OMV

OMV TUNESIEN PRODUCTION

Environmental impact assessment of the gas pipeline construction project (PK52-PK370). Nawara Concession Development Project.

STGP-TESCO-PMT-0805-HS-REP-0001

Final report **March 2014**

Developed by:

TESCO
Consulting for Sustainable Development Engineering

TÜVRheinland® CERT ISO 9001

- **Mission:** Environmental impact assessment of the gas pipeline construction project
  Nawara Concession Development
  STGP-TESCO-PMT-0805-HS-REP-0001

- **Developed by :** TESCO

- **For:** OMV Tunesien Production Gmbh.

- **Reference:** 02 2013

- **Version:** 02

Introduction of TESCO

- **Company name:** TESCO

- **General Manager:** Mourad Kaabi

- **Activity:** Design, Consultancy and Technical Assistance in Industrial and Environmental domains

- **Address:** 11, rue du Lac Ichkeul
  1053 Les Berges du Lac. Tunis

- **Telephone** +216 71 960 055/ +216 71 960 077/
  +216 71 965 232

- **Fax :** +216 71 962 717

- **Web site:** www.tesco.com.tn

- **Email:** info@tesco.com.tn

10/11 2(0 14:28 FAX 001/001

République Tunisienne

Ministère de l'Equipement
et de l'Environnement

AGENCE NATIONALE DE
PROTECTION DE L'ENVIRONNEMENT

الجمهورية التونسية

وزارة التجهيز والبيئة

الوكالة الوطنية
لحماية المحيط

Tunis le : 18 NOV 2013

N° 3940

DPPP/ BS/390/2013

JE/24 D
A rappeler à chaque correspondance

A Monsieur le Directeur Général
de OMV South Tunisia Ltd
Immeuble Waterside – Impasse du Lac Turkana
Les Berges du Lac - 1053 Tunis
Fax : 71 162 555

Objet : Avis de l'ANPE concernant le projet de développement de la concession Nawara (projet de construction du gazoduc (PK52-PK370), gouvernorat de Tataouine, Medenine, Kebeli et Gabes.
Réf : Vos transmissions du 30 mai 2013.

Monsieur,

Suite à vos transmissions relatives aux projets ci-dessus mentionnés, et afin de permettre à l'Agence Nationale de Protection de l'Environnement de se prononcer quant à la conformité de vos projets aux exigences de protection de l'environnement, nous vous demandons de nous faire parvenir une étude d'impact sur l'environnement actualisée, qui tient compte de la réglementation en vigueur et des insuffisances suivantes :

1. Le mode de gestion détaillé des eaux de l'hydrotest ;
2. L'identification avec précision du champ d'application de la dérogation, à certaines dispositions de la norme NT 109,01, accordée par le Ministère de l'Industrie et de la Technologie ;
3. L'étude de l'impact social du projet de pose et d'exploitation du gazoduc.

Veuillez agréer, monsieur, nos sincères salutations

DIRECTION GENERALE

Le Directeur Général
de l'Agence Nationale de Protection
de l'Environnement
Sami Kaïs BLOUZA

المركز العمراني الشمالي · 15 ، نهج 7051 – حي السلام – 2080 تونس – ص.ب. عدد 52 البلفيدير – الهاتف : 71 233 600 – الفاكس : 71 232 811
Centre Urbain Nord - 15, rue 7051 - Cité Ennasr - 2080 Tunis - B.P. N° 52 Le Belvédère - Tél. : 71 233 600 - Fax : 71 232 811
E-mail : B.O.C.anpe@anpe.nat.tn

Update of the assessment in the light of ANPE comments

Subject: Response to the notice of ANPE concerning the construction of the pipeline (Pk52-PK370) within the framework of the Nawara project.

Ref: mail n° 3940 (IE 2413) of 18 November 2013
Attachment*:* mail n° 3940 (IE 2413) of 18 November 2013.

To the attention of the General Manager

Further to your letter pertaining to the environmental impact assessment of the proposed Nawara concession development, and the construction of the gas pipeline, please find below the items that have been updated:

1. **Detailed management method for the hydro test water**

- **Page 36**

Hydraulic tests: The pipe is filled with water and then tested at a pressure of 150% of the nominal service pressure, in compliance with the Tunisian standard NT 109.01 in order to check its tightness before putting it into service.
Hydraulic tests Water will be collected in watertight evaporation pits which characteristics are as follows

- **Page 42**

Before commissioning of the pipeline, all lines will be subjected to a hydraulic test according to the technical specifications required to verify the integrity of the pipeline.

Water, originally used for hydraulic test, have similar physical and chemical properties to drinking water; it will be mixed with corrosion inhibitors and antioxidants to ensure pipeline integrity as the duration of stay of this water will be important and will be the same used during hydraulic tests for the other sections

The test of each section will be made by 32-km section, separated by temporary scrapers. These scrapers can both clean the pipeline and control the amount of water introduced into the pipeline.

Therefore, only the water in the first section is supposed to contain the waste existing within the pipeline.

Supposedly contaminated by welding debris, additives and possibly grease and sand, the water will be collected in evaporation ponds that have sealed walls.

After the hydrostatic test, the pipeline will be wiped to remove any residual water by means of an injection of air or gas. Once dried, the pipeline will be blown off with nitrogen prior to being put to service.

The evaporation ponds will be built at the CPF (Nawara). They are made from the pits resulting from the extraction of limestone used in the construction of the central processing unit (CPF).

Additional evaporation ponds can be built according to the project requirements. The choice of the location will be made by the contractor according to the specificities and the choice of the hydro test method; Furthermore OMV is committed to communicate the final location of these pits and to ensure, through the contractor, to implement the necessary requirements for environmental preservation.

The parameters of the local environment (wind, temperature) promote the establishment of evaporation ponds which will be designed and managed in compliance with environmental, health and safety requirements of the World Bank for the development of 'Onshore Oil & Gas'.

The design of the evaporation pond must consider the following requirements:

- The choice of the coating which should provide a permeability coefficient (sides and bottom) inferior or equal to 1 x 10-7 cm / s;
- The coating material will be selected in accordance with the characteristics of the water that will be used. The coating will be thick and strong enough to preserve the integrity of the pits;
- Preventive measures are taken to prevent the intrusion of surrounding natural elements or the pit failure during heavy storms
- Means to prevent the intrusion of people, livestock or wildlife (eg camels);
- At the end of operations, the elements contained in the evaporation pond will be eliminated as a result of analysis and in compliance with the waste management plan. The site will return to its initial state.

- **Page 74**

The hydro test water will be collected in evaporation pits with sealed walls.

Additional evaporation ponds can be built according to the project requirements. The choice of the location will be made by the contractor according to the specificities and the choice of the hydro test method; Furthermore OMV is committed to communicate the final location of these pits and to ensure, through the contractor, to implement the necessary requirements for environmental preservation.

- **Page 94**

Additional evaporation ponds can be built according to the project requirements. The choice of the location will be made by the contractor according to the specificities and the choice of the hydro test method; Furthermore OMV is committed to communicate the final location of these pits and to ensure, through the contractor, to implement the necessary requirements for environmental preservation.

- **Page 102**

Environmental management plan:

Potential impact on surface and underground water during the construction phase: risk of contamination by the hydro test water.

Mitigation measure: Designing evaporation pits with watertight walls to collect this type of water so as to prevent infiltration.

- **Page 108**

The hydro test water will be collected in evaporation pits with sealed walls, arranged at Nawara.

Additional evaporation ponds can be built according to the project requirements. The choice of the location will be made by the contractor according to the specificities and the choice of the hydro test method; Furthermore OMV is committed to communicate the final location of these pits and to ensure, through the contractor, to implement the necessary requirements for environmental preservation.

2. **Identifying precisely the scope of the exemption, in relation to application standard NT 109.01, approved by the Ministry of Industry and Technology (page 16)**

OMV has addressed an exemption request to the security department.
The security department of the industry ministry granted his approval for the exemption (Appendix 1).

In the urban area (about 10 km from the gas treatment plant in Gabes), the NT 109.01 standard will be adopted.

3. **The social impact assessment of the proposed installation and operation of the pipeline (Page 34)**

Land management will be delegated to a specialized contractor who will ensure that the process will be made in accordance with and not limited to the following:

- The Hydrocarbon Law applicable to the land management process (Articles 84-85-86) and any Tunisian law applicable to this process

- Tunisian Labour Code
- Tunisian laws and decrees concerning the transportation of oil and gas.
- The NT 109-01 concerning the gas pipeline
- Tunisian laws concerning the uprooting of olive and palm trees
- Provide a comprehensive list of lawyers, notaries and bailiffs in each governorate (Tataouine, Kebili Mednine and Gabes) involved in the crossing of the pipeline, for the conduct of administrative and paralegal services related to the acquisition process and land management
- Provide a comprehensive list of landowners who will be covered by the compensation
- Hold meetings with owners and local authorities to discuss the rights of way
- Prepare minutes of meetings with owners and local authorities
- Actually work with lawyers, notaries and bailiffs throughout the whole period of service provision
- Regular update of maps and gas pipeline route
- Involve agricultural experts and land surveyors during the expertise in order to properly assess compensation ...

This procedure will be detailed in the social study that will be attached to this Environmental impact assessment

Table of content

List of tables

List of figures

Acronyms and abbreviations

ANGed: Agence Nationale de Gestion des Déchets

ANPE: Agence Nationale de Protection de l'Environnement

ASME: American Society of Mechanical Engineers

AfDB: African development Bank

BBL: Barrel

CES : Complexes des Eaux du Sud

CI : Continental Intercalaire

CO2 : Carbon dioxyde

CPF : Central Processing Facility

CRDA : Commissariat Régional au Développement Agricole

CT : Complexe Terminal

DGE : Direction Générale de l'Energie

EIA : Environmental impact assessment

ESA : Environmental and social assessment

ETAP : Entreprise Tunisienne des Activités Pétrolières

INM : Institut National de Météorologie

INS: Institut National des Statistiques

MEDD : Ministère de l'Environnement et de l'énergie Durable

mrem: milli-roentgen equivalent man

NOx: Nitrogen oxide

O_3: Ozone

ODS: Office du Développement du Sud

OMV: Österreichische Mineralölverwaltung

NGO: Non Governmental Organization

ONAS : Office National d'assainissement

PEES: Environmental and social assessment Procedures

RMC: Regional member country

PV : Minutes

PM_{10}: particulate matter *10* (a particle which diameter is below 10 µm)

RN: Route Nationale

RL: Route Locale

RR: Route Rurale

SASS: Système Aquifère du Sahara Septentrional

SONEDE : Société Tunisienne d'Exploitation et de Distribution des Eaux

SNDP: Société Nationale de Distribution du Pétrole

STEG: Société Tunisienne D'Electricité et de Gaz

SOx: Sulphur Oxide

TESCO: Tunisian Engineering and Services Company

Executive Summary

Within the context of the Nawara project, **OMV (Tunesien) Production Gmbh** plans to erect a Gas Pipeline that will convey gas from the central processing facility (CPF) in the Nawara field (governorate of Tataouine) to the gas treatment plant in the Ghannouch industrial area (Governorate of Gabès).

The assessment is carried out in compliance with the decree 2005-1991 dated July 11th 2005 relating to the EIA and to the different unit categories highlighted in the project specifications.

The Gas Pipeline construction will be done in accordance with the current legislations and particularly the NT 109.01 standard pertaining to Gas Transportation safety for Gas Pipeline facilities.

OMV has addressed an exemption request to the security department.

The security department of the industry ministry granted his approval for the exemption. (Appendix 1).

In the urban area (about 10 km from the gas treatment plant in Gabes), the NT 109.01 standard will be adopted.

The pipeline consists of a 24" inner diameter steel pipe along 370 Km. The gas pipeline will cross the governorates of Tataouine, Kébili, Mednine and Gabes.

The final products, produced in the processing plant (sales gas, propane, butane) will be conveyed respectively to STEG and SNDP through steel export lines respectively sized 20", 6" and 4".

The impacts of the various phases of the project, i.e. the construction phase, the operation phase and the abandonment stage, on physical and human environment along the planned route have been listed in this study.

The impacts assessment of the proposed pipeline construction was based on the degree, duration, certainty and possibility of mitigation or compensation for these impacts.

The majority of identified impacts is limited to the construction phase due to the nature of the work to be undertaken (dig, uprooting of trees, excavation).

In fact, during this phase, the impacts would be:

- Destruction of certain trees and plants (olive, palm,), especially when crossing through farmland.

- Disruption of life due to work areas (storage of materials and excavation area,) and to the nature of activities.
- Landscape changes due to excavation.
- Pollution due to the release of dust and exhaust.
- Noise due to the mobilization of machinery and work equipment.
- Risk to public safety in view of the size of the gear and type of equipment deployed.
- Contamination of soil and water resources by water (sanitary and hydro test) and accidental spills of fuels.
- Disruption of Saharan tourist activities

These impacts are largely mitigated by the chosen route. Yet, some risks, nuisances and negative effects on environment are still present and do require a particular efficient management.

In conclusion, thanks to the wise choice of the Gas Pipeline route and to the various safety measures and to the projected environmental management plan, the Gas Pipeline construction project shouldn’t cause any harmful or dangerous impact to the crossed area.

1. Introduction/Project Justification

A. Overall background of the assessment

OMV (Tunesien) Production GmbH intends to achieve the Nawara Project which includes the following components;

a. The development of the Nawara field which is the subject of a separate EIA

b. The construction of a gas pipeline, which is the subject of this study that will convey the gas from the Nawara concession to the gas treatment plant in Gabes.

c. The construction of a gas treatment plant in the Ghannouch industrial area (governorate of Gabes) to provide the final products (commercial gas, propane, butane and condensate) to STEG and SNDP. This phase will be the subject of a separate EIA.

The purpose of this Environmental impact assessment is to identify and assess the potential impacts of the pipeline erection on the surrounding areas involved by the project, and to propose mitigation measures to offset or eliminate the possible effect of these impacts on the environment while complying with environmental requirements.

This assessment will develop the following items:

- The introduction of the client and the actors
- The legal and institutional framework for the transportation of oil and gas in Tunisia
- The detailed project description and the selection of the pipeline route
- The initial state of the layout plan and the analysis of existing environmental components that may be impacted
- Definition and impacts assessment
- Program of environmental management and mitigation measures

OMV (Tunesien) Production Gmbh submits for approval this Environmental impact Assessment for the gas pipeline construction project to the National Agency of Environmental Protection (ANPE)

B. Project Justification

B1. Social and economic factors

In the first phase, the Nawara project aims at exploiting the untapped gas reserves at the Nawara concession in Southern Tunisia. The gas will be conveyed through the pipeline to the gas treatment plant in Gabes. This gas will be processed and distributed as a final product to STEG and SNDP

The construction of this gas pipeline is therefore useful as it will facilitate the transportation of an important quantity of raw material to value and exploit it.

Different phases of the project (land development and construction, operation and maintenance) will offer new career opportunities to the local workforce and will enhance economic activities (public services, housing, side activities,...) in the vicinity of the gas pipeline, which will cross the major governorates of southern Tunisia (Tataouine, Mednine, Kébili and Gabès).

B2. Technical factors

The Western Route choice was made on the basis of several important criteria and in particular:

- The length of the pipeline and the altitude of the crossed lands

- The distance run by the pipeline is about 370 Km, and the fields are relatively flat

The western route has also been chosen as it crosses less road infrastructures and fewer rivers, and it will be located on an area where there are already gas pipelines that are installed by other companies (figure 1 & 2)

- The gas pipeline will be installed while respecting a safety distance of 30 m away from other gas pipelines.

Security corridors will also be respected in compliance with the standards of NT 109.01 and ASME code.

Figure 1 : Current Gas Pipeline in Tataouine

Figure 2 : Current Gas Pipeline in Gabès

B3. Environmental factors

The choice of the gas pipeline route was based on several environmental criteria: Indeed, the western route was chosen because of the following criteria:

- It is distant from human activities and settlements
- It has no negative impact on agricultural activities
- The gas Pipeline will be buried because of its length and will not have visual/aesthetic impacts
- No conflict with the existing infrastructure (roads, Gas Pipeline, oil pipeline...) and with the urban areas it crosses (Gabès in particular).
- The gas pipeline will not harm the wildlife, as other pipelines are already installed there.
- Underground water will not be impacted by the construction activities because it is deeper than the proposed depth for laying down the Gas Pipeline.

During the different construction, operation and maintenance phases, OMV is committed to applying all safety standards relating to Gas transportation (NT 109.01) and to respecting all safety rules covering employees and residents.

2. Identification and presentation of the developer

OMV E&P entered Tunisia in 1971, as a partner in the Marin du Golf d'Hammamet license in which oil was discovered 1977. The Halk el Menzel concession was awarded in 1980 in which OMV acquire Shell's remaining interest in 1990.

In 2003 OMV acquired the international assets of Preussag Energie which were comprised of TP which operates four concessions and Serept, which operates the Ashtart concession on behalf of OMV and ETAP, the Tunisian state oil Company. In the same year, OMV signed the Jenein Sud Exploration license. In 2005 the Warda-1 exploration was successfully drilled and tested, resulting in the first of a series of gas-condensate discoveries in this license.

Since then, OMV has consolidated its portfolio by selling the Chergui and Halk el Menzel concessions and acquiring 80% of the Sidi Mansour exploration block in the Gulf of Gabes In terms of further activities, OMV is working on the development of the Nawara concession, which was granted within the Jenein Sud exploration area and contains most of the discoveries. OMV strives to use its production expertise in Tunisia to maximize recovery from the current oil production facilities in the Gulf of Gabes.

The Ashtart field is located approximately 60 km offshore in the Gulf of Gabes in a water depth of 6 m. The field was developed with a platform complex and an offloading vessel in 1974, which makes it the first offshore development in Tunisia. Current Ashtart production is around 10,000 bbl/d.

The TPS fields, one offshore and 4 onshore, are located in the vicinity of Sfax and Kerkennah Island.

The oil production of around 5,000 bbl/d is treated and collected at two stations from where it is transported to storage and offloading facilities in La Skhira.

