPLOITATION DES INSTALLATIONS

3.1 STRUCTURES DES LIEUX DE TRAVAIL, ZONES DE TRAVAIL ET DE CIRCULATION

3.1.1 Chaque entité, filiale et sous-traitant de ContourGlobal doit maintenir les surfaces, structures et installations faciles à nettoyer et à entretenir, et ne pas autoriser l'accumulation de composants dangereux.

3.1.2 Les sols des zones d'accès au public, zones d'accès aux employés, passages, zones de stockage et locaux techniques, doivent rester propres, rangés et sains.

3.1.3 Toutes les personnes doivent se débarrasser des déchets, ordures, chiffons gras et usés et autres déchets ménagers en accord avec la procédure ContourGlobal en matière d'élimination des déchets. Les ordures et autres déchets doivent être débarrassés à des intervalles fréquents et réguliers.

3.1.4 Les zones de travail doivent rester dégagées et propres à l'issue des opérations ou au terme de chaque jour de travail. Le nettoyage régulier est particulièrement important dans les zones avec des matériaux et des équipements dangereux. Les débris doivent être dégagés des zones de travail, des passages et des escaliers au sein et autour des bâtiments et autres structures.

3.1.5 Tous les solvants doivent être conservés dans des récipients approuvés, correctement étiquetés.

3.1.6 Les locaux électriques, mécaniques, les cabines téléphoniques, les vides sanitaires et les combles non-équipées de sprinklers doivent rester libres de tous matériaux combustibles, et fermés à clé. Les produits consommables, directement associés au fonctionnement ou à la maintenance des installations, se trouvant au sein de ces espaces peuvent être autorisés (e.g. filtres, ampoules, fluide frigorigène). Les stocks de ces produits doivent être conservés à leur minimum. Selon la quantité de produits et le niveau de danger associé, soit à l'équipement ou inhérent aux produits eux-mêmes, l'entreposage de ces produits peut en outre être limité à des conteneurs de stockage spécialisés (e.g. placards métalliques).

3.1.7 Les bâtiments doivent être, du point de vue de la structure, sûrs, fournir une protection adéquate face aux conditions climatiques et avoir des conditions d'éclairage et de protection contre le bruit satisfaisantes.

3.1.8 Des matériaux résistant au feu, qui absorbent le bruit, doivent, dans la mesure du possible, être utilisés pour le revêtement des plafonds et des murs.

3.1.9 Les sols doivent être nivelés, réguliers et antidérapants.

3.1.10 Les machines lourdes oscillantes, tournantes ou alternantes, doivent être situées dans des bâtiments prévus à cet effet ou des sections structurellement isolées.

3.1.11 Des inspections pour détecter les pratiques et situations dangereuses doivent être conduites périodiquement, un plan d'action doit être défini et mis en œuvre et les comptes-rendus conservés.

3.1.12 La direction doit mener des inspections sécurité régulières sur le lieu de travail, tenir des comptes-rendus et contrôler de manière continue le programme d'efficacité.

3.1.13 Les installations doivent être conçues et construites en prenant en compte les besoins des personnes handicapées.

3.1.14 Dans les lieux où sont utilisés des équipements de manutention mécanique, des hauteurs sûres suffisantes doivent être prévues dans les couloirs, les quais de chargement, au niveau des portes d'entrée et dans tous les lieux de passages et de manœuvre.

3.1.15 Tous les lieux de travail doivent rester propres dans la mesure où la nature du travail le permet.

3.1.16 Le sol de chaque espace de travail doit rester aussi propre et sec que possible. Toutes les fuites doivent être contenues (seau, cuve, etc.) et réparées dans un délai court. En parallèle, une notification doit être affichée à proximité pour informer l'employé ou le responsable du magasin de la réalisation des réparations et la date à laquelle la correction sera faite. Une évacuation adéquate doit être maintenue là où sont utilisés des processus humides. Des faux planchers, plateformes, tapis ou autres postes permanents secs doivent être fournis là cela est utile.

3.1.17 Pour faciliter le nettoyage, tout sol, lieu de travail et couloir doit rester libre de clous qui dépassent, de failles, de planches branlantes et de trous et ouvertures inutiles.

3.1.18 Toutes les balayures, déchets solides ou liquides, déchets ménagers et ordures doivent être enlevés afin d'éviter de créer une menace pour la santé et aussi souvent que nécessaire ou de façon appropriée pour maintenir un lieu de travail sain.

3.1.19 Chaque lieu de travail fermé doit être construit, équipé et entretenu, autant que faire se peut, afin d'en empêcher l'entrée ou l'installation de rongeurs, insectes et autres animaux nuisibles. Un programme d'extermination continu et efficace doit être instauré si leur présence est détectée.

3.1.20 Des conteneurs d'élimination des déchets fabriqués à partir de matériaux souples, résistants à la corrosion, facilement nettoyables ou jetables doivent être mis à disposition et utilisé pour l'élimination des déchets alimentaires. Le nombre, la taille et l'emplacement desdits conteneurs doit encourager leur utilisation et ne pas avoir pour résultat d'être trop remplis. Ils doivent être vidés au moins une fois par jour de travail, sauf s'ils n'ont pas été utilisés, et doivent rester propres et sains. Les conteneurs doivent être fournis avec un couvercle ajusté et solide sauf si des conditions sanitaires peuvent être maintenues sans utilisation de couvercle.

3.1.21 Les équipements et installations nécessitant un entretien, une inspection, et/ou un nettoyage doivent disposer d'un accès dégagé, libre, immédiat et sûr.

3.1.22 Des mains courantes, des barrières basses et des plinthes doivent être installées sur les escaliers, les échelles fixes, les plateformes, les échafaudages et les ouvertures de dalle.

3.1.23 Des couvertures et/ou des garde-corps doivent être fournis pour protéger le personnel des dangers des puits à ciel ouvert, des réservoirs, des cuves, des fossés, etc.

3.1.24 Les ouvertures doivent être scellées par des barrières ou des chaînes amovibles.

3.1.25 Des mesures pour empêcher l'accès non autorisé à des zones dangereuses doivent être mises en place.

3.1.26 Les symboles "attention sol humide" doivent être affichés en évidence quand les sols sont humides à la suite du nettoyage, de l'entretien, de fuites ou du temps.

3.1.27 Les sols doivent rester dégagés de dangers de chute, faux-pas, glissade (e .g. cordes, câbles, fils, équipement, outils). Tout sol, , zone de travail et couloir doit être maintenu libre de clous qui dépassent, de failles, de trous et de planches branlantes.

3.1.28 Tout revêtement de sol défectueux (moquette et carrelage) doit être remplacé. Les tapis de sol usés ou déformés doivent être jetés.

3.1.29 Les allées permanentes et les couloirs doivent être convenablement marqués de chaque côté.

3.1.30 Les embrasures et autres obstacles au-dessus du niveau de la tête doivent être correctement identifiés avec des signalisations de hauteur sûre.

3.1.31 Toute structure utilisée à des fins de stockage doit être signalée avec une charge nominale et le stockage ne doit pas l'excéder.

3.1.32 Les signalisations des charges nominales ne doivent pas être enlevées ni abîmées.

3.1.33 Les angles morts doivent être signalés et des miroirs adéquats ou d'autres appareils d'avertissement doivent être installés et maintenus.

3.1.34 Les escaliers ne doivent pas être utilisés à des fins d'entreposage de matériels.

3.2 SIGNALISATION ET ETIQUETAGE

3.2.1 La signalisation et l'étiquetage doivent être en accord avec les normes internationales.

3.2.2 Les signes d'avertissement et le contrôle d'accès doivent avoir une formulation dans la langue locale (pays de travail).

3.2.3 La formulation de chaque panneau doit être facilement lisible et concise. Le panneau doit contenir suffisamment d'informations afin d'être facilement compris. La formulation doit présenter une suggestion positive, plutôt que négative et doit être factuelle et précise.

3.2.4 Les zones dangereuses doivent être clairement signalées par une signalisation adéquate.

3.2.5 Des panneaux d'avertissement doivent être disposés, là où nécessaire, afin d’empêcher que des substances chimiques ne puissent causer des problèmes de santé ou des accidents.

3.2.6 Des mesures de sécurité et précautions doivent être clairement affichées.

3.2.7 La signalisation doit être facilement comprise par les travailleurs, les visiteurs et le public en général, selon le cas.

3.2.8 Tous les employés doivent être informés que les signalisations de dangers indiquent un danger immédiat et que des précautions spéciales sont nécessaires.

3.2.9 Les panneaux d'avertissement ne doivent être utilisés que pour prévenir des dangers potentiels ou mettre en garde contre des pratiques dangereuses.

3.2.10 Le marquage doit être positionnés aussi près que cela est potentiellement sûr de leurs dangers respectifs à l'aide d'un dispositifsûr tel qu'une ficelle, un câblel ou un adhésif pour empêcher leur perte ou leur retrait involontaire.

3.2.11 Les panneaux doivent avoir des coins arrondis ou émoussés, sans bordures coupantes, accroc, failles ou autres proéminences tranchantes. Les bouts ou têtes des boulons ou autres éléments de fixation doivent être placés de manière à ne pas constituer de danger.

3.2.12 Placer des panneaux pour alerter et informer les employés des dangers suffisamment en amont pour éviter le danger et prendre une action appropriée. Les employés ne doivent pas encourir de risque avant de lire le panneau.

3.2.13 Placer les panneaux de façon à ce qu'ils soient lisibles, qu'ils ne créent pas de distraction ni ne constituent eux-mêmes un danger.

3.2.14 Les panneaux ne doivent pas être positionnés sur des objets mobiles ou près d'objets mobiles tels que portes, fenêtres, etc. si le mouvement cache le panneau.

3.2.15 Lorsqu'un éclairage est nécessaire en situation d'urgence, les panneaux doivent être pourvus d'un éclairage d'urgence (à piles) ou être réfléchissants ou les deux.

3.2.16 Les équipements d'urgence (e.g. extincteurs, douches de sécurité, rince-œil, etc.) doivent être dégagés de tout obstacle et signalé à l'aide de panneaux.

3.2.17 Une attention supplémentaire doit être accordée pour éviter que les panneaux de sécurité ne soient bloqués, cachés ou endommagés. Dans ce cas, la zone doit être dégagée ou les panneaux rapidement remplacés.

3.2.18 Les panneaux de sécurité doivent être compris comme information supplémentaire. Par conséquent, toutes les autres exigences en matière de prévention sécurité doivent rester en place.

3.2.19 Tous les équipements doivent porter les indications de normes internationales d'essai clairement visibles.

3.2.20 Les réseaux de tuyauteries qui contiennent des substances dangereuses doivent être étiquetés avec la direction du flux et un code couleurs.

3.2.21 Lorsqu'une tuyauterie traverse un mur ou le sol ou est interrompue par une vanne ou un élément de connexion, un marquage doit être indiqué des deux côtés de la tuyauterie pour assurer la continuité.

3.2.22 Les emballages, conteneurs, tuyauteries contenant une substance chimique dangereuse doivent être étiquetés avec l'indication du contenu, du danger, et autres symboles applicables nécessaires pour signaler les risques associés.

3.3 INSTALLATION SANITAIRES

3.3.1 Chaque entité, filiale ou sous-traitant de ContourGlobal doit disposer d'installations sanitaires adaptées au nombre d'employés et de visiteurs sur le site et être séparées pour les hommes et les femmes.

3.3.2 Un système de fermeture des toilettes doit exister.

3.3.3 Les toilettes doivent disposer d'un approvisionnement adéquat en 'eau courante, chaude et froide, de savon et de sèche-mains.

3.3.4 Aucun n'employé n'est autorisé à consommer de la nourriture ou des boissons dans les toilettes ou dans toute zone exposée à un matériau toxique.

3.3.5 Si les travailleurs venaient à être exposés à des produits chimiques dangereux, des installations pour se doucher et se changer (entre vêtements de ville et vêtements de travail) doivent être en place.

3.3.6 Les vestiaires doivent disposer de moyens pour ranger de manière sûre les effets personnels.

3.3.7 Un approvisionnement adéquat en eau potable doit être mis à disposition.

3.3.8 L'approvisionnement en eau doit être fournis au moyen d'une fontaine avec un jet d'eau vers le haut ou un autre dispositif sain pour collecter et boire de l'eau propre.

3.3.9 Lorsque l'eau potable n'est pas disponible, elle doit être fournie dans des conteneurs hermétiquement clos, qui permettent un nettoyage facile, en particulier quand elle est utilisée sur le site.

3.3.10 L'eau fournie dans les zones de préparation des repas ou à des fins d'hygiène personnelle (pour se laver ou se doucher) doit répondre aux normes de qualité des eaux potables.

3.3.11 La qualité de l'eau doit être testée de manière régulière (basée sur une évaluation des risques d'une contamination potentielle), ou annuellement, selon la période la plus courte.

3.3.12 Les prises d'eau non potable, telle que l'eau industrielle ou de lutte contre l'incendie, doivent être affichées ou bien signalées d'une manière qui indiquera clairement que l'eau n'est pas sûre et n'est pas bonne pour la consommation, pour se laver, cuisiner, rincer les aliments, laver les ustensiles de cuisine ou pour manger, laver les préparations alimentaires ou traiter les locaux, les pièces de service du personnel ou laver les vêtements.

3.3.13 La construction de réseaux d'eau non potable ou de réseaux transportant toute autre substance non potable doit être telle qu'elle évite un retour ou un reflux au sein du système d'eau potable.

3.3.14 Des zones adéquates propres pour manger doivent être mises en place pour assurer que les travailleurs ne sont pas exposés à des substances dangereuses ou nocives.

3.4 BARRIERES, ACCES PROVISOIRE ET SUR

3.4.1 Chaque entité, filiale ou sous-traitant de ContourGlobal doit mettre en place une procédure recouvrant l'installation et l'entretien de barrières sur le site pour restreindre l'accès à et/ou avertira les travailleurs des zones dangereuses, présentant des situations anormales, ou où sont exécutées opérations inhabituelles.

3.4.2 Les exigences minimales doivent inclure : lignes directrices générales relatives aux barrières, le balisage des zones de construction (élévation), des routes, des zones de radiographie.

3.4.3 Des barrières et des couvertures appropriées doivent être prévues pour protéger les ouvertures dans le sol, excavations, tranchées, fosses, obstacles dans les couloirs et autres lieux présentant un danger d'empiètement. Les barrières / couvertures doivent être clairement visibles pour permettre les manœuvres d'évitement pour contourner le danger.

3.4.4 Si le cadre du travail nécessite le retrait de garde-corps, rampes, caillebotis ou autre barrière physique existante, le responsable du site doit donner son accord préalable. Les barrières qui ont été enlevées pour faciliter le travail doivent être correctement repositionnées une fois le travail terminé. Les ouvertures non protégées doivent être surveillées en permanence.

3.4.5 Si des couvertures sont nécessaires pour protéger les ouvertures du plancher, excavations, tranchées, fossés, le responsable du site doit :

3.4.5.1 S'assurer que la couverture est capable de supporter, sans défaillance, au moins deux fois le poids de tout employé, équipement et/ou matériel qui peut être posé sur la couverture en une fois.

3.4.5.2 Sécuriser toutes les couvertures, une fois installées, pour éviter le déplacement accidentel par les forces de la nature, des équipements ou les employés.

3.4.5.3 Les couvertures situées sur des chaussées ou des allées de circulation doivent pouvoir supporter, sans défaillance, deux fois la charge maximale par essieu du plus gros véhicule qui pourrait traverser.

4 RISQUES PHYSIQUES

4.1 BRUIT

4.1.1 Chaque entité, filiale ou sous-traitant de ContourGlobal doit disposer d'un plan de contrôle du bruit en place, approprié au niveau d'exposition.

4.1.2 Aucun employé ou sous-traitant de ContourGlobal ne doit être exposé à un niveau de bruit supérieur à 85 dB(A) en moyenne sur une durée de plus de 8 (huit) heures sans protection auditive appropriée.

4.1.3 Aucune oreille non protégée ne doit être exposée à une pression acoustique de crête (bruit instantané) de plus de 140 dB(C).

4.1.4 Si l'exposition atteint 85 dB(A) en moyenne ou les niveaux acoustiques de crête peuvent atteindre 140 dB(C), un plan de réduction du bruit doit être mis en place pour baisser ces niveaux.

4.1.5 Un plan de contrôle du bruit doit considérer l'utilisation de matériaux d'isolation phonique, l'isolation des sources de bruit et tout processus ou autres contrôles mécaniques qui réduiront l'exposition au bruit.

4.1.6 Bien qu'une protection auditive soit nécessaire si l'exposition est supérieure à 85dB(A), réduire la durée de l'exposition est aussi une mesure de contrôle. Pour chaque augmentation de 3dB(A) du niveau de bruit, la période d'exposition doit être réduite de 50%.

4.1.7 Des études de bruit régulières doivent être entreprises pour évaluer les niveaux de bruit durant la construction et le fonctionnement des installations et des équipements.

4.1.8 Les études de bruit doivent être menées par des professionnels compétents et doivent être documentées et conservées dans un fichier.

4.1.9 Le suivi doit être répété à chaque fois qu'un changement au niveau de la production, du processus, des équipements ou des contrôles augmente les expositions au bruit dans la mesure où :

4.1.9.1 D'autres employés peuvent être exposé au niveau ou au-dessus du niveau d'action; ou

4.1.9.2 L'atténuation fournie par les protections auditives utilisées par les employés peut devenir insuffisante selon la règlementation locale.

4.1.10 Les instruments utilisés pour mesurer l'exposition au bruit des employés doit être calibrée pour assurer la précision de la mesure.

4.1.11 Chaque entité, filiale ou sous-traitant de ContourGlobal doit maintenir un compte-rendu précis de toutes les mesures d'exposition des employés pour une période définie par la réglementation locale.

4.2 VIBRATIONS

4.2.1 Chaque entité, filiale ou sous-traitant de ContourGlobal doit être conçu et équipé de telle sorte qu'il minimise l'exposition aux vibrations du corps tout entier. Les vibrations impliquent généralement l'utilisation régulière et fréquente de : appareils électriques portatifs, équipements électriques guidés à la main et machines qui traitent les matériels portatifs.

4.2.2 L'achat d'outils électriques portatifs doit prendre en considération le niveau d'exposition aux vibrations de la main et du bras.

4.2.3 Les niveaux d'exposition doivent être vérifiés sur la base du temps quotidien d'exposition et des données fournies par les fabricants d'équipements. Si les limites d'exposition peuvent être au-dessus des limites d'exposition recommandées, un plan de contrôle des vibrations aux réglementations du travail doit être développé par chaque entité, filiale ou sous-traitant de ContourGlobal.

4.2.4 Lorsqu'un plan de contrôle des vibrations au travail est nécessaire, il devra :

4.2.4.1 Prévoir une surveillance médicale (contrôles médicaux réguliers) et évaluer le risque de vibrations sur les employés en faisant une liste des équipements pouvant causer les vibrations, du type de travail pour lequel ces équipements sont utilisés, qui utilise l'équipement vibrant et pour quels travaux.

4.2.4.2 Définir s'il est possible que les employés soient exposés au-dessus de la valeur d'exposition pour laquelle une action doit être réalisée.

4.2.4.3 Fournir des informations et une formation aux employés sur les risques pour la santé et les actions prises pour contrôler ces risques ;

4.2.5 Les mesures de contrôle pour réduire l'exposition aux vibrations doivent comprendre des tampons ou appareils amortisseurs et une limitation de la durée de l'exposition.

4.3 RAYONNEMENTS IONISANTS ET NON-IONISANTS

4.3.1 Pour chaque entité, filiale ou sous-traitant de ContourGlobal où des sources de rayonnement ionisant sont installées, elles ne doivent pas exposer les personnes à des rayonnements dangereux.

4.3.1.1 Toutes les sources de rayonnement ionisant doivent être signalées avec un trèfle.

4.3.1.2 L'exploitation de sources radioactives doit respecter les exigences nationales ou locales.

4.3.1.3 Les personnes ne doivent pas être exposées à une dose instantanée supérieure à 7,5 mSv/h (millisieverts par heure).

4.3.1.4 Les personnes ne doivent pas être exposées à une dose instantanée supérieure à 50 mSv/h (millisieverts par heure).

4.3.1.5 Un registre du lieu et de la nature des sources de rayonnement ionisant doit être conservé.

4.3.1.6 Les sources de rayonnement ionisant doivent être opérées de manière sûre.

4.3.1.6.1 Les personnes qui font fonctionner un équipement de travail contenant des sources de rayonnement ionisant doivent être correctement formées sur les risques associés à leur utilisation et sur les procédures adaptées en matière de sécurité d'exploitation.

4.3.1.7 Les sources de rayonnement ionisant doivent être maintenues de manière sûre.

4.3.1.7.1 Toutes les sources de rayonnement ionisant doivent être maintenues par un professionnel compétent, interne ou externe, pour assurer une exploitation suivie sûre.

4.3.1.7.2 Les sources de rayonnement ionisant doivent être testées contre les fuites tous les deux ans ou à une fréquence déterminée par un organisme de contrôle, par exemple en fonction de l'âge de l'équipement, les fréquences de ces contrôles peuvent être augmentées.

4.3.1.7.3 Des comptes-rendus de ces tests doivent être conservés.

4.3.2 Une évaluation de l'exposition aux risques des employés au rayonnement non-ionisant doit être réalisée.

4.3.2.1 Des moyens de protection adéquats doivent être prévus pour minimiser ces risques d'exposition.

4.4 RESERVOIRS SOUS PRESSION

4.4.1 Les réservoirs sous pression sont des équipements contenant des fluides sous pression interne ou externe. Chaque entité, filiale ou sous-traitant de ContourGlobal doit effectuer un inventaire de tous les équipements sous pression présents sur le site.

4.4.2 Tous les réservoirs sous pression doivent avoir des dispositifs indiquant la température et la pression de fonctionnement.