OMV's exploration activities in Tunisia are presently focused on Sidi Mansour, where seismic data have been gathered in the shallow waters between Sfax and Kerkennah Island to evaluate drilling prospects.

Following completion of successful drilling campaigns, further activities are planned in the Jenein Sud exploration license.

In November 2009, OMV commenced a five-well drilling campaign in Jenein Sud and, early 2010, was granted the Nawara production concession, (50% OMV, 50% ETAP (Tunisian State Oil Company).

Development work is on-going and includes the construction of field infrastructure and the STGP, which will facilitate the transportation of gas from the south to Gabes and on to the Tunisian domestic market.

In early 2012 and after Pioneer acquisition, OMV has boosted its activities in South Tunisia

- Production increased by 55% to 10.1 kboe/d in 2011
- Nine consecutive successful wells proved >400 bcf gas (>68 mn boe)
- 2 OMV operated rigs drill for South Tunisian oil development project.

The figure below shows OMV activity fields in Southern Tunisia

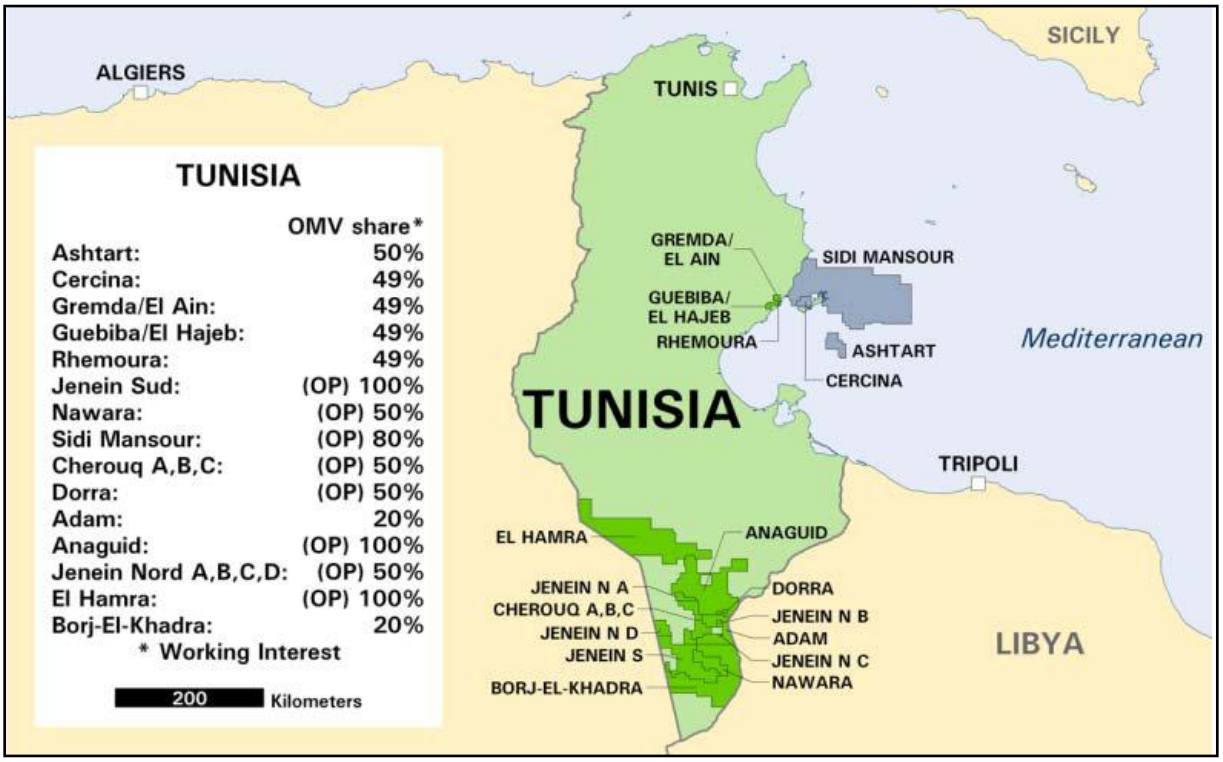

Figure 3 : OMV activity fields in Tunisia.

OMV applies the principles of best practices as well as strict standards in the fields of health, safety, environment and quality during the execution of operational activities.

OMV strive to engage themselves, their neighbours and all stakeholders in minimizing the impact on the environment and in enabling sustainability in their areas of operation.

3. Introduction of the actors

3.1 Introduction of the impact assessment consulting firm

TESCO is a consulting and engineering company in charge of developing this Environmental Impact assessment.

Founded in 2005, **TESCO** is continuously gaining ground in the market in the field of elaborating environmental impact assessments and waste water treatment. TESCO has elaborated EIAs for national and international companies.

3.2 Introduction of the Gas Pipeline EPCC contractor

The Gas Pipeline contractor has not yet been selected at the date of preparation of this study.

OMV will choose national and international contractors.

Once selected, the contractor's name will be transmitted to ANPE.

Contractors must respect all environment, health and safety standards and guidelines and will be committed to follow the recommendations proposed by the present EIA.

Project legal and institutional framework

1. Legal and institutional framework

- Decree no. 2005-1991 of July 11th, 2005, relating to the Environmental Impact Study.

- - Law no. 75-16 of March 31st, 1975, enacting the Water Code that contains various provisions governing, safeguarding and valorising the public water domain. According to the terms of article 109 of this code, it is illegal to allow for the flow, discharge or throw away into the public water domain any residual waters as well as waste or substances that are likely to impact public health or the proper use of such waters for any potential usage.

- Law no. 82-60 dated June 30th, 1982, pertaining to the transportation of hydrocarbons in the form of gas or liquid.

- Law no. 88-20dated April 13th, 1988, as modified by the Law no.2005-13 dated January 26th, 2005, pertaining to the revision of the Forest Code.

- Law no. 88-91 of August 2nd, 1988, establishing the creation of the "Agence Nationale de Protection de l'Environnement" (ANPE) as modified by the Law No.92-115 of November 30th, 1992. According to the terms of article 8 of this law, industrial operators who harm the environment or whose activities cause environmental pollution through solid, liquid or gaseous waste or other, are required to dispose, reduce or possibly recover the discharged materials as well as to repair the resulting damages. The National Environmental Protection Agency (ANPE) is entitled to go to court and defend any case aiming at repairing any damage to public properties.

- Law no. 90-56 of 18 June 1990, concerning the incentivization of exploration and production of hydrocarbons.

- Law no. 91-39 of 8 June 1991, pertaining to the management of major disasters.

- Law no. 94-35 of February 24th, 1994, pertaining to archaeological, historic and traditional heritage code.

- Law no. 96-41 of June 10th, 1996, concerning wastes and the control of their management and disposal. Wastes are classified according to their origin as domestic waste or industrial waste and according to their characteristics as hazardous, non-hazardous or inert waste. The management method of hazardous waste is regulated. The list of hazardous waste is established by the Decree no. 2000-2339 of October 10th, 2000.

- Law no. 97-37 of June 2nd, 1997, instituting the rules that govern the road transportation of hazardous material aiming at preventing the risks and damages that are likely to impact persons, properties, and environment. Hazardous materials are divided into 9 classes. The list and definition of

materials of each class, which could be transported by road, are determined by decree.

- Law no. 99-93 of August 17th, 1999, enacting the Hydrocarbons Code as modified by the Law n° 2002-23 dated 14 February 2002, the Law n° 2004-61 dated 27 July 2004 and the Law n° 2008-15 dated 18 February 2008.

- Law no. 2001-14 of January 30th, 2001, establishing the simplification of Procedures in relation to the authorizations delivered by the "Ministère de l'Environnement et de l'Aménagement du Territoire" in the area of its jurisdiction.

- Decree NO 84-1556 dated 29 December 1984 regulating industrial allotments.

- Decree no. 85-56 of January 2nd, 1985, relating to the organization of waste disposal into receiver environment (sea, lakes, sebkhas, streams, underground water tables, etc.). Waste water can be discharged into the receiver environment only after having been processed in accordance with the appropriate standards.

- Decree No. 87-654, dated 20 April 1987, determining the forms and conditions of road occupancy.

- Decree no. 90-2273 of 25 December 1990, governing the internal regulation of ANPE inspectors.

- Decree no. 2002-693 of April 1st, 2002, setting up the conditions and modalities for lubricants and used filters recovery, in an effort to ensure their rational management and to prevent their discharge into the environment

- Decree no. 2005-2317 of August 22nd, 2005, establishing the "Agence Nationale de Gestion des Déchets", (ANGed). With reference to article 4 of this decree, the Agency prepares the specifications and the authorizations files pertaining to waste management in accordance with the regulation in force and follows up their execution. In addition, the Agency is required to monitor the registers and the rosters that must be held by institutions and enterprises in charge of the collection, transportation, disposal and recovery of waste for their own benefit or on behalf of third parties.

- Decree no. 2005-2933 of November 1st, 2005, establishing the prerogatives of the Ministry of Environment and Sustainable Development, which include the necessity of making sure that the Tunisian government abides by international environmental agreements.

- Decree n° 2005-3079 of November 29th 2005, establishing the list of hazardous materials transported by road under the control and escort of security units.

- Decree no. 2005-3395 of December 26th, 2005, establishing the conditions and the modalities for collecting used accumulators and batteries.

- Order of the Ministry of Industry and Commerce dated 17 September 1987 enacting the Tunisian standard NT 109.01 governing the transportation of liquid hydrocarbons by gas Pipelines.

- Order of the Ministry of National Economy of July 20th, 1989, enacting the Tunisian standard NT 106.02 which defines the conditions for discharging Waste effluents into water (marine public domain, hydraulic public domain and sewage network)

- Order of the Ministry of National Economy of December 28th, 1994, enacting the Tunisian standard NT 106.04 concerning the limit values and guideline values of pollutants into the air.

- Order of the Ministry of National Economy of August 15th, 1995, enacting the Tunisian standard NT 109.01 concerning safety procedures during the construction of gas Pipelines.

- Order of the Ministry of Environment and Sustainable Development dated March 23rd, 2006, pertaining to the creation of a hazardous waste processing unit as well as reception, storage and transfer centres.

- Order of the Ministry of Agriculture and Hydraulic Resources of July 19th, 2006 establishing the list of rare and endangered species of wild fauna and flora.

- Order of the Minister of Environment and Land-use Planning dated February 28th, 2001 approving the specifications establishing modalities and conditions of collecting, transporting, storing, processing, disposing, recycling and recovering non-hazardous waste**.**

The Tunisian legislation extends to the following international conventions:

- Vienna Convention for the protection of the ozone layer, Vienna March 22nd, 1985 (accession of Tunisia by the Law no. 89-54 of March 14th, 1989)

- Montreal Protocol on substances that deplete the ozone layer, Montreal September 16th, 1987 (accession of Tunisia by the Law no. 89-55 of March 14th, 1989)

- The United Nations Convention on Biological Diversity signed by Tunisia during the Earth Summit in Rio De Janeiro on June 5th, 1992, and ratified on May 3rd, 1993 by the law N0.93-45

- United Nations Framework Convention on Climate Change signed in 1992 in Rio, during the Earth Summit. Tunisia, which has ratified this convention on 15 July 1993, has the obligation to communicate to the Conference of the Parties the required information pertaining to the national inventory of greenhouse

gases and to provide an action plan aiming at mitigating climate change and its negative effects;

- The Kyoto protocol, appended to the United Nations Framework Convention on Climate Change, adopted in Kyoto on 10th of December 1997 (accession of Tunisia by the Law no. 2002-55 of June 19th, 2002)

- The Stockholm Convention on persistent organic pollutants (POPs) adopted in Stockholm on May 22nd, 2001, and signed by Tunisia on 23 May 2001 (approved by Tunisian Law no. 2004-18 of March 15th, 2004).

2. Other regulations

In Tunisia, it is necessary to refer to the French regulations such as:

- Order of November 9th 1989 pertaining to the distance conditions of which depends the delivery of authorization for liquefied gas tanks. Modified by the order of 9 September 1993, the order of 30 October 2001 and the order of 5 June 2003.

- Order of November 19th 1975 modifying the order of September 4th 1987 relating to the rules of construction and Operation of petroleum and derivatives processing plant.

3. AfDB environmental guidelines

The African Development Bank has set up some environmental assessment guidelines which are employed by the bank's project officers in order to apply the bank environmental policy of the bank which had been approved by the Board in 1990. In addition to defining the environmental categories of the projects that are funded by the AfDB and the associated level of environmental assessment, the guidelines present for each stage the requirements and the responsibilities related to the environmental assessment of the various stages of the project cycle.

The AfDB environmental policy takes into consideration challenges and opportunities available throughout the continent and relies on the fundamental principles hereinafter that should normally be considered as prerequisites for any sustainable development and which are listed in a certain number of international agreements:

- A strong and diversified economy represents a clear condition for capacity building in the field of environment protection; however, all decision-taking processes at the level of the Bank take into account economic, social and environmental factors;

- Environment management tools, in particular environment assessments, contribute to ensure the ecological viability of the Bank's operations and to systematically monitor their environmental performance;

- Community participation in decision-taking about the management of natural resources that has an impact on the most excluded and vulnerable groups, must be ensured, and the importance of traditional knowledge should be recognized and preserved;

- Transparency and accountability of management structures and institutions, that are mindful of the needs and priorities of the impacted communities in general, and of the poor populations and vulnerable groups in particular, need to be encouraged;

- A coordinated approach for ecological initiatives throughout the continent must be adopted by setting up partnerships with other actors, in particular with multilateral development banks, bilateral organizations, UN institutions, research institutions and NGOs.

In order to implement this environmental policy, the AfDB adopts the following approaches:

- Taking into consideration the ecological sustainability in all Bank operations
- Strengthening of the existing environmental assessment procedures and creation of new tools for environment management
- Clear definition of Internal responsibilities levels
- Institutional support and capacity building for RMCS
- Public consultation and information dissemination
- Setting up Partnerships
- Compliance evaluation and follow-up

Project presentation

1. Project limits and timeframe

1.1 Project limits

The projected Gas Pipeline will connect Nawara CPF (Governorate of Tataouine) to the gas treatment plant in Gabès crossing the Governorate of Kébili (South Douz and North Douz) and Mednine (far west of Beni khedache) (Fig.4).

It will be buried because of its length (about 370 Km). The burial will be in compliance with safety and security measures required by the NT 109.01 standard.

The steel piping will have a 24” diameter.

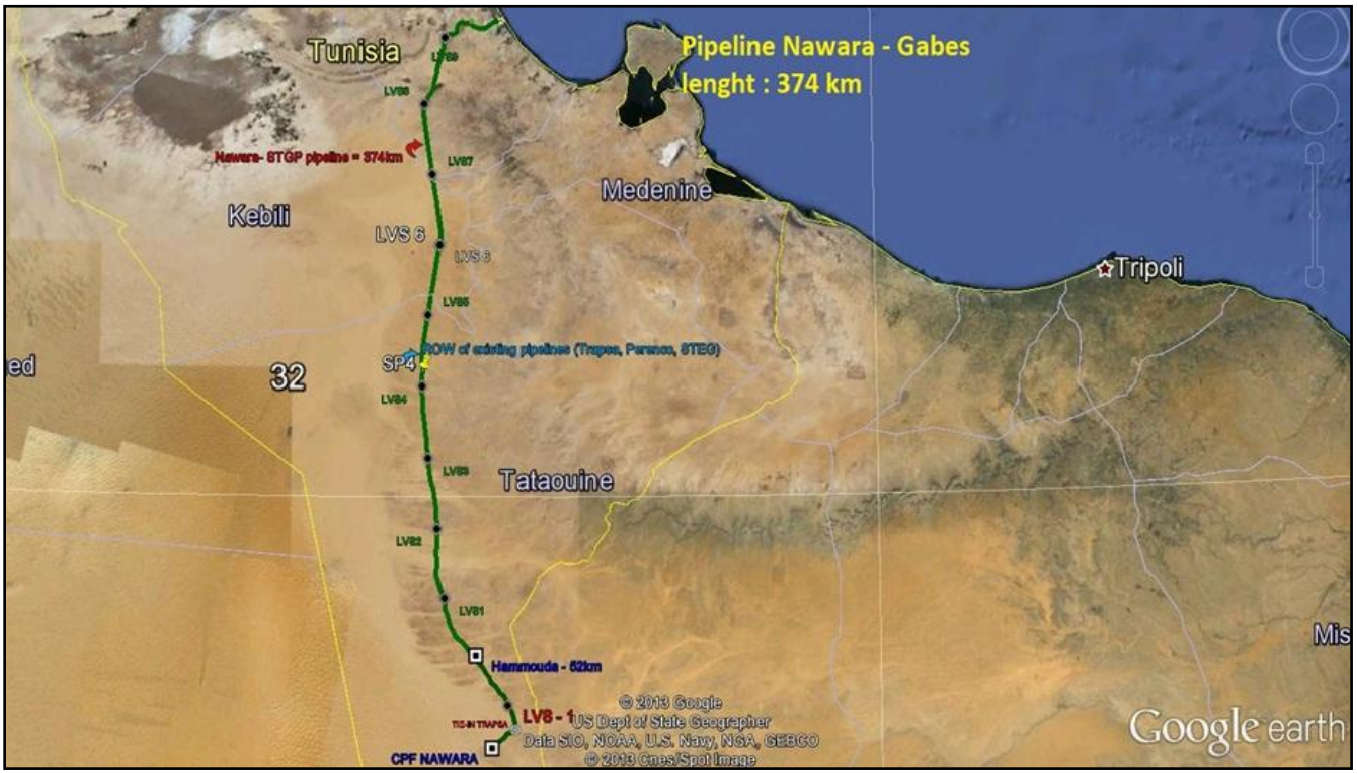

Figure 4 : Project limits

1.2 Timeframe

a- Field development and construction

This stage includes:

- Preliminary work: (design, permits...)
- Field arrangement along the gas pipeline route to prepare for its laying
- Preparation of temporary access roads

- Installation of mobile and temporary offices for contractors and engineering companies...

- Installation of concrete analysis laboratories

- Preparation of temporary storage areas

The table below shows the estimated implementation schedule for the various steps involved in the construction of the pipeline:

Table 1: Project schedule

Stage	Duration	Starting date	Ending date
Engineering	288 days	17/4/2014	25/12/2015
Supply	365 days	3/7/2014	25/11/2015
Construction	289 days	11/2/2015	21/3/2016
Tests and commissioning	112 days	26/11/2015	29/4/2016

b- Operation phase

The projected Gas Pipeline Operation duration is 30 years.

c- Abandonment phase

Some solutions relating to the abandonment of the Gas Pipeline will be presented in this study taking into consideration all the factors that would allow to restore the original aspect of the field without causing any damage to the environment.

2. Description of the project

2.1 Project general description

The project involves the construction of a 370 Km long pipeline.
The route crosses four governorates, i.e. Tataouine, Kébili, Mednine and Gabes. The gas pipeline will convey the gas processed in the Nawara concession in Southern Tunisia (Appendix 3). The gas will be transported through the pipeline to the treatment plant of Gabes where it will be distributed to STEG (commercial gas and condensate) and to SNDP (propane and butane) through export lines whereas the stabilized condensate will be transported by pipeline or trucking, these two alternatives will be developed by the EPCC contractor

2.2 Project detailed description

a- Gas pipeline route

Two alternatives were initially proposed for the Gas Pipeline route: the Eastern Route and the Western Route.

The Eastern Route was chosen on the basis of security standards and economical and environmental analyses. The choice of the Western Route was based on the fact that the “western route” runs along an existing gas Pipeline.

Choice criteria were therefore based on technical and economical studies according to the existing facilities and infrastructures in the compression station of Oued Zar and/or the treatment plant in Gabès.

Precise cost estimate was an important factor for making the choice of the appropriate Route.

The Western Route was chosen taking into consideration some factors such as the length of the Gas Pipeline and the existing infrastructure, ranging from Hammouda station to the processing plant in Gabès.

The Western Route crosses four Governorates, i.e.:

- Governorate of Tataouine: Remada and Dhéhiba
- Governorate of Mednine: far west of Beni Khédache
- Governorate of Kébili: Northern Douz and Southern Douz
- Governorate of Gabès: El Hamma, Matmata, Matmata Djedidah and Western Gabès.

Along the gas Pipeline, 12 line valve stations will be installed to ensure the control and safety of the gas transportation from the Nawara CPF to the Gabès treatment plant

The land management will be delegated to a specialized contractor who will ensure that

The process will be made in accordance with and not limited to the following:

- The Hydrocarbon Law applicable to the land management process (Articles 84-85-86) and any Tunisian law applicable to this process
- Tunisian Labour Code
- Tunisian laws and decrees concerning the transportation of oil and gas.
- The NT 109-01 concerning the gas pipeline
- Tunisian laws concerning the uprooting of olive and palm trees
- Provide a comprehensive list of lawyers, notaries and bailiffs in each governorate (Tataouine, Kebili Mednine and Gabes) involved in the crossing of the pipeline, for the conduct of administrative and paralegal services related to the acquisition process and land management
- Provide a comprehensive list of landowners who will be covered by the compensation
- Hold meetings with owners and local authorities to discuss the rights of way
- Prepare minutes of meetings with owners and local authorities

- Actually work with lawyers, notaries and bailiffs throughout the whole period of service provision
- Regular update of maps and gas pipeline route
- Involve agricultural experts and land surveyors during the expertise in order to properly assess compensation ...

This procedure will be detailed in the social study that will be attached to this Environmental impact assessment

b- Construction related equipment

The different equipments to put in place are:

- A 24'' diameter steel pipe for the main pipeline arriving from the CPF Nawara concession.

- A steel pipe with a 20" diameter for the export line of commercial gas arriving from the gas processing station to STEG.

- A steel pipe with a 6" diameter for the export line of propane going from the gas processing station to SNDP.

- A steel pipe with a 4" diameter for the export line of butane going from the gas processing station to SNDP.

- Markers every 10km (along the main pipeline).

- 12 line valve stations along the route, one every 30 km (safety distance as per the ASME code).

c- Gas Pipeline installation

The various stages of the gas pipeline installation are as follows:

- Design of the route: To get the proper layout, the design of the pipeline must:
* Respect environment
* Minimize disturbance to land owners and residents
* Avoid significant natural barriers

- Stock-taking of the status before the works: It consists of evaluating the Existing site status. It will help define the compensation for loss or damage by the end of the field works.

- Preparing the Runway: Aimed at facilitating the continuous traffic of the construction and earthmoving machinery and the storage of excavated material. This will be temporary and will go along the gas pipeline installation.

- Cladding: It is the transportation, loading and pipe alignment along the track.

- Bending: the pipes are bended on site to adapt to the terrain profile and to the turns of the route.

- Welding: the pipes are welded end to end in compliance with the standards and regulations in force.

- Welding control: The welding is controlled by X ray method to ensure the proper implementation of the line assembly.

- Coating: the welding seams are covered with three layers of polyethylene.

- Trenching: Earth moving is done in two steps in order to separate the vegetal soil coat from the deeper layers.

- Coating control: the quality of the anti-corrosion coating is inspected right before the burial.

- Burial: The pipeline shall be deposited gradually in the bottom of the trench.

- Topographic survey: the pipeline position is precisely determined so as to design the right plans for a good implementation.

- Backfilling: It is done in two steps so as to have the vegetal coat on the surface.

- Hydraulic tests: The pipeline is filled with water, and then tested at a pressure of 150% of the rated working pressure, in compliance with the Tunisian standard NT 109.01. in order to check its tightness before filling it with gas.
Hydraulic tests Water will be collected in watertight evaporation pits which characteristics are as follows

- Restoration: the initial site profile is totally reconstituted, the trenches and banks are restored, and fences are rebuilt. The soil that is packed by the heavy machinery is decompacted by sub soiling.

- Stock-taking of the status after works: It allows to identify the damages that were caused and to determine the amount of compensations to be engaged.

3. Utilized resources

3.1 Raw materials

a. Construction stage

For the construction of the gas pipeline and the transportation of final products, steel pipes are required.

The following table shows the various pipe features:

Table 1 : Gas Pipeline and final products Export lines characteristics.

material	Design pressure Bar	Maximum design pressure °C	Maximum pressure during transfer °C	Diameter	Length km
Nawara gas					
Steel	111.	55.	50.	24.	370.
Sale gas					
Steel	92.	50.	55.	20 "	0.6.
Propane					
Steel	40.	60/ -44	50.	6''	1.
Butane					
Steel	40.	60/ -10	55.	4''	1.

The gas pipeline will be coated by 3 polypropylene layers.

b. Operational stage

The Gas transferred from the Nawara concession will have the following compounds:

Table 2 : Nawara Gas Composition

Components	Light	composition	Rich
Nitrogen	0.3230.	0.434.	0.5126.
Carbon dioxide	2.5102.	2.136.	2.0624.
Methane	86.5701.	78.522.	74.7733.
Ethane	5.2734.	7.085.	7.6734.
Propane	2.3702.	3.965.	4.2712.

Isobutane	0.4940.	0.912.	0.9987.
Butane	0.6650.	1.254.	1.4117.
Isopentane	0.3590.	0.693.	0.8650.
n-pentane	0.2280.	0.693.	0.5552.
PC6A*	0.2180.	0.05	0.0609.
PS1A*	0.5500.	0.164.	0.2127.
PS2A*	0.1950.	0.099.	0.1284.
PS3A*	0.1160.	0.066.	0.0866.
PS4A*	0.0490.	0.035.	0.0468.
PS5A*	0.0090.	0.007.	0.0088.
Hexane	0.0190.	0.715.	0.9964.
PS-1*	0.0110.	1.298.	1.9264.
PS-2*	0.0010.	0.827.	1.2364.
PS-3*	0.0010.	0.575.	0.9211.
PS-4*	0.0010.	0.291.	0.5493.
PS-5*	0.0010.	0.091.	0.2229.
C7-C7*	0.0000.	0.097.	0.1399.
C8-C9*	0.0000.	0.073.	0.1046.
C10-C11*	0.0000.	0.042.	0.0604.
C12-C14*	0.0000.	0.041.	0.0589.
C15-C30*	0.0000.	0.081.	0.1161.
PS1S*	0.0140.	0.001.	0.0000.
PS2S*	0.0070.	0.001.	0.0000.
PS3S*	0.0030.	0.0001.	0.0000.

PS4S*	0.0010.	0.0001.	0.0000.
PS5S*	0.0000.	0.0001.	0.0000.
PS6S*	0.0110.	0.0001.	0.0000.

Gas characteristics are as follows:

- Water dew point: -12 ° C
- Hydrocarbon dew point at 35 bars: +5 ° C
- CO2 content: < 2 mole %

The Gas Pipeline will ensure the transfer of a maximum of 10 m^3 /day of raw gas.

3.2 Human Resources

a. Construction stage

Construction operations and laying of the pipeline will require the employment of 300 people working for 12 hours per day divided into three camps of temporary life.

b. Operation stage

During this phase, a team of six people will maintain the gas pipeline.

3.3 Energy

a. Construction stage

During the construction stage, the fuel supply will be ensured by licensed companies. The storage will be close to the construction fields in appropriate tanks.

Potable water will be supplied in bottles (mineral water). The daily consumption will be about 100l/p.

Tightness tests require water that will be supplied from water well at the level of NAWARA concession and for which drilling permit is underway with regional and central agricultural and water bodies.

b. Operation stage

During the Operation stage, electric energy of the LVS will be generated by photovoltaic facilities. Nitrogen, which will be required for such facilities, will be supplied in cylinders.

4. Handling of raw materials, sub-products and finished products

The steel pipe shall be stored in defined areas and chosen each time in accordance with the development of the pipeline construction on the side of the road under construction at a predefined halfway.

The auxiliary products are stored in a mobile store.

In the first stage, the gas generated in Nawara concession will be forwarded to the gas treatment plant in Gabes where it will be processed and distributed to STEG and SNDP.

The administrative procedures pertaining to the storage of radioactive material after usage,(seal welding inspection) as well as its storage and use on site , will be taken care of by the inspection agency in charge of the non-destructive tests for the welding seals by X-ray.

This radioactive resource will be stored in tight bunkers to prevent irradiation risks.

On the construction site, the operators must wear special outfits, be provided with badges and dosimeter- pens that will subsequently be analyzed every two months by the National Centre for Radiation Protection officers. The minimal age of the operators should not be lower than18 years.

5. Means of transportation

5.1 Construction stage

The pipes are brought by trailers. Each trailer will be loaded with 10 sections and each section should not exceed 14.6 meters in length.

Pipe sections to lay down will be maintained by side-booms.

The administrative procedures pertaining to the import, transportation, and shipment of radioactive material after usage, (seal welding inspection) as well as its storage and use on site, will be taken care of by the inspection agency in charge of the non-destructive tests for the welding seals by X-ray

The imports of radio-active material require the preliminary authorization of the Ministries of interior, public health, industry and transportation. The control agency must provide an imports license and a certificate for the utilization of the radioactive material

The radioactive material should be transported into sealed containers of B (U) type that are specially designed to prevent radiation risks.

Upon arrival at the port or airport, containers are strictly controlled. The tightness of the container is checked. The transportation to the inspection authority is made by

road under strict control and escort of security units of the National Guard (Decree 2000-439 of 14th December 2000).

Before arrival to the site, the radioactive material is filled into sealed containers and put aboard a vehicle, equipped with revolving lights, beacons, and a safety form.. The safety form is specified by the order of the 'Ministry of Interior' and 'Ministry of transportation' dated March 18th 1999. It specifies the template of the safety form pertaining to the transportation of the hazardous material by road, outlining the information that should be contained, namely:

- The name of the substance and its class (Class 7 radioactive material in accordance with Article 13 of Law 97-37 of 02/06/1997)
- The nature of hazards entailed by the material
- General guidelines to be respected in case of accident or incident.
- First aid
- Identity, address, phone number and Fax number of the sender.

A copy of the safety form must be displayed in the passenger compartment and should be clearly visible and accessible.

5.2 Operation stage

The gas from Nawara will be conveyed through the pipeline constructed over a length of 370 Km

6. Balance sheet

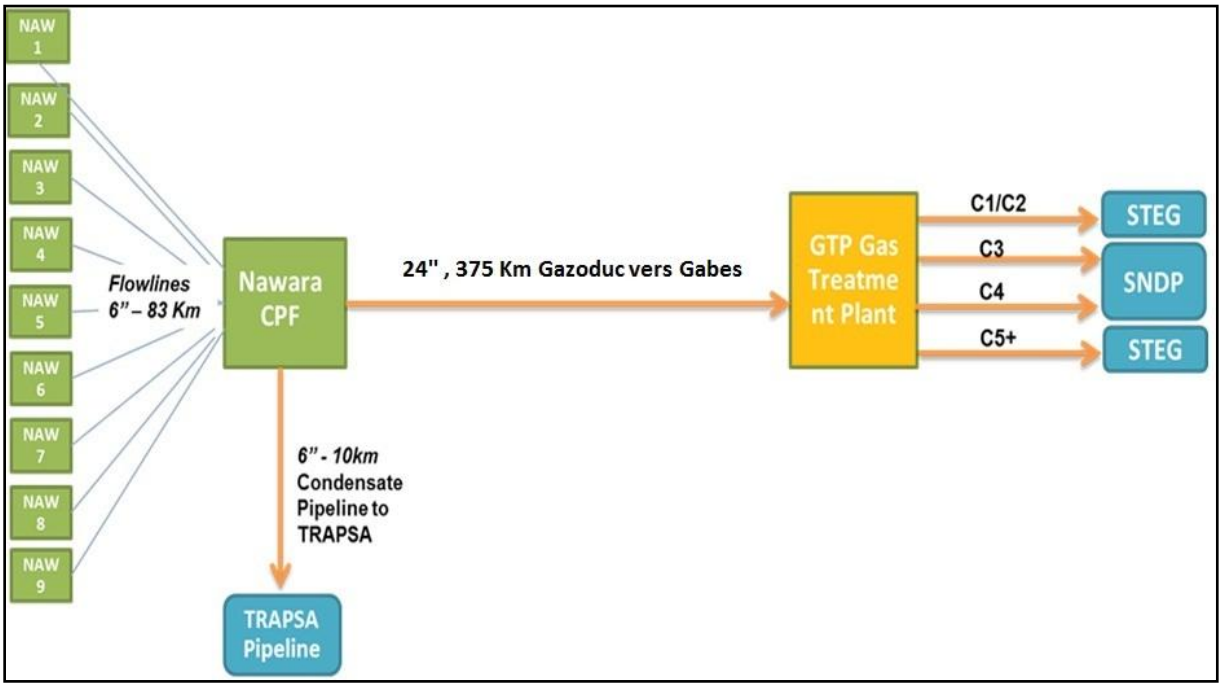

Figure 5 : Balance sheet

The Gas Pipeline will ensure the transfer of a maximum of 10 m^3 /day of raw gas.

7. Control, waste elimination and effluent treatment

7.1 Construction stage

- Solid waste: These are food waste (food, plastic bottles ...) and industrial (batteries, tires…).

Among the solid waste, we can find pipes plastic caps that count as much as 53000 caps.

The waste is collected and sorted (food, batteries, plastic bags...) and transferred to the closest dump and treated according to the usual procedures. The details of the procedures will be developed by the EPCC contractor of the gas pipeline.

The recovery, processing and disposal of waste must be ensured before demobilizing the contractor.

- Waste water: Water discharges are of two types: sanitary water and hydro test water.

Sanitary water is collected in septic tanks that are built within the workers life camp which is erected in the vicinity of the trench to be built and then treated.

These pits are emptied every day. At the end of the construction phase, these pits will be backfilled.

Before commissioning of the pipeline, all lines will undergo a hydraulic test in accordance with the technical specifications required to verify the integrity of the gas pipeline.

Water, originally used for hydraulic test, will have similar physical and chemical properties to drinking water; it will be mixed with corrosion inhibitors and antioxidants to ensure pipeline integrity as the duration of stay of this water will be important and will be the same used during hydraulic tests for the other sections

The test of each section will be made by 32-km section, separated by temporary scrapers. These scrapers can both clean the pipeline and control the amount of water introduced into the pipeline.

Therefore, only the water in the first section is supposed to contain the waste existing within the pipeline.

Supposedly contaminated by welding debris, additives and possibly fat and sand, the water will be collected in evaporation ponds that have sealed walls.

After the hydrostatic test, the pipeline will be wiped to remove any residual water by means of an injection of air or gas. Once dried, the pipeline will be blown off with nitrogen prior to being put to service.

The evaporation ponds will be built at the CPF (Governorate of Tataouine). They are made from the pits resulting from the extraction of limestone used in the construction of the pre-processing station (CPF).

Additional evaporation ponds can be built according to the project requirements, the choice of the location of these tanks will be made by the contractor according to the specificities and the choice of the hydro test method; Furthermore OMV undertakes to communicate the final location of these tanks and to ensure, through the contractor, to implement the necessary requirements for environmental preservation.

The local environment parameters (wind, temperature and expanse) promote the establishment of evaporation ponds which will be designed and managed in compliance with environmental, health and safety requirements of the World Bank for the development of 'Onshore Oil & Gas'.

The design of the evaporation pond must consider the following requirements:

- The choice of the coating which should provide a permeability coefficient (sides and bottom) inferior or equal to 1 x 10-7 cm / s;
- The coating material will be selected in accordance with the characteristics of the water that will be used. The coating will be thick and strong enough to preserve the integrity of the tank;
- Precautionary measures are taken to prevent the intrusion of surrounding natural elements or the pit failure during heavy storms
- Means to prevent the intrusion of people, livestock or wildlife (e.g. camels);

At the end of operations, the elements contained in the evaporation pond will be eliminated as a result of analyses and in compliance with the waste management plan. The site will return to its initial state.

The heavy machinery is maintained in a drain bay, and used water is collected in a tank. Used water will be treated regularly.

- **Atmospheric emissions**: Mobilization of transportation means for pipelines (trucks, side-booms,) and gear for the construction generates exhaust gas and dust, which also comes from the tracks and development work and pipe laying.