4.4.3 Tous les réservoirs sous pression doivent être installés de telle sorte que toutes les canalisations, bouches d'aération et les trous d'homme soient facilement accessibles.

4.4.4 Les réservoirs sous pression installés dans des espaces confinés doivent respecter les exigences suivantes :

4.4.4.1 Avoir au moins 2 (deux) entrées différentes largement suffisantes, dégagées en permanence et positionnées sur des côtés opposés ;

4.4.4.2 Avoir un accès facile et sûr pour les activités d'entretien, de fonctionnement et d'inspection. Les garde-corps, si utilisés, doivent être conçus de telle sorte qu'ils évitent aux personnes de tomber (par exemple, en plus de la main-courante, une plinthe et une lisse intermédiaire doivent être considérés).

4.4.4.3 Avoir une ventilation permanente, avec des entrées d'air conçues pour ne pas être bloquées ;

4.4.4.4 Éclairage selon la législation locale ;

4.4.4.5 Mise en place d'un éclairage d'urgence.

4.4.5 Tous les réservoirs sous pression doivent avoir apposée sur leur structure, à un endroit visible, une plaque indélébile d'identification comprenant au minimum, les informations suivantes :

4.4.5.1 Identification du fabricant ;

4.4.5.2 Identification de l'équipement (numéro de série de fabrication) ;

4.4.5.3 Date de la fabrication de l'équipement ;

4.4.5.4 Code / année de fabrication

4.4.5.5 Pression et température maximales autorisées

4.4.5.6 Essai de pression hydrostatique

4.4.5.7 Date à laquelle l'équipement a été mis en service

4.4.6 Les réservoirs sous pression doivent avoir des manuels d'utilisation et / ou des instructions de fonctionnement, conservés sur le site où ils sont installés, dans la langue locale et avec un accès facile et libre aux opérateurs, avec, au moins, les informations suivantes :

4.4.6.1 Procédures de mise en marche et d'arrêt ;

4.4.6.2 Paramètres de fonctionnement et procédures de routines ;

4.4.6.3 Procédures d'urgence ;

4.4.6.4 Procédures générales de santé, sécurité et d'environnement.

4.4.7 Le contrôle et les dispositifs des réservoirs sous pression doivent rester calibrés et dans de bonnes conditions de fonctionnement.

4.4.8 Toutes les modifications et réparations sur les réservoirs sous pression doivent être réalisées selon le code de conception de construction et les recommandations du fabricant en ce qui concerne :

4.4.8.1 Les matériaux ;

4.4.8.2 Les procédures de performance ;

4.4.8.3 Les procédures de contrôle qualité ;

4.4.8.4 La qualification et la certification des personnes.

4.4.9 La plaque d'identification des réservoirs sous pression doit être mise à jour quand les résultats de l'inspection indiquent une modification des données d'identification.

4.5 CHAUDIERES

4.5.1 Chaque entité, filiale ou sous-traitant de ContourGlobal doit s'assurer que toutes les chaudières ont, apposée sur leur structure, à un endroit visible, une plaque d'identification indélébile contenant, au minimum, les informations suivantes:

4.5.1.1 Identification du fabricant ;

4.5.1.2 Identification de la chaudière (numéro de série de fabrication) ;

4.5.1.3 Date de la fabrication de la chaudière ;

4.5.1.4 Code / année de conception

4.5.1.5 Pression et température maximales autorisées ;

4.5.1.6 Essai de pression hydrostatique ;

4.5.1.7 Capacité de production de vapeur ;

4.5.1.8 Zone de surface chauffante ;

4.5.2 La catégorie de la chaudière doit être définie selon la législation locale et être mentionnée avec l'identification de chaudière.

4.5.3 Si la chaudière est installée à l'extérieur, la zone de la chaudière doit répondre aux exigences suivantes :

4.5.3.1 Être placée à au moins 3 (trois) mètres de :

4.5.3.1.1 Autres structures

4.5.3.1.2 Réserve de combustible, sauf pour les réservoirs de démarrage n'excédant pas 2000 (deux milles) litres de capacité ;

4.5.3.1.3 Limites d'installations tiers ;

4.5.3.1.4 Installations publiques ;

4.5.3.2 Avoir au moins 2 (deux) entrées suffisamment larges, dégagées en permanence et positionnées sur des côtés opposés.

4.5.3.3 Accès facile et sûr pour les activités d'entretien, de fonctionnement et d'inspection. Les garde-corps, si utilisés, doivent être conçus pour empêcher les personnes de tomber (par exemple, en plus de la main-courante, une plinthe et une lisse intermédiaire doivent être considérés).

4.5.3.4 Avoir un système d'évacuation des particules et des émissions de gaz en accord avec la législation environnementale locale;

4.5.3.5 Éclairage selon la législation locale ;

4.5.3.6 Mise en place d'un éclairage d'urgence.

4.5.4 Si la chaudière est installée dans des espaces confinés, la chaufferie doit répondre aux exigences suivantes :

4.5.4.1 Bâtiment isolé établi à partir de matériaux ignifugés. Le cas échéant, il est permis qu'un mur se trouve à proximité d'autres installations du site, mais les trois autres murs doivent rester à au moins 3 (trois) mètres des autres bâtiments, des limites d'installations tiers, des installations publiques et et des réserves de combustible, sauf pour celles ayant une capacité de 2000 litres servant au démarrage.

4.5.4.2 Avoir, au moins, 2 (deux) entrées suffisamment larges, dégagées en permanence et positionnées sur des côtés opposés ;

4.5.4.3 Avoir une ventilation permanente, avec des entrées d'air conçues pour ne pas être bloquées ;

4.5.4.4 Détecteur de fuite de gaz pour les chaudières à gaz ;

4.5.4.5 Accès facile et sûr pour les activités d'entretien, de fonctionnement et d'inspection. Les garde-corps, si utilisés, doivent être conçus pour empêcher les personnes de tomber (par exemple, en plus de la main-courante, une plinthe et une lisse intermédiaire doivent être pris en considération).

4.5.4.6 Avoir un système d'évacuation des particules et des émissions de gaz en accord avec la législation environnementale locale.

4.5.5 Chaque chaudière doit disposer d'un manuel d'utilisation mis à jour, dans la langue locale, avec un accès facile pour les opérateurs et comprendre, au minimum :

4.5.5.1 Procédures de mise en marche et d'arrêt ;

4.5.5.2 Paramètres de fonctionnement et procédures de routines ;

4.5.5.3 Procédures d'urgence ;

4.5.5.4 Procédures générales de santé, sécurité et d'environnement ;

4.5.6 Le contrôle des chaudières et des dispositifs doivent rester calibrés et dans de bonnes conditions de fonctionnement.

4.5.7 La qualité de l'eau doit être contrôlée et le traitement doit être amélioré si nécessaire afin de conserver ses paramètres physico-chimiques selon la conception et le fonctionnement de la chaudière.

4.5.8 Toutes les réparations ou modifications de la conception de la chaudière doivent respecter le code de conception et de construction du fabricant, en ce qui concerne:

4.5.8.1 Les matériaux ;

4.5.8.2 Les procédures de performance ;

4.5.8.3 Les procédures de contrôle qualité ;

4.5.8.4 La qualification et la certification du personnel

4.5.9 Une inspection initiale doit être effectuée sur des chaudières neuves, avant leur mise en opération, sur le site de fonctionnement, y compris une évaluation interne / externe et des tests hydrostatiques et d'accumulation.

4.5.10 Une inspection périodique de sécurité comprend une évaluation interne / externe et un test hydrostatique, à des fréquences qui respectent la législation locale.

4.5.11 L'inspection de sécurité doit être effectuée par un "professionnel compétent" ou selon la législation locale.

4.5.12 La plaque d'identification de la chaudière doit être mise à jour lorsque les résultats de l'inspection indiquent une modification des données d'identification.

4.6 GAZ COMPRIMES

4.6.1 Chaque entité, filiale ou sous-traitant de ContourGlobal doit établir, mettre en place et maintenir un programme recouvrant les exigences relatives à l'inspection, le test, le marquage, la requalification, le traitement de réchauffage, la réparation et la reconstruction des bouteilles, sphères et tubes (conteneurs) pour le transport de marchandises dangereuses.

4.6.2 Un programme d'inspections périodiques doit être mis en place qui examinera les régulateurs, les vannes de décompression et la connexion de la bouteille, pour s'assurer que les bouteilles sont exemptes de corrosion, fuite, piqûres, bosses ou creux.

4.6.2.1 Les bouteilles doivent être testées de nouveau ou inspectées tous les cinq ans ou plus souvent si la législation locale l'exige. La date de chaque test doit être apposée sur la bouteille.

4.6.2.2 Une valve endommagée ne doit jamais être ouverte. Le fournisseur de gaz doit être contacté pour tout conseil.

4.6.2.3 Un équipement approprié doit être utilisé pour vider un gaz particulier de sa bouteille.

4.6.3 Une évaluation des contrôles de la ventilation et des autres méthodes de contrôle des dangers doit être réalisée dans les lieux où les gaz comprimés sont utilisés.

4.6.3.1 Les systèmes de ventilation doivent être conçus et construits de telle sorte qu'ils ne provoquent pas de danger imprévu.

4.6.3.2 Les hottes, conduits, filtres à air et ventilateurs doivent être fabriqués à partir de matériaux compatibles avec le gaz utilisé.

4.6.4 Le stockage des bouteilles de gaz comprimés doit être séparé, éloigné des zones de traitement et de manutention, et des matériaux incompatibles.

4.6.4.1 L'utilisateur doit vérifier les informations de réactivité et les sections sur les exigences de stockage des Fiches de Données de Sécurité pour tout détail concernant les matériaux incompatibles avec un gaz comprimé particulier.

4.6.5 Les zones de stockage doivent disposer de murs, de planchers et d'installations faits à partir de matériaux appropriés.

4.6.6 Les bouteilles doivent être enchaînées ou maintenues dans une position droite le long d'un mur, sur une étagère ou une autre structure solide, quel que soit l'endroit où ils sont rangés, manipulés ou utilisés.

4.6.7 Le stockage des bouteilles de gaz comprimés doit se faire dans des zones qui sont :

4.6.7.1 Bien ventilées et sèches

4.6.7.2 Hors du rayonnement direct du soleil, des tuyaux de vapeur, des chaudières et autres sources de chaleur.

4.6.7.3 À l'épreuve du feu et équipées d'un équipement approprié de lutte contre l'incendie y compris des sprinklers, là où cela est nécessaire

4.6.7.4 Eloignées des circuits électriques et des sources d'allumage telles que des étincelles, des flammes ou des surfaces chaudes.

4.6.7.5 Accessibles en tout temps, mais loin des ascenseurs, des escaliers ou des axes principaux de circulation, où les bouteilles peuvent être des obstacles dangereux

4.6.7.6 Marquées avec des signes d'avertissement appropriés.

4.6.7.7 Les bouteilles pleines doivent toujours être stockées séparément des bouteilles vides.

4.6.7.8 Conserver la quantité de gaz comprimés en stock aussi petite que possible.

4.6.7.9 Inspecter régulièrement les zones de stockage pour tout défaut tels que des bouteilles endommagées ou présentant des fuites et un mauvais entretien.

4.6.7.10 Corriger tous les défauts aussi tôt que possible

4.6.8 À sa réception, la bouteille doit être inspectée avant d'être positionnée afin de s'assurer qu'elle n'est pas endommagée et qu'elle est convenablement étiquetée.

4.6.8.1 Les bouteilles défectueuses ne doivent pas être acceptées.

4.6.8.2 Le marquage des bouteilles doit être intacte et lisible.

4.6.9 La capsule de sécurité doit solidement rester en place jusqu'à ce que la bouteille soit utilisée.

4.6.9.1 Les bouteilles doivent être transportées avec les capsules de sécurité ou toute autre protection de la valve en place.

4.6.10 Les bouteilles doivent être transportées sur des chariots à main ou des trolleys spécialement construits.

4.6.10.1 Tous les appareils de transports doivent disposer d'un moyen pour s'assurer que les bouteilles ne tombent.

4.7 RISQUES ELECTRIQUES

4.7.1 Exigences générales

4.7.1.1 Chaque entité, filiale ou sous-traitant de ContourGlobal doit développer, mettre en place et maintenir des procédures de travail pour les opérations où les employés sont exposés à des dangers électriques. Cela inclut toute opération sur ou au voisinage de pièces et circuits, installations ou équipements électriques permanents ou temporaires, tout travail lié à la construction, l'installation, les tests, la mise en service, le déplacement, la rénovation ou la modification de pièces ou circuits, installations ou équipement électriques, effectués sous la responsabilité de ContourGlobal.

4.7.1.2 Tous les travailleurs doivent être sensibilités aux dangers électriques potentiels présents dans leur environnement de travail pour éviter des situations qui pourraient les rendre vulnérables au danger d'électrocution ou d'autres blessures.

4.7.1.3 La sensibilisation doit inclure les besoins d'identification et de contrôle des dangers électriques, les exigences minimales de formation, l'utilisation des EPI, et autres contrôles.

4.7.1.4 Les travailleurs travaillant sur ou au voisinage de pièces ou équipements électriques alimentés doivent utiliser les équipements de protection individuelle (EPI) adéquats et les outils pour se protéger d'un choc électrique potentiel, des arcs-flash électriques et des dangers d'incendie issus de l'équipement sur lequel ou au voisinage duquel le travail a lieu.

4.7.1.5 Les travailleurs travaillant sur ou au voisinage de pièces ou équipements électriques doivent porter des vêtements, y compris des sous-vêtements, qui n'augmenteront pas les risques d'une exposition aux flammes ou à un arc électrique, tels que des matériaux faits à partir de fibres naturelles non-synthétiques, ou d'un tissu spécialement conçu pour une utilisation près de pièces électriques. Les travailleurs doivent retirer les objets conducteurs, tels que bagues, montres, chaînes, etc., avant de travailler sur ou au voisinage de pièces électriques.

4.7.1.6 Toutes les pièces électriques sous tension doivent être recouvertes, enfermées ou protégées de tout contact avec tout travailleur.

4.7.1.7 Au moins 2 (deux) travailleurs doivent être présents pendant que les opérations suivantes sont effectuées :

4.7.1.7.1 L'installation, le retrait ou la réparation de lignes qui sont alimentées à plus de 600 volts (ligne - terre), ou selon la législation locale.

4.7.1.7.2 L'installation, le retrait ou la réparation de lignes qui sont hors tension si un travailleur est exposé au contact avec d'autres pièces sous tension à plus de 600 volts (ligne - terre), ou selon la législation locale.

4.7.1.7.3 L'installation, le retrait ou la réparation d'équipement tels que transformateurs, condensateurs et régulateurs, si un travailleur est exposé au contact avec de pièces sous tension à plus de 600 volts (ligne - terre), ou selon la législation locale.

4.7.1.7.4 Les travaux impliquant l'utilisation d'équipements mécaniques autres que les nacelles élévatrices isolées, au voisinage de pièces sous tension à plus de 600 volts (ligne-terre), ou selon la législation locale.

4.7.2 Travail hors tension

4.7.2.1 Lorsque cela est possible, mettre hors tension tous les circuits électriques avant de commencer le travail, consigner/déconsigner les systèmes et les contrôles hors tension et mettre en place un balisage sur le site de façon à restreindre l'accès et / ou à prévenir les travailleurs des zones où existent des dangers électriques.

4.7.2.1.1 Un marquage doit être positionné et maintenu lisible pour identifier l'équipement ou les circuits sur lesquels le travail est réalisé

4.7.2.1.2 La meilleure protection pour le travail à proximité de lignes ou d'équipement à haute tension est de conserver une distance de sécurité par rapport aux lignes et à l'équipement. Les distances doivent être définies en fonction des directives SST de CG ou selon la législation locale.

4.7.2.1.3 Si des espaces appropriés ne peuvent être assurés, la ligne ou l'équipement doivent être mis à la terre.

4.7.2.2 Toutes les lignes ou équipements doivent être convenablement testés et mis à la terre avant tout contact de la part du personnel, selon les définitions et exigences suivantes :

4.7.2.2.1 Isolation : La ligne ou l'équipement à haute tension doit être séparée de la source de tension selon les procédures de consignation / déconsignation qui conviennent. Une communication adéquate avec le distributeur doit être appliquée, le cas échéant.

4.7.2.2.2 Test : La ligne ou l'équipement doit être testé en utilisant un tensiomètre approprié qui indiquera si une haute tension est présente.

4.7.2.2.3 Mise à la terre : une application correcte des prises de terre utilisant des outils de ligne sous tension approuvés est nécessaire. Les étapes ci-dessous doivent être suivies :

4.7.2.2.3.1 Sélectionner la taille correcte des prises de terre pour le courant de défaut et le système sur lequel travailler.

4.7.2.2.3.2 Inspecter l'état et le bon fonctionnement des prises de terre

4.7.2.2.3.3 Utiliser les EPI adaptés lors de l'installation des prises de terre p. ex. casque de sécurité, protection des yeux, gants et vêtements appropriés.

4.7.2.2.3.4 Utiliser une longueur appropriée d'outil de ligne sous tension pour l'application de la terre.

4.7.2.2.3.5 Installer en premier la prise de terre au raccordement du potentiel de terre.

4.7.2.2.3.6 Installer l'autre extrémité de la prise de terre à la ligne ou à l'équipement sur lequel travailler.

4.7.2.2.3.7 Terres visibles : si les prises de terre ne sont pas visibles depuis le lieu de travail, un point de terre de travail doit être appliqué en utilisant des pratiques approuvées.

4.7.2.3 Une attention spéciale doit être prêtée aux générateurs, à la tension induite et aux autres circuits qui peuvent présenter un courant de retour.

4.7.3 Travail sous tension

4.7.3.1 Quand le travail hors tension n'est pas possible, chaque entité, filiale ou sous-traitant de ContourGlobal doit garantir par les procédures locales que :

4.7.3.1.1 Les travailleurs possèdent une autorisation de travail électrique sous tension avant que le travail ne commence.

4.7.3.1.2 Les travailleurs ont un plan écrit pour effectuer le travail sous tension en sécurité. Des procédures d'analyse de risques au poste de travail doivent être établies et suivies pour tous les travaux sous tension.

4.7.3.1.3 Les travailleurs utilisent des équipements de protection individuelle (EPI) appropriés.

4.7.3.1.4 Un balisage doit être mis en place sur le site pour restreindre l'accès et / ou prévenir les travailleurs des zones où existent des dangers électriques.

4.7.3.2 Seul le personnel spécialement qualifié peut travailler sous tension. Des distances de sécurité appropriées à un second point de contact doivent être observées durant le travail sous tension selon les directives SST de CG et la législation locale.

4.7.3.3 Lors du travail "sous tension" à proximité de pièces nues sous tension, les exigences suivantes doivent être observées :

4.7.3.3.1 Le travailleur doit signer une autorisation de travail électrique sous tension qui décrit le travail à effectuer, expose brièvement les précautions, les équipements/outils, les équipements de protection individuelle, et les procédures à utiliser durant le travail et la raison pour laquelle il doit être effectué sous tension.

4.7.3.3.2 L'autorisation de travail doit identifier la(les) personne(s) qualifiée(s) par son/leur nom et comprendre des numéros de téléphone d'urgence. Les travaux sous tension doivent être autorisés par une personne responsable du site.

4.7.4 Sécurité électrique des installations et des équipements

4.7.4.1 Chaque entité, filiale ou sous-traitant de ContourGlobal doit s'assurer que chaque sectionneur ou fusible nécessaire pour un service, une ligne d'alimentation ou un circuit de dérivation, est clairement étiqueté pour indiquer la fonction du circuit, et l'étiquette ou le marquage doit être positionné au point d'où le circuit provient.

4.7.4.1.1 Chaque déconnexion pour les moteurs et les appareils doit être lisiblement marquée pour indiquer son usage.

4.7.4.1.1.1 Ces signalisations doivent être d'une durabilité suffisante pour résister à l'environnement impliqué : temps, produits chimiques, chaleur, corrosion ou tout autre environnement auquel elles pourraient être exposées.

4.7.4.2 Les rallonges électriques ne doivent jamais être utilisées à la place d'un câblage permanent.

4.7.4.2.1 Les rallonges électriques ne peuvent être utilisées qu'en tant que solution temporaire et doivent être jugées aptes à traiter la charge attendue.

4.7.4.2.2 Les rallonges électriques doivent être utilisées individuellement (pas d'extension sur extension pour former une chaîne).

4.7.4.2.3 Les rallonges électriques ne doivent pas passer à travers les murs, les portes, les fenêtres, les plafonds ou les cloisons.

4.7.4.3 Toutes les rallonges électriques, les câbles et les appareils électriques portatifs doivent être régulièrement inspectés visuellement pour vérifier la présence de câbles effilochés et fils dénudés. Tout équipement ou câble défectueux doit être mis hors service et remplacé.

4.7.4.4 Tout équipement électrique pouvant être utilisé en milieu humide doit être doublement isolé, mis à la terre et avoir des circuits protégés par un disjoncteur-détecteur de fuites à la terre (DDFT).

4.7.4.5 Les câbles électriques doivent être protégés de l'usure.

4.7.4.5.1 Aucun câble électrique ne doit passer par les couloirs ou sous les tapis.

4.7.4.5.2 Tous les câbles électriques qui passent au-dessus des tapis doivent être protégés par une bande de ruban.

4.7.4.5.3 Chaque cordon ou câble d'alimentation qui peut être exposé à la circulation doit être soit correctement protégé, soit suspendu au-dessus des zones de circulation et convenablement indiqué.

4.7.4.6 Une procédure de contrôle de sécurité des appareils portables (PAT) doit être mise en place et menée par un professionnel compétent.