Activities related to the installation of the pipe take place 6 days a week at the rate of 12 hours a day.

Emissions will be minimized through regular maintenance of equipment and permanent watering of the tracks.

Workers will be protected by work uniforms and protective equipment (respiratory masks).

- **Sounds and noise**: The various activities on site as well as the mobilization of equipment and trucks will produce noise throughout the work period. These noises are temporary.

Work schedules will be respected in order to minimize noise especially in populated areas.

Workers will be protected by helmets

- **Oils and lubricants**: The maintenance of equipment will be done in oil drain bays. Oils and lubricants will be collected in metal drums to be delivered to the SOTULUB.

- Radioactive waste: After laying the pipes, the welding seams are tested by a radioactive source.

By the end of use, the agency in charge of inspection should make an export request for the disposal of the exhausted radioactive source after its use in the inspection of the welding seals, to the same country that shipped it.

The radioactive source will be returned according to the storage and transportation conditions that are required for imports.

7.2 Operation stage

Maintenance and cleaning of the pipes will entail a minimum volume of released gas. Such quantities are not harmful and will have no impact on environment, due to the safety features that are available throughout the gas pipeline.

8. Accidents, risks/ Follow up and control

During the land development and construction operations stages, as well as during gas pipeline operation, controls are undertaken by workers, engineers and various operators so as to avoid or minimize risks of potential accidents.

Accidents and risks potentially generated by these activities are:

- Risk of accident during the mobilization of the trailers while transporting pipes;
- Work accident while handling machinery during construction
- Negligence in operation during handling;
- Gas leak, or broken pipe or rupture or anomaly in the operation of facilities.
- Gas leak or burst pipes during trials with gas;
- Risk of visual pollution can be caused by a pile of pipes;
- Traffic disturbance

- Destabilization and contamination of soils.
- Change in the natural flow of surface waters.
- Risk of groundwater pollution and rising
- Solid waste generation (domestic, industrial, construction material).
- Risk of radioactive radiation during the welding seals test.

The gas Pipeline route is close to El Hamma quarries, near Gabès (figure 6).

The risk of pipe bursting or subsidence / ground elevation due to the pressure caused by the explosives used in quarries is to be considered as potential. Thus, measurement campaigns for the wave propagation during explosions should be undertaken so as to be sure that the gas pipeline is not impacted by such waves.

Risks could also be natural and threaten human life or facilities related to the Gas Pipeline. These are for instance:

- Seismic activity
- Risks caused by dune displacement
- Landslide
- Subsidence due to ground collapse.

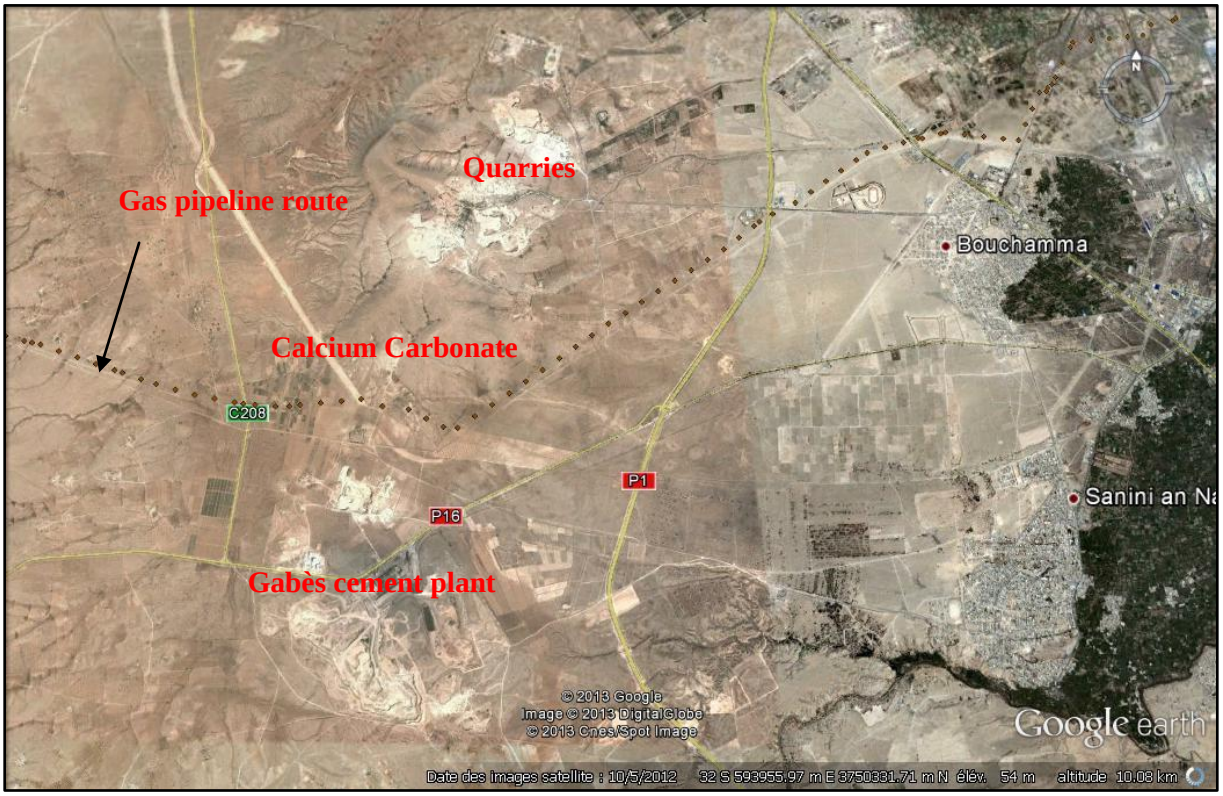

Figure 6: Location of the gas pipeline in relation to El Hamma quarries.

In a normal situation as well as in a situation of emergency, a network communication system by fibre optic, with a “bell” shape configuration, is installed along the gas pipeline route; it supplies all data and media required for a proper communication.

Project natural framework

1. Introduction

The description of the natural environment was based on a literature review and site visits have been scheduled in two campaigns, the first was carried out from 13 to 16 May 2013 and covered the governorates of Gabes and Kébili and the second, conducted on 22 and 23 March, 2013, was carried out to describe the NS section of the route starting from Tataouine Governorate (Nawara CPF).
The photos included in this study were taken during these visits.

2. Baseline survey of the project site and its environment

2.1 Description of the natural environment

a- Geology

Southern Tunisia is considered as a stable platform which relays southward the South Chott Range. This area is divided into two zones: the Dahar Jeffara to the West and Jeffara in the East (Figure 7). The Dahar is a steep sloped plateau, and Jeffara is a collapsed structure filled with a very thick siliciclastic series that date back to the Mio-Plio-Quaternary.

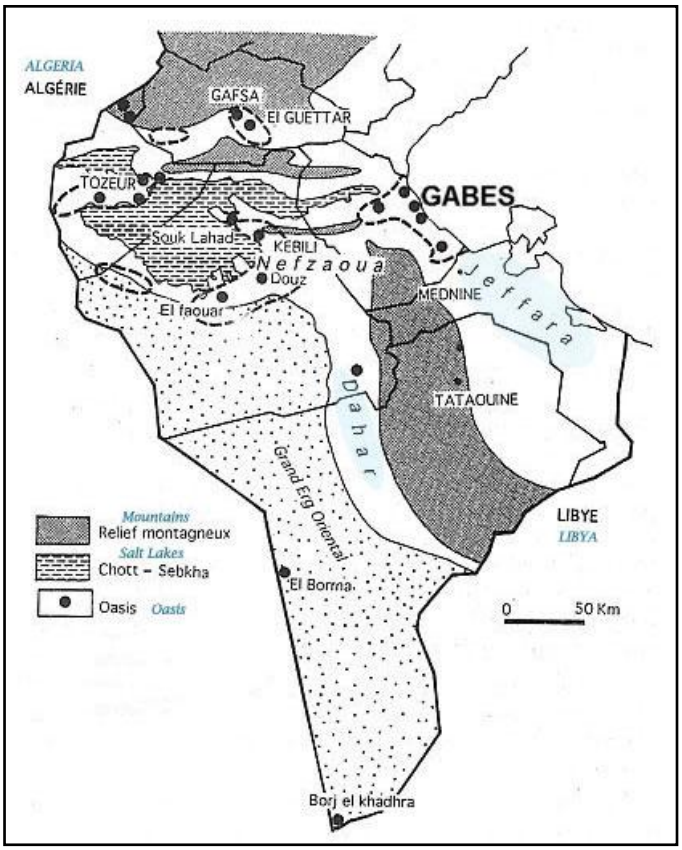

Figure 7 : Southern Tunisia

The Dahar lithostragraphic series dates back to the upper Triassic-Cretaceous. Lithofacies are of an evaporitic, carbonate and clayey-marly nature. This series refers to a platform-type sedimentary environment. Northward (the southern chott range, Matmata, El Hamma...) the lithostratigraphic series show intervals of sandstone and sand (lower cretaceous)

The project route will cross the Dahar structure and El Hamma Mountains. Two different geological situations are present:

- N-S portion crosses the Dahar. The substratum dates back to the Coniacian-Campanian. It is represented by the alternation of marly limestone and stratified often chalky limestone. This succession is covered by crusts and dunes (figure 8,9 and 10).

Figure 8 : Planned Gas Pipeline crossing by Remada pavement

Figure 9 : planned Gas Pipeline crossing by Bir soltane dunes

Figure 10 : limestone crust

- The NE-SW stretch will cross El Hamma Mountains and the plain of Gabes (figures 11, 12). The series dates back to the Lower Cretaceous- Miocene. It consists of clay, marl, limestone, dolomites, silt and sand. The route crosses variable age units.

Figure 11: Carbonates and clay of Lower Cretaceous, El Hamma.

Figure 12 : Silt

From the Structural point of view, the Dahar corresponds to a tabular structure that is locally impacted by faults. The layers are sub-tabular and rarely show a dip of 5° on average (figure 13). The Matmata-El Hamma Mountains are linked to the distortion of the chott range. These are anticline structures that are greatly affected by rifts.

Figure 13: tabular structure of the Dahar, el Hamma.

b- Geomorphology

For the N-S stretch, geomorphology is characterized by the dunes of the eastern Erg located on the West (figure 14 and 15). All the way along the route, Geomorphologic elements are the same.

Figure 14 : Crossing of the planned gas pipeline.

Figure 15 : Eastern erg dunes, Bir Soltane.

For the NE-SW stretch, geomorphology changes and it consists of regional loess development, with a regional extension (figure 16).

Figure 16: Loess

Structures are crossed by talweg and ravines. Dolomitic limestones form plateaux in the shape of cuestas with steep slopes (figure 17and 18).

Figure 17: Projected Gas Pipeline crossing at El Hamma Mountains

Figure 18 : Ravines, El Hamma

Geomorphologic formations are particularly visible in Matmata-El Hamma. The main elements are:

- ***Upper terraces:***

They are typical of the main wadis flowing from Matmata Mountains. These terraces date back to Mio-Plio-Villafranchian period. They could have hectometric extentions. They are composed of heterometric pebbles of variable types. Red to beige silt lentils, of calcareous concretions, of variable development, sometimes fit between coarse formations. The deposit which is loose at its base, is characterized by a progressive consolidation of the elements at the top, where a brittle crust and/or a limestone crust in slabs or in sheets are developed. But the most frequent aspect is puddingstone with the cementing of the detritus.

- ***Silts with calcareous concretions and calcareous crusts:***

A considerable volume of silts (loess) fills intra-mountains basins such as the one in Matmata, Techine and Beni Zeltène. These silts, which thickness may sometimes exceed 15 meter, display various sequences of colours and are more or less carbonated, as well as levels of calcareous crust and paleosoils. Undoubtedly caused by wind, they underwent a complex evolution since their deposit. Silts of the same type, with calcareous concretions, also spread in the coastal plain and the northern edge of Dahar. It is a thin wind veneer on the dolomitic and limestone slopes as well as on

Mio-Plio-Villafranchian material of the interfluves strips. Along the oueds, silts fossilize the raw deposits of the upper terrace.

- ***Middle terraces and glacis:***

Between Gabès and Oued Akarit, a glacis pf accumulation, between Gabes and Oued Akarit, sliced by 10 meter high oueds, extends from Jebel Eddissa and Dahar Ouedhref to the sea.

The glacis forms a steep cliff at the mouth of Oued Akarit. Between Gabes and Wadi Zigzaou, a terrace which often fits into the whole Mio-Pio-Villafranchian and, more rarely, in the upper terrace of variable width: it may indeed be in the form of a bench , as wadi El Ghirane, or a depositing plain of one kilometre wide along the oueds of Essoureg and Jir.

These middle terrace and glacis of accumulation contain silt and gypsum clay, that is crystallized (desert rose) and slightly compacted with various colours (red, white, beige, yellow) of a few meters thick. Some beds are containing black organic material that range in thickness from centimetres to meters and are visible at different spots in the banks of Oued Akarit, Gabes, Essoureg and Marsit.

Some lenticular coarse partings, intercalate within the silty clay formations. At the top develops a gypsum crust that is often thick.

- ***Lower terrace:***

It is present throughout the oueds and fits indistinctly into the Mio-Plio-Villafranchian, the upper or the middle terrace. It is little extended upstream, but it widens up downstream, reaching 1 km. The two meter thick deposit displays a longitudinal grain shaped formation containing pebbles and gravels at the outlet of the mountains range, becoming gradually finer downstream.

Due to its extension between the dunes of the great eastern Erg and the chott El Djerid depression on one side, and theTebaga Range and Matmata mountains on the other side, the Nefzaoua displays the more representative geomorphologic landscape of the Tunisian Sahara. The pattern evolves from cuestas to piedmonts and to Hamadas.

- ***Cuestas***

Monocline forms constitute the cuestas: those of the Tebaga Range, which are formed by one single cliff at the level of Djebel Aziza and which constitute westward a first cliff (476 m) at Foum el Argoub, and a second one, further north, with only 422 m.

- ***Piedmonts***

They are interlocked glacis ending downstream into talweg. Around the Chott, they have the shape of dissected mounds.

- ***Hamada***

They form the typical landscape of the region, bordered by the Tebaga in the North, the Dahar to the East, the Great Erg dunes to the South and the Nefzaoua to the West. The hamadas consist of slab and cracked blocs that develop on Senonian formations. The Water system stems from the Tebaga Range and Matmata mountains to the closed depressions in the region (Garaet or chott). Some oueds reach the Chott Djerid. Nowadays, only the oueds coming from Matmata Mountains are active. Man can also find wind formation such as sand dunes which are distributed throughout the region and become dense southward near the great eastern Erg. They are lined up and oriented SW-NE in harmony with the dominant wind, and they usually cover the Hamadas.

c- Climate

Southern Tunisia is characterized by an arid climate with strict temperature variation between night and day The maximum temperature is 40 ° C in summer, while in winter it is 15 ° C on average

Annual evapotranspiration is about 2500 mm. These severe climate factors make water runoff rare and contribute very little to the recharge of deep groundwater aquifers.

Table 3 : Average temperatures, Relative humidity and Evapotranspiration in the crossed governorates.

Governorates	Average annual temperatures (°C)	Relative humidity %	Evapotranspiration (mm)
Tataouine	**20**	**<10%**	**1693.**
Kébili	**21.32**	**54.3**	**727**
Gabès	**18.5**	**35%**	**1568.1**

Source: INM, 2011

The annual rainfall is unevenly distributed throughout the year. It is below 150 mm/year. The climate is very severe: the average annual rainfall varies between 80 and 150 mm/year.

Table 4 : Annual Average of rainfall in the crossed governorates

Station	Average annual rainfall (mm)
Tataouine	123
Kébili	60.2
Gabès	74.28

Source: INM, 2011

Table 5 : Wind in the three Governorates

Governorates	Season	Windy days	Number of sirocco days	Maximum speed Km/h
Tataouine	Winter	-	37days /year	13
	spring			
	summer			
	autumn			
Kébili	Winter	7	0	116
	spring	12	2	
	summer	8	12	
	autumn	5	4	
Gabès	Winter	5	14	25
	spring			
	summer			
	autumn			

d- Hydrology

From the South to the North, the water system varies according to rainfall. The N-S stretch, one can find flat bed oueds that get occasionally flooded (figure 19).

Figure 19 : Example of an Oued bed crossed by a segment of the N-S gas pipeline

In the region of Matmata-Gabes-el Hamma, the water system is more developed. The catchments basins are represented by monocline geological structures (figure 20)

Figure 20 : A tributary at El Hamma.

e- Hydrogeology

Aquifers

Aquifers are variable in age, nature, depth and extension. Chemical composition of water varies from an aquifer to another. In southern Tunisia, Groundwater aquifers are numerous and unevenly distributed at the level of their importance. There are two types of aquifers: the deep aquifers that are vital for water needs and those which are superficial and that have less importance.

In southern Tunisia, there are two deep aquifer systems that have an extension at the level of the northern Sahara. The 'Northern Water System of the Sahara' "SASS", extends over a vast area which limits are located in Algeria, Tunisia and Libya. The basin includes a series of aquifer layers which have been regrouped in two reservoirs known as 'Continental Intercalaire' (CI) and 'Complexe Terminal' (CT).

In the region of Gabes- el Hamma- Matmata, Aquifers cover a complex geological area (figure 21). Lower Cretaceous or 'Continental Intercalaire' outcrops in Chott El Fajjej. Several oil or water tallied it in depth, under Jeffara and in the sea where water quality is bad. The 'continental Intercalaire' consists of four distinct units:

1. Clay and sandstone unit (bottom): It dates back to Wealdian and its local deposit is found in chott El Fajjej as part of the great Saharan Groundwater of 'continental Intercalaire'.
2. Clay and gypsum unit (Neocomian)

3. Sandstone unit (Barremian) found in the drilling operations of Ouedhref and Metouia and giving bad quality water.
4. Aquifer Dolomitic unit (Albo-Aptian) in Koutine.