4.7.4.7 Tous les tableaux électriques doivent être maintenus fermés à tout moment.

4.7.4.8 Les tableaux et circuits électriques doivent être consignés durant l’entretien et la maintenance.

4.7.4.8.1 Les lignes d'alimentation électrique doivent être isolées ou situées loin des lignes d'eau, des lignes téléphoniques, des conduites d'air ou d'autres matériaux conducteurs afin qu'un circuit endommagé n'alimente pas les autres systèmes.

4.7.4.8.2 Toutes les pièces et câbles électriques, permanents ou temporaires, doivent être enfermés ou protégés et se conformer aux exigences applicables du code électrique et de la construction.

4.7.4.8.3 Les transformateurs à huile ne doivent pas être utilisés sous terre sauf s’ils sont situés dans une enceinte à l'épreuve du feu, convenablement ventilée vers l'extérieur et entourée d'un remblai pour retenir les contenus du transformateur en cas de rupture.

4.7.5 Mise à terre et mise à la masse

4.7.5.1 Chaque entité, filiale ou sous-traitant de ContourGlobal doit développer, mettre en place et maintenir des normes pour réduire les dangers particuliers liés aux opérations de mise à la terre et de mise à la masse.

4.7.5.2 Les normes doivent réduire les dangers liés à une remise sous tension impromptue des conducteurs et de l'équipement de toutes les sources.

4.7.5.3 Ces normes aborderont la vérification d'absence de tension et les techniques nécessaires pour choisir la taille appropriée des matériaux de mise à la terre pour les diverses applications.

4.7.5.4 Ces normes établiront également le niveau minimum d'EPI requis pour ces applications.

4.7.5.5 Les normes doivent inclure les conseils tant sur la mise à la terre de la potence que la mise à la terre équipotentielle.

4.7.5.6 La trajectoire de mise à la terre à partir des circuits, équipements et les boîtiers doit être permanente et continue et doit couvrir les domaines suivants :

4.7.5.6.1 Tous les systèmes électriques doivent être mis à la terre.

4.7.5.6.2 Tous les supports et boîtiers pour conducteurs doivent être mis à la terre**.**

4.7.5.6.3 Toutes les enceintes métalliques pour équipement de service doivent être mises à la terre**.**

4.7.5.6.4 Toutes pièces nues métalliques, non conductrices de courant, d'un équipement immobilisé doivent être mis à la terre

4.7.5.6.5 Toutes les pièces nues métalliques non conductrices de courant, exposés à la terre, des outils et équipements raccordés par cordon et prise doivent être mis à la terre.

4.7.5.6.6 La mise à la terre doit être installée pour les parties métalliques des équipements non électriques suivants :

4.7.5.6.6.1 Charpentes et chenilles de grues électriquement dirigées.

4.7.5.6.6.2 Châssis de cabines d'ascenseurs conduits de manière non électrique auxquels des conducteurs électriques sont attachés.

4.7.5.6.6.3 Cordes de déplacement métalliques opérés à la main ou câbles d'ascenseurs électriques.

4.7.5.6.6.4 Cloisons métalliques, grilles, et autres boîtiers métalliques similaires à proximité d'équipements de plus de 600V (ligne-terre).

4.7.5.6.6.5 Grues mobiles, derricks et véhicules lorsqu'ils sont déplacés ou opérés à proximité des lignes ou équipements sous tension.

4.7.6 Formation en sécurité électrique

4.7.6.1 Tous les travailleurs qui utilisent l'électricité, des équipements ou des appareils électriques dans le cadre de leurs fonctions habituelles, doivent être formés aux dangers et aux protections générales pour l'utilisation de l'électricité, des équipements et appareils électriques.

4.7.6.2 Tous les travailleurs qui doivent effectuer un travail électrique ou travaillent au voisinage de pièces nues sous tension doivent être qualifiés et formés aux risques spécifiques liés à leur domaine d'activité, aux règles de sécurité qui leur sont nécessaires pour faire leur travail en sécurité, et les exigences listées dans les directives SST de CG et / ou la législation locale.

4.7.6.3 Toutes les personnes qualifiées qui sont amenées à effectuer un travail électrique, à travailler sur ou au voisinage de pièces nues électriques, ou de construire, enlever ou démolir des éléments ou équipements électriques doivent être formées aux risques associés, aux règles de sécurité qui leur sont nécessaires pour effectuer leur travail en sécurité, et les exigences listées dans les directives SST de CG et / ou la législation locale. Elles doivent aussi être formées sur:

4.7.6.3.1 Les compétences et les techniques nécessaires pour distinguer les pièces nues sous tension des autres pièces.

4.7.6.3.2 Les compétences et les techniques nécessaires pour déterminer la tension nominale de pièces nues sous tension.

4.7.6.3.3 Les procédures de sécurité, les distances de sécurité, et les distances minimales d'approche nécessaires pour travailler au voisinage de pièce nues sous tension.

4.7.6.3.4 Les travailleurs amenés à utiliser des EPI électriques, pour se protéger des chocs électriques ou des arcs-flash, doivent recevoir une formation sur ces EPI en ligne avec les directives SST de CG et / ou la législation locale.

4.7.6.3.5 Les travailleurs doivent être reformés si nécessaire, ou au moins une fois tous les trois ans, pour s'assurer que des pratiques et procédures de sécurité adéquates sont maintenues et suivies, ou qu'à un moment donné les travailleurs ne soient pas en mesure de démontrer suffisamment leurs connaissances sur les précautions de sécurité nécessaires.

4.7.6.3.6 Tous les travailleurs habilités électriquement amenés à effectuer un travail électrique doivent être formés aux premiers soins, RCP (réanimation cardio-pulmonaire) et aux procédures d'urgences nécessaires pour les tâches qui leur sont affectées.

4.7.6.3.7 Toutes les formations réalisées dans le cadre de ce programme doivent être enregistrées et suivies comme demandé par la direction du site et / ou le représentant local de la sécurité.

4.7.6.3.8 ContourGlobal doit certifier par écrit que la formation des employés a été réalisée et est tenue à jour.

4.7.6.3.9 La certification doit contenir le nom et les dates de formation de chaque employé. Tous les employés qui installent, enlèvent et inspectent les prises de terre doivent être formés et avoir des connaissances sur :

4.7.6.3.9.1 Le but de la mise à la terre à fins de protection du personnel.

4.7.6.3.9.2 Les principes de la mise à la terre et de la mise à la masse.

4.7.6.3.9.3 L'importance de fournir une liaison de faible résistance autour du travailleur

4.7.6.3.9.4 Les raisons pour lesquelles la mise à la terre équipotentielle protège en cas de remise sous tension accidentelle

4.7.6.3.9.5 Les raisons pour lesquelles les procédures écrites sur l'installation de terres sur les installations sont applicables à chaque employé affecté.

4.7.6.3.9.6 Les effets de l'induction du champ électrique (capacitif) et de l'induction du champ magnétique (inductif).

4.7.6.3.9.7 Les effets de l'induction sur le courant qui circulera dans le conducteur et les prises de terre quand plus d'un ensemble de terres sont installés sur un circuit et comment la mise à la terre / mise à la masse protectives sont nécessaires pour contrôler la tension et le courant à un niveau qui est sûr pour le travailleur.

4.7.6.3.9.8 Les limitations de la mise à la terre de la potence et la nécessité d'un plan de mise à la terre protective.

4.7.6.3.9.9 Les composants appropriés et l'assemblage des ensembles de terre.

4.7.6.3.9.10 La maintenance correcte, l'entretien et l'inspection des ensembles et assemblages de terre.

4.8 PROGRAMME DE PROTECTION CONTRE LES CHUTES

4.8.1 Exigences générales

4.8.1.1 Chaque entité, filiale ou sous-traitant de ContourGlobal doit développer, mettre en place et maintenir un programme écrit de protection contre les chutes pour toutes les activités où ses employés et sous-traitants travaillent à une hauteur de 2 mètres (six pieds) ou plus, ou selon la législation locale.

4.8.1.2 Une évaluation du risque de chute doit être menée pour identifier tous les postes de travail élevés, dans toutes les opérations, processus et tâches y compris les bâtiments, tours, nacelles et machines, pour identifier les opportunités de travail en hauteur. L'évaluation doit aborder tant les opérations courantes habituelles que les opérations temporaires qui peuvent avoir lieu au cours de la maintenance et de la construction.

4.8.1.3 Le programme écrit de protection contre les chutes doit inclure tous les points suivants: identification des dangers, sélection du moyen de contrôle du risque de chute, inspection des équipements et formation des employés.

4.8.1.4 Avant que le travail en hauteur ne commence, une analyse de risque au poste de travail doit être entreprise et des instructions pertinentes délivrées au personnel impliqué dans l'opération. Les points suivants doivent être pris en compte :

4.8.1.4.1 Vent, conditions météorologiques actuelles et prévisions météorologiques.

4.8.1.4.2 Équipement de protection contre les chutes et son adéquation à la tâche spécifique en question.

4.8.1.4.3 Etat de l'échafaudage, des échelles et des plateformes.

4.8.1.4.4 Moyens sûrs d'accès et d'évacuation.

4.8.1.4.5 Sécurisation des zones sujettes à la circulation de poids lours ou de piétons, y compris panneaux d'avertissement.

4.8.1.4.6 Les charges qui pourraient être rencontrées.

4.8.1.4.7 Les communications entre ceux au sol et ceux en hauteur.

4.8.1.4.8 L'aptitude du personnel sélectionné à exécuter les tâches.

4.8.1.4.9 Les techniques de secours en situations d'urgences.

4.8.1.4.10 L'accès à la zone de travail pour les nacelles élévatrices et/ou les grues.

4.8.1.4.11 La mise en place de barrières / le balisage de la zone au-dessus de laquelle l'opération est effectuée

4.8.1.5 Le programme doit être communiqué aux employés concernés (pas uniquement ceux qui travaillent en hauteur).

4.8.1.6 Les employés qui travaillent dans des lieux élevés doivent être formés aux exigences du programme de protection contre les chutes y compris l'utilisation et l'inspection des équipements de protection contre les chutes.

4.8.1.7 Les dossiers de formations doivent être conservés.

4.8.1.8 Tout équipement servant à protéger les personnes dans le cadre du protection contre les chutes doit être régulièrement inspecté selon les recommandations de maintenance du fabricant et visuellement inspecté avant chaque utilisation.

4.8.1.9 Le programme de protection contre les chutes doit spécifier la fréquence et la méthode d'inspection de chaque partie de l'équipement qui comprend mais n'est pas limité à: harnais de sécurité, cordes, échelles, plateformes de travail, échafaudage, lignes de vie, plateformes élévatrices mobiles, etc.

4.8.1.10 Pour les sites en opération, une évaluation annuelle doit être conduite sur le site pour vérifier que tous les postes de travail élevés sont identifiés afin de s'assurer que les modifications au niveau des dangers de chutes sont prises en compte et que des contrôles fournissent une protection suffisante. L'évaluation doit aborder les activités et tâches courantes habituelles ainsi que les activités ponctuelles qui peuvent avoir lieu au cours d'opération de maintenance, y compris tout incident ou presqu'incident lié à la protection contre les chutes.

4.8.1.11 Pour les sites en construction, le responsable du site doit déterminer la fréquence adéquate des évaluations pour le travail en hauteur des opérations du chantier, en fonction de la phase de construction, car les conditions peuvent changer rapidement, même plus d'une fois par jour dans le cadre d'activités spécifiques.

4.8.1.12 Lorsque, dans une zone, un risque de chute d'objets existe, les casques de sécurité doivent être portés par toutes les personnes dans la zone, et chaque effort doit être fait pour éviter que les objets ne tombent des postes de travail sur les personnes se situant sous la zone de travail.

4.8.2 Sécurité relative à l'utilisation d'échelles

4.8.2.1 Chaque entité, filiale ou sous-traitant de ContourGlobal doit développer et maintenir un programme de sécurité relative à l'utilisation d'échelles qui réponde à la réglementation locale et fournit un environnement de travail sûr au personnel et aux sous-traitants de ContourGlobal.

4.8.2.2 Les personnes qui travailleront sur des échelles sur le lieu de travail devront recevoir une formation sur les procédures pour les inspecter en matière de sécurité. Le cas échéant, une formation complémentaire au programme de protection contre les chutes doit également être fournie avant le début des opérations.

4.8.2.3 Toutes les échelles utilisées sur le lieu de travail doivent être examinées visuellement avant utilisation pour identifier une usure excessive, des barreaux cassés ou fêlés et des montants cassés. Par ailleurs :

4.8.2.3.1 Toutes les échelles doivent être munies de barres structurelles qui empêchent l'expansion de l'échelle au-delà de sa longueur utilisable.

4.8.2.3.2 Toutes les échelles doivent répondre aux normes applicables en matière de charge admissible (au minimum l'échelle devrait être capable de supporter 4 fois le poids total de l'équipement et des personnes qui utiliseront l'échelle).

4.8.2.3.3 L'utilisation d'échelles provisoires en bois doit être évitée. Si elles sont utilisées, les échelles en bois doivent mesurer moins de 4 mètres (20 pieds), ne doivent pas être faites à partir de bois à basse densité (tendres), et doivent être inspectées visuellement avant l'utilisation, pour identifer des éclats, une usure excessive, des fissures et une détérioration générale.

4.8.2.3.4 Les échelles ne doivent être utilisées que selon les instructions du fabricant (par exemple, les échelles ne doivent pas être liées ensemble pour prolonger la longueur de l'échelle).

4.8.2.3.4.1 La base de l'échelle doit toujours être positionnée sur une surface plate, dure et solide, et dans le cas d'opérations prolongées avec une échelle verticale, le sommet doit toujours être stabilisé contre la structure sur laquelle elle est appuyée.

4.8.3 Échafaudage

4.8.3.1 Chaque entité, filiale ou sous-traitant de ContourGlobal doit être responsable du développement, de la mise en place et de la maintenance d'un programme en matière d'échafaudages qui réponde à la réglementation locale et aux besoins de l'organisation pour fournir et maintenir un environnement de travail sûr au personnel et aux sous-traitants de ContourGlobal.

4.8.3.2 Le type d'échafaudage approprié doit être sélectionné, en tenant compte de l'activité qui sera entreprise

4.8.3.3 ContourGlobal doit désigner une personne compétente pour :

4.8.3.3.1 La supervision et la direction du montage, du déplacement et du démontage ou de la modification des échafaudages ;

4.8.3.3.2 L'inspection des composants de l'échafaudage pour identifier des défauts visibles avant chaque période de travail, après l'installation initiale, après chaque modification, après chaque déplacement et après chaque fait qui pourrait affecter l'intégrité structurelle d'un échafaudage et une fois par semaine.

4.8.3.4 Tous les systèmes d'échafaudage doivent comprendre : des étiquettes clairement visibles avec la date et la signature qui indiquent si le système d'échafaudages est sûr à utiliser ou non.

4.8.3.4.1 Les échafaudages en cours de montage, de modification ou de démontage ne doivent pas être étiquetés comme prêts pour utilisation. Seules les personnes participant aux opérations (de montage, modification, démontage) peuvent y accéder.

4.8.3.5 L'échafaudage doit être conçu et monté selon le livret technique des fabricants ou fournisseurs. Toutes les modifications ou transformations proposées doivent être conçues par un professionnel compétent.

4.8.3.6 Tous les travailleurs doivent être compétents pour le type de travail sur échafaudage qu'ils entreprennent et doivent avoir reçu la formation appropriée en lien avec le système sur lequel ils travaillent.

4.8.3.7 Un registre des échafaudages doit mentionner les défauts et les actions corrective prises.

4.8.3.8 Les planchers de l'échafaudage doivent être inspectés et contrôlés en ce qui concerne :

4.8.3.8.1 Les planches de bois utilisées pour les plateformes de l'échafaudage doivent être en bois de qualité adaptée pour la construction d'échafaudages.

4.8.3.8.2 Les planchers des échafaudages doivent être inspectés et contrôlés à la réception et avant l'utilisation.

4.8.3.8.3 Les inspections doivent identifier tous les défauts qui pourraient affecter l'intégrité structurelle du plancher (p. ex. dégradation, fissures, coupures, etc.).

4.8.3.8.4 Lors de leur chargement, les planchers de l'échafaudage ne doivent pas dévier de plus du 1/60ème de la longueur entre les porteurs.

4.8.3.8.5 Le bois de construction ignifugé doit avoir un taux de capacité de poids de 80 à 85 pour cent de bois de construction non traité.

4.8.3.9 Le matériau de l'échafaudage doit être stocké d'une manière à éviter d'endommager l'équipement.

4.8.3.10 La personne compétente devra s'assurer que chaque travailleur impliqué dans le montage, le démontage, le déplacement, le fonctionnement, la réparation, la maintenance ou l'inspection d'un échafaudage, aura reçu une formation de la part d'un professionnel compétent pour reconnaitre tous les dangers associés au travail en question. La formation doit comprendre les sujets suivants, le cas échéant :

4.8.3.10.1.1 La nature des dangers liés aux échafaudages.

4.8.3.10.1.2 Les procédures correctes de montage, démontage, déplacement, fonctionnement, réparation, inspection et maintenance du type d'échafaudage en question.

4.8.3.10.1.3 Les critères de conception, la capacité maximale de charge prévue et l'utilisation prévue de l'échafaudage.

4.8.4 Travail sur toiture

4.8.4.1 Chaque entité, filiale ou sous-traitant de ContourGlobal doit s'assurer que toutes les opérations de travail sur toiture seront pré-planifiées et correctement supervisées.

4.8.4.2 Le travail sur toiture ne doit être entrepris que par des travailleurs qui sont physiquement et psychologiquement aptes et qui ont les connaissances et l'expérience nécessaires pour un tel travail.

4.8.4.3 Le travail sur toiture ne doit pas être réalisé sous des conditions météorologiques menaçant la sécurité des travailleurs.

4.8.4.4 Les planches à tasseaux, les passerelles et échelles de toit doivent être accrochées de manière sûre à une structure solide.

4.8.4.5 Toutes les couvertures pour les ouvertures sur les toits doivent être d'une construction solide et être positionnées d'une manière sûre.

4.8.4.6 Au cours d'un travail prolongé sur le toit, des barrières solides ou des garde-corps et des plinthes doivent être mis à disposition pour empêcher une personne de tomber du toit.

4.8.4.6 Si les travailleurs sont amenés à travailler sur ou près des toits ou d'autres lieux recouverts par un matériau fragile, à travers lequel il est possible de tomber, on doit leur fournir des échelles de toit ou des planches à tasseaux qui soient suffisamment solides et en travers des supports pour que la couverture du toit puisse soutenir ces travailleurs.

4.8.4.7 Dans le cas où des échelles de toit, des barrières, des garde-corps ou tout autre dispositif de protection ne peuvent être fournis, des EPI pour le travail en hauteur, avec un ancrage ou une ligne de vie appropriée, doivent être utilisés.

4.9 TRAVAUX A CHAUD

4.9.1 Chaque entité, filiale ou sous-traitant de ContourGlobal doit mettre en place un programme écrit de sécurité en matière de travaux à chaud (les travaux à chaud peuvent être : arc électrique, la soudure au gaz, l'abrasion, la découpe, ou d'autres activités à flamme nue) afin d'empêcher toute blessure due à une exécution inappropriée de l'opération et les dangers d'incendie liés aux matériaux combustibles dans la zone locale.

4.9.2 Avant que le travail à chaud ne soit autorisé, la zone doit être inspectée par la personne responsable de l'autorisation des opérations de travail à chaud.

4.9.3 Un permis de feu (autorisation de travail à chaud) est nécessaire quand :

4.9.3.1 Des gaz ou des liquides inflammables ou combustibles sont présents et peuvent s'enflammer ou exploser.

4.9.3.2 Des matériaux inflammables ou combustibles sont présents et peuvent s'enflammer s'ils ne sont pas correctement protégés ou contrôlés.

4.9.3.3 Des vapeurs flash et les gaz non condensables peuvent s'accumuler et développer des mélanges inflammables.

4.9.4 Si possible, retirer l'objet qui doit être soudé ou coupé vers un emplacement exempt de combustibles dangereux.

4.9.4.1 Si l'objet qui doit être soudé ou coupé ne peut être facilement déplacé, tous les dangers d'incendie à proximité qui peuvent être déplacés doivent être emmenés dans un lieu sûr.

4.9.4.2 Si l'objet qui doit être soudé ou coupé ne peut être déplacé, et si tous les dangers d'incendie ne peuvent être retirés, des protections doivent être utilisées pour confiner la chaleur, les étincelles et les scories, et pour protéger les dangers d'incendie fixes.

4.9.5 Des panneaux d'avertissement doivent être positionnés durant les opérations.

4.9.6 Les besoins en ventilation doivent être pris en compte lors de l'évaluation de des risques pour la sécurité de tout travail à chaud.

4.9.7 Des procédures doivent être mises en place pour s'assurer que le matériel de soudure, de coupe et d'abrasion est stocké, maintenu et transporté d'une manière sûre.

4.9.8 Les personnes impliquées dans des opérations, y compris la surveillance anti-incendie et les observateurs, doivent porter les équipements de protection individuelle appropriés.

4.9.9 Seules les personnes autorisées, ayant reçu la formation appropriée et étant qualifiées pour l'utilisation du matériel de soudure, de coupe et d'abrasion peuvent mener des opérations de soudure et de coupe.

4.9.9.1 Une liste des personnes autorisées à mener ces opérations doit être conservée et tenue à jour.

4.9.10 Précautions en matière de prévention des incendies :

4.9.10.1 Le travail à chaud ne doit être autorisé que dans des zones qui sont ou été conçues à l'épreuve du feu.

4.9.10.2 Quand le travail ne peut, de manière pratique, être déplacé, la zone doit être rendue à l'épreuve du feu en retirant tous les combustibles des sources d'allumage, en humidifiant la zone, en étalant des sacs de toile humide sur le plancher, ou en étirant des toiles ou d'autres matériaux non-combustibles, qui sont à l'épreuve des flammes, sur toute la zone où le travail doit être exécuté.

4.9.10.3 Vérifier s'il y a des matériaux combustibles adjacents de l'autre côté des cloisons métalliques, des plafonds ou du toit et qui sont susceptibles de s'enflammer par conduction ou radiation.

4.9.10.4 Si la soudure doit être réalisée sur un mur, une cloison, un plafond ou un toit métallique qui est en contact avec des combustibles qui ne peuvent être déplacés, une surveillance anti-incendie de l'autre côté de la zone de travail doit être prévue.

4.9.10.5 Si le travail à chaud est effectué dans une zone qui comprend des planchers grillagés, des précautions spéciales doivent être prises pour s'assurer que les étincelles et les scories chaudes ne passent pas à travers la grille vers les niveaux inférieurs.

4.9.10.6 Les conduits et des systèmes de transporteurs qui peuvent emporter les étincelles vers des combustibles éloignés doivent être correctement arrêtés ou obturés.

4.9.10.7 Un extincteur portable de secours, adapté aux types de feu possibles, doit être placé sur la zone de travail. Si des tuyaux incendie sont disponibles, ils doivent être connectés et prêts à fonctionner.

4.9.10.8 Les surveillances anti-incendie doivent disposer d'équipement d'extinction incendie et tout équipement de protection individuelle nécessaire facilement disponible et une formation sur leur utilisation doit avoir été réalisée. Ils doivent être familiarisés avec les procédures pour faire retentir une alarme en cas d'incendie.

4.9.10.9 Surveiller l'apparition d'incendie dans toutes les zones exposées et les éteindre si possible avec l'équipement disponible ou dans le cas contraire faire immédiatement retentir l'alarme.

5 RISQUES CHIMIQUES

5.1 ÉVALUATION DES RISQUES CHIMIQUES

5.1.1 Chaque entité, filiale ou sous-traitant de ContourGlobal doit identifier les substances chimiques dangereuses, qui sont ou peuvent être présentes au cours des opérations. Les risques et impacts correspondants (problèmes de santé ou accidents) doivent être évalués. L'évaluation des risques doit prendre en compte :

5.1.1.1 Les propriétés dangereuses des substances chimiques dangereuses doivent être identifiées, tant de manière séparée que prise ensemble.

5.1.1.2 Les informations sur les propriétés dangereuses et les mesures nécessaires pour la protection de la santé et de la sécurité doivent être fournies par le fournisseur.

5.1.1.3 Le mode de manipulation, les équipements de travail, la quantité, la pression et la température, les mesures préventives prises pour la manipulation et autres conditions préalables à prendre au cours de l'activité ou des substances chimiques dangereuses sont présentes.

5.1.1.4 L'exposition aux substances chimiques dangereuses, sa nature, son niveau et sa durée.

5.1.1.5 Des rapports d'activité concernant la gêne, l'état de santé ou accidents considérés comme étant liés à la présence de substances chimiques.

5.1.1.6 Les conclusions, qui peuvent être tirées de toute surveillance médicale déjà entreprise.

5.1.2 L'évaluation des risques doit être mise à jour en cas de changement au niveau de l'opération ou lorsque de nouvelles informations apparaissent et sont en lien avec le profil de risque.

5.1.3 Des pratiques de travail doivent être développées et mise en œuvre pour réduire le déversement de contaminant dans l'environnement de travail.

5.1.4 Les instructions de manipulation et de sécurité, qui sont nécessaires, doivent être transmises aux employés dans une langue qu'ils comprennent.

5.1.4.1 Les instructions doivent être adaptées aux opérations de manipulation courante sur le lieu de travail.

5.1.4.2 Les instructions doivent être par écrit et disponibles sur le lieu de travail.

5.1.5 Les poussières, vapeurs et gaz contaminants doivent être maintenus en dessous de la valeur limite d'exposition (VLE), recommandée par la Conférence américaine des hygiénistes industriels gouvernementaux (ACGIH) ou selon la législation locale.

5.1.6 Si l'air ambiant contient certains matériaux qui ont des effets similaires sur les organes du corps (effets cumulatifs), une exposition combinée doit être évaluée au moyen des calculs recommandés par l'ACGIH ou selon la législation locale.

5.1.7 Si les périodes de travail s'étalent au-delà de 8 heures, l'exposition doit être calculée au prorata en utilisant les critères recommandés par l'ACGIH ou selon la législation locale.

5.1.8 Des informations doivent être fournies concernant les valeurs limites d'exposition professionnelle pour les substances présentes et les autres précautions qui s'appliquent au travail, ainsi que les routines existantes pour le contrôle interne des produits chimiques.

5.1.9 Un registre des produits chimiques et des substances utilisés sur le site doit être mis en place.

5.1.9.1 Les noms de produits doivent être listés en ordre systématique.

5.1.9.2 La liste doit rester à jour et doit comprendre la date de la dernière modification.

5.1.9.3 Les listes doivent être maintenues facilement disponibles aux employés qui travaillent avec ou sont susceptibles d'entrer en contact avec ces produits chimiques.

5.1.10 Un produit chimique, qui est dangereux pour la santé ou inflammable, ne peut être utilisé avant qu'une fiche de données de sécurité - FDS – contenant les informations nécessaires sur les risques et la sécurité concernant le produit, soit fournie aux employés concernés, par le fournisseur de produits chimiques ou toute autre source fiable.

5.2 RISQUES LIES AU CONTACT AVEC LA PEAU, LA PROJECTION DANS LES YEUX ET L'INGESTION

5.2.1 Chaque entité, filiale ou sous-traitant de ContourGlobal doit mettre à disposition sur le lieu de travail des moyens pour enlever les substances qui peuvent causer des blessures lorsqu'elles sont en contact avec la peau ou les yeux, et ce avant que la blessure ne devienne sérieuse.

5.2.2 Une personne qui manipule ou entre en contact avec une substance chimique dangereuse de telle sorte qu'il existe un risque sur sa santé, doit observer une bonne hygiène personnelle.

5.2.3 La peau, qui a été contaminée par une substance chimique, doit être nettoyée sans attendre, s'il y a un risque de lésion de la peau ou un autre problème de santé.

5.2.4 Les vêtements de travail et de protection qui ont été contaminés par une substance chimique dangereuse pouvant causer des problèmes de santé ou un accident doivent être remplacés sans attendre.

5.2.5 Les vêtements de travail et de protection doivent être rangés de façon à empêcher la propagation de substances chimiques dangereuses.

5.2.6 La nourriture et les boissons ne peuvent être préparées, consommées ou conservées, les produits du tabac ne peuvent être utilisés et les cosmétiques ne peuvent être appliqués là où une substance chimique dangereuse est utilisée ou stockée.

5.3 STOCKAGE ET EMBALLAGE

5.3.1 Chaque entité, filiale ou sous-traitant de ContourGlobal doit développer un processus d'identification et de stockage des produits chimiques afin que les produits soient rangés avec des produits compatibles.

5.3.2 Le risque de blessure par contact avec la peau doit être évité en maintenant propre la partie externe des emballages et des récipients.

5.3.3 Les emballages et les récipients de substances chimiques dangereuses doivent être fabriqués à partir de matériau et avoir une conception et une résistance telles que les risques sur la santé ou les risques d'accident dus à leur contenu soient évités.

5.3.4 Les quantités en vrac de produits chimiques doivent être conservées dans des zones séparées de la zone de travail.

5.3.5 Les produits chimiques doivent être stockés dans des zones bien ventilées, sous des températures et une humidité appropriées.

5.3.6 Les produits chimiques ne doivent jamais être stockés avec, ou près d'aliments, y compris dans ou près de réfrigérateurs utilisés pour les aliments.

5.3.7 Les zones de stockage doivent faire l’objet d’inspections visuelles périodiques.

5.3.7.1 Les conditions à observer doivent inclure : déversements accidentels, fûts bombés, défaut d'étiquetage, stockage de produits incompatibles, détérioration du récipient, fortes odeurs, etc.

5.3.8 Une sécurité appropriée doit être fournie afin que le personnel non autorisé n'ait pas accès aux produits dangereux.

5.3.9 Les produits chimiques qui ne sont plus utilisés doivent être périodiquement éliminés du site afin de réduire les risques associés à un tel stockage et à une gestion de l'inventaire sur site.

5.3.10 Les produits chimiques corrosifs, oxydants et réactifs doivent être séparés des produits inflammables et des autres produits chimiques de classes incompatibles. (p. ex. acides versus bases, oxydants versus réducteurs, produits sensibles à l'eau versus produits à base d'eau, etc.)

5.3.11 Les produits réactifs à l'eau doivent être isolés pour réduire la probabilité de leur implication dans un incendie où l'eau est utilisée en tant qu’agent extincteur.

5.3.12 Les produits extrêmement toxiques et les produits réglementés (cancérigènes) doivent être isolés pour fournir un degré de contrôle sur leur distribution et réduire la possibilité de déversements accidentels.

5.3.13 Les produits chimiques corrosifs, oxydants et réactifs doivent être stockés sur une rétention secondaire appropriée pour réduire le risque de contamination par mélange au cours des déversements.

5.3.14 Un équipement de lutte contre les déversements doit être mis en place.

5.4 MANIPULATION DE PRODUITS CHIMIQUES ET CONSIGNES DE SECURITE

5.4.1 Chaque entité, filiale ou sous-traitant de ContourGlobal doit avoir une consigne relatives aux exigences en matière de manipulation sûre et cohérente des produits, qui définisse les travaux pour lesquels la consigne est prévue, la personne qui l'émet et la date d'émission.

5.4.2 Les consignes doivent être établies par quelqu'un qui connaît particulièrement bien les conditions de travail et a suffisamment d’expérience dans le domaine d’activité considéré.

5.4.3 Les points suivant doivent être inclus dans cette consigne :

5.4.3.1 Préparation du travail :

5.4.3.1.1 Endroit où le travail est réalisé.

5.4.3.1.2 Disposition des panneaux d'avertissement et des barrières

5.4.3.1.3 Vérification des équipements et appareils

5.4.3.1.4 Disposition des équipements de protection et des agents de décontamination en cas de déversements.

5.4.3.2 Description détaillée du travail, présentant :

5.4.3.2.1 Les quantités des différents produits chimiques à ajouter, dans quel ordre et avec quel équipement de dosage.

5.4.3.2.2 Les mesures à prendre afin de réduire les risques présents, p. ex. utilisation d'unités locales d'extraction et d'armoires ventilées.

5.4.3.2.3 Les équipements de protection individuelle à utiliser au cours des diverses opérations.

5.4.3.3 Procédure une fois le travail terminé :

5.4.3.3.1 Élimination des déchets.

5.4.3.3.2 Décontamination et nettoyage.

5.4.3.3.3 Nettoyage ou non de la peau ou de l'équipement de protection individuelle utilisé.

5.4.3.4 Procédure en cas d'accident ou incident (tels qu'une réaction violente, un incendie, le déversement accidentel ou l'émission dans l'air) :

5.4.3.4.1 Mesures à prendre par les employés eux-mêmes

5.4.3.4.2 Utilisation d'un équipement de protection individuelle ou non ?

5.4.3.4.3 Comment demander de l'aide

5.4.3.4.4 Premiers secours qui peuvent être nécessaires.

5.4.3.4.5 Personnes à avertir.

5.4.4 Les travailleurs qui doivent manipuler des produits chimiques corrosifs, oxydants et réactifs doivent avoir une formation spéciale sur la gestion des risques associés.

5.4.5 Les travailleurs qui doivent manipuler des produits chimiques corrosifs, oxydants et réactifs doivent avoir reçu les EPI appropriés (p. ex. gants, tabliers, combinaison anti-éclaboussures, masque de protection ou lunettes de protection, etc.)

5.4.6 Si des produits corrosifs, oxydants ou réactifs sont utilisés, manipulés ou stockés, des secouristes qualifiés doivent être disponibles.

5.4.7 Si des produits corrosifs, oxydants ou réactifs sont utilisés, manipulés ou stockés, des postes équipés de premiers secours doivent être accessibles sur tout le lieu de travail.

5.5 COMMUNICATION DES CODES DE DANGERS ET FICHES DE DONNEES DE SECURITE (FDS)

5.5.1 Chaque entité, filiale ou sous-traitant de ContourGlobal doit afficher des copies de tous les systèmes de codes de dangers utilisés sur le site, à l'extérieur de l'installation, aux accès d'urgence, où elles sont susceptibles d'attirer l'attention du personnel des services d'urgences.

5.5.2 Des fiches de données de sécurité (FDS) doivent être disponibles pour tous les produits chimiques utilisés sur le site au point d'utilisation du produit chimique et être tenues dans un fichier central qui peut être visualisé sur écran ou sur papier.

5.5.3 La documentation sur les produits chimiques (FDS ou équivalent) doit être facilement accessible durant chaque période de travail à tous les employés (y compris ceux des autres employeurs sur le site) de l'opération.

5.5.4 La documentation sur les produits chimiques (FDS ou équivalent) doit être rédigée dans la langue locale et conservée sur fichier pendant au moins cinq (5) ans après son émission initiale ou la dernière révision.

5.5.5 Le site doit avoir une « SOP » écrite (Procédure opérationnelle standard) pour approuver les produits chimiques (y compris ceux demandés à travers l'introduction de nouveaux matériaux/Introduction de nouveaux processus) pour la fabrication, l'importation, la réception, le stockage et l'utilisation au cours de l'opération.

5.5.6 Ces « SOP » écrites doivent établir les exigences minimales d'approbation préalable (p.ex. : besoin d'une FDS, quantités estimées nécessaires, description de l'utilisation prévue, origine de l'importation, etc.).

5.5.7 Une communication régulière et documentée avec les services d'urgences doit être mise en place.

5.5.7.1 Les services d'urgences doivent être invités à participer à des visites d'orientation périodiques pour s'assurer qu'ils sont familiers avec la disposition du site et les dangers potentiels qui peuvent être présents.

5.6 AMIANTE

5.6.1 L'utilisation de matériaux contenant de l'amiante (MCA) doit être évitée au cours des activités de construction ou de rénovation.

5.6.2 Un diagnostic amiante doit être prévu dans le cadre du processus de « due diligence » lors de l'acquisition de toute installation.

5.6.3 Les installations existantes soupçonnées de contenir des MCA doivent faire l'objet d'un diagnostic amiante mené par un sous-traitant qualifié.

5.6.4 Une copie du registre des matériaux contenant de l'amiante doit être conservée sur chaque site.

5.6.4.1 Une personne responsable doit être nommée par le propriétaire du bâtiment sur chaque site pour s'assurer que le registre est disponible à la consultation et est maintenu en bon ordre.

5.6.4.2 Le type d'amiante et son état (p. ex. si elle est sous une forme friable avec un potentiel de libération de fibres) doit être décrit en détails.

5.6.5 Des panneaux et étiquettes de danger doivent être placés de manière stratégique au sein du bâtiment. Les panneaux doivent être installés pour avertir les occupants, les visiteurs, le personnel de construction et de maintenance qu'un matériau contenant de l'amiante est présent.

5.6.6 L'installation doit décrire en détail les procédures de contrôle continu de l'état des MCA. p. ex. : Réduire le dérangement, limiter les matières en suspension dans l'air, prévenir l'inhalation des fibres, zones à accès restreint.

5.6.6.1 Les procédures doivent être disponibles à tous les travailleurs impliqués dans l'opération et la maintenance, réalisées dans des zones qui contiennent des MCA, et les travailleurs doivent également être conscients des risques et être formés pour éviter les dommages et l'exposition.

5.6.6.2 L'installation doit avoir une procédure d'inspection là où les tâches sont réalisées et un appareil respiratoire certifié de classe P2 doit être porté à chaque instant et les personnes avisées de ne pas avoir de contact direct avec la peau avec toute amiante identifiée.

5.6.7 Tout travail qui implique le retrait de matériaux d'isolation thermique ou phonique contenant de l'amiante, les zones de tôles en fibrociment, ou le travail sur des matériaux qui peuvent générer de la poussière d'amiante doivent être réalisés par un sous-traitant agréé pour l'élimination de l'amiante.

5.6.8 Tous les déchets d'amiante doivent être éliminés selon les obligations légales locales. Si celles-ci n'existent pas, le responsable environnement de ContourGlobal doit être informé pour obtenir des conseils avant élimination.

6 RISQUES BIOLOGIQUES

6.1 VOYAGE INTERNATIONAL

6.1.1 Chaque entité, filiale ou sous-traitant de ContourGlobal doit s'assurer que les personnes qui voyagent pour affaires ou en détachement en tant qu'expatriés consultent une clinique santé-voyage locale pour obtenir les conseils et les traitements médicaux appropriés (p. ex. les vaccinations) de préférence au moins 4 semaines avant le voyage.

6.1.2 Les conseils médicaux et de traitement doivent comprendre les risques pour la santé spécifiques à la destination ainsi que les procédures à suivre en cas de situation médicale d'urgence.

6.2 CONTROLE DU RISQUE LEGIONELLE

6.2.1 Une évaluation des risques des tours de refroidissement, des condenseurs à air et des autres systèmes de production d'eau chaude de la centrale doit être entreprise et être suffisante pour couvrir les éléments clés pour contrôler la prolifération de la bactérie Légionelle et d'autres microorganismes.

6.2.2 Un professionnel compétent doit conduire l'évaluation des risques.

6.2.3 L'évaluation des risques doit être revue au moins tous les deux ans ou en cas de modification du système, lorsqu’il devient évident que l'évaluation des risques initiale n'est plus valide c.à.d. selon les résultats ds contrôles, la surveillance microbienne, de nouvelles informations.

6.2.4 Un plan d'actions doit être mis en place afin de corriger toute non-conformité identifiée au cours de l'évaluation.

6.2.5 Les informations sur tous les systèmes évalués doivent être documentées et maintenues et comprennent :

6.2.5.1 Des schémas mis à jour du système y compris les points à partir desquels des échantillons de laboratoire courants doivent être pris.

6.2.5.2 Évaluations des risques précédentes (si elles sont disponibles).

6.2.5.3 Compte-rendu de suivi avec une mention particulière des écarts importants aux conditions de fonctionnement acceptables.

6.2.6 Les systèmes évalués doivent avoir un plan de surveillance pour réduire la prolifération de la Légionelle, y compris :

6.2.6.1 Les paramètres de qualité demandés (p. ex. température, pH, niveaux des biocides, etc.), identifiés dans l'évaluation des risques, doivent être suivis selon une fréquence définie.

6.2.6.2 Des comptes totaux de bactéries viables (TVC) de l'eau d’appoint, de l'eau des tours de refroidissement et des autres systèmes identifiés doivent être suivis selon une méthode appropriée et une fréquence adéquate définies par l'évaluation des risques et les normes appropriées.

6.2.6.3 Une révision du programme de traitement doit être effectuée si les comptes totaux de bactéries viables donnent des résultats entre 10 x 4 et 10 x 5 UFC/ml ou selon la législation locale. Par ailleurs, tout compte doit être répété.

6.2.6.4 Des actions correctives doivent être réalisées si les comptes totaux de bactéries viables donnent des résultats supérieurs à 10 x 5 UFC/ml ou selon la législation locale. Toutes les révisions et actions correctives du programme qui en découlent doivent être documentées.

6.2.7 Tout écart aux conditions optimales spécifiées de qualité de l'eau doit être vérifié et donner lieu à des actions correctives efficaces et documentées.

6.2.8 Un nettoyage et une désinfection des systèmes doivent être effectués au moins tous les 6 mois, cela comprend l'équipement principal, la tuyauterie associée et tous les systèmes en contact.

6.3 MALADIE A TRANSMISSION VECTORIELLE

6.3.1 Chaque entité, filiale ou équipe de santé sous-traitante de ContourGlobal doit travailler étroitement avec les autorités de santé de la communauté, pour développer et mettre en place une stratégie de contrôle contre les maladies liées aux moustiques et aux arthropodes. Certaines choses doivent être prises en compte lors de la planification du contrôle des maladies à transmission vectorielle :

6.3.1.1 Prévention de la propagation des larves et des adultes au moyen de l'amélioration sanitaire et de l'élimination des habitats de reproduction à proximité du site.

6.3.1.2 Elimination de l'eau stagnante inutilisable.

6.3.1.3 Augmentation de la vitesse d’écoulement de l'eau dans les voies naturelles et artificielles.

6.3.1.4 Mise en place de programmes intégrés de contrôle des vecteurs.

6.3.1.5 Promotion de l'utilisation d'insectifuges, de vêtements, de moustiquaires et autres barrières pour prévenir les piqûres d'insectes.

6.3.1.6 Formation du personnel du site et des habitants de la région sur les risques, la prévention et le traitement disponible.

6.3.1.7 Surveillance de la communauté durant les saisons à haut risque

6.3.1.8 Distributions de supports d'information appropriés.

7 RISQUES ERGONOMIQUES

7.1.1 Chaque entité, filiale ou sous-traitant de ContourGlobal doit mettre en place un programme écrit d'évaluation de l'ergonomie.

7.1.2 Le programme doit décrire les processus pour signaler la douleur, l'inconfort et les autres symptômes précoces de troubles musculo-squelettiques (TMS) et la procédure pour signaler les facteurs de risques liés à l'ergonomie, tels que le poids des objets, les positions/postures gênantes, la fréquence et la durée de ports de charge, les prises de mains inadéquates, la pression de contact, les facteurs environnementaux, entre autres.

7.1.3 Le programme doit s'assurer que ces procédures sont comprises par les employés.

7.1.4 Les rôles et responsabilités de tous les composants du programme d'ergonomie doivent être attribués, décrits dans un programme écrit, et compris par les personnes qui en ont la responsabilité.

7.1.5 Toutes les données relatives aux blessures ou maladies doivent être revues une fois par an pour identifier les tendances liées à l'ergonomie et par un travail d'équipe.

7.1.6 Toutes les blessures et maladies doivent être évaluées au cours du processus d'investigation de l'accident/incident pour déterminer si des facteurs de risques liés à l'ergonomie ont contribué à l'incident et si une évaluation plus détaillée de l'ergonomie est nécessaire.