The Middle Cretaceous includes the little permeable clay, gypsum and dolomite Cenomanian and the dolomite Turonian which is cracked and Aquiferous.The latter forms an important water relay under Matmata Mountains feeding the Jeffara from the waters flowing from the great sahara CI aquifer. Upper Cretaceous consists of lowerer Senonian with the following composition:

1. Marl and gypsum unit with intercalation of calcareous banks that could be Aquiferous. It is called Horizon B of Mareth.

2. The calcareous unit, which is the main aquifer of Jeffara, is known as horizon A. It is sometimes highly karstified, and is used for coastal drillings between Ghannouch and Zarrat.

The transition from upper Cretaceous to Miocene corresponds to a sedimentary gap. The Miocene is represented by marine Vindobonian, including a series of sandy Aquifers in Djerba-Zarzis. The Mio-Pliocene is a continental series which consists of:

- A 50 meter thick sand unit lying on either marl gypsum lower Senonian, or on the limestone A unit of the lower Senonian, or directly on Barremian sandstone of the CI, in Metouia and Ouedhref. This sandy unit constitutes the main aquifer in Northern Gabes.

- A marl-gypsum unit constitutes the impermeable top of the sand layer. Its thickness is about 30 to 150 m, sometimes reaching 500m.

Quaternary deposits cover the entire Djeffara plain: More or less clayey wind sand, locally cemented, alluvial wadis, shelly limestone; they form the deposit of a relatively continuous surface layer. The water system of Zeus Koutine, in the southern limit of the Gabes plain consists of calcareous and dolomite structures of upper Jurassic.

For example, the coastal region of Gabes and its hinterland include about ten Aquifer levels, whether separated or not by impermeable or semi-impermeable layers, and contain several extensions. These Aquifers are respectively, in geological formation order, from the bottom to the top:

- Calcareous and dolomite of the Upper Jurassic in Zeuss Koutine
- Clay sandstone unit of the Wealdian in ‘Continental Intercalaire’ in Chott El Fajjej
- Sandstone of Barremian
- Dolomite of the Albo-Aptian in Koutine
- Cracked dolomitic Turonian

- Calcareous horizon B of Lower Senonian in Mareth
- Calcareous Horizon A of lower Senonian in Southern and Northern Gabes
- Vindobonian Sand layer
- Mio-Pliocene sand unit of Northern Gabes
- Quaternary Superficial aquifer

The Jeffara plain structurally corresponds to is a NW-SE tectonic pit bordered to the West by the Dahar monocline.

The collapsed part is made of NW-SE tiers and orthogonal faults which affect the eastern edge of Matmata and Tebaga mountains. The main faults are: Mednine-El Hamma fault and the coastal fault.

The deep water hydrodynamics is strongly determined by these two faults (figure 19).

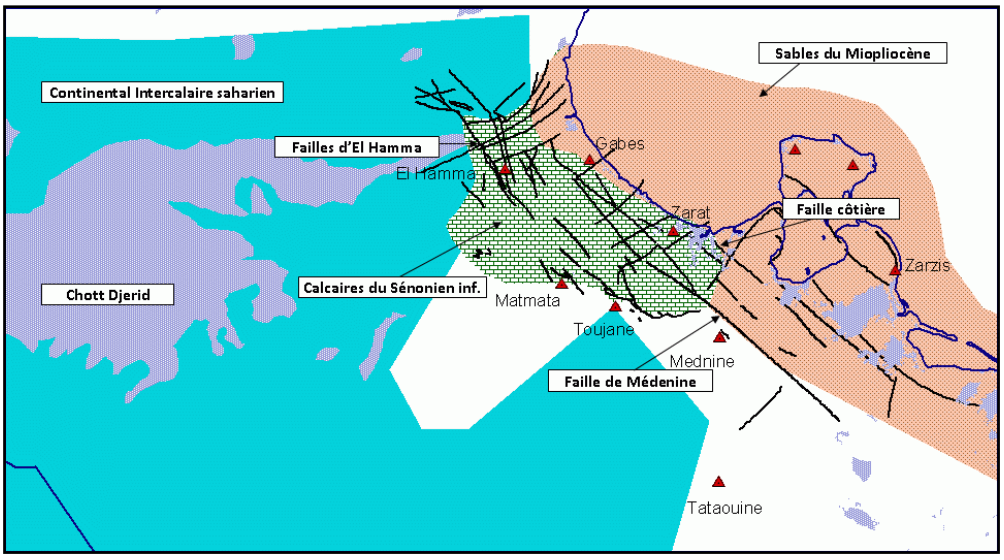

Figure 21 : Map of aquifers in Gabès region (ADF, BRGM, 2010-2013 projects)

In the region of Nefzaoua, three groundwater tables are exploited; they are different according to their geological and chemical characteristics and according to the feed in zones.

- The groundwater Terminal Complex: it feeds in Senonian and Mio-Pliocene formations from rainwater and runoff, their flow is about 9.6 m3 / s and salinity is variable between 1 and 3 g / l within a N/S gradient in the Nefzaoua.

- The Quaternary superficial groundwater located in clay-gypsum and sand quaternary formations in chott El Fajjej and Chott El Djerid

- The groundwater table of the Intercalaire Complex is fed by the faults of El Hamma, Gabès and Mednine: its flow is about 5.3 m^3/s and its average salinity is 4 g/l

f- Soil cover

The nature and quality of the soil cover are widely affected by the ancient and current climate. Thus, soils are primitive and not much developed in general. Soils are developing on limestone and dolomite, on calcareous crusts and/or gypsum and on a gross colluviums of the slope (figure 22).

Figure 22 : Primitive soil development on calcareous crust.

The different types of soil are:

- Treated soils (poorly developed soils): These are erosion soils (lithosoils and Regosoils)

- Alluvial soils particularly developed in 'jessours' made by the inhabitants on the ravines, similar to hill reservoirs.

- Isohumic Soils with sierozenes that are more or less encrusted;

- Calcomagnesimorphic soils on crust or gypsum crusting,

- Holomorphic soils developed around sebkhas and dry lakes.

This soil cover is influenced by drought cycles and by the substratum nature (figure 23). Thus, the relief allow for the development of lithosoils and regosoils: That is the case in El Hamma, Matmata and Dahar.

Figure 23 : Palm trees affected by drought.

g- Air quality

In the absence of industrial activities (except for Gabès), atmospheric pollution is due to aerosol (mineral dust) caused by wind.

In the neighborhood of Gabès, atmospheric pollution is caused by industrial activities (phosphates and derivatives). Air pollutants are mainly SOx, NOx, O3 and PM10. Air quality index is not well documented in Gabes

h- Flora

Flora is widely affected by the arid climate. Disseminated vegetation is depending on soil quality. The Identified species in southern Tunisia are:

Atriplex suberecta, Bassia indica, Bromus catharticus, Caesalpinia gilesii, Casuarinas stricta, Cionura erecta, Fumaria capreolata, Fumaria mirabilis, Heliotropium currassavicum, Hordeum murinum, Hornungia procumbens, Lawsonia inermis, Malvaparvi flora parviflora, Nicotiana glauca, Ocymum basilicum, Rubia tinctoria, Sphenopus divaricatu

The vegetation inventory in Nefzaoua shows two types of vegetal cover:

- Vegetation adapted to sand such as: Limoniastrum guyonianum, tamarix pauciovulata, Suaeda fruticosa

- Vegetation more adapted to salt and drought such as: Zygophyllum album,Halocnemum stabilacum, Salicornia Arabica, Nitraria retusa, Vegetal cover is dominated by chamephyte steppes (figure 24).

Figure 24 : Steppe development

Among species in the region, man can find esparto, Sparta, Jujuba, retam, ankle, tamaris, white Artemisia vulgaris, rantherium, gymnocarpos decander, aristida pungens, calligonum comsum.

Salty soils are covered by halophyte vegetation.

Thanks to 'jessours' (figures 25), farming activities of the Dahar mountains inhabitants has developed in the form of cultivated plots with fruit-trees (fig trees, olive-trees, palm-trees, vines, almond trees,...) and cereals. The rest of the mountainous space is devoted for pasture and esparto production.

Figure 25 : Type of 'Jessours'.

The water and soils conservation adjustments have a direct impact on run-off reduction with sediment settling and water storage increase in the soil. CES adjustments trap solid supply brought by water that is composed of thin fractions of silt, clay and sand. That contributes to reconstituting the soils behind the 'Jessours', leading to fertile lands.

In the Matmata mountains, soil accumulation in the back of the 'Jessours', their high content of organic materials and their good capacity of water retention contribute to the development of fertile land that is appropriate for fruit trees and cereals growing in an environment of poor quality soil. The fruit-trees and cereals plantation in the space of water retention contributes to the production enhancement and the soil stabilization against hydric erosion.

In the regions of Matmata Al jadida, el Hamma and Gabès, lands are used as plots for seasonal cultivation and for planting fruit-trees, olive- trees and oases

i- fauna

From the Dahar to the Eastern Erg, animals exist and populate the arid zones. The sand gazelle lives in the northern and eastern parts of the Great Erg. The gundi, fennec and other rodents, reptiles and insects are also living there.

Many sedentary bird species are adapted to the climatic conditions and several migratory species make a rest there. This zone is a route for camel drivers according to climate conditions.

In the Matmata and El Hamma mountains, wild life is represented by sedentary and migratory birds, fennecs and rodents, reptiles and insects.

Domestic fauna is mainly represented by dromedaries, ewes and goats. Piedmonts and depressions constitute the best routes for this fauna.

The Gas Pipeline route is devoid of ecological interest areas.

j- Protected areas

According to article 7 of the order of the Minister of agriculture and water resources dated September 24th 2008, pertaining to the organization of hunting during the season 2008/2009, hunting, destruction, capture, sales, purchase, hawking and possession of the following species is forbidden at all times:

- - Mammals: Barbary deer, gazelle, buffalo, serval, mountain goat, lynx, cheetah, hyena, fennec, porcupine, bats, white hedgehog, wild cats, otter, monk seal, wild boar and all baby mammals
- - Birds: bustards, pink flamingo, stork, spoonbill, slender-billed curlew, white-headed duck, marbled teal, ferruginous duck, sultan buzzard, corncrake, nocturnal and diurnal raptors , as well as nests, clutch and eggs.
- - Reptiles and amphibians: tortoise, turtle, desert lizard, frog, chameleon.

Export, import and transit of all wild species is forbidden in any form whatsoever except when a special authorization is granted by the forest General Manager.

Taxidermy of wild species is submitted to the specifications approved by the order of the Minister of the agriculture on March 28th 2001.

2.2 Landscape

Three landscapes are available along the route of the Gas Pipeline:

- **Desert landscape: :** (figure 26) with two essential elements: the last outcrops to the west of the Dahar, covered by calcareous crusts and by little and big dunes of the eastern Erg. The route crosses these two elements.

Figure 26 : desert landscape crossed by the NS stretch of the route.

- **<u>Mountainous landscape:</u>** **(figure 27)** represented by the Matmata-el Hamma relief's. It is materialized by cuestas and depressions filled with silts. Some small oases exist there. This landscape is also characterized by the 'Jessours" (hill reservoirs) which stabilize, recover and form soils.

Figure 27 : Mountainous landscape crossed by the planned gas pipeline (El Hamma).

- **Plain landscape:** (figure 28) represented by North Djeffara. It consists of plains used as routes and as cereal cultivation land, oases and seasonal fruit trees cultivation.

Figure 28 : Projected crossing near cultivated areas at Chenchou, Gabès.

2.3 Description of the human, socio-economic and cultural environment

a- Background data

The Western Route will cross the delegations of Gabes West, El Hamma, Matmata Djedidah, Matmata (Governorate of Gabes), Douz North and Douz South (Governorate of Kebili), and Dhehiba and Remada (Governorate of Tataouine).

Characteristics of the governorate of Tataouine (ODS, 2011)

- Natural and geographic characteristics: vast spaces, diversified natural Resources (petroleum, gas, useful substances and groundwater)

- Economic characteristics: The region economy is mainly based on agricultural activities such as animal breeding and fruit tree cultivation.

- Tourism: it's a growing sector with promising prospects. The region has presently eight hotel units as well as relay and tourist stations.

Characteristics of the governorate of Kebili (ODS, 2011)

- Important natural potential: mobilized water resources estimated at 269.2 million m3, cultivated lands (50 thousands ha) and wide grazing routes (approx. 587.4 thousands ha) and potentially industrial useful substances (clay, rocks...)

- Population 131914 inhabitants in 1994, 143.200 in 2004 and 152.900 in 2011.

- Infrastructure consist of roads (760 km asphalt roads), industrial zones (89.4 ha) and a telecommunication network that connects the region to the national and international spaces.

- Diversified economic activities, based on date's production (112.000 t/ year), the production of early fruits and vegetables by geothermal waters as well as breeding, and a growing tourist sector with 12 listed hotels, 27 travel agencies, 28 leisure centres...

Characteristics of the governorate of Gabes (ODS, 2011)

- A good geographic situation within the Mediterranean basin.

- A coastal oasis

- A diversified economy consisting of agricultural activities, fishing, an important industrial hub, various attractive natural sites, handicraft activities and various small professions.

- A modern and appropriate infrastructure composed of a commercial port, an international airport, railways (135 km) and roads (2118 km), as well as three

industrial zones (864 ha), an international trade-show, a university composed of 12 institutions..

- Important manpower.

b- Socio-economic data

Pastoral activities are the most important occupation in southern Tunisia. Non cultivated lands represent about 9/10th of the total surface.

In Gabes, farming activities are the dominant sector in spite of the increasing development of the industrial sector.

Agricultural activity:

The table below shows the agricultural surfaces in the delegations that will be crossed by the Gas Pipeline:

Table 6 : Agricultural areas crossed by the gas pipeline.

Governorates	Delegations	Field crops (Ha)	Vegetable crops (Ha)	Fern (Ha)
Gabès	Gabès West	700	395	-
	El Hamma	3.500	1.750	-
	Matmata Jadida	2.000	162	-
	Matmata	300	50	-
Kébili	Douz Nord	-	200	514
	Douz Sud	-	150	256
Tataouine	Remada	618	140	-
	Dhehiba	1.600	38	-

According the soil occupation map, the gas pipeline route will cross steppes and bare rocks.

Animal breeding activities:

Breeding in the main activity associated to the nomadic lifestyle. This sector becomes marginal because of the disappearance and depletion of the vegetal cover.

The following table shows the distribution of breeding in the different delegations

Table 7: Breeding distribution in the delegations crossed by the gas pipeline route.

Governorates	Delegations	ovine	caprine	camel	bovine	poultry
Gabès	Gabès West	17.400	10.080	-	5.645	90.000
	El Hamma	38.628	17.360	637	490	-
	Matmata Jadida	9.744	7.910	63	25	-
	Matmata	7.656	10.080	127	-	-

Kébili	Douz Nord	16.300	15.000	3.340	48	-
	Douz Sud	13.500	12.000	5.148	48	-
Tataouine	Remada	70.000	60.000	4.800	-	-
	Dhéhiba	26.000	29.000	1.300	-	-

Tourism

Saharan tourism is increasing despite the difficulties of this sector caused by many factors such as accessibility. The rehabilitation of accommodation buildings, roads, leisure sites, roman and Islamic remains, becomes necessary to the development of this sector in Tunisian Sahara.

Gabès region is characterized by a favourable geographic position in the Mediterranean basin. It is characterized by oases and hot thermal water springs. Gabès constitutes a transit point, contributing to considerable tourist activities in the southern sub-Saharan regions.

The southern region, covered by the study, is a military zone. The access must be authorized by a desert pass obtained from Tataouine Governor.

Historical sites

On the basis of published materials and the archaeological map of the area that will be crossed by the Gas Pipeline, the western route does not cross any historical or archaeological site. The only exception is a Barbary monument that exists on the edge of the route far from any contact zone with the Gas Pipeline.

In case of a discovery (archaeological remains, artistic or traditional objects) during the construction, laying and burial stage of the gas pipeline, OMV commits itself to inform competent authorities of the Ministry of Culture and Heritage preservation, or the nearest territorial authorities to monitor (should the need arise) the remains throughout the works.

Impacts assessment

1. Direct and indirect environmental impacts analysis

1.1 Construction phase

a- Impacts on geology and soil

Planned activities will have very limited impacts on geology and soil of the area, subject of the study.

Indeed, most of the crossed area is made of flat field, the topography will not be changed and erosion risks or soil destabilization will be reduced by mechanical compaction planned during the works.

Excavated materials will be used for backfilling. No additional material will be required for the burial of the Gas Pipeline. Nevertheless, in presence of rocky terrain, sand backfilling must be supplied from the neighbouring quarries to coat the pipeline with a 20cm thick sand layer so as to avoid the wearing of its polyethylene coating by contact with rocky bodies.

The backfill must be slightly raised from the floor to allow the soil to come back to its normal level after compaction.

However, the only risk incurred by the soil (modification of the vegetation) consists on an oil or lubricant, or fuel accidental leak from heavy machinery. These risks are negligible.

b- Impacts on superficial waters

Impacts of the construction stage are temporary and negligible.

Direct impacts are restricted to erosion and potential sedimentation in oueds during the rainy period. Gabions will be installed in order to avoid landslides, thus reducing erosion impact.

The hydro test water will be collected in evaporation pits with sealed walls.

Additional evaporation ponds can be built according to the project requirements. The choice of the location will be made by the contractor according to the specificities and the choice of the hydro test method; Furthermore OMV is committed to communicate the final location of these pits and to ensure, through the contractor, to implement the necessary requirements for environmental preservation.

An accidental fuel leak from the machinery threatens superficial waters. This risk could be avoided by regular maintenance for transportation and construction engines. Used maintenance waters are collected into pits.

c- Impacts on the deep waters

Groundwater will not be impacted by excavation and construction activities for the gas pipeline because the excavation depth will not reach the groundwater level.

d- Impacts on fauna

Construction and installation activities will cause a temporary disturbance to the animal life for the species living in the neighborhood of the gas pipeline route. This disturbance will stop after the end of the construction stage and the animals living in the sector will resume their normal life.

The pipeline sections during welding must be designed so as to preserve animal routes and itineraries.

Impacts on fauna are therefore negligible and temporary.

e- Impacts on vegetal cover

The installation procedures for the gas pipeline will require the destruction of trees as well as some vegetal species. After the end of these activities, vegetal life will start again gradually and slowly (at least 5 years) in view of the region climate.

The NS stretch does not require any vegetation destruction since, all the way through the route, no cultivated area will be crossed, as there is only a desert landscape devoid of any form of life protected or used by men (figure 29).

Figure 29 : No cultivated perimeters along the NS section.

However, from the town of El Hamma, the NE-SW section begins to cross some private and public irrigated perimeters. These perimeters represent cultivated areas (palm trees, olive trees, fruit trees ...) fenced by tabias to protect them from desertification, or greenhouse farming.

According to the map of irrigated perimeters distribution supplied by the CRDA of Gabes (figure 33), the Gas Pipeline route will cross:

- An irrigated perimeter in Chenchou (Figures 30 and 31)
- A private irrigated perimeter at El Khansria (Figure 32)
- A public irrigated perimeter close to Bouchemma. it is supplied by used and treated waters produced by a nearby station.

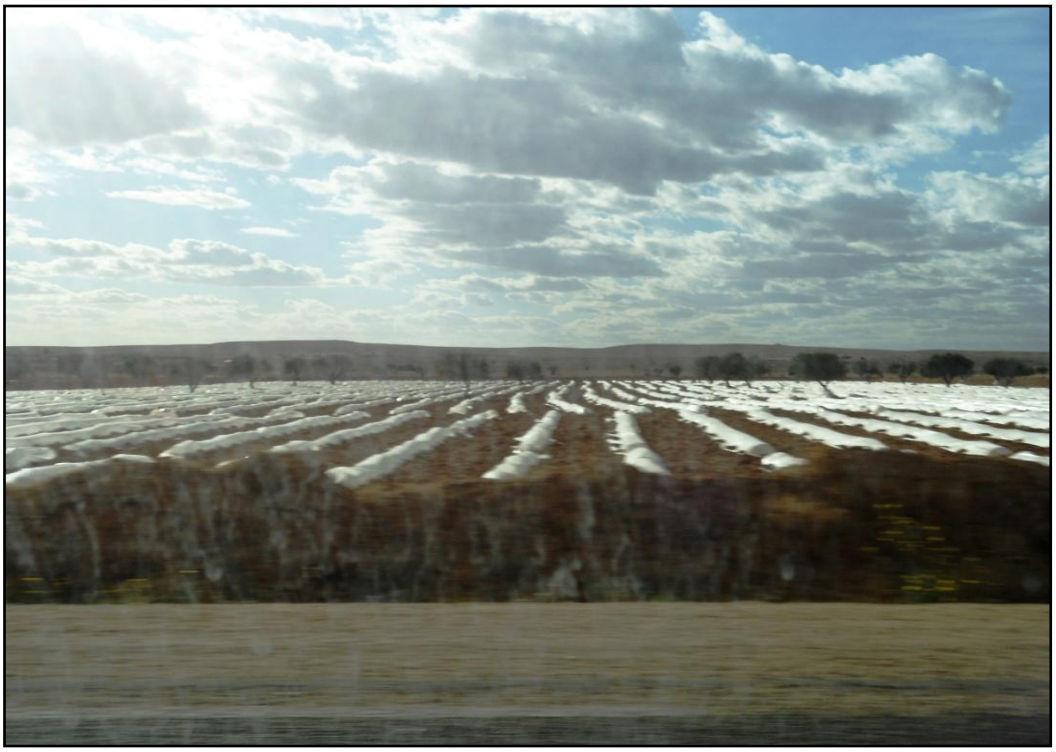

Figure 30 : Greenhouses at Chenchou

Figure 31 : Olive-trees at Chenchou

Figure 32 : Private irrigated area at El Khansria

It should be noted that a project "Bou Nejma" of geothermal farming extending over an area of 100 ha, will be located in Henchir Ed Douleb, it will be powered by the existing gas pipeline and by drill water under study.

Before actually accessing to the concerned space, the contractor has to give notice, in writing to the owners, the administration and public authorities at least one month before beginning works.

The developer designates a representative in charge of real estate, to take care of any issue raised by land occupation, whether private or public.

The owners will be compensated for the permanent occupation of the land (right of easement and right of way on a 6m wide strip for a period of 30 years and for any damage caused during the construction stage.

The estimate of these compensations will be made by a chartered agricultural expert operating in the region. A precise inventory of the damages will be made by the developer for each lot before starting the works.

The reduction of the work track in some places where the space between two rows of olive trees is less than 10 m so as to avoid as much as possible felling.

The developer must take any appropriate measures to make sure that rich vegetal soil, which will be put back on the surface during backfilling, is not mixed up with excavation material, which is unfit for cultivation.

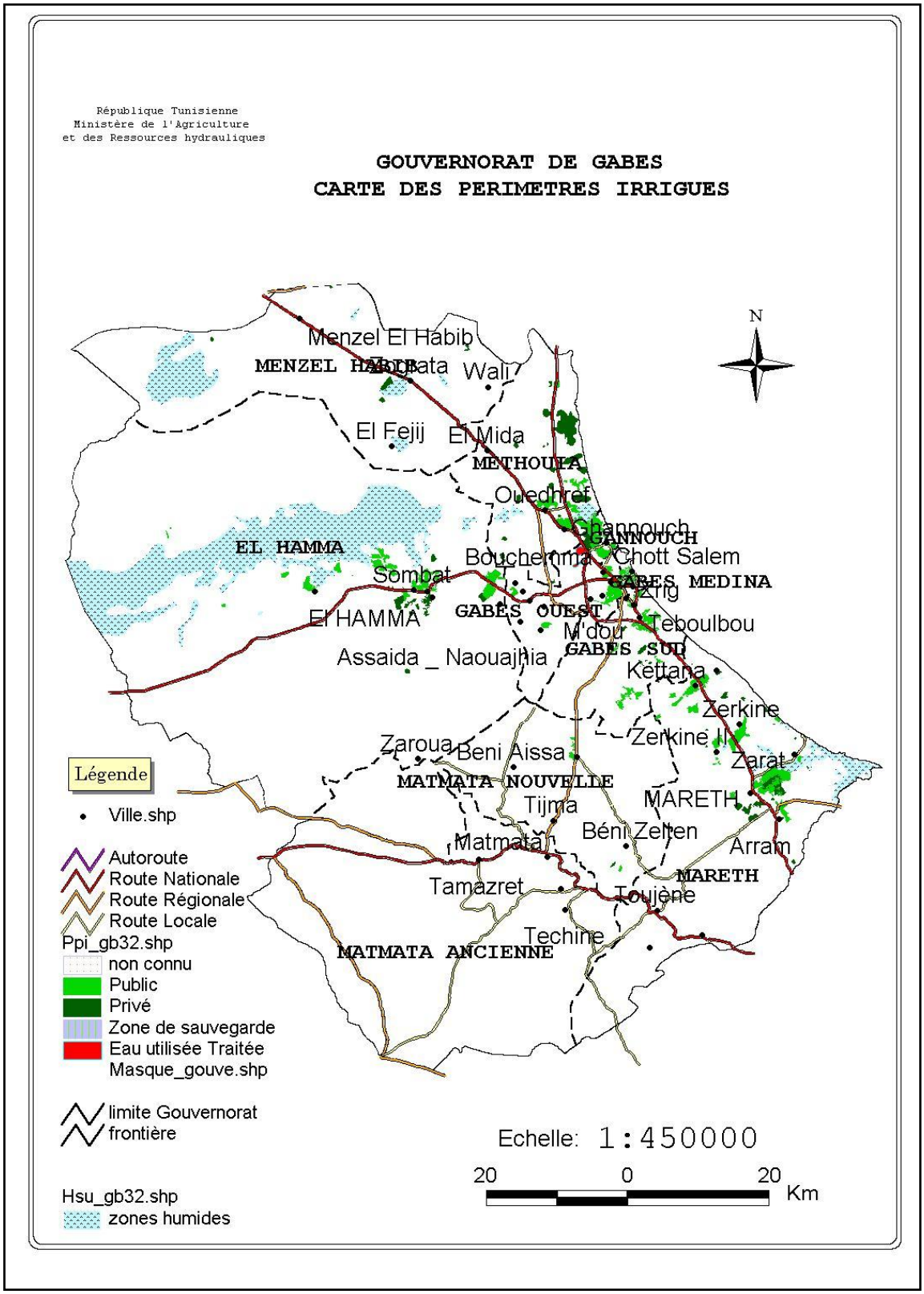

Figure 33 : Map of irrigated perimeters in the governorate of Gabès (Source CRDA Gabès).

Another risk threatening the vegetation is caused by the potential contamination of the soil by oil or lubricants leak. This risk is negligible and requires the workers' vigilance on site

f- Atmospheric pollution

Mobilized equipment and excavation activities can cause some noise and dust nuisances.

Gas Pipeline installation activities are to be implemented in desert areas except for Douz and Gabes where the route was chosen at the outskirts of the urban zones so as to avoid disturbing residents.

Noise is caused by construction engines and equipment. Construction activities are undertaken during the daily working times.

Atmospheric emissions (mainly dust and CO2) are caused by earth works and Gas Pipeline-laying activities. Construction activities will be conducted on the basis of 6 days per week and 12 hours per day. According to wind direction, dust will have an impact on vegetation and houses that may be present, particularly from Chenchou onward (olive trees, fruit trees...).

The atmospheric pollutants will consist of dust and fuel smoke generated by construction engines.

Before commissioning the gas pipeline, computed volumes of Nitrogen will be injected to remove the residual air to avoid explosion. Inert Nitrogen will be flared in the atmosphere beyond an air vent.

Atmospheric pollutants and noise will therefore be limited to the construction stage

g- Solid waste

During the construction stage, solid wastes are generated and consist of domestic waste (packing, plastic bags, bottles...), polyethylene waste, scrap, batteries...

Solid waste is also generated by the preparatory earth works for the operational strip over a 20 m. width (removal of the vegetal soil and cleaning of the track), excavation of the trench.

h- Waste oil

Maintenance operations will be carried out in specialized stations and drain bays which will be installed in the vicinity of the permanent life camp. Risks of oil Leak from used oils remain possible on the construction site and they threaten the quality of soil and superficial water.

i- Impacts on infrastructure and buildings

During the construction and pipeline erection stage, some infrastructures and constructions (electric poles, phone network, houses...) may be subject to risk, particularly when towns and populated areas are reached (Governorate of Kebili and Gabes) except in case of bypass.

The pipeline will pass close to two telephonic relay poles near Tafoutchana (Governorate of Gabes) (figure 34) and Bir Soltane (Governorate of Kebili) (Figure 35).

Figure 34 : telephone relay near the gas pipeline route.

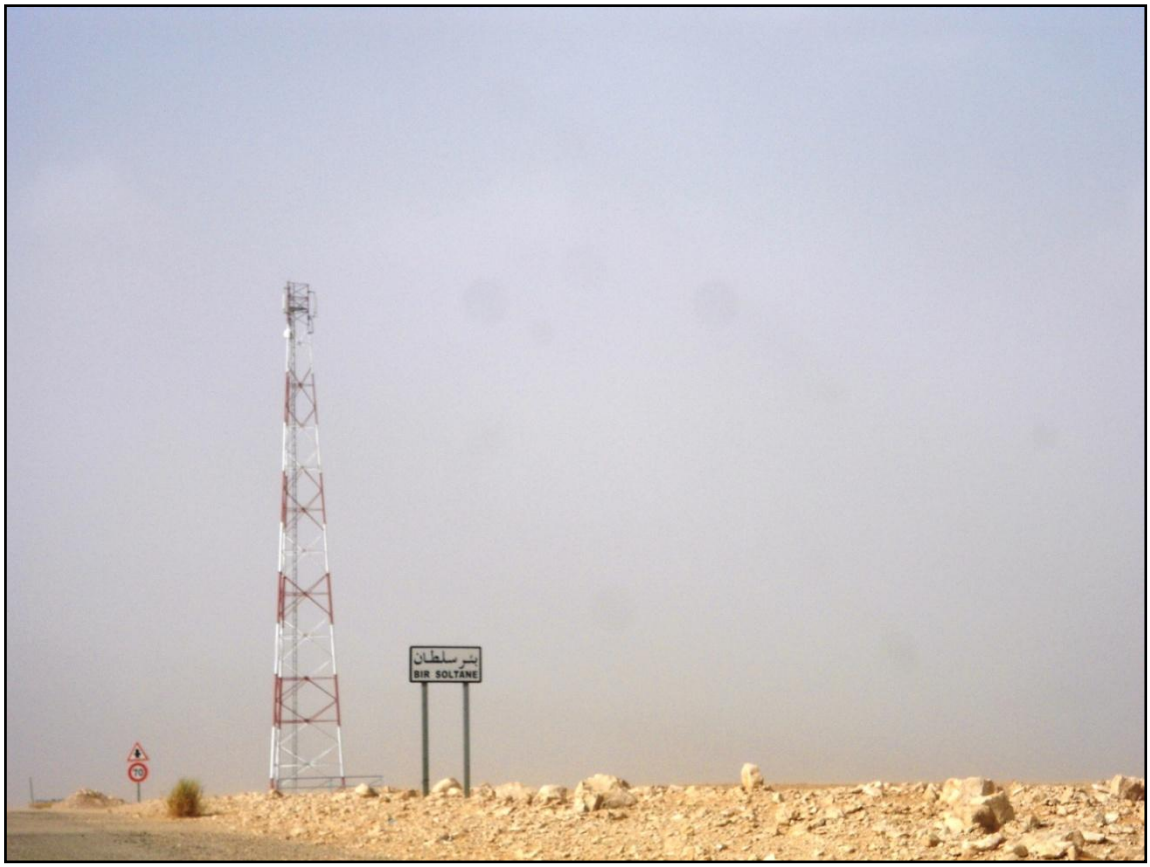

Figure 35 : telephone relay pole at Bir Soltane, close to the route.

The crossing of the gas pipeline by a "jessours" system is planned without causing any damage to the previous infrastructure (figure 36)

Figure 36 : Crossing close to the 'Jessours'

The planned Gas Pipeline will be parallel to an Existing Gas Pipeline (figure 37).

Figure 37 : Existing Gas Pipeline

The planned Gas Pipeline will cross close to electric poles in el Hamma as shown on figure 38

Figure 38 : Crossing of the pipeline near electric poles near the city of El Hamma.

Excavation activities (at low depth), laying down of pipes, backfilling and earth works will have no impacts on buildings and infrastructure stability in the neighbourhood of the works.

j- Impacts on the traffic

The route of the pipeline will cross the national roads RN1, RN16, RN20, regional routes RR104, RR107 (figure 39), RR114 and RR211 and local routes RL957, RL 1009 and RL 1021.

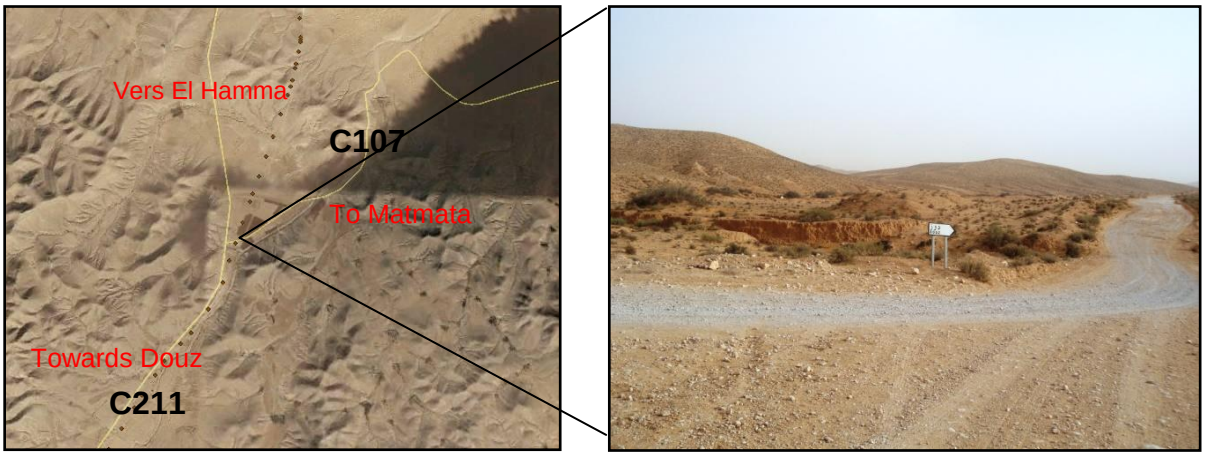

Figure 39 : junction between planned Gas Pipeline and RR 107

During the construction stage, the road traffic will be slightly disturbed. This will be caused by the engines mobilization transporting equipment and construction material, and to the mobility in the construction area.

This disturbance is temporary and local, as the construction areas will change as the pace of construction moves forward.

k- Impact on Safety and health

The excavations may be risky if they stay open too long especially by night and in particular close to urban settlements (Douz and Gabès delegations).

During construction operations and laying, some workers and staff are also at risk of recreational accidents (usual accidents).

During the construction stage and the inspection of the welding seal by (X) rays, some workers may be exposed to irradiation. Thus, various measures must be taken into consideration.

Close to El Hamma, anthropogenic activities start to appear and some domestic garbage or construction waste is deposited in the desert open space (figure 40). This can be risky for the health of the workers. Construction waste must therefore be

sorted and stored in specific areas to ensure the proper conduct of construction activities.

Figure 40 : Construction waste and household waste dumped in deserted areas.

I- Impact on archaeological and historical sites

The NS trench does not cross any historical or archaeological site. Actually, the planned crossing area is mostly a desert and the route will cross far from the troglodytes of Matmata and the 'Jessours' of Techine.

Similarly, the NE-SW trench that crosses el Hamma and Gabes is far away from the historic monuments of Gabes (mosques, mausoleum...).

Therefore, the Gas Pipeline construction will not have an impact on archaeological and historic sites in the governorates crossed by the pipeline.

m- Noise nuisance

During the construction stage, le sound level caused by the heavy engines mobilization (trax, side-boom, bulldozers...) remains below the acceptable limit values (60dB) for short–term exposure.

n- Impact of pipe storage before installation

The storage of pipes before installation can cause harmful effects to the environment in the area involved in the works.