7.1.7 Les installations et postes de travail doivent être conçus afin de satisfaire la majorité du personnel d'exploitation. (5$^{\text{ème}}$ au 95$^{\text{ème}}$ %).

7.1.7.1 Les postes de travail doivent offrir un choix de réglages pour s'adapter aux différents travailleurs.

7.1.7.2 Des réglages raisonnables des postes de travail et des installations doivent permettre de répondre aux besoins des employés qui en ont besoin.

7.1.8 Une formation renforçant les aspects positifs de l'ergonomie doit être donnée, y compris sur :

7.1.8.1 La manutention manuelle pour les employés qui sont amenés à porter et transporter du matériel et des outils

7.1.8.2 Le maintien d'une posture correcte/neutre, c'est-à-dire que la colonne vertébrale doit être droite, les postures non exagérées, qu'il ne doit pas y avoir de contraintes sur les muscles et le dos, et le poignet ne doit pas être cassé.

7.1.9 Des moyens mécaniques doivent être utilisés si les poids limites pour le port de charges sont dépassés

7.1.10 Des pauses pour se reposer et s'étirer doivent être incluses aux processus de travail.

7.1.11 Les outils doivent être choisis afin de réduire la force nécessaire, le temps de maintien de la charge et pour améliorer la posture.

8 RISQUES MECANIQUES

8.1 PROTECTION DES MACHINES

8.1.1 Chaque entité, filiale ou sous-traitant de ContourGlobal doit conduire une étude de site des équipements installés, pour évaluer les risques potentiels pour le personnel de ContourGlobal, associés au fonctionnement, à la maintenance et à la réparation des équipements.

8.1.2 Pour chaque risque potentiel identifié, une ou plusieurs méthodes de protection des machines doit être fournie(s) pour protéger des dangers l'opérateur et les autres personnes et sous-traitants de ContourGlobal présents dans la zone des machines. Des exemples de méthodes de protection à prendre en compte dans cette évaluation sont les barrières de protection, les dispositifs électroniques de sécurité, etc.

8.1.3 Les protections doivent :

8.1.3.1 Être si possible fixées à la machine et sécurisées partout ailleurs si, pour quelque raison que ce soit, la fixation sur la machine n'est pas possible.

8.1.3.2 Être telles qu'elles ne constituent pas elles-mêmes un danger.

8.1.3.3 Protéger la zone d’'opération (la zone où le travail est effectué sur le matériel, tel que la découpe, le façonnage, le forage ou la formation de stock) où une personne ou un sous-traitant de ContourGlobal peut être exposé à une blessure.

8.1.3.4 Être en conformité avec toutes les normes appropriées, ou, en l'absence de normes spécifiques applicables, elles doivent être conçues et construites de telle sorte qu'elles empêchent l'opérateur d’avoir une partie de son corps dans la zone de danger au cours du cycle d'exploitation.

8.1.3.5 Si nécessaire, des protections avec dispositifs de verrouillage doivent être installées pour empêcher qu’elles ne soient contournées.

8.1.3.6 Si les protections doivent être enlevées, des procédures de sécurité doivent être définies pour s'assurer que la machine a été éteinte. p. ex. un programme de consignation / déconsignation

8.1.4 Un contrôle de l'énergie mécanique ou électrique doit être réalisé sur chaque machine afin que l'opérateur puisse couper l’alimentation de chaque machine sans quitter sa position au point d'opération.

8.1.5 Les opérateurs doivent porter les vêtements de protection adaptés à la tâche, éviter les vêtements larges, les cravates ou les bijoux, qui peuvent être attrapés par les pièces en mouvement.

8.1.6 Une formation doit être réalisée sur les risques identifiés liés à chaque machine, notamment :

8.1.6.1 Les équipements de protection individuelle applicables nécessaires au cours de l'opération ou de la maintenance.

8.1.6.2 Être capable de reconnaître les dangers associés aux différents types de machines et outils alimentés et les précautions de sécurité nécessaires.

8.1.6.3 Utiliser l'outil adapté au travail.

8.1.6.4 Examiner chaque outil à la recherche d'éventuels dommages avant l'utilisation et ne pas utiliser d'outils endommagés.

8.2 OUTILS A MAIN ET OUTILS A MOTEUR PORTATIFS

8.2.1 Chaque entité, filiale ou sous-traitant de ContourGlobal doit développer, mettre en place et maintenir un programme de sécurité écrit pour les travailleurs qui utilisent des outils à main et les outils à moteur portatifs, y compris la manipulation correcte, l'utilisation d'EPI et autres moyens pour réduire ou écarter tout risque pour le personnel et les sous-traitants de ContourGlobal pendant l'utilisation.

8.2.2 Chaque site doit réaliser une étude de tous les outils à main et les à outils ç moteur portatifs fournis par l'entité pour une utilisation par le personnel de ContourGlobal et ses sous-traitants. L'étude doit se concentrer sur les dangers potentiels pour la santé et la sécurité des travailleurs.

8.2.3 Les instructions du fabricant relatives à l'entretien et à la maintenance doivent être suivies, et tout outil présentant un défaut doit être immédiatement mis hors service jusqu'à ce qu'il soit correctement révisé et réparé.

8.2.4 Tous les dispositifs de protection du fabricant et les interrupteurs de sécurité doivent être utilisés en conformité avec les recommandations du fabricant, sans manipulation ni altération pour faciliter ou accélérer l'utilisation.

8.2.5 Avant d'utiliser un outil, l'opérateur doit l'inspecter pour vérifier qu'il est propre, que toutes les parties mobiles fonctionnent librement, que l'outil est en bon état, que les câbles d'alimentation (s'ils existent) ne sont pas dénudés ou dangereux, et que toutes les zones de travail sont libres de tout obstacle.

8.2.6 Aucun outil ne doit être laissé sans surveillance à un endroit où il serait rendu disponible à des utilisateurs non autorisés.

8.2.7 Tous les outils à main et les outils à moteur portatifs conçus pour la découpe, le meulage ou le déchiquetage doivent avoir un interrupteur à arrêt par relâchement ou un dispositif de sécurité manuel comparable qui nécessite un acte positif de la part de l'utilisateur pour alimenter l'équipement.

8.2.8 Les personnes qui utilisent des outils à main et des outils à moteur portatifs doivent être formées à leur utilisation correcte, la maintenance, et le stockage de ces outils dans l'exercice de leur travail.

8.2.9 Les travailleurs qui utilisent des outils électriques doivent être protégés par des disjoncteurs différentiels ou un programme de mise à la terre par conducteur et être conscient du danger d'électrocution ainsi que des dangers supplémentaires, comme les brûlures et les chocs électriques.

8.2.10 Les outils pneumatiques doivent être vérifiés pour vérifier que le flexible d'air est bien raccordé et qu'il ne risque pas de se débrancher et pour se conformer aux recommandations du fabricant.

8.2.11 Les outils à moteur thermique fonctionnent généralement à l'essence, ce qui peut créer de graves dangers associés aux vapeurs du carburant qui peuvent brûler ou exploser et aussi émettre des fumées d'échappement dangereuses.

8.3 GROUPES ELECTROGENES PORTATIFS

8.3.1 Chaque entité, filiale ou sous-traitant de ContourGlobal doit développer, mettre en place et maintenir un programme de prévention des blessures liés aux groupes électrogènes portatifs. Le programme doit inclure des précautions sur :

8.3.1.1 Les chocs et l'électrocution liés à une utilisation incorrecte de l'alimentation ou des autres systèmes électriques de mise sous tension.

8.3.1.2 Les incendies liés à un approvisionnement incorrect en carburant du groupe ou à un stockage inapproprié du carburant.

8.3.1.3 Une ventilation adéquate par rapport au monoxyde de carbone (CO) issu de l'échappement du groupe.

8.3.1.4 Inspecter les groupes électrogènes à la recherche d'éventuels dommages ou des lignes de carburant non/mal fixées qui peuvent survenir au cours du transport et/ou de la manipulation.

8.3.1.5 Maintenir le groupe électrogène au sec.

8.3.1.6 Maintenir et faire fonctionner les groupes électrogènes en accord avec les instructions d'utilisation et de sécurité du fabricant.

8.4 ÉQUIPEMENT DE LEVAGE / MANUTENTION

8.4.1 Chaque entité, filiale ou sous-traitant de ContourGlobal qui utilise des équipements de levage et de manutention (pour personnes et/ou équipement) doit mettre en place un programme de levage et de manutention qui doit, au minimum, comprendre les directives suivantes.

8.4.1.1 Un superviseur de levage et de manutention doit être affecté à chaque activité du site et sa responsabilité doit être définie.

8.4.1.2 Tout équipement de levage et de manutention doit être utilisé par une personne compétente, certifiée ou considérée comme suffisamment qualifiée, spécialisée dans l'appareil utilisé (personne désignée).

8.4.1.3 Des copies du permis doivent être conservées dans le fichier des employés.

8.4.1.4 Le permis des conducteurs sous-traitants doit être inspecté avant que le travail ne commence sur le site.

8.4.2 Les opérateurs de levage et de manutention doivent passer une visite médicale annuelle pour s'assurer qu'ils sont aptes à assurer leur rôle.

8.4.3 Une maintenance préventive doit être menée selon les recommandations du fabricant et des tests de charges doivent être conduits selon une périodicité non inférieure à celle recommandée par le fabricant et avant toute opération de levage critique. Des comptes-rendus doivent être conservés pour tous les tests de charge.

8.4.4 Avant toute opération de levage et de manutention, tous les équipements doivent être inspectés visuellement, une pré-attribution des tâches de toutes les personnes associées doit être effectuée et un périmètre de sécurité doit être établi pour éviter que d'autres personnes ne soient mises en danger par les opérations. Les procédures doivent comprendre :

8.4.4.1 S'assurer que les analyses de risques au poste de travail et les plans de levage critiques ont été approuvés.

8.4.4.2 S'assurer que le personnel de manutention a les capacités nécessaires pour réaliser le travail, est disponible et porte les équipements de protection individuelle adaptés.

8.4.4.3 La zone de levage doit être dégagée de tout personnel non nécessaire.

8.4.4.4 Vérifier le matériel et tous les contrôles des équipements pour s'assurer de leur bon fonctionnement avant utilisation.

8.4.4.5 Informer les personnes impliquées dans l'opération

8.4.4.6 Barricader les zones accessibles situées dans le rayon de giration de la grue.

8.4.4.7 Inspecter le câble métallique, les chaînes et le crochet à la recherche d'éventuel dommage.

8.4.4.8 Vérifier tout gréement avant utilisation, ne pas enrouler les câbles de levage ou les chaînes autour de la charge.

8.4.4.9 Connaître le poids de la charge que la grue doit soulever.

8.4.4.10 S'assurer que la charge ne dépasse pas la capacité nominale pour l'angle de la flèche prévu.

8.4.4.11 Vérifier la présence de lignes électriques aériennes et maintenir une distance de sécurité d'au moins 3 mètres (10 pieds) avec les lignes électriques sous tension.

8.4.4.12 Un coup de klaxon (avertissement) doit être donné pour alterter les travailleurs à proximité.

8.4.4.13 Lever la charge de quelques centimètres pour vérifier l'équilibre et l'efficacité du système de freins.

8.4.4.14 Étendre au maximum les stabilisateurs. S'assurer que les stabilisateurs sont supportés sur les dispositifs appropriés de partage de charge pour empêcher tout dégât sur les réseaux souterrains et/ou une rupture du sol lors des opérations.

8.4.4.15 Ne pas déplacer une charge au-dessus des travailleurs.

8.4.5 La personne en charge de l'inspection des équipements de levage et de manutention doit répondre aux exigences et disposer des papiers de la personne compétente désignée remplis et placés dans le fichier individuel.

8.4.6 Toutes les grues, treuils, plateformes aériennes, nacelles élévatrices à ciseaux et autres équipements de levage et de manutention doivent avoir des certificats de test appropriés pour s'assurer qu'ils sont adaptés à l'utilisation prévue et ne doivent être utilisés que pour les opérations spécifiques pour lesquels cet équipement a été conçu.

8.4.7 Pour des applications spéciales, avant utilisation, ContourGlobal ou le sous-traitant responsable de l'activité doit obtenir l'approbation des fabricants des grues à tour, des grues mobiles, des ponts roulants, des derricks, des mâts de charge et autres.

8.4.8 Les appareils de levage et de manutention ne doivent pas être chargés au-delà de leur charge nominale sauf pour les contrôles de charges. La charge nominale doit être affichée sur l'équipement et clairement visible pour l'opérateur.

8.4.9 Les charges doivent être sécurisées et correctement équilibrées avant d'être soulevées à plus de quelques centimètres.

8.4.10 Les câbles doivent être inspectés avant et après chaque utilisation. Les câbles présentant une détérioration ou une usure excessive doivent être immédiatement mis hors service.

8.4.11 Les câbles ne doivent pas être noués, entortillés ou tordus sur eux-mêmes et seuls des câbles métalliques doivent être utilisés.

8.4.12 Tous les câbles qui sont restés inutilisés pendant une période d'un mois ou plus, due à un arrêt ou un rangement de la grue sur laquelle ils sont installés, doivent être minutieusement inspectés avant leur utilisation. Cette inspection doit vérifier tout type de détérioration et être effectuée par une personne nommée dont l'approbation doit être nécessaire avant une nouvelle utilisation du câble.

8.4.13 Aucune modification à l'équipement de levage ne doit être faite. Si des modifications sont nécessaires, aucune opération ne doit être menée avec l'équipement modifié jusqu'à ce que des certifications mécaniques appropriées (par un ingénieur qualifié ou le fabricant de l'équipement) aient été faites sur l'équipement par rapport à la capacité de charge.

8.4.14 Un compte-rendu de certification doit être disponible pour inspection et doit inclure la date de l'inspection, la signature de la personne qui a effectué l'inspection et l'identification du câble inspecté.

8.4.15 Les travailleurs ne doivent pas être autorisés rester en dessous des charges manipulées par l'équipement de levage ou de manutention.

8.4.16 Lorsque des exigences de sécurité de manutention et de levage sont applicables, une procédure de manutention écrite doit être préparée pour :

8.4.16.1 Les levages ou mouvements de plus de 50 tonnes

8.4.16.2 Le montage de colonnes, tours ou cuves industrielles, et de turbines ou générateurs.

8.4.16.3 Levages au-dessus d'unités/équipements en exploitation

8.4.16.4 Levages ou mouvements d'une difficulté ou géométrie inhabituelles.

8.4.16.5 Levage de personnes.

8.4.16.6 D'autres cas considérés comme prudents par la compagnie ou si demandés par contrat

8.4.17 Si une activité est considérée comme une opération de levage critique, elle doit comprendre :

8.4.17.1 Un plan de levage critique

8.4.17.2 Dessins à l'échelle

8.4.17.3 Une liste des équipements

8.4.17.4 Les certifications des équipements

8.4.17.5 Des tests de résistance aux charges

8.4.17.6 Les poids de levage

8.4.17.7 Les capacités de levage

8.4.17.8 Les calculs des déterminations de facteur de sécurité de l'élingue et du câble métallique, une analyse des blocs et du palan d'amarrage, les charges au sol, les écarts de distribution des charges, les détails structurels, l'analyse de stabilité (chaland hors chargement, charges sur le sol), les déterminations du poids de charge.

8.5 CIRCULATION SUR SITE, CONDUITE DE VEHICULES, CHARIOTS DE MANUTENTION AUTOMOTEURS ET CHARIOTS ELEVATEURS

8.5.1 Chaque entité, filiale ou sous-traitant de ContourGlobal doit établir une politique de circulation sur le site, qui doit, au minimum, comprendre les directives suivantes.

8.5.1.1 Tous les véhicules ou équipements transportant des matériaux doivent respecter les lois de la ville, du comté, de l'État ou les lois fédérales qui se rapportent au poids, hauteur, longueur, largeur, marchandises et charge. Les permis / licences obligatoires doivent être demandés par le responsable du site ContourGlobal ou le sous-traitant désigné comme responsable du site.

8.5.1.2 Les véhicules avec une visibilité arrière restreinte doivent être équipés d'une alarme sonore.

8.5.1.3 Tous les véhicules doivent être équipés de ceintures de sécurité et les conducteurs, opérateurs et passagers doivent les utiliser.

8.5.1.4 Des extincteurs doivent être positionnés sur tous les véhicules ou équipements et inspectés tous les mois. Les comptes-rendus doivent être archivés sur site.

8.5.1.5 Les véhicules motorisés ou de transports ne doivent pas être laissés avec le moteur allumé.

8.5.1.6 Seul le personnel qualifié doit être autorisé à utiliser les équipements en location ou appartenant à la compagnie.

8.5.1.7 Les équipements appartenant à la compagnie ou en location ne doivent pas être utilisés en dehors du site sauf pour les affaires de la compagnie ou en cas d’accord de la direction du site.

8.5.1.8 Le personnel ne doit pas être autorisé à rouler sur des marchepieds ou hayons, ou laisser des parties du corps dépasser du véhicule ou de l'équipement.

8.5.1.9 Les personnes non employées par la compagnie ne doivent pas opérer ou rouler en tant que passager dans un équipement appartenant à la compagnie ou en location sauf s'il en est autorisé par le responsable / superviseur du site.

8.5.1.10 Les véhicules ou équipements utilisés pour transporter des explosifs, de l'essence, du fioul ou d'autres matériaux inflammables ou combustibles ne doivent pas transporter de passagers.

8.5.1.11 Les chariots de manutention automoteurs et les chariots élévateurs ne peuvent être opérés que par des opérateurs formés et qualifiés d'au moins 18 ans.

8.5.1.12 Tous les chariots de manutention automoteurs doivent répondre aux exigences de conception et de construction pour les chariots de manutention automoteurs, établies par la règlementation locale.

8.5.1.13 Tous les chariots doivent porter une étiquette ou une autre marque d'identification qui indique que les contrôles appropriés ont été conduits par rapport à la charge et l'utilisation.

8.5.1.14 Les instructions de capacité, de fonctionnement et de maintenance, les plaques minéralogiques, d'immatriculation et autocollants doivent être à jour et changées en conséquence si des modifications sont faites au véhicule.

8.5.1.15 Les chariots de manutention automoteurs sont conçus pour des types d'utilisation et de fonctionnement spécifiques, et ne doivent être utilisés que pour ces opérations spécifiques.

8.5.1.16 Pour des opérations impliquant l'utilisation de chariots de manutention automoteurs pour déplacer des matériaux potentiellement dangereux, inflammables ou du fioul, l'opérateur doit être formé sur la prévention spécifique du danger, et un briefing sécurité doit être fait à toutes les personnes associées à l'opération.

8.5.1.17 Les véhicules doivent être entretenus selon les recommandations du fabricant.

8.5.1.17.1 Tous les éléments de sécurité des véhicules et équipements doivent être régulièrement inspectés et révisés par un mécanicien qualifié, soit sur site, soit hors site.

8.5.1.18 L'opérateur doit effectuer une inspection quotidienne et documentée des véhicules ou équipements, avant l'utilisation selon les conseils SST de CG et / ou la législation locale et rapporter toutes situations dangereuses.

8.5.1.18.1 Les situations dangereuses doivent rendre les véhicules ou équipements hors service jusqu'à leur correction.

8.5.1.19 Chaque entité, filiale ou sous-traitant de ContourGlobal doit s'assurer que les véhicules ont un tableau de charge durable et lisible qui soit facilement disponible pour l'opérateur.

8.5.1.20 Les équipements lourds, les outils ou individus ne doivent pas opérer/travailler dans un rayon de 3 mètres (distance minimum) (10 pieds) de tout câble d'alimentation ou composant électrique exposé sauf s'il est hors tension et visiblement mis à la terre ou fourni avec une barrière isolante efficace.

8.5.1.21 Une limitation de vitesse sur le site doit être définie, clairement signalée et mise en vigueur. La vitesse maximale sur l'ensemble du site doit être définie selon les risques locaux et des panneaux d'avertissement doivent être affichés le long des rues et des routes.

8.5.1.22 Les conducteurs doivent ralentir sur les surfaces encombrées ou glissantes.

8.5.1.23 Lors de la circulation sur site, si le véhicule est équipé de feux de détresse, ceux-ci doivent être allumés.

8.5.1.24 Sur les sites en construction, selon la taille et la phase du projet, des signaleurs sont recommandés :

8.5.1.24.1 Les signaleurs doivent être responsables d'arrêter la circulation de temps en temps selon les besoins en fonction de l'avancement des travaux ou pour maintenir un trafic continu à vitesse réduite pour aider à protéger les travailleurs et l'installation.

8.5.1.25 Des axes de circulation sur le site doivent être construits afin que la surface de conduite soit adaptée à l'utilisation prévue.

8.5.1.26 Le site doit disposer d'une bonne visibilité, de lumières appropriées et en état de fonctionnement, de nids de poule comblés, de signalisations et de panneaux clairs et les déversements doivent être rapidement nettoyés.

8.5.1.27 La circulation des véhicules et des piétons doivent avoir des voies clairement séparées.

8.5.1.28 Des axes de circulation sûrs doivent :

8.5.1.28.1 Être suffisamment larges et disposer d'une distance de sécurité pour permettre les mouvements en toute sécuritédu véhicule le plus long autorisé à les utiliser (y compris les véhicules visiteurs);

8.5.1.28.2 Être construits à partir de matériaux adaptés à l'endroit, au type de trafic, à la taille de la route, et au sol ou à la fondation sur lequel ils reposent ;

8.5.1.28.3 Avoir des surfaces solides et nivellées et être correctement drainés;

8.5.1.28.4 Éviter les pentes raides. Si les pentes raides sont inévitables, elles doivent être correctement indiquées ;

8.5.1.28.5 Éviter les virages brusques ou sans visibilité.

8.5.1.28.6 Être entretenus afin de fournir une bonne surface pour les véhicules et les personnes.

8.6 ASPIRATION ET SABLAGE

8.6.1 Chaque entité, filiale ou sous-traitant de ContourGlobal doit s'assurer qu'il y a un programme de contrôle en place pour l'aspiration et le sablage.

8.6.2 Avant le début de chaque travail, ContourGlobal ou son sous-traitant doit vérifier si l'équipement est nettoyé pour voir s'il y a un danger potentiel pour le personnel provenant de débris (qui peuvent être éjectés comme des projectiles), des produits chimiques corrosifs ou toxiques, des liquides ou vapeurs inflammables, etc.

8.6.3 Des barrières doivent être installées pour empêcher le personnel non autorisé d'entrer dans la zone de sablage.

8.6.3.1 Un bouclier doit être placé sur l'arrière des tubes d'échangeur pour limiter les jets d'eau et l'ampleur de l'opération de piquage.

8.6.3.2 Les équipements nécessitant une protection contre les jets d'eau à haute pression, ou les unités électriques devant être protégés contre la pulvérisation d'eau, doivent être protégés à l'aide de matériel approprié.

8.6.4 Chaque entité, filiale ou sous-traitant de ContourGlobal doit développer et mettre en place un programme de protection respiratoire en accord avec les exigences locales et fournir des protections respiratoires adaptées aux opérations de sablage.

8.6.5 Des systèmes de confinement/ventilation doivent être conçus et opérés afin de créer une dépression au sein de la structure, de façon à réduire la dispersion de poussière dans l'environnement.

8.6.6 La conception de la structure de confinement et des systèmes de ventilation doit être spécifique pour chaque tâche, dans la mesure où les conditions peuvent considérablement varier d'un site de travail à un autre.

8.6.6.1 L'air chargé de poussière doit être filtré avant d'être libéré dans l'atmosphère.

8.6.7 L'utilisation de sable siliceux (ou d'autres substances contenant plus d'1% de silice cristalline) comme matériel de sablage est interdite.

8.6.7.1 Une variété de matériaux tels que les scories ou la grenaille d'acier est disponible comme autres matériaux de sablage. Puisque certains matériaux de remplacement peuvent avoir leurs propres dangers, la FDS du matériau de remplacement doit être consultée avant utilisation.

8.6.8 Le nettoyage des projections avec des abrasifs recyclables tels que la grenaille d'acier ou l'oxyde d'aluminium nécessite un équipement spécialisé pour l'aspiration ou la collecte de l'abrasif pour réutilisation, en séparant la poussière et les fines de plomb de l'abrasif réutilisable, et, dans le cas de la grenaille d'acier, en conservant l'air propre et sec afin d'éviter la corrosion de l'abrasif.

8.6.9 Les équipements de recyclage doivent être correctement entretenus et régulièrement contrôlés.

8.6.10 L'utilisation d'inhibiteurs peut être nécessaire pour éviter une corrosion rapide et le confinement doit être conçu pour capturer l'eau et les débris générés par le processus de nettoyage.

8.6.11 Des précautions pour le travail à haute pression doivent être prises lors de décapage à haute pression.

8.6.12 Des panneaux d'avertissement concernant la haute pression doivent être affichés dans la zone où la tâche sera effectuée et les personnes impliquées doivent être correctement formées.

9 RISQUES ET OPERATIONS SPECIAUX

9.1 ESPACES CONFINES

9.1.1 Chaque entité, filiale ou sous-traitant de ContourGlobal doit développer, mettre en place et maintenir un programme relatif aux espaces confinés incluant les éléments ci-dessous.

9.1.1.1 Chaque installation doit effectuer une étude complète du site pour identifier les emplacements d'espaces confinés.

9.1.1.2 Chaque installation doit conserver une liste/inventaire de tous les espaces confinés, et chaque espace confiné doit être désigné soit comme espace confiné avec permis soit comme espace confiné sans permis.

9.1.1.3 Chaque entité, filiale ou sous-traitant de ContourGlobal doit formellement affecter un représentant du site responsable du programme sur les espaces confinés.

9.1.2 Le programme doit inclure :

9.1.2.1 Les procédures pour l'entrée et le travail à réaliser doivent être évaluées avant chaque entrée et en tant que partie courante des activités d'inspection.

9.1.2.2 Identification des personnes autorisées qui ont été formées à l'entrée en espaces confinés pour effectuer le travail et intervenir en urgence.

9.1.2.3 Les travailleurs exposés aux risques en espaces confinés doivent recevoir une formation sécurité adéquate et continue et disposer de pratiques relatives aux actions nécessaires de contrôle, d'urgence et de secours.

9.1.2.4 Un plan de secours et des procédures d'urgence doivent être suivis.

9.1.2.5 Procédures de communication durant l'entrée et les opérations.

9.1.3 Pour tous les espaces confinés, un permis de pénétrer en espace confiné est nécessaire pour chaque entrée proposée dans l'espace et inclut :

9.1.3.1 L'espace dans lequel la personne doit pénétrer.

9.1.3.2 Le but de l'entrée.

9.1.3.3 La date et la durée autorisée de l'entrée.

9.1.3.4 Les noms des personnes autorisées à entrer

9.1.3.5 Les personnes identifiées comme surveillants

9.1.3.6 Les superviseurs identifiés de l'entrée, qui seront responsables de :

9.1.3.6.1 L'évaluation de tous les espaces confinés y compris ceux qui n'ont pas besoin d'une autorisation, pour s'assurer que tous les dangers sont contrôlés.

9.1.3.6.2 Le remplissage du permis de pénétrer indiquant l'équipement de sécurité exigé.

9.1.3.7 Les précautions spéciales à observer.

9.1.3.8 Le nombre d'employés autorisés à entrer.

9.1.3.9 La durée du permis.

9.1.3.10 L'annulation du permis.

9.1.3.11 Les dangers de l'espace où l'on doit entrer.

9.1.3.12 Les mesures utilisées pour isoler l'espace et éliminer ou contrôler les dangers de l'espace avant l'entrée et durant les opérations.

9.1.4 Le contrôle de l'air ou de l'atmosphère au sein des espaces confinés doit être effectué avant l'entrée pour déterminer le contenu en oxygène, la présence potentielle de gaz toxiques, les atmosphères inflammables ou explosives et l'hydrogène sulfuré. Des tests supplémentaires peuvent être exigés en fonction des circonstances de l'entrée. Une ventilation mécanique peut être nécessaire pour assurer un apport adéquat en air frais. Cela est essentiel lorsque des bouteilles de gaz portatives et un équipement à moteur thermique sont utilisés au sein de l'espace en raison des dangers d'accumulation des échappements des moteurs.

9.1.4.1 L'entrée ne doit pas être autorisée sauf si l'atmosphère au sein des espaces confinés est contrôlée et la teneur en oxygène se situe entre 19,5 et 23 pour cent et que la présence de gaz ou vapeurs inflammables ne dépasse pas 25 pour cent de sa Limite Inférieure d'Explosivité (LIE) respective, ou selon la législation locale.

9.1.4.2 Les détecteurs de gaz doivent être calibrés au moins tous les 6 mois ou selon les recommandations du fabricant.

9.1.4.3 La calibration des détecteurs de gaz doit être confirmée comme à jour avant l'entrée dans un espace confiné.

9.1.5 Des panneaux doivent être affichés sur ou près des espaces avec permis du site pour informer les employés des types de dangers qui peuvent être présents et que seul le personnel autorisé peut entrer dans ces espaces.

9.1.5.1 Chaque point d'entrée d'un espace confiné doit avoir un panneau d'un matériau et d'une taille appropriés indiquant "Danger Espace Confiné - Entrée soumise à permis de pénétrer uniquement". Le panneau doit être collé aussi près que possible du point d'entrée. S'il est impossible de placer et de maintenir les panneaux sur chaque entrée, des systèmes alternatifs d'avertissement doivent être mis en place pour empêcher l'entrée non autorisée à des espaces confinés.

9.1.5.2 Chaque espace confiné doit être facilement identifiable par une signalisation et doit être numéroté de manière exclusive.

9.1.5.3 Chaque panneau ou étiquette affiché doit être présenté d'une manière qui peut être perçue et comprise par tous les employés.

9.1.5.4 Le placement et l'état des panneaux doivent être inclus dans la liste des contrôles réguliers.

9.1.6 Seuls les outils électriques à double isolation ou les outils raccordés à un disjoncteur différentiel doivent être autorisés dans des espaces confinés.

9.1.7 Tous les lumières et outils portatifs doivent être à l'épreuve des explosions lors du travail dans un espace confiné où il y a un risque d'atmosphère inflammable ou explosive.

9.1.8 Les équipements mécaniques et électriques installés dans l'espace confiné doivent être déconnectés de leur source d'alimentation et consignés.

9.1.9 Les fiches de données de sécurité (FDS) de tous les produits et matériaux de nettoyage utilisés dans l'espace confiné doivent être revues avant leur entrée. La FDS doit être disponible avec le permis au niveau de l'entrée dans un espace confiné exigeant un permis.

9.1.10 Les superviseurs doivent s'assurer que seuls les employés autorisés qui ont reçu la formation appropriée sont autorisés à entrer dans les espaces confinés.

9.1.11 La personne en charge ou autorisant l'entrée doit avoir une formation supplémentaire sur l'évaluation des espaces confinés en s'assurant que le permis exige des garanties adéquates. Cette personne doit savoir comment utiliser les équipements de contrôle et de suivi et tous les autres aspects de la procédure d'entrée.

9.1.12 Les employés qui sont amenés à travailler dans un espace confiné ou en support à ceux qui travaillent dans un espace confiné doivent être formés au contrôle des dangers, y compris une expérience pratique des équipements de sécurité impliqués, par un formateur compétent et qui comprend :

9.1.12.1 La compréhension des risques généraux et spécifiques associés aux dangers de chaque espace confiné dans lequel une personne entrera.

9.1.12.2 La reconnaissance des signes et symptômes d'une exposition à un danger et les conséquences de l'exposition.

9.1.12.3 Comment les communications doivent être maintenues entre le surveillant et les travailleurs dans des espaces confinés.

9.1.12.4 Les procédures d'entrée et de sortie d'urgence

9.1.12.5 L'utilisation des appareils respiratoires et autres équipements de protection

9.1.12.6 Premiers soins et RCP (réanimation cardio-pulmonaire)

9.1.12.7 Procédures de consignation et d'isolation

9.1.12.8 Utilisation des équipements de sécurité

9.1.12.9 Procédures de sauvetage

9.2 TRAVAIL ISOLE

9.2.1 Chaque entité, filiale ou sous-traitant de ContourGlobal doit s'assurer que chaque situation de travail isolé est évaluée pour déterminer si l'activité présente un risque élevé ou faible en fonction du lieu, du type de travail, de l'interaction avec le public, ou les conséquences d'une urgence, d'un accident, d'une blessure, etc.

9.2.2 Les activités à risque élevé mentionnées ci-dessous ne doivent pas être entreprises par un travailleur isolé.

9.2.2.1 Travail en hauteur.

9.2.2.2 Travail dans des espaces confinés.

9.2.2.3 Travail avec de l'électricité au-dessus de 440 V ou sur un équipement électrique sous tension, ou selon la législation locale.

9.2.2.4 Travail avec des substances ou matériaux dangereux.

9.2.2.5 Travail avec un équipement dangereux tel que scies à chaîne ou armes à feu.

9.2.2.6 Travail avec des matériaux à grande pression, ou sur toute machine opérationnelle non protégée.

9.2.2.7 Les travailleurs employés sur la construction, la transformation, la maintenance ou la réparation de cheminées élevées.

9.2.3 Là où les travailleurs peuvent être amenés à effectuer un travail dans des conditions solitaires ou isolées, chaque entité et projet de construction de ContourGlobal doit développer et mettre en place des Procédures d'opération standard (SOP) pour s'assurer que les EPI et les mesures de sécurité sont en place avant que le travailleur ne commence à travailler.

9.2.4 Certains préalables sont exigés de la part de la personne qui travaille seule :

9.2.4.1 Vérifier s'il y a des conditions médicales préexistantes qui peuvent augmenter le risque.

9.2.4.2 Vérifier si la personne a les niveaux d'expérience et de formation appropriés. (Par exemple : premiers secours, réparation des systèmes de communication, pannes des véhicules, procédures administratives pertinentes, et/ou survie en extérieur, selon l'activité à effectuer.

9.2.5 Les SOP doivent mentionner les mesures de contrôle du risque pour aider à assurer la sécurité du travailleur isolé comme suit :

9.2.5.1 Évaluer les dangers du lieu de travail.

9.2.5.2 Identifier si le travail est effectué dans un endroit éloigné ou isolé

9.2.5.3 Le type de mode de transport nécessaire pour y parvenir.

9.2.5.4 Vérifier si le véhicule sera équipé de fournitures d'urgence telles que de la nourriture et de l'eau portable, ainsi que d'un kit de secours.

9.2.5.5 Établir un plan de secours si le véhicule tombe en panne.

9.2.5.6 Le type de machines, outils ou équipements qui seront utilisés.

9.2.5.7 Identifier si l'activité impliquée est considérée comme à "haut risque"

9.2.5.8 Vérifier si le travail aura lieu à des températures extrêmes.

9.2.5.9 Analyser si la fatigue risque d'être un facteur de risque.

9.2.5.10 Vérifier s'il y a un risque d'attaque d'animaux, de piqûres d'insectes (venimeux ou réaction allergique), etc.

9.2.5.11 S'assurer que le travailleur a la capacité de chercher une aide d'urgence.

9.2.5.12 Établir des moyens pour retrouver des personnes (visuellement ou verbalement) pendant qu'elles travaillent.

9.2.5.13 Programmer les tâches à haut risque durant les heures normales de travail, ou lorsqu'un autre travailleur, capable d'aider en cas d'urgence, est présent.

9.2.5.14 Vérifier si la personne travaille à l'intérieur d'un bâtiment verrouillé, et comment les services d'urgence seront en mesure d'y entrer.

9.2.6 Les SOP doivent définir les moyens de travailler pour les travailleurs isolés :

9.2.6.1 Un plan de travail quotidien doit être préparé afin de savoir où le travailleur isolé sera et à quel moment il y sera.

9.2.6.2 Définir les circonstances dans lesquelles l'employé isolé pointera, avec qui, et à quelle fréquence.

9.2.6.3 La personne de contact devra périodiquement appeler ou rendre visite à l'employé isolé afin de s'assurer qu'il ou elle va bien.

9.2.6.4 Développer un plan d'action d'urgence à suivre si l'employé isolé ne pointe pas quand il ou elle doit le faire.

9.2.6.5 Au minimum, un contact verbal doit être fait avec le travailleur au moins une fois par heure.

9.2.6.6 Définir les moyens de communication à utiliser.

9.2.6.7 Si les systèmes de communication sont situés dans un véhicule, des arrangements doivent être trouvés pour atteindre la personne quand elle se trouve loin du véhicule.

9.3 CONSIGNATION / DECONSIGNATION (LOTO)

9.3.1 Chaque entité de ContourGlobal ou sous-traitant qui effectue un travail pour ContourGlobal ou sur des propriétés de ContourGlobal à travers le monde, doit développer et mettre en place un programme de consignation / déconsignation (Lockout / Tagout - LOTO) avec des procédures et des directives sécurité pour le contrôle des opérations à haut risque.

9.3.2 Le programme LOTO doit être mis en place au cours de toute opération qui pourrait avoir pour résultat une blessure potentielle du fait d'une libération d 'énergie stockée (systèmes sous pression, chaleur extrême, pneumatique, liquide, etc.) ou pendant l'entretien ou la maintenance de tout système au cours duquel le démarrage ou la mise sous tension imprévus pourraient libérer de l'énergie provoquant des blessures au personnel ou des dommages au système.

9.3.3 Le programme LOTO doit, au minimum, intégrer les directives de sécurité suivantes :

9.3.3.1 Le programme doit clairement et spécifiquement présenter dans leurs grandes lignes, le périmètre, le but, l'autorisation, les règles et techniques à utiliser pour le contrôle de l'énergie dangereuse, et les moyens d'appliquer la conformité.

9.3.3.2 Le programme doit exiger les éléments écrits suivants :

9.3.3.2.1 Procédures documentées du contrôle de l'énergie (y compris le but, le périmètre, l'autorisation, les règles, les techniques, l'application de la conformité etc.).

9.3.3.2.2 Le programme de formation pour le personnel de ContourGlobal.

9.3.3.2.3 Inspections périodiques des procédures.

9.3.4 Toutes les personnes qui effectuent des opérations de LOTO doivent être correctement formées et qualifiées pour mener ces opérations, et une liste des opérateurs autorisés doit être conservée.

9.3.5 Le programme doit s'assurer qu'à l'achèvement de l'entretien ou de la maintenance, et avant d'enlever les dispositifs de consignation et de restaurer l'alimentation d'un équipement ou d'un système, le personnel est :

9.3.5.1 Sûr que l'équipement ou le système a été restauré à des conditions de fonctionnement

9.3.5.2 Informé que l'équipement ou le système est remis au service.

9.3.6 Tout appareil de consignation ne doit avoir qu'une clé, qui doit rester en possession de la personne qui travaille sur la machine/l'équipement.

9.3.7 Les procédures de consignation doivent inclure les étapes suivantes :

9.3.7.1 Préparation de l'arrêt,

9.3.7.2 Arrêt de la machine/équipement,

9.3.7.3 Isolation de la machine/équipement de la/des source(s) d'alimentation,

9.3.7.4 Application du/des dispositif(s) de consignation et/ou de mise hors service au(x) dispositif(s) d'isolation de l'alimentation,

9.3.7.5 Libération sûre de toute énergie stockée,

9.3.7.6 Vérification de l'isolation de la machine/équipement avant d'effectuer la maintenance/entretien.

9.3.8 Le programme écrit doit identifier la personne qui sera le responsable final de la mise en application, de l'interprétation et de la maintenance du programme LOTO.

9.3.9 Le programme doit identifier qui ou quelle organisation est l'autorité de contrôle, p. ex. les opérateurs de la centrale, les opérateurs du système, les superviseurs, les travailleurs, pour les machines et équipements des centrales.

9.3.10 Quand un remplacement, une réparation, une rénovation ou une modification importante des machines ou des équipements est effectué, et quand de nouvelles machines ou équipements sont installés, des dispositifs d'isolation de l'alimentation pour de telles machines ou équipements doivent être conçus pour accepter un dispositif de consignation.

9.4 SYSTEME DE PERMIS DE TRAVAIL (WPS)

9.4.1 Chaque entité et sous-traitant de ContourGlobal doit établir, mettre en œuvre et maintenir un système de permis de travail pour les opérations à haut risque.

9.4.2 Les activités/processus où un permis de travail est exigé inclut notamment mais non exclusivement les situations suivantes :

9.4.2.1 Permis de travail à froid pour effectuer toute activité de maintenance / nettoyage / contrôle dans le site qui ne produit pas suffisamment de chaleur pour enflammer un air inflammable - un mélange d'hydrocarbures ou une substance inflammable.

9.4.2.2 Permis de feu pour effectuer toute activité qui produit une chaleur capable de causer un incendie dans un air inflammable ou un mélange de vapeurs.

9.4.2.3 Permis de pénétrer en espace confiné pour entrer dans tout espace confiné.

9.4.2.4 Permis de fouille pour effectuer toute excavation sur le site.

9.4.2.5 Permis de travail électrique :

9.4.2.5.1 Pour travailler sur une ligne et / ou un équipement haute tension (HT) ou pour toutes les isolations et alimentations d'équipements électriques (HT).

9.4.2.5.2 Pour travailler sur une ligne et / ou un équipement basse tension (BT) ou pour toutes les isolations et alimentation d'équipements électriques (BT).

9.4.2.5.3 Pour le ré-enclenchement d'équipement HT et/ou BT.

9.4.2.6 Permis de travail en hauteur pour toute activité effectuée à 2 m ou plus sur une structure provisoire ou fixe, non conçue pour effectuer un travail particulier en toute sécurité.

9.4.2.7 Permis de radiographie pour tous les travaux qui produisent un rayonnement ionisant.

9.4.3 Toute personne, qui est autorisée à émettre ou recevoir un permis de travail, doit être soumise à une formation pour une période minimum d'une journée, qui couvre les différents aspects du système de permis de travail et une formation de recyclage une fois tous les deux ans sur le système de permis de travail et les enregistrements conservés.

9.4.4 Avant d'émettre un permis, la personne autorisée doit visiter le lieu pour déterminer les conditions et l'environnement réels de la tâche à effectuer de façon à déterminer les informations appropriées à inclure dans le permis.

9.4.5 Le permis de travail doit inclure :

9.4.5.1 La période de validité, en termes de date, début et fin des opérations.

9.4.5.2 Le lieu du travail doit être spécifié clairement en termes de site, zone, bâtiment, réservoir ou équipement. Le numéro d'identification de l'équipement doit être mentionné. Quand cela est nécessaire, un croquis de l'endroit doit être joint au permis pour plus de précision.

9.4.5.3 Une description précise du travail qui doit être effectué

9.4.5.4 Les équipements à utiliser pour la tâche

9.4.5.5 Les EPI requis

9.4.5.6 Les obligations en termes d'intervention d'urgence

9.4.6 Les autres activités (habituelles ou non) effectuées à proximité, qui peuvent créer des conditions dangereuses pour l'exécution du travail sujet à permis, doivent être prises en comptes et les personnes concernées doivent en être informées.

9.4.7 En cas d'accident ou d'incendie sur le site de travail, le permis doit être automatiquement annulé. Un nouveau permis doit être obtenu pour pouvoir redémarrer le travail.

9.4.8 Sauf en cas d'accident ou d'incendie sur le site de travail, tout permis émis doit être fermé une fois que le travail est effectué pour s'assurer qu'il a été correctement effectué et que la zone est laissée dans des conditions sûres.