Indeed, the piling up of pipes although arranged in a developed area that is separate and fenced, constitutes a danger to public safety and causes visual pollution.

These impacts are temporary and will be mitigated by measures that allow for the delivery, storage and installation method while ensuring the protection of people and environment.

1.2 Operation stage

a- Visual impacts

The Gas Pipeline will be buried, and therefore, will not cause a visual impact.

b- Noise and vibration

The Operational stage will not generate noise or vibration. Indeed, the Gas Pipeline will not be equipped with noisy elements because all facilities are mechanical and have a static activity. Moreover, the major part of these facilities will be buried or installed into closed buildings.

c- Gas Leak

To prevent gas leaks, OMV provides for a set of preventive measures:

- Placement of posts indicating the presence of the buried pipeline
- Signing of the pipeline RoW (right of way) to ensure safety
- Inform the authorities about the locations of the pipeline and its related facilities (LVS) and provide maps of the route ...

In case of accidental leakage, OMV has an emergency response plan. Indeed, the leak detection will be provided by a telecommunication and alert system: 'Leak gas system' with ultrasound sensitivity. The actuation of the stop valves (LVS) will isolate the network section during repair and maintenance operations.

d- Operation and maintenance waste

No waste will be generated during maintenance and Operation stages. In case of intervention on the Gas Pipeline, waste will be generated depending on the intervention type. These waste will be collected in a sealed pit..

e- Impacts on water resources

The Gas Pipeline will be totally buried and will not have an impact on superficial water resources. However, Gas Leak from the pipe may threaten underground water resources through the condensate that may deposit there.

f- Impacts on fauna

The Gas Pipeline will be buried and will not have impact on fauna.

g- Impacts on flora

The Gas Pipeline will not have an impact on flora in the crossed area. Agricultural perimeters and oases will not be disturbed. Owner just needs to avoid the final route which will be marked by beacons in compliance with the NT 109.01

h- Risks to the neighborhood

The most important impact is related to safety, i.e. gas leak or explosions of different nature. Construction activities will be done in compliance with the NT 109.01.

In the vicinity of urban areas that are close Gas Pipeline Douz, El Hamma, Western Gabès), some safety measures must be undertaken during the operation stage, such as the regular follow-up of the pipeline and sensitization performance of the interested departments by providing them with the gas pipeline master plan and its secondary facilities..

i- Impacts on socio-economical activities

The buried Gas Pipeline will not be an obstacle to socio-economic activities or to the extension of urban and other developments in the areas crossed by it. Regulatory protection measures have just to be respected.

1.3 Abandonment phase

The Operation stage is estimated to 30 years. At the end of this period, three scenarios are proposed to reduce the impact of the out of service pipe on the environment.

- Carry out the take-off for the pipes and all related elements and transfer them to a public dump.
- Give up the pipe in situ and assess its impacts on natural environment
- Consider the potential reuse of the pipeline.

2. Environmental impact assessment

The environmental Impacts assessment is based on potential impact resources sources that are inherent to the different stages of the project. The assessment is determined by estimating the importance and the certainty of the impact.

2.1 Importance of the impact

The importance of the impact is an indicator which allows estimating the effect on the environment after the construction and operation of the gas pipeline. It depends on three parameters:

- Resilience of the environmental element expressing the difficulties encountered during the project implementation according to the harm caused to this element.

- Its disturbance which is a qualification allowing to assess the impact intensity. It is assessed on the basis of the level of disturbance caused to the element impacted by the project.

- The extent of the impact that allows assessing the proportion of population or domain impacted.

The correlation between these indicators allows defining the level of impact:

- Major impacts: Those that generally correspond to the deep alteration of the nature or the use of an environmental element that has a high resistance and that meets the interest of the totality of the population or an important part of the population in the region of the project.

- Medium impacts: Those that correspond to a partial alteration of the nature or the use of an environmental element with medium resistance and that interest a limited group of the population in the region involved in the project.

- Minor impacts: corresponding to a minor alteration of the nature or the use of a natural element with minor resistance and interesting a minor group of the population in the region of the project.

- Minor to no impacts: Those that correspond to a minor alteration of the nature or the use of an environmental element with low resistance and interesting a limited group of the population in the region of the project.

2.2 Impact certainty

Three impact certainty levels are listed:

- An impact is **certain** when we are sure it will happen after its analysis
- An impact is **probable** when we are little sure it will happen after its analysis
- An impact is **less probable** when we are not sure it will happen after its analysis.

2.3 Impact duration

It is about defining the temporal aspect and reversibility characteristics of the impact. Three levels of duration are listed:

- **Long duration**: the effect is continuously felt during the project life cycle and even after.
- **Medium duration**: the effect is continuously felt but for a shorter period than the life cycle of the project.
- **Short duration:** the effect is felt for a short time generally for a shorter period than one year.

2.4 Type of impact

- **Positive** : if it presents advantages to the surrounding environment
- **Negative:** if it presents harmful impacts to the surrounding environment.

2.5 Impact level

- An impact is **high** if it destroys or modifies strongly the environmental element
- An impact is **medium** if it modifies an environmental element. This alteration modifies the quality of the element without jeopardizing its existence.
- An impact is **low** if it slightly modifies an environmental element

2.6 Impact mitigation level

A residual impact is defined by its capacity to be totally or partially mitigated by a mitigation measure.

A residual impact can be:

- **Incorrigible*:*** if no Mitigation measure can be defined to minimize its harmful effect.
- **Correctable** if Mitigation measures are defined in order to minimize partly or totally or even neutralize its effect.

3. Summary tables and impacts fact sheets

3.1 Construction stage

Table 8 : Summary table of impacts during the construction phase.

Environment	Environment components	Potential impacts	Impacts assessment				
			I	C	D	T	A
Physical environment	Soil occupation	Destruction of some olive and palm trees	1	E	1	-	O
		Occupation of large areas by storing pipes and equipment related to construction	2	C	2	-	O
	Landscape	Modifications due to excavation	1	E	1	-	O
	Air quality	Dust	1	C	1	-	O
	Noise and vibration	Engines noise	1	C	1	-	O
	Geology	No Impact					
	Morphology	No Impact					
	Protected areas	No Impact					
	Archaeological sites	No Impact					
Biological environment	fauna	Life system destabilization	2	P	1	-	O
	Flora	Destruction of olive-trees and some species	2	P	2	-	O
Natural resources	Water resources	Accidental leak of fuel, chemicals	1	P	1	-	O
Human and socio-economic environment	Employment	Job creation and re-energize the local economy and trade	3	C	2	+	
	Population	Public security	2	E	2	-	O
	Urbanization	No Impact					
	Tourism	Disruption of Saharan tourist activities	1	C	1	-	O
	Agriculture	Tree cutting	2	C	2	-	O
	Commerce and industry	No Impact					

Legend:

I:Importance	**C:Certitude**	**D : Duration**	**T : Impact type**	**A : Mitigation level**
1 : minor	C : certain	1 : short	+ : positive	O : correctable impact
2 : average	P : probable	2 : average	- : negative	N : incorrigible
3 : major	E : little probable	3 : long		

3.2 Operation stage

Table 9 : Impacts summary during operational stage.

Environment	Environment components	Potential impacts	Impacts assessment				
			I	C	D	T	A
Physical environment	Land occupation	No Impact					
	Landscape	No Impact					
	Air quality	No Impact					
	Noise and vibration	No Impact					
	Geology	No Impact					
	Morphology	No Impact					
	Protected areas	No Impact					
	Archaeological sites	No Impact					
Biological environment	fauna	No Impact					
	Flora	No Impact					
Natural resources	Water resources	No Impact					
Human and socio-economic environment	Employment	No Impact					
	Population	No Impact					
	Urbanization	No Impact					
	Tourism	No Impact					
	Agriculture	No Impact					
	Commerce and industry	No Impact					

Legend:

I:Importance	**C:Certainty**	**D : Duration**	**T : Impact type**	**A : Mitigation level**
1 : minor	C : certain	1 : short	+ : positive	O : correctable impact
2 : average	P : probable	2 : average	- : negative	N : incorrigible
3 : major	E : little probable	3 : long		

Mitigation Plan and Environmental management plan

1. Measures to reduce, remove or compensate damage consequences on the environment

1.1 Construction stage

Before construction starts, the staff must be informed of the required safety and protection measures for the environment:

- ✓ Inform largely in advance the various parties involved (Private owners, national guard, SONEDE, STEG, ONAS, TELECOM,...) to schedule a suitable intervention plan for all
- ✓ If necessary, modify slightly the Gas Pipeline route to avoid trees cutting or damage to infrastructure
- ✓ drawings and archives must be updated
- ✓ Include in the work specifications all operations related to waste management (clearing, collection and removal)

During the construction phase, general measures must be undertaken to minimize or reduce the impact on different environmental elements.

a- Soil protection

Excavation material will be reused for the backfilling. The superficial layer (less than 20cm) will be stored separately to be put back on the surface.

During the various work steps, a restoration of the work fields to the initial topography and soil profile, as well as excavating embankments on top of the gas pipeline , must be undertaken.

b- Deep groundwater protection

Rigorous monitoring will be done at the construction site to eliminate any leaks that may be generated during the handling of hydrocarbons (diesel, gasoline) and / or chemicals used during the construction of the pipeline.

As for groundwater, and in case of presence of aquifers during operations of excavation, a layer of clay will be placed and compacted to avoid water rising. Leak test water will be disposed of in evaporation pits that have tight walls arranged at the Nawara CPF.

c- Superficial water protection

If the gas pipeline route has to cross an Oued, the crossing has to be made by drilling underneath the oueds to avoid obstruction of the water flow and to reset the initial topography in the crossed areas in parallel with the works progress.

d- Vegetal cover protection

During the staking activities for the gas pipeline route, particular care will be given to the protection of some fauna species that need to be protected.

e- Dust and noise protection

To reduce the noise impact in the crossed area (mainly in Douz, El Hamma and Western Gabès), work sessions must take place between 7am and 7pm. The noise limit allowed between 7am and 10pm in the industrial and commercial zones is about 70 dBa, whereas in residential and institutional zones it is about 55 dBa.
Workers must systematically spray the work fields to minimize the quantity of dust generated during works.

f- Waste management

During the pipeline construction and laying out stage, a proper waste management must be undertaken. Measures are but not limited to:

- Collection and sorting out of solid waste
- Storage of waste in separate and appropriate areas
- Regular dispatching of ordinary garbage dumpsters to the nearest public dumps or to the nearest community.
- Collection of used oils in tight barrels to be forwarded to appropriate recycling facilities.
- Domestic water treatment
- Storage of tightness test water in evaporation pits with sealed walls arranged at the Nawara CPF. Additional evaporation ponds can be built according to the project requirements. The choice of the location will be made by the contractor according to the specificities and the choice of the hydro test method; Furthermore OMV is committed to communicate the final location of these pits and to ensure, through the contractor, to implement the necessary requirements for environmental preservation.

g- Infrastructure protection

To avoid any damage to the various networks along the Gas Pipeline route, the various operators must be informed before the beginning of works so as to obtain the required information about the various infrastructure positions, and particularly the underground ones. These data are taken into consideration in the different studies pertaining to the Gas Pipeline.

A lot of care should be taken to avoid damaging the infrastructure. In case of accident, the relevant operator must be immediately informed. Repair costs will of course be borne by the company in charge of the works.

Any damage to encountered infrastructure should be repaired as the work progresses.

h- Road Traffic management

In public roads, the contractor will elaborate a traffic plan in coordination with municipalities and local authorities.

To avoid traffic disturbance during the roads crossing, the National Guard will be requested to handle the traffic, in addition to installing road signs, indicating the presence of works, as well as revolving lights and fluorescent beacon strips indicating the limits of the work perimeter. Construction workers must wear high visibility jackets.

In case of regional or local roads junction, directional drilling (hobbing underpass) will be used to avoid damage to infrastructure and traffic disturbance.
Finally, contractors must respect the bearing capacity of the roads and damage must be immediately repaired.

i- Safety measures

The company should strive to minimize the time during which excavations remain open so as to avoid accidents particularly by night. These provisions are limited to signals (revolving lights) and to the surveillance of excavations mainly in the semi urban areas.

The works perimeter will be bordered and no unauthorized person would be allowed access. Workers must wear helmets, safety shoes and gloves. They will be informed about risks and safety and about the different measures to apply on the work field.

Delivery and installation of pipes before laying should be organized so as to reduce the space for storage.

The appropriate storage area for the pipes must be closed and must contain the necessary warning signs to warn workers and organize the movement of vehicles Access will be prohibited to unauthorized persons.

Inspection patrols in relevant locations and outside the sites should be carried out under the supervision of the environment officer, at least once a week.

During the works, a permanent doctor and an ambulance will be ready to intervene if necessary.

The gas release test will be done in tranches thanks to the line valves. A regular monitoring along the section under test will be made so as to inform the population and to intervene in case of problem.

Strict safety standards relating to the inspection of seal welding by gamma rays (law n° 81-51 dated June 18th, 1991, decree n° 86-433 dated May 28th 1986 relating to individual, environment and property protection...) have been established to define the threshold of irradiation below which we can state that no damage to the body would be feared.

Concerning the protection against irradiation, the three following measures must be applied:

- **Distance to the source : (figure 41)**

Controlled zone: this area must be enclosed with barriers and danger signs. It a forbidden area for any unauthorized person during radiography, and beyond which all those who are designated to work directly under irradiation (operators), can operate safely. Radiography is remote controlled. The flow of the dose equivalent is limited to 0.75 mrem/h.

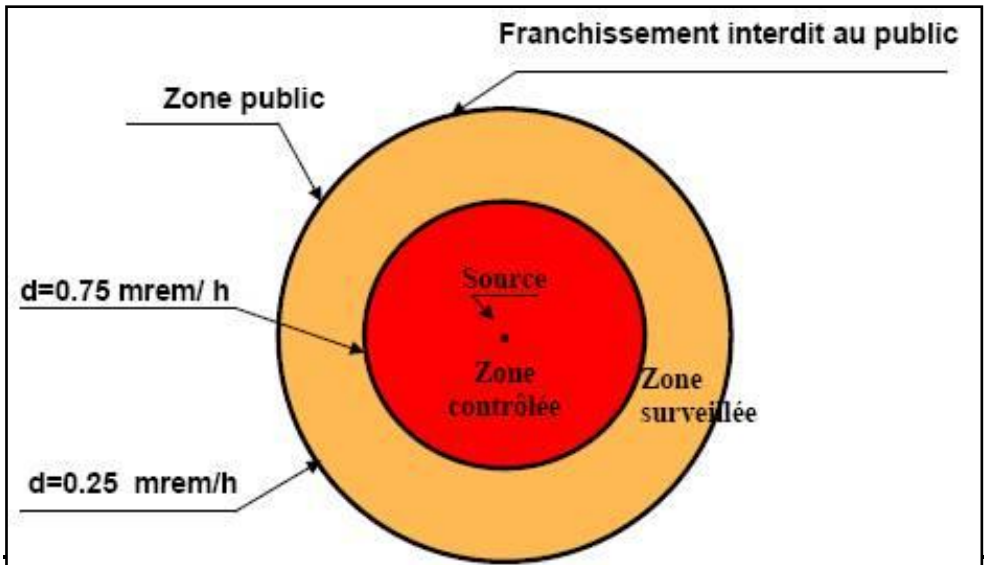

Figure 41 : Protection distance from the source.

Surveillance zone: It is the action area for staff members who are not designated to operate directly under irradiation. The flow of the dose equivalent is about 0.25mrem/h

Public zone: It is a safety public zone for moving and static people.

The flow of the irradiation dose is inversely proportional to the square of the distance from the source. The distances of the zones to be respected depend on the type of the source and on its capacity.

- **Exposure duration**

The irradiation tolerated may be increased ten times for occasional short exposures (i.e. at the level of a road junction...).

- **Screen**

Radiography must be done inside the pipeline so as to have a good screen protection against irradiation.

In general, the safety distance should exceed 100 m.
On site, operators must wear special uniforms and have badges and dosimetric pens which should be analyzed every two months by the National Radioprotection Centre. The minimal age of the operators is fixed at 18 years.

With regard to safety guidelines to take into consideration during radiography operations for seal welding, operators should:

- Demarcate the work area within a radius of 17 m
- Provide for sound detectors and radiation meter in the work area
- If possible, work outside rush hours and high road traffic periods.

Formal procedures should be established to ensure the registration of all public complaints, track the actions of the company and the progress of corrective actions.

j- Reclamation and cleanup

- Rehabilitation of the areas that were used for the storage of engines and machinery during the works
- Restore infrastructures (road, tracks, various networks...)
- Restore and clearing of the work fields and restoration of the initial soil topography.

k- Other measures

- Machinery maintenance in appropriate licensed stations.
- Maintenance of transportation vehicle and machinery to be in good operational condition so as to avoid oil or fuel leaks.

1.2 Operation stage

a- Water resources protection

Rigorous monitoring will be done during maintenance operations so as to eliminate any leaks that may occur during the handling of hydrocarbons (diesel, gasoline) and / or chemicals used.

b- Waste management

In accordance with the applicable legislation related to solid waste, a management and disposal program for the waste generated by operational and maintenance activities will be set up. This program is similar to the one planned for the construction phase.

c- Safety measures

In compliance with the standard NT109.01, any incident or any circumstance that is likely to cause disorder and insecurity must be reported immediately to the Energy General Department (DGE).

To mitigate, or even to avoid such incidents, OMV plans to apply, without being limited to, the following measures:

- A Thicker wall for the gas pipeline in the semi-urban areas
- Regulatory beacons along the Gas Pipeline
- Sign posts marked ‘caution- Gas Pipeline’

- Periodic tests for gas corrosivity
- Monitoring of the Gas Pipeline status and anti-corrosion protection
- Measurements of channelling Potential and electric resistivity
- Regular pigging of the condensate deposit in the gas pipeline;
- Regular check of gas leaks by gas detectors
- Sensitization of the staff and users of the crossed areas about the magnitude of hazards and about measures to apply in case of accident;
- Inform the relevant authorities in case of major intervention on the Gas pipeline
- An emergency plan must be prepared and approved by the relevant authorities.