9.4.9 Tous les permis émis doivent être conservés à fins d'archivage.

9.5 INCENDIE ET EXPLOSION

9.5.1 Chaque entité, filiale ou sous-traitant de ContourGlobal doit prévenir les risques d'incendie et d'explosion par :

9.5.1.1 La prévention de manipulation de substances chimiques d'une manière telle qu'elle peut entraîner la formation de concentrations inflammables des substances dans l'air.

9.5.1.2 La prévention de la présence de sources d'inflammation là où elles peuvent provoquer un incendie ou une explosion.

9.5.1.3 Le choix des installations de travail et des dispositifs techniques par lesquels les incendies ou explosions entraîneront le moins de risque possible de blessure.

9.5.1.4 La prévention de situations pouvant provoquer des réactions chimiques dangereuses ou la formation de substances chimiques dangereuses indésirables.

9.5.2 Les substances chimiquement instables doivent être manipulées d'une manière telle que les situations qui augmentent le risque de décomposition ou de polymérisation incontrôlées soient évitées.

9.5.2.1 Des stabilisants doivent être utilisés lorsque cela est possible, en fonction de l'utilisation de la substance.

9.5.2.2 Le contenu du stabilisant doit être régulièrement contrôlé.

9.5.3 Les récipients doivent être conservés à l'abri de la rouille, d'autres accumulations ou contaminants, qui peuvent catalyser la réaction dans le récipient.

9.5.4 Les matériaux inflammables et leurs lieux de stockage doivent :

9.5.4.1 Être éloignés de sources d'inflammation et des matériaux oxydants.

9.5.4.2 Être éloignés des points d'entrée et de sortie au sein des bâtiments.

9.5.4.3 Être éloignés des arrivées de la ventilation ou des bouches d'aération de l'installation.

9.5.4.4 Disposer d'une ventilation naturelle ou passive au niveau du sol et du plafond.

9.5.4.5 Utiliser des appareils anti-étincelles.

9.5.4.6 Être équipés des dispositifs appropriés d'extinction des incendies et de portes à fermeture automatique.

9.5.4.7 Être construits à partir de matériaux faits pour résister au contact avec les flammes pendant une période modérée.

9.5.4.8 Disposer d'une rétention appropriée pour contenir les déversements.

9.5.4.9 Disposer d'équipements appropriés de lutte contre les déversements.

9.5.5 Les zones présentant un risque d'incendie doivent être clairement identifiées par une signalisation appropriée et un avertissement de règles spéciales (p. ex. interdiction de travaux à chaud, utilisation de téléphones portables ou de tout dispositif qui provoque des étincelles ou des flammes).

9.5.6 Une formation de lutte contre l'incendie par un spécialiste doit être fournie à ceux qui travaillent dans des zones de stockage de produits inflammables.

9.5.7 Des équipements de lutte contre l'incendie approprié doivent être installés en nombre suffisant.

9.5.7.1 Les équipements doivent être adaptés aux dimensions et à l'utilisation des locaux, de l'équipement installé, des propriétés physiques et chimiques des substances présentes et du nombre maximal de personnes présentes.

9.5.7.2 Une provision appropriée Des équipements manuels de lutte contre l'incendie doivent être fournis de façon appropriée et être facilement accessibles, dégagés et facile d'utilisation.

9.5.8 Tous les équipements liés aux incendies doivent être régulièrement maintenus en bon état de marche.

9.6 PLAN D'URGENCE EN CAS D'INCENDIE OU D'EXPLOSION

9.6.1 Chaque entité, filiale ou sous-traitant de ContourGlobal doit développer, mettre en place et maintenir un plan d'urgence en cas d'incendie ou d'explosion pouvant affecter la santé et la sécurité des travailleurs, par rapport aux équipements et systèmes principaux des sites.

9.6.2 Chaque site, selon ses caractéristiques et la législation locale, doit définir et classifier les équipements et les systèmes locaux qui seront considérés comme importants pour faire partie du plan.

9.6.3 Tous les employés et sous-traitants de ContourGlobal impliqués ou risquant d'être concernés par les cas d'urgence en équipements tels que les incendies chimiques, électriques, structurels et les explosions de poussière, doivent être formés aux procédures et interventions de prévention correspondantes. Il convient de s'assurer que tous les travailleurs sont correctement formés à :

9.6.3.1 Rapidement identifier, évaluer et réagir aux urgences potentielles sur le site du travail

9.6.3.2 Procédures de premiers secours et de lutte contre les incendies

9.6.3.3 Sensibilisation aux risques du site

9.6.3.4 Exercices d’urgence du site

9.6.3.5 Les exercices d'urgence impliquant les autorités locales, les agences et les communautés directement affectées, en cherchant l'intégration entre le site et les services de secours publics.

9.6.4 La définition du programme doit impliquer les travailleurs de différentes responsabilités telles que l'inspection, les opérations, la maintenance, l’ingénierie , les achats, la surveillance des fournisseurs et les activités de mise en service, puisque les accidents ou défaillances résultent, généralement, de :

9.6.4.1 Imperfections au niveau de la conception et/ou des matériaux

9.6.4.2 Problèmes au cours de la fabrication, l'assemblage et la mise en service

9.6.4.3 Mauvaise utilisation ou corrosion d'un composant.

9.6.4.4 Erreurs humaines dues au manque de formation technique ou de confiance en soi

9.6.4.5 Certaines conditions opérationnelles, comme dans des applications à hautes températures où des modes de défaillances compliqués apparaissent, tels que l'effet de cliquet du fluage, la rupture et le fluage-fatigue.

9.6.5 Chaque site doit s'assurer que la conception des équipements et des systèmes au niveau des projets en cours de construction et les procédures d'exploitation et de maintenance des sites en exploitation ont des recommandations spécifiques concernant une inspection correcte et une maintenance préventive et prédictive de ces équipements et systèmes, en plus du planning stratégiques opérationnel et des politiques en matière de pièces de rechange.

9.6.6 Chaque site doit mettre en œuvre et maintenir un programme d’entretien pour éviter l’accumulation de matériaux combustibles à l'intérieur (bois, papier, chiffons, plastiques, liquides, gaz et poussières inflammables) et à l'extérieur des bâtiments (feuilles, herbes et broussailles, substances inflammables dues au processus du site, autres).

9.6.7 Chaque site doit développer, mettre en œuvre et maintenir un programme de communication d'urgence pour ses employés, ses sous-traitants, les autorités locales et le public risquant d’être affectés. Il doit être formellement mis en application et revu tous les ans en cherchant des réponses efficaces aux situations d'urgences.

9.6.8 Chaque site doit effectuer des audits réguliers pour vérifier la sécurité et la conformité des opérations avec le plan d'urgence.

9.6.9 Toutes les urgences au niveau des systèmes ou des équipements du site, qui sont classifiées et incluses dans le plan d'urgence doivent être analysées.

9.6.9.1 Une équipe d'investigation doit être formellement établie et annoncée à toutes les parties impliquées.

9.6.9.2 L'équipe d'investigation doit déterminer la cause, l'origine et les impacts de l'événement. Bien qu'il s'agisse d'une action en réaction, il sera extrêmement important d'éviter la réapparition d'urgences.

9.6.9.3 Le cas échéant, pour identifier la cause profonde, l'équipe 'd'investigation devra inviter ou recruter des professionnels experts, internes ou externes à la compagnie pour effectuer des tests ou des inspections spécifiques selon les Codes de la « National Fire Protection Association » (NFPA), de la « National Electrical Manufacturers Association » (NEMA), des « Underwrites Laboratories » (UL) et de l' « American Society for Testing Materials » (ASTM) ou selon les exigences de la législation locale.

9.6.9.4 Les résultats des défaillances des équipements ou des systèmes doivent être envoyés à toutes les entités de ContourGlobal concernées, incluant au moins :

9.6.9.4.1 L'analyse des causes profondes

9.6.9.4.2 Des recommandations adaptées

9.6.9.4.3 Un plan d'action avec les contre-mesures et les dates limites respectives.

9.6.9.4.4 Les noms et signatures de l'équipe d'investigation

10 ÉQUIPEMENTS DE PROTECTION INDIVIDUELLE

10.1 POLITIQUE EN MATIERE D'EPI ET EVALUATION DES DANGERS

10.1.1 ContourGlobal et ses sous-traitants doivent mettre en place une politique présentant les exigences générales en matière d'EPI, applicable à tous les sites/personnel, incluant au minimum, les directives suivantes :

10.1.1.1 Les exigences en matière d'EPI doivent être présentées dans divers programmes (p. ex. Sécurité électrique, protection respiratoire, protection contre les chutes, etc.).

10.1.1.2 Les équipement de protection doivent être fournis, utilisés et conservés dans des conditions saines et fiables, là où cela est nécessaire en raison de risques liés aux processus ou à l'environnement, de risques chimiques, radiologiques ou des agents irritants mécaniques rencontrés, capables de causer une blessure ou des troubles au niveau du fonctionnement de certaines parties du corps, par absorption, inhalation ou contact physique.

10.1.1.3 ContourGlobal, ses contractants et leurs sous-traitants ont la responsabilité de s'assurer que les EPI sont utilisés tel qu'exigé pour les activités en cours.

10.1.1.4 Chacun doit porter des vêtements adaptés aux conditions météorologiques et au travail. Au minimum, la tenue de travail sur le terrain doit inclure : une chemise à manches courtes, un pantalon long et des chaussures ou bottes en cuir ou d'un autre matériau protecteur, avec des bouts renforcés en acier.

10.1.1.5 Les employés ne doivent utiliser que les EPI approuvés et fournis par ContourGlobal.

10.1.1.6 Les sous-traitants doivent fournir leurs propres EPIs à leurs employés.

10.1.1.7 Tous les équipements de protection individuelle doivent être d'une conception et fabrication sûre et doivent répondre aux exigences de l'industrie, de la législation ou de la compagnie.

10.1.1.8 La politique en matière d'EPI doit définir le processus de gestion des achats d'EPI sur le site.

10.1.1.9 Pour permettre de sélectionner les bons EPI, les sites ContourGlobal doivent préparer une analyse des dangers de l'environnement de travail.

10.1.1.10 Le besoin en EPI doit prendre en compte les critères suivants :

10.1.1.10.1.1 Dangers SST résiduels sur le lieu de travail

10.1.1.10.1.2 Les parties du corps en danger

10.1.1.10.1.3 La spécification de performance de l'EPI

10.1.1.10.1.4 Le niveau acceptable d'exposition au danger

10.1.1.10.1.5 Adaptation à l'individu

10.1.1.10.1.6 La commodité de l'EPI pour l'utilisation proposée

10.1.1.11 Le site doit développer un processus documenté pour communiquer les conclusions initiales, et toutes les mises à jour de l'évaluation, à tous les employés concernés.

10.1.1.12 Basé sur l'évaluation des dangers, chaque site doit choisir et demander à chaque employé concerné d'utiliser les types d'EPI qui les protégeront des dangers identifiés.

10.1.1.13 Des installations appropriées pour le nettoyage et le rangement des équipements de protection doivent être fournies par l'entité ou les sous-traitants de ContourGlobal.

10.1.1.14 Aucun EPI défectueux ou endommagé ne doit être utilisé et il doit être remplacé immédiatement.

10.1.1.15 Avant chaque utilisation, l'employé doit inspecter l'EPI pour s'assurer qu'il est propre et en bon état. L'EPI doit aussi être inspecté à intervalles réguliers par le service sécurité.

10.1.1.16 L'utilisation correcte des EPI doit être suivie.

10.1.1.16.1 Un contrôle régulier doit être entrepris pour s'assurer que lesEPI sont portés dans les zones désignées et sont correctement portés.

10.1.1.17 La distribution et la redistribution des EPI doivent être enregistrées.

10.1.1.17.1 Un registre, qui suit la distribution des EPI à chaque personne, doit être conservé et comprendre la date de distribution et de la redistribution ultérieure.

10.2 PROTECTION DES YEUX ET DU VISAGE

10.2.1 Chaque entité ou projet de construction de ContourGlobal doit s'assurer que les employés utilisent une protection des yeux et du visage appropriée quand ils sont exposés à des dangers pour les yeux ou le visage provenant de particules volantes, métal en fusion, produits chimiques liquides, liquides acides ou caustiques, gaz ou vapeurs chimiques ou au rayonnement de lumière potentiellement nuisible.

10.2.2 La protection des yeux doit être utilisée lors de la manipulation de substances et doit être faite à partir de matériau imperméable à la substance à laquelle il est exposé et suffisamment robuste pour dévier tous projectiles.

10.2.3 Des procédures d'opération de sécurité (SOP) doivent être mises en place pour toutes les activités qui peuvent affecter les yeux du personnel : travail de ponçage, de broyage, ou travail qui utilise ou se trouve à proximité de produits chimiques liquides ou de systèmes sous pression.

10.2.4 Des lunettes de protection ou des écrans de protection du visage doivent être portés quand la personne est exposée aux dangers électriques y compris lors du travail sur des systèmes électriques sous tension.

10.2.5 Une protection appropriée et suffisante doit être en place pour protéger les travailleurs ou les passants des solides, liquides ou gaz rejetés.

10.2.6 Les masques, les lunettes de protection et une protection des yeux appropriés doivent être obligatoires pour les personnes qui effectuent les tâches et celles qui peuvent interagir avec le travail.

10.2.7 Des précautions doivent être prises pour les personnes qui portent des lunettes correctrices par l'utilisation de sur-lunettes ou de lunettes à correction renforcée.

10.2.8 Les masques de protection et les casques de soudeur doivent être portés impérativement au-dessus de la protection des yeux, telle que des lunettes ou des lunettes de protection.

10.2.9 Les personnes qui ont besoin de verres correcteurs pour leurs lunettes de sécurité doivent porter des lunettes de sécurité qui répondent aux exigences ANSI Z87, OU des lunettes/lunettes de protection qui répondent à ces normes et qui peuvent être utilisées avec des lunettes de correction régulières.

10.2.10 Les verres utilisés pour se protéger des dangers de la lumière doivent être appropriés au danger.

10.3 PROTECTION DE LA TETE

10.3.1 Tous les employés, sous-traitants ou visiteurs concernés doivent porter un casque de protection ou des casquettes renforcées lorsque l'évaluation du risque de la zone de travail identifie qu'il y a une probabilité de blessure à la tête par chute d'objets.

10.3.2 Afin de le maintenir en place, un casque de sécurité doit être fourni avec une jugulaire.

10.3.3 Le casque doit être conçu pour réduire le potentiel de danger de choc électrique s'il est porté par un employé qui travaille près de conducteurs électriques exposés qui pourraient entrer un contact avec la tête.

10.3.4 Des mesures doivent être déterminées pour garantir un lieu de travail sûr et des pratiques de travail sûres pour les employés qui sont amenés à porter une protection de la tête, y compris ceux qui doivent porter un voile en raison de leur religion.

10.3.5 Toutes les personnes qui reçoivent une protection de la tête ont la responsabilité de la porter comme indiqué. Les employés doivent utiliser les équipements de protection individuelle appropriés tel que requis par la directive d'évaluation des risques, cependant, en cas d'obligations religieuses relatives aux couvre-chef (p. ex. les turbans portés par les Sikhs), ces personnes doivent travailler là où le risque de blessure est supprimé ou réduit, pour autant qu'elles puissent continuer à porter ces couvre-chef en toute sécurité.

10.3.6 Un casque de sécurité ne doit pas être modifié, en perçant des trous ou en le pliant. Tous les casques défectueux ou fendus doivent être immédiatement mis de côté.

10.4 PROTECTION DES PIEDS

10.4.1 Tout employé concerné doit porter des chaussures de sécurité quand l'évaluation des risques de la zone de travail identifie qu'il y a un potentiel de blessures dû :

10.4.1.1 à la chute ou roulement d'objets

10.4.1.2 aux objets qui transpercent les semelles

10.4.1.3 aux conditions de sols glissants/gras

10.4.1.4 à l'exposition aux dangers électriques

10.4.1.5 aux substances dangereuses

10.4.2 Des chaussures de sécurité doivent fournir une protection adéquate aux orteils des employés.

10.4.3 Des chaussures de protection, telles que des chaussures de sécurité, des bottes en caoutchouc, doivent être portées par toutes les personnes qui prennent part au travail sur le terrain.

10.4.4 Les chaussures de protection doivent convenir au type de travail réalisé.

10.4.5 Des bottes en caoutchouc avec des bouts renforcés doivent être utilisées pour protéger contre les éclaboussures de produits chimiques et dans des zones où il y a de l'eau, de la boue profonde ou des fonds.

10.4.6 Des bottes en caoutchouc isolantes doivent être utilisées pour le travail électrique quand un choc électrique est prévu.

10.5 PROTECTION DES MAINS

10.5.1 Selon l'évaluation des risques, chaque site doit choisir et exiger des employés d'utiliser, une protection des mains adéquate quand les mains des employés sont exposées à des dangers tels que l'absorption par la peau de substances nocives ; des coupures ou des lacérations graves ; des écorchures graves ; des piqûres ; des brûlures chimiques ; des températures extrêmes nuisibles et des travaux électriques.

10.5.2 La protection des mains doit être portée dès qu'il y a un risque de blessures aux mains résultant de la manipulation d'objets ou de substances.

10.5.3 La protection des mains utilisée lors de la manipulation de substances doit être faite à partir de matières imperméables à la substance manipulée.

10.5.4 Le choix de l'EPI approprié doit se faire sur la base de leurs caractéristiques de performance de protection des mains liée à la (aux) tâche(s) à effectuer, les conditions actuelles, la durée d'utilisation et les dangers et dangers potentiels identifiés.

10.5.5 Tous les employés de ContourGlobal qui utilisent des cutters ou des appareils similaires doivent porter des gants, résistant aux coupures, appropriés (Kevlar) sur une main ne tenant pas de cutter.

10.5.6 Des gants en coton ou en cuir doivent être portés pour le travail qui implique la manipulation de matériaux rugueux ou coupants, qui peuvent provoquer des coupures mineures, des égratignures ou des écorchures.

10.5.7 Pour la protection contre la chaleur, des gants résistant à la chaleur doivent être portés lors de la manipulation de matériaux chauds ou quand les personnes sont exposées à une chaleur excessive. L'utilisation de gants à base d'amiante doit être évitée en raison des risques pour la santé.

10.5.8 Pour la protection contre les produits chimiques, les solvants, etc. nocifs, des gants faits à partir de matériaux spéciaux tels que le Néoprène, le PVC et le caoutchouc doivent être portés.

10.5.9 Des gants et des manches isolantes doivent être utilisés lors de l'exposition à des dangers électriques et des gants en caoutchouc approuvés doivent être utilisés pour le travail électrique.

10.5.10 Des gants en caoutchouc pour travaux lourds doivent être utilisés pour le travail du béton.

10.6 PROTECTION DU CORPS / DES BRAS

10.6.1 Selon l'évaluation des risques, chaque entité et projet de construction de ContourGlobal doit choisir et exiger des employés d'utiliser, une protection du corps / des bras adéquate quand les employés sont exposés à des dangers tels que l'absorption par la peau de substances nocives ; des coupures ou des lacérations graves ; des écorchures graves ; des piqûres ; des brûlures chimiques ; des brûlures thermiques et des températures extrêmes nuisibles.

10.6.2 Une protection du corps doit être utilisée quand les personnes sont exposées à des quantités de substances toxiques ou corrosives qui présentent un risque pour elles ou quand elles sont exposées à des températures très élevées ou très basses (pompiers, personnes travaillant avec des congélateurs, etc.)

10.6.3 La protection du corps pour l'utilisation de substances dangereuses doit être imperméable à la substance.

10.6.4 Le choix de l'EPI approprié doit se faire sur la base des caractéristiques de performance de l'équipement lié à la (aux) tâche(s) à effectuer, les conditions actuelles, la durée d'utilisation et les dangers et dangers potentiels identifiés.

10.6.5 La protection thermique doit être appropriée aux conditions d'utilisation et ne doit pas limiter, de façon déraisonnable, la tâche en cours.

10.7 PROTECTION AUDITIVE

10.7.1 Chaque entité de ContourGlobal doit mettre des protections auditives à la disposition de tous les employés exposés à une moyenne de 85 décibels ou plus pendant une période de 8 heures.

10.7.2 Chaque entité de ContourGlobal doit s'assurer la bonne taille initiale et surveiller l'utilisation correcte des toutes les protections auditives.

10.7.3 Chaque entité de ContourGlobal doit former tout employé qui est exposé au bruit à une moyenne de 85 décibels ou plus pendant une période de 8 heures en accord avec les exigences de cette section.

10.7.4 Chaque entité de ContourGlobal doit s'assurer que tous ses sous-traitants mettent des protections auditives à la disposition de leurs employés exposés à une moyenne de 85 décibels ou plus pendant une période de 8 heures.

10.7.5 Les protections auditives doivent être remplacées dès que cela est nécessaire.

10.7.6 Les protections auditives doivent être facilement disponibles et utilisées par tout le personnel concerné quand les limites de bruits dépassent les limites d'exposition admissibles selon les règlementations locales.

10.7.7 Une protection auditive doit être choisie en fonction de la nature du bruit et du travail p. ex. : des bouchons d'oreilles réutilisables permanents, des bouchons d'oreilles jetables, des casques anti-bruit, des protecteurs sensibles à l'amplitude, des protecteurs sélectifs en fréquence

10.8 SYSTEME DE PROTECTION INDIVIDUELLE CONTRE LES CHUTES

10.8.1 Quand un risque de chute ou une autre exposition existe pour des hauteurs de travail supérieures à 1,5m ou 5 pieds, ou selon la législation locale, la nature et le cadre du travail seront évalués en termes de conditions et facteurs environnementaux avant de choisir le système approprié de protection contre les chutes (actif, passif ou une combinaison de mesures, tel que cela est approprié).

10.8.2 Les harnais de sécurité doivent être bien attachés à un objet élevé de solide portance , capable de supporter 3 fois le poids de la personne.