This plan shall include actions to be taken for example in case of fire, explosion or Asphyxia especially in case of death or Injuries and lesions likely to cause the death of one of the workforce.

- In case of an accidental pollution, an environmental diagnosis must be carried out
- A decontamination study must be submitted to the ANPE.

d- Mitigation of the impacts on existing oueds and infrastructure

- **Oueds crossing :** On the basis of the visual prospecting campaigns and geotechnical tests, it would be possible to restrict the sensitive areas to washouts:
  - ✓ Artificial retaining structures and slope covers against erosion will be provided for in unstable banks
  - ✓ Permanent equipments will be installed downstream to ensure the continuity of the flow (nozzles)
  - ✓ Soil subsidence at the level of the trench will be reduced by soil analysis and use of the appropriate techniques of watering and compacting.

- **Roads junctions:** the pipeline is buried at a depth of about 1 m. At this depth, it has been proven that the load transmitted to the pipeline as a result of gear movement (12 tons per axle for trucks and 25 tons per axle for trucks). is very limited and does not impact the resistance of its walls

- **Reduction measure of impacts on other underground works:** Risks that may be generated by the proximity to other works (water pipeline, cables ...) will be reduced by applying the following measures:
  - ✓ The Minimal distance between water generators of both pipelines is set at 0.5m

- ✓ In case of junction between a metal structure or concrete, potential test points will be installed to check the potential value of each pipe and correct any possible disturbance in their cathode protection.

- ✓ All underground obstacles and roads crossed by the gas pipeline will be listed in an inventory of obstacles indicating precisely :

  - The exact milestone of the obstacle
  - The obstacle nature
  - The pipeline thickness according to the location category (type (A), (B) or (C) zone,
  - Type of road crossing, irrigation canals, drain canals, railways
  - Cathodic protection to install (withdrawal posts, sacrificial anodes, potential test points...)

1.3 Abandonment stage

The first scenario consists of removing the Gas Pipeline and transferring all its elements to the public dump, but this is not acceptable for the following reasons:

- Major agricultural damages will be caused by excavation works, lifting, pipeline cutting, backfilling and evacuation to the dump.
- Expensive costs comparatively similar to the installation costs.

The second scenario consists in abandoning the Gas Pipeline in situ, and it has the following advantages:

- This solution will not entail damages to farming lands.
- After some years the pipeline will dissolve into the soil because of corrosion. Ferrous minerals will not alter the soil but they will contribute to fertilizing it. However, the polyethylene cover will not dissolve quickly into the soil, because of its chemical properties. Yet, abandoning it into the trench will not be risky to the environment as no chemical reaction will happen with the surrounding soil.

The third scenario proposes that the pipeline will be kept for a potential reuse by another operator, all the more as the crossed areas are made of a strip that is already used for gas transportation.

The abandonment stage will be subject to a separate EIA.

2. Environmental management plan

The Environmental Management Plan (EMP) describes the measures, actions and resources that will be implemented to eliminate or reduce to acceptable levels the significant impacts of construction, installation and operating the pipeline which were identified during this study, on the biophysical and socio-economic environment,

More specifically, the EMP should ensure:

- The protection of the health and safety of the staff and the prevention of environmental risks;
- Compliance with standards, regulations, know-how and best practices as well as the implementation of appropriate technologies;
- Carrying out the work in accordance with the principles of good management and use of equipment in good operating condition;
- Taking into consideration measures allowing monitoring and controlling environmental risks and setting up prevention and correction means in case of an event that may be dangerous to health and to environment.

The Environmental Management Plan for the construction, installation and operation of the pipeline is divided into seven sections:

- Impacts register;
- Waste management;
- Preventing and mitigating pollution;
- Rehabilitation of the site at the end of works;
- Environmental monitoring;
- Personnel training;
- Project Cost.

2.1 Impacts register

On the basis of the EIA findings, of the national and international standards and best practices, the impacts register summarized:

- The potential project adverse effects on the environmental level ;
- The methods used to mitigate those effects;
- The required monitoring actions allowing verifying the implementation and smoothing functioning of the selected mitigation measures.

2.2 Environmental mitigation measures summary

Table 10 : Mitigation measures

Stage	Main impacts		Mitigation measures	Party in charge	Cost
	Type, milieu	**Magnitude**			
Construction 11/02/2015-21/03/2016	**Soil:** - Soil compacting ; - Topography change ; - Lithologic layer change.	medium	- mechanical earthwork embankment ; - Initial profile restoration ; - The superficial layer will be stored separately to be put back on the surface.	Contractor/OMV	-
	Superficial water: - Watercourse change ; - Water contamination by liquid waste. - Contamination by hydro test water	Minor	- Crossing under the bottom of the oueds ; - Solid and liquid waste management plan - Development of evaporation pits with water tight walls - Rigorous monitoring to eliminate any event of accidental leakage of chemicals and / or hydrocarbons.	Contractor/OMV	-
	Underground water: - Groundwater level	Minor		Contractor/OMV	-

	rise ; - Deep water contamination. - Contamination by used oils - Risk of contamination by hydro test water		- Storage of used oil in drums and delivery to SOTULUB - Discharge of tightness test water in sealed pits		
	Vegetal cover: Vegetal cover reduces.	medium	- In the best conditions avoid uprooting trees or plants in cultivated land by bypassing them when selecting crossing points for the pipeline	-	-
	fauna: Fauna habitations disturbance.	medium	- Forbidding of any form of hunting - Workers will be accommodated in life camps	-	-
	Noise and dust : - Noise emissions nuisance; - Dust nuisance	Minor	- Limitation of working hours from 7 am to 19 H (depending on season); - Systematic spraying of the ground. - Protection of workers on site by wearing work gear (masks, helmets, ...)	Contractor/OMV	20,000

	Working areas: Waste generated by construction works - Solid waste ; - Hydric waste	Minor	- Selective collection of waste ; - Disposal of non-hazardous waste in the nearest landfill - Transfer of plastic waste, batteries, paper, scrap... to the appropriate recycling units ; - Used oil collection and transfer to SOTULUB. - Collection of used domestic water in septic tanks which are to be emptied daily - Collection of tightness test water in evaporation pits that have water tight walls	Contractor/OMV	50,000
	Impacts on Health and safety : - Risk of accidents associated with open excavations; - Occupational injury;		- Leave excavations open the shortest time possible ; - Prohibiting access to the construction site and storage of materials area for unauthorized persons; - Continuous surveillance of the work field and installation of revolving lights ; - Workers will wear helmets, safety shoes and gloves ; - Gas release by section, and continuous monitoring.	Contractor/OMV	30,000

	- Risk of leakage or burst when injecting gas.				
	Traffic disturbance : - Pipeline junction with roads.		- National Guard intervention ; - Tunnel crossing ; - Respect of road bearing capacity ; - Use of signposts indicating the presence of works, as well as revolving light ; - Reset the initial profile of the site.	Entrepreneur	100,000
	Sit-in and demonstrations		- The public relations officers of both parties (OMV and contractor) have communication plans and adequate responses in case of sit-in. The social study will provide more details	OMV/ Contractor	-
	Impacts on Infrastructure and buildings - Damage risks to existing infrastructure		- Inform the various regional services involved; - Meeting the costs of damage repair in case of accident ; - gradually repair as works progress	Contractor/OMV	-

Operation 04/2016	**Impacts on water resources** - Leak and water contamination risk		- Measures for the prevention of corrosion, - Periodic scraping of the Pipeline - Rigorous monitoring during maintenance so as to avoid any possibility of accidental leak of the maintenance product	OMV	
	Impacts on flora - None	-	-	-	-
	Waste from maintenance activities.	-	Establishment of a program for the management and disposal of waste	OMV	20,000
	Impacts on socio-economical activities - None	-	-	-	-
	Risks threatening safety - Gas Leak; - Fire ; - Explosion		- - Regulatory beacons along the Gas Pipeline - Installation of warning signs; - - Periodic tests for gas corrosiveness - Potential measurements of the pipe and the pipe-soil	OMV	50,000

			electrical resistivity at different points of the route; - - Regular scraping of the condensate deposit in the gas pipeline ; - Regular checks for gas leak by gas detector; - Sensitizing the personnel and users of the crossed zones about the extent of the risks and about the measures to take in case of accident ; - - An emergency plan must be prepared and submitted to the relevant authorities		
	Noise nuisance and Vibrations - No impact	-	-	-	-

2.3 Waste management

OMV advocates the use of the waste disposal strategy based on the principle of 4RE, subject to the local environmental regulations, and to the availability of resources to manage waste. These 4RE are as follows:

Reduce	:	At the source;
Reuse	:	The waste as it is;
Recycle	:	Convert waste into a usable material;
Recover	:	Material or energy from waste;
Eliminate	:	An unavoidable and ultimate waste which requires, then, a dumping method which is chosen according to defined factors.

The strategy combines usually two or more of these methods, reduction and recycling or recovery and disposal. The choice of the appropriate method is based on the following factors:

- The nature of waste ;
- The level of cleanliness of waste;
- Impacts on environment;
- Logistics;
- Availability of acceptable elimination methods.

a. Management of liquid waste

Three types of liquid waste will be generated by construction works, installation and operation of the pipeline: sanitary wastewater, hydro test water and used oils.

a1. Domestic used water

Sanitary wastewater generated by the construction team, in the order of 5m3 / d, which come from the staff facilities during the construction and installation of the pipeline will be collected in a 30 m3 sealed pit which will be emptied on a daily basis by specialized companies.

At the end of the works, the pit will be backfilled with soil. Sanitary wastewater will be recovered by septic tank pump truck and transported by truck to the ONAS water treatment plant.

a2. Hydro test water

The hydro test water will be collected in evaporation pits with sealed walls, arranged at Nawara. Additional evaporation ponds can be built according to the project requirements. The choice of the location will be made by the contractor according to

the specificities and the choice of the hydro test method; Furthermore OMV is committed to communicate the final location of these pits and to ensure, through the contractor, to implement the necessary requirements for environmental preservation.

a3. Used oil

Engine oils, hydraulic oils and gear oils obtained from routine maintenance of equipment and engines, will be stored in metal drums and delivered to SOTULUB for regeneration. The volume of recovered oils is estimated at 100 liters during the whole construction period. A register will be kept by the contractor for the reporting of waste in accordance with the Decree No. 2002-693 of 1 April 2002.

b. Solid Waste management

Solid waste that can be generated by construction, installation and operation of the pipeline may be of various kinds. However, we can divide the waste into three broad categories. These categories are defined in accordance with the terminology indicated by the 96-41 Act which states that: "Waste is classified according to its origin as domestic waste or industrial waste and according to its characteristics as hazardous, non-hazardous or inert waste". This classification is also consistent with the one adopted by the European guidelines.

b1. Inert waste

The Act 96-41 in question defines inert waste as follows: "Is considered inert waste, the waste consisting of land and natural rock extracted from quarries or from demolition, construction or renovation works, with mainly a mining nature and which is not contaminated by hazardous substances or other elements that may generate potential nuisance. "

b2. Non-hazardous waste

Household waste constitutes the main type of waste generated during construction works. This type of waste which quantity is estimated at 1 kg / day per person can be divided into organic waste, which will be evacuated to the nearest landfill, and recoverable or recyclable waste such as plastic materials (bottles, cups, etc..) or cans to be delivered either to ECO-LEF points, or to companies licensed by the MEDD for the collection and recycling of waste.

Other waste in the form of industrial waste can be represented by:

- Packaging (cardboard, polystyrene, plastic film, drums, wooden pallets, etc...) That will be made available to collection companies approved by the MEDD within the context of the ECO-LEF system;
- Scrap, welding waste and used spare parts that will be entrusted to scrap dealers authorized by the MEDD.

b3. Hazardous waste

Hazardous waste generated during construction activities and installation of the pipeline such as batteries, paints, solvents, medical waste, etc... Will be recovered by specialized firms approved by the MEDD for the collection and processing of waste and shall in no case be left or placed in the area under study. The EPCC contractor will record all hazardous waste including quantities and disposal methods.

C. Management of gas waste

These emissions are caused by fuel combustion in vehicles and in static and mobile facilities. The optimal operation, monitoring and regular maintenance of these allow to minimize the effects of these emissions on environment. The tracks will be sprayed at a frequency of two times a day.

2.4 Summary table of waste and its management

Table 11 : Summary table of waste and its management

Waste		Origin	Management method
Liquid waste	**Domestic used water**	Work team	Discharged into septic tanks that will be emptied on a daily basis
	Hydro test water	Water used in the inspection test for pipe water tightness	Collection into evaporation pits with water tight walls
	Lubricant oils	Machinery	Collection in metal drums for transfer to SOTULUB
Solid waste	**Inert waste**	Construction waste (rocks) resulting from construction works	Collection and transportation to the landfill
	non-hazardous waste	Organic waste (food) generated by staff	Collection and transfer to the landfill
		Recyclable waste (plastics, cans, ...) generated by staff	Collection and transfer to ECO-LEF or to a company authorized by the MEDD
		Industrial waste	

		generated by construction works - Wood packaging , plastic, metal drums) - Scrap	Collection and transfer to ECO-LEF or to a company authorized by the MEDD -Collection and transfer to scrap merchants licensed by the MEDD.
	Hazardous waste (batteries, medical waste)	Machinery, staff cares...	-Selective collection and transfer to specialized companies licensed by the MEDD.
Atmospheric pollution	**- Machinery exhaust gas** **- Dust emission**	-Vehicles and construction machinery - working Track and construction works	Regular Maintenance of the machinery pump-out station - Spraying the tracks twice per day

3. Preventing and mitigating accidental pollution

3.1 Pollution Prevention

The transportation and storage of hazardous materials will be subject to a written procedure for the prevention and control of spill. The aim of the procedure is to prevent pollution by identifying potential spill scenarios and developing procedures to prevent and control them.

Transportation of hazardous materials (including waste) will be conducted in accordance with Tunisian regulations.

3.2 Mitigating accidental pollution

The cleaning and rehabilitation of polluted areas due to accidental spills of hazardous materials shall be carried out in compliance with Tunisian regulations.

As a general rule, corrective actions based on the risk analysis will be applied in all activities of cleaning and rehabilitation.

4. Rehabilitation and cleanup

To reduce the residual impacts to demobilization, the rehabilitation of the site would require:

- Waste collection from domestic and industrial waste and their transfer to the dump of Tataouine and removal of any remaining debris;
- The remains of hazardous waste will be transported off-site to be processed and disposed properly;
- The septic tank will be emptied and backfilled with soil

5. Environmental monitoring

Environmental monitoring is necessary to measure the operational impacts on site. With the establishment of sufficiently detailed plans, it would be possible to minimize the generation of waste, to minimize disruption and to operate in a responsible manner. The environmental monitoring program will be implemented by the field team in accordance with the environmental management plan and it includes:

- The monitoring of the management of waste generated by construction, installation and operation works of the pipeline and holding a record of waste monitoring;
- The processing of hazardous waste by companies certified by the MEDD;
- The commitment to submit, at the end of the work, a report on the management of hazardous waste (Waste types, volume, chemical analyzes of potential pollutants and mode of processing and disposal).
- Environmental audits will be scheduled, conducted and integrated in the performance indicators of the project.

6. Training

Although people who are employed by the contractor are qualified professionals, it is necessary to train them according to their specific activities.

Such a training, which consists of technical, theoretical and practical coaching, is provided by the HSE.

7. Project Cost

The cost of land, construction, installation and operation of the pipeline as well as site development amounts to five hundred million Tunisian Dinars (500 MTD).

8. Control and monitoring scheme

Table 12 : Control scheme and environmental monitoring

Measures	Source	Monitoring parameters	Sampling points	Means and methods used	Frequencies	Leaders
Construction phase						
Dust monitoring	Machinery traffic and development work	Particles in suspension	In the work site and in the immediate neighborhood of the site.	Analysis by an approved laboratory	Twice during the construction phase	Contractor/OMV
Monitoring of the sound level	Machinery traffic and construction equipment	Noise level in dBA	Site neighborhood, all residential and sensitive areas. -In the work site and in the immediate neighborhood of the site.	Measurement by sound-level meter	Twice during the construction phase	Contractor/OMV
Solid Waste monitoring	- Food construction-related waste (rocks, packaging, uprooted plants, ...) -batteries and scrap ...	Collection and transfer to the dump or to a company authorized by the MEDD	In the work site and in the immediate neighborhood of the site.	Site inspections and monitoring forms	Every day	Contractor/OMV

Operation stage						
Gas leak monitoring		Pipe tightness	Measurement of gas Flow between the two gas expansion stations	- gas leak detector with ultrasound sensitivity	Twice per year	(OMV) Head of Safety and Environment

9. Institutional arrangement for the implementation of the mitigation plan and monitoring program

To ensure the proper operation and sustainability of the project, OMV will consider putting in place an institutional arrangement for the implementation of the mitigation and monitoring program, which content is mentioned hereinafter:

- The appointment and training of safety and environment Officer;
- The possession of a manual on environment protection (solid waste management, used oils, atmospheric pollution, domestic wastewater, etc.).
- Periodic tightness testing of structures, piping and intervention if required ;
- Recording all control and repair interventions and preparation of an annual report.

10. Cost of environment protection

The table below shows the estimated costs of implementing preventive and mitigation measures related to the environmental management plan and the environmental monitoring program.

Table 13: Cost of EMP mitigation measures and implementation

Measures	Involved parties	Investment (TND)	Maintenance and annual consumables
Environmental impact assessment	OMV	39,000	
Mitigation measures during the construction stage	OMV/ Contractor	200,000	
Mitigation measures during the operation stage	OMV		70,000
Monitoring during the construction stage	OMV	30,000	
Monitoring during the operation stage	OMV		50,000

Designation of a safety and environment Officer			40,000
Total	**-**	**269,000.**	**160,000**

Appendices

Appendix 1

Exemption

Appendix 2

Approval of the DGE for the Nawara Development Plan

Appendix 3

Gas pipeline route