10.8.3 Le travailleur doit rester attaché à chaque instant, même quand il se déplace lors de l'exécution de la tâche.

10.8.3.1 Afin d'y parvenir et d'assurer une protection à 100%, le travailleur peut avoir besoin d'utiliser deux longes. La longe principale n'est jamais décrochée jusqu'à ce que la longe secondaire soit bien attachée.

10.8.3.2 Le type de travail et les conditions environnementales déterminent le choix des longes et des lignes de vie. Lorsque des opérations de soudage, nettoyage chimique, sablage peuvent endommager les longes, les connecteurs ou les lignes de vie, , etc., il faut soit, protéger les composants soit, utiliser un type de système mieux approprié.

10.8.3.3 Les longes et lignes de vie doivent comporter, ou être utilisées avec, un dispositif de décélération approprié.

10.8.3.4 Les longes et lignes de vie ne doivent utiliser que des mousquetons de verrouillage et en aucun cas deux mousquetons de longe ne doivent être raccrochés.

10.8.4 Une fois en cours d'utilisation, l'efficacité du système doit être contrôlée.

10.9 ÉQUIPEMENT ET VETEMENTS DE PROTECTION POUR LE TRAVAIL A CHAUD

10.9.1 L'Utilisation de gants à l'épreuve des flammes, de tabliers, capes, de casques de protection ou couvertures de rassemblements, des jambières et de bottes élevées commercialement disponibles suit, obligatoirement, les points suivants :

10.9.1.1 Tabliers pour la protection contre les projections d'étincelles.

10.9.1.2 Les capes, couvertures de rassemblement, des couvre-chefs et si besoin est, la protection auditive pour le soudage en hauteur.

10.9.1.3 Des jambières à l'épreuve du feu et des bottes élevées pour le travail lourd.

10.9.2 Des vêtements de laine sont préférables au coton et protègent contre les changements de température.

10.9.3 Le polyester, le nylon, et les autres vêtements synthétiques similaires doivent être évités.

10.9.4 Des manches longues sont exigées et doivent être boutonnées.

10.9.5 Les manchettes et les poches ajustables doivent être évitées.

10.9.6 Les pantalons ne doivent pas être rentrés dans les bottes durant le travail à haute température.

10.9.7 Des casques de protection avec cagoule sont exigés pour le travail effectué dans des zones où il y a des dangers en hauteur, dans les zones de construction ou là où cela est exigé selon l'évaluation des risques.

10.10 ÉQUIPEMENT DE PROTECTION RESPIRATOIRE

10.10.1 ContourGlobal doit protéger les travailleurs et le public des expositions à la poussière, aux fumées, vapeurs, aux brouillards ou gaz qui dépassent les valeurs moyennes d'exposition (VME) ou les valeurs limites d'exposition (VLE), telles que mentionnées par l'administration hygiène et santé (OSHA), la Conférence américaine des hygiénistes industriels gouvernementaux (ACGIH) ou toute autre réglementation locale applicable.

10.10.2 Chaque entité ou projet de construction de ContourGlobal doit mettre en place un programme de protection respiratoire, qui comprend la maintenance et l'entretien corrects des respirateurs et tout équipement associé.

10.10.2.1 La protection respiratoire doit être portée quand les personnes sont exposées à des niveaux atmosphériques de poussières, fumées, vapeurs ou gaz qui dépassent les réglementations locales appropriées.

10.10.2.2 Les filtres des protections respiratoires doivent être régulièrement remplacés selon les recommandations du fabricant et les dates de péremption.

10.10.2.3 Tous les utilisateurs doivent parfaitement comprendre les buts et les limitations des différents types de respirateurs et d'appareils respiratoires.

10.10.3 Le personnel qui doit porter un équipement de protection respiratoire doit être formé, apte et médicalement qualifié pour porter de tels dispositifs.

10.10.4 Les respirateurs ne doivent pas être utilisés si des gaz ou des vapeurs sont présents à de grandes concentrations ou dans des espaces confinés ou un manque d'oxygène peut apparaître.

10.10.4.1 Appareil respiratoire individuel : il doit être utilisé quand l'équipement ci-dessus ne peut pas offrir de protection respiratoire, telle qu'un manque en oxygène, des concentrations élevées de gaz ou vapeurs toxiques, etc.

10.11 FORMATION

10.11.1 Chaque employé amené à porter un EPI doit recevoir une formation qui couvre :

10.11.1.1 Quand et quel type d'EPI est nécessaire

10.11.1.2 Comment mettre, enlever, ajuster, porter correctement l'EPI et les limites de l'EPI

10.11.1.3 L'entretien, la maintenance, la durée d'utilisation et l'élimination de l'EPI

10.11.1.4 Comment signaler des articles défectueux et/ou obtenir un remplacement

10.11.2 Chaque employé concerné doit démontrer sa capacité à utiliser correctement l'EPI avant d'être autorisé à effectuer le travail qui nécessite l'utilisation de l'EPI.

10.11.3 Une formation doit être renouvelée quand :

10.11.3.1 Des changements dans le lieu de travail et les types d'EPI à utiliser rendent les anciennes formations obsolètes.

10.11.3.2 Des insuffisances dans les connaissances des employés concernés ou l'utilisation de l'EPI désigné indiquent que l'employé n'a pas conservé la compréhension ou les compétences nécessaires.

10.11.4 La formation doit être documentée et suivie avec ces informations : La (les) date(s) et le sujet de la formation et le nom de chaque employé formé.

11 PROGRAMME DE CONTROLE DE LA SANTE AU TRAVAIL (OHCP)

11.1 SURVEILLANCE MEDICALE

11.1.1 ContourGlobal doit établir, mettre en œuvre et maintenir un programme de contrôle de santé au travail (OHCP – Occupationel Health Control Plan) mis à jour annuellement pour tous ses employés et effectué par un médecin du travail.

11.1.2 Tous les sous-traitants de ContourGlobal doivent avoir un programme de contrôle de santé au travail (OHCP) mis à jour annuellement pour tous leurs employés et effectué par un médecin du travail.

11.1.3 L'OHCP doit se concentrer sur la prévention, le suivi et le diagnostic préventif des maladies professionnelles, même sans présenter de symptômes apparents, et faire des recherches sur l'existence de maladies professionnelles ou dommages irréversibles sur la santé des travailleurs.

11.1.4 L'OHCP doit être planifié sur la base des risques pour la santé des travailleurs, en particulier ceux identifiés par l'analyse des risques.

11.1.5 L'OHCP doit comprendre entre autres le suivi obligatoire et le support médical gratuit :

11.1.5.1 Examen médical d'embauche à effectuer avant que le travailleur ne commence à travailler.

11.1.5.2 Examen médical périodique, au moins une fois par an, selon les directives du médecin du travail.

11.1.5.3 Examen médical de reprise du travail (examen obligatoire à effectuer le premier jour de reprise, pour un travailleur absent pendant 30 (trente) jours ou plus, suite à une maladie ou un accident professionnel ou non ou suite à un accouchement).

11.1.5.4 Examen en cas de mutation (obligatoirement avant la mutation), considéré, pour le but de ces normes, comme nouvelle activité impliquant des risques différents de ceux existant sur l'activité précédente.

11.1.5.5 Contrôle médical avant la retraite ou la démission pour établir la présence ou l'absence d'une maladie professionnelle, apparue au cours de la période d'emploi dans la compagnie.

11.1.6 Les données issues des examens médicaux, y compris l'évaluation clinique et les tests complémentaires, les conclusions et les recommandations appliquées doivent être notées dans le dossier médical du travailleur, qui sera tenu par le médecin du travail. Ces données doivent être classées comme confidentielles.

11.1.7 Les restrictions cliniques qui ont un impact sur la performance d'activités spécifiques, dues à des problèmes physiques ou psychologiques permanents ou temporaires doivent être évaluées par le médecin du travail qui émet le rapport de contrôle médical au service des ressources humaines, qui devra alors déplacer ces personnes sur des fonctions compatibles avec leurs capacités.

11.1.8 S'il est détecté, au cours de l'évaluation clinique ou des examens du travailleur, une exposition excessive aux risques par rapport aux limites de tolérance de la législation locale, même s'il n'y a pas de signe ou preuve clinique, le travailleur doit rester éloigné de ses activités ou des risques associés, jusqu'à ce que l'indicateur d'exposition revienne à la normale et que des mesures de contrôle de l'environnement soient mises en place.

11.1.9 Les résultats des examens médicaux doivent être conservés pendant au moins 20 (vingt) ans ou plus selon la législation locale et les comptes-rendus médicaux relatifs à l'activité professionnelle conservés séparément des comptes-rendus médicaux individuels.

11.1.10 Tous les employés doivent être informés de l'existence, de la localisation et de la disponibilité des comptes-rendus médicaux et comptes-rendus d’'exposition.

11.1.11 Les informations médicales envoyées, copiées ou conservées sur support électronique doivent être protégées par un accès non autorisé.

11.1.12 Les employeurs doivent conserver un registre de tous les employés qui ont subi une supervision médicale en accord avec ces dispositions.

11.1.13 Le registre doit contenir les informations suivantes :

11.1.13.1 Le nom de l'employé

11.1.13.2 À quel type d'exposition(s) l'employé a été soumis.

11.1.13.3 La durée de cette (ces) exposition(s).

11.1.13.4 Les résultats des examens et pour les études d’employabilité, quand ils ont été conduits et par qui.

11.2 CONTROLE DES AGENTS PATHOGENES ET INFECTIONS A DIFFUSION HEMATOGENE

11.2.1 Chaque entité, filiale ou sous-traitant de ContourGlobal doit établir, mettre en place et maintenir un programme écrit pour le contrôle des agents pathogènes et des infections transmissibles par le sang, dues au risque d'exposition professionnelle à ces agents pathogènes.

11.2.2 Les contrôles et les EPI appropriés tels que gants, vestes, tabliers et masques doivent être mis à la disposition des employés soumis à des risques d'exposition professionnelle à des agents pathogènes transmissibles par le sang.

11.2.3 Un programme de vaccination doit être fourni aux employés avant toute activité pouvant présenter un risque d’exposition à des agents pathogènes et aux infections transmissibles par le sang.

11.2.4 Les travailleurs soumis à un risque d’exposition doivent être formés tous les ans aux précautions générales de protections contre les agents pathogènes transmissibles par le sang et à l'utilisation correcte des EPI.

11.2.5 Une procédure adéquate d'élimination des agents à risque biologique (collecte, transport et élimination des matériaux) doit être mise en place.

11.2.6 Tous les conteneurs d'élimination d'agents biologiques et de clous doivent être en accord avec les normes de la législation et correctement étiquetés.

11.2.7 ContourGlobal doit mettre en place une évaluation annuelle pour identifier les travailleurs (p. ex. : les premiers secours, l'équipe médicale, la maintenance et autres) soumis au risque d’exposition à des agents pathogènes et aux infections transmissibles par le sang.

11.3 PRESERVATION DE L'AUDITION

11.3.1 ContourGlobal et tous les sous-traitants de ContourGlobal doivent établir, mettre en œuvre et maintenir un programme de prévention contre la perte de l'audition pour les personnes soumises à une exposition à un niveau de bruit supérieur à 85 dBA (08 heures ou plus en moyenne / exposition quotidienne).

11.3.2 Tous les travailleurs inclus au programme de prévention contre la perte de l'audition doivent être évalués à l'aide de tests audiométriques en accord avec la législation locale, au cours du processus d'embauche ou de l'affectation des fonctions et une fois par an, au cours du travail dans les zones avec un niveau élevé d'exposition au bruit.

11.3.3 Le programme doit être fourni aux employés sans aucun coût.

11.3.4 Les tests audiométriques doivent être effectués par un audiologiste, un otorhinolaryngologiste ou un autre médecin agréé ou certifié ou par un technicien qui est agréé par la législation locale et doit être effectué dans des cabines acoustiques certifiées ou "chambres silencieuses", ce qui signifie moins de 40 dBA.

11.3.5 Les sonomètres et / ou les dosimètres de bruit doivent être calibrés tous les ans par un fournisseur certifié.

11.3.6 Les employés qui ont subi un changement dans leur niveau d'audition après le nouveau test doivent être reformés à l'utilisation des protections auditives et le résultat du test audiométrique doit être évalué à nouveau par un spécialiste (médecin du travail ou oto-rhino-laryngologiste).

11.3.7 Tous les cas qui impliquent des pertes d'audition liées au travail doivent être identifiés et correctement rapportés et tous les résultats audiométriques doivent rester confidentiels.

11.4 INSTALLATIONS MEDICALES ET PREMIERS SECOURS

11.4.1 Chaque entité, filiale et sous-traitant de ContourGlobal doit fournir des postes de premiers secours correctement équipés sur des lieux appropriés au sein de l'installation.

11.4.1.1 Les kits de premiers secours ne doivent pas contenir de médicaments en prescription ou en vente libre.

11.4.1.2 Les kits de premiers secours doivent être équipés de gants et de masques.

11.4.2 Des stations de douche oculaire et/ou des douches de sécurité doivent être mises à disposition près de toutes les zones de travail où le rinçage immédiat à l'eau est la mesure de premiers secours recommandée.

11.4.3 Les sites éloignés doivent disposer de procédures documentées pour faire face aux cas de traumatismes ou de maladies graves jusqu'au point où un patient doit être transporté vers une installation médicale appropriée.

11.4.4 Le stock de matériel et de médicaments doit faire l'objet d'un inventaire en ce qui concerne la quantité, le stockage et la date de péremption.

11.4.5 Chaque entité, filiale et sous-traitant de ContourGlobal doit s'assurer qu'il y a un accès aux services appropriés formés aux premiers secours.

11.4.5.1 Une formation doit être donnée par un organisme de formation certifié et doit inclure les risques d'infection par des agents pathogènes transmissibles par le sangà travers le contact avec des liquides et tissus corporels.

11.4.5.2 Les secouristes doivent suivre des renouvellements de formations au moins une fois tous les trois ans.

12 SITUATION D’URGENCE ET CAPACITE A REAGIR

12.1 PLAN D'URGENCE

12.1.1 Chaque entité, filiale et sous-traitant de ContourGlobal doit développer, mettre en œuvre et maintenir un plan d'urgence qui vise à réduire les risques associés aux situations d'urgence sur leurs sites.

12.1.2 Chaque entité, filiale et sous-traitant de ContourGlobal doit identifier les situations d'urgence potentielles spécifiques à leur emplacement, usine ou activités commerciales. Les situations liés à l’entité ContourGlobal et celles causées par des événements extérieurs doivent être prises en comptes au cours de l'analyse :

12.1.2.1 Une situation « liée à l’entité » signifie une situation d'urgence ou avec victimes ou nécessitant le déclenchement du plan d'urgence de ContourGlobal et qui est le résultat d’actions ou opérations des installations de ContourGlobal (incendies, victimes de la centrale, déversement de produits chimiques toxiques, etc.).

12.1.2.2 Une situation « causées par des événements extérieurs » signifie une situation d'urgences ou avec victimes, qui n'est pas le résultat d’actions ou d’opérations des installations de ContourGlobal, mais peut avoir un impact sur les installations de ContourGlobal et nécessite la mise en œuvre du plan d'urgence de ContourGlobal (incendies, inondations, séismes, troubles civiles, etc.).

12.1.3 Pour chaque situation d'urgence identifiée, des procédures et plans spécifiques doivent être mis en place pour assurer le niveau maximum de sécurité qui peut être donné aux personnes.

12.1.4 Ces documents doivent comprendre :

12.1.4.1 La méthodologie pour faire remonter l'urgence, la communication de la situation d'urgence à toutes les personnes (sorte de système d'alarme, avec un soutien disponible) et la mise en œuvre de la procédure d'urgence.

12.1.4.2 Une liste détaillée de téléphones/communication est requise pour identifier les autorités extérieures et les informer du besoin d'assistance et/ou les avertir des dangers pour le public.

12.1.4.3 Identification des rôles et responsabilités de toutes les personnes qui répondent.

12.1.4.4 Identification d'une chaîne de responsabilités et d'un cadre de communications clairs (tant interne qu'externe à l'entité ContourGlobal).

12.1.4.5 Procédures de mise en œuvre du plan d'issues de secours/évacuation d'urgence.

12.1.4.6 Procédures de secours et personnel médical selon les besoins.

12.1.4.7 Les procédures pour mettre l'installation en sécurité de façon à minimiser l'impact de, ou supprime, la situation qui exige la mise en œuvre du plan d'urgence.

12.1.5 Des exigences spécifiques doivent être mentionnées dans le plan d'urgence, ou indiquées en référence par le plan, pour amener l'équipement d'urgence requis à répondre à la situation d'urgence, y compris la maintenance, l'entretien et la formation sur cet équipement. Le plan doit spécifier les lieux de stockage pour tout équipement de sécurité et de réponse aux urgences.

12.1.6 La formation doit être délivrée à toutes les personnes de façon régulière. La formation doit inclure, quand cela est possible, des simulations avec une analyse critique et des révisions s'il y a lieu. Des revues du plan d'urgence doivent être conduites quand les personnes de ContourGlobal sont nommées au départ ainsi que quand le rôle d'une personne au sein du plan d'urgence change.

12.1.7 Le plan d'urgence doit être écrit et disponible pour une revue par les personnes de ContourGlobal. Les comptes-rendus des formations liées à la formation au plan d'urgence doivent être conservés.

12.2 EVACUATION ET ISSUES DE SECOURS

12.2.1 Des issues de secours doivent être présentes en nombre, localisation et dimensions suffisantes, pour faciliter l'évacuation en toute sécurité du nombre maximal de personnes dans l'installation.

12.2.2 Les passages vers les issues de secours doivent être clairement définis.

12.2.3 Les passages vers les issues de secours doivent être dégagés à chaque instant.

12.2.4 Tous les itinéraires et issues de secours doivent être bien éclairés.

12.2.4.1 Un éclairage d'urgence d'une intensité appropriée doit être installé et s'activer automatiquement lors de la défaillance de l'alimentation principale pour permettre une mise à l'arrêt et une évacuation en toute sécurité.

12.2.4.2 L'autonomie de l'éclairage d'urgence doit être régulièrement contrôlée.

12.2.5 Les chemins d'évacuation ne doivent pas exposer les personnes en train d'évacuer à des dangers supplémentaires au cours de l'évacuation.

12.2.6 Toutes les installations doivent être pourvues d'un nombre approprié de systèmes de détection incendie adéquats (fumée ou chaleur).

12.2.7 Toutes les installations doivent être pourvues d'un système d'alarme automatique approprié

12.2.7.1 Il doit y avoir une activation manuelle du système d'alarme.

12.2.7.2 Il doit y avoir des postes d'alertes incendie situés à chaque issue de secours.

12.2.7.3 L'alarme doit disposer de moyens notification de l'activation tant sonores que visuels.

12.2.8 Les groupes incendie, les alarmes et l'éclairage d'urgence doivent être connectés à un générateur et correctement testés.

12.2.9 Un point de rassemblement doit être défini et être clairement identifiable.

12.2.10 Un comptage des effectifs doit avoir lieu pour s'assurer que tout le monde (employés de ContourGlobal, visiteurs, sous-traitants, etc.) a quitté l'installation et est retrouvé en sécurité.

12.2.11 Le temps mis pour terminer l'évacuation doit être enregistré.

12.2.12 Un exercice d'évacuation doit être planifié pour avoir lieu au moins une fois par an (une fausse alarme ou une erreur du système ne compte pas comme un exercice).

ANNEXE 8: LIST OF CONSULTED PERSONS

Nom des personnes rencontrées	Organisation	Fonction
M. Papa Toby Gaye	SENELEC	Coordinateur du Projet
M. Moussa Diop	SENELEC	Chef de la division environnement et qualité
M. Ibrahima Gueye	SENELEC	Division environnement et qualité
Mme Guene	DEEC	Directrice adjointe de la DEEC
M. Sada Kane	DEEC	Chef de la Division des Installations Classées (DIC)
M. Momar Sow	DEEC	Chef de la Division Des Evaluations D'impact Sur L'environnement (DEIE)
M. Sall	Préfecture de Rufisque	Préfet
M. Ibrahima Ndiaye Sall	Mairie de Rufisque	Directeur Administratif et Financier
M. El Malick Fall	Mairie de Rufisque	Directeur adjoint à l'Aménagement Urbain
M. Balla Kante	Service départemental du développement rural de Rufisque	Chef de Service
M. Bruno Lamba	Service départemental du développement rural de Rufisque	Agent
M. Pathé Samb	Sapeurs-pompiers de Rufisque	Adjudant-chef
M. Ousseynou Dia	Municipalité de Rufisque	Chef du quartier de Darou- Salam Azur
M. Alassane Sow	Ecole primaire publique de Dioukoul	Directeur
M. Momar Ndoye	Ecole primaire et secondaire privée Maguette Ndoye, Dioukoul	Directeur
M. Mohamet Ciss	Daara coranique El Hadji Ibrahima ciss	Directeur
Mme Aita Ndoye Gueye	Daara franco-arabe	Directrice
M. Momar Ndiaye	Commission Environnement du quartier de Dioukoul	Membre de la commission

ANNEXE 9: LIST OF CONSULTANTS INVOLVED IN THE IMPACT ASSESSMENT STUDY

Experts	Organisation	Role
Oumar Karamoko Ndiaye	2iEC	Coordinateur du Projet
M. Diagne	2iEC	Expert environnement
Camille Maclet	ERM	Directeur de Projet
Bernard Vanlieferinghen	ERM	Chef de Projet
Lucien Briand	ERM	Consultant
Bernard Vanlieferinghen	ERM	Chef de Projet
Nicolas Glénat	ERM	Consultant
Begona Rodrigo	ERM	Consultant
Jacopo Signorini	ERM	Consultant
Marilena Di Stefano	ERM	Consultant
Monica Angostinone	ERM	Consultant
Pierrick Léger	ERM	Consultant
Benoit Vanwelde	ERM	Consultant
Cyril Barbier	ERM	Consultant