OMV

OMV TUNESIEN PRODUCTION

Environmental Impact Assessment for Nawara Construction Project of the Gas Treatment Plant of Gabès

STGP-TESCO-PMT-0805-HS-REP-0002

Final report **January 2014**

Developed by:

TESCO
Consulting for Sustainable Development Engineering

TÜVRheinland® CERT ISO 9001

Introduction of TESCO

- **Introduction:** Environmental impact assessment- gas treatment unit. Nawara Concession Development Project. Governorate of Gabès.
- **Developed by :** TESCO
- **For:** OMV Tunesien Production Gmbh.
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الجمهورية التونسية
وزارة التجهيز والبيئة
الوكالة الوطنية
لحماية المحيط

D E E E /AS-ABO-BSL /7832-2013

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A Monsieur le Directeur Général
Société OMV Tunesien Production Gmbh
Immeuble Waterside - Impasse du Lac Turkana
Les bergers du lac 1053 TUNIS

IE /4713
A rappeler à chaque correspondance

Objet : Etude d'impact sur l'environnement de développement de la concession Nawara par la construction d'une usine de traitement de gaz à la zone industrielle de Ghannouche, Gouvernorat de Gabès.

Réf : Votre transmission du 2 septembre 2013.

Monsieur le Directeur Général,

Suite à votre transmission relative au projet ci-dessus mentionné, et afin de permettre à l'Agence Nationale de Protection de l'Environnement de se prononcer quant à la conformité de votre projet aux exigences de protection de l'environnement, nous vous demandons de nous faire parvenir une étude d'impact sur l'environnement actualisée, comprenant notamment les insuffisances suivantes :

- Le plan de masse de l'usine,
- Justification du choix du site à la zone industrielle de Gannouche et non pas dans la concession de Nawara,
- La composition chimique du gaz brut et la nécessité d'une étape d'élimination du H_2S,
- Plus de précisions concernant le procédé de traitement définitivement adopté (surtout pour l'élimination du mercure),
- Le devenir des gaz résiduels,
- Précisions concernant le devenir des déchets contamines par le mercure, les condensâts ainsi que les solutions utilisées pour l'élimination du CO_2.
- L'accord de l'ONAS pour le branchement de l'usine au réseau d'assainissement.

Veuillez agréer, monsieur, nos sincères salutations

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

Centre Urbain Nord 15 rue 7051 cité Essalem 1080 - Tunis B-P N° 52 le belvédère Tél.: 71 233 600 - Fax : 71 332 811

Update of the EIA in the light of ANPE comments

Subject: Response to ANPE comments regarding the construction of the gas treatment unit in the industrial area of Ghannouch, Governorate of Gabès.

Ref: mail n° 3746 (IE 4713) of 1st November 2013
Attachment: mail n° 3746 (IE 4713) of 1st 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 treatment unit, please find below the items that have been updated:

1. **Plot Plan of the GTP (page 38- appendix 2)**

The initial plot plan has been attached to the assessment.

2. **Justification of the site choice of the industrial zone of Ghannouch (pages 16-17)**

Site selection was done taking into account economic, environmental and industrial parameters.

Indeed, OMV has opted for the Ghannouch industrial area by adopting the principle of industrial ecology and after having considered other options that have proven not feasible at all levels as they imply safety, environmental and economic risks.

The justifying factors for this choice are:

- The site, which is dedicated to industry, is already developed and will allow the unit to be connected to different networks such as electricity, sewerage...

- Proximity to customers (STEG and SNDP) which will allow the transfer of the final products (sales gas, propane, butane and condensate) through short-length pipes to minimize environmental and safety risks

- Minimize environmental and safety risks that would be caused by the construction of four export pipeline from the Nawara concession to transport the final products

- Centralized storage as the SNDP will ensure the storage of final products. An agreement between OMV, Tunisia and SNDP has already been signed.

- Reduction of investment costs on the various concessions connecting to the infrastructure project

- The proximity of port structures.

The table below shows a comparison between the impacts that would be caused in the industrial area of Ghannouch and in the Nawara concession.

	Ghannouch industrial area	**Nawara concession**
Environmental and safety risks	Minimal risks given the proximity of clients (STEG and SNDP) as this proximity will allow the transfer of the final products (sales gas, propane, butane and condensate)	High risks caused by the construction of four export pipelines from the Nawara concession (370 km) to transport the final products
Centralized storage	Vicinity of SNDP that will ensure the storage of final products. An agreement between OMV, Tunisia and SNDP has already been signed	Construction of a storage area
Site laying out	The site, which is dedicated to industry is already developed and will allow the unit to be connected to different networks such as electricity, sewerage	Desert area that requires development work for the installation of the gas treatment unit
Investment costs	Reduced costs in view of the construction of a single pipeline of 370 Km, no need to build a storage area, and no development work near port structures...	High Costs in view of the construction of four 370 km pipelines , construction of a storage area, site development works
services network and utilities	Use of existing utilities on site ONAS, SONEDE, STEG, Civil defence…	Unavailable public utilities (ONAS, SONEDE, STEG, Civil defence…)
Proximity of port structures.	Available	Unavailable

3. Chemical composition of raw gas and the need for a phase allowing for the removal of H2S

- **Page 44- 45: Composition of gas at the inlet of the GTP**

Components	MW	Light composition summer	rich summer components	Components light winter	Components rich winter
Nitrogen	28.01	0.3299	0.4620	0.3299	0.4621
Carbon dioxide	44.01	1.8004	1.8010	1.8005	1.8006
Methane	16.04	88.4009	83.5799	88.4199	83.6011
Ethane	30.07	5.3849	7.5409	5.3860	7.5430
Propane	44.10	2.4131	4.1910	2.4144	4.1918
Isobutene	58.12	0.4786	0.8558	0.4804	0.8600
n-Butane	58.12	0.6109	1.0085	0.6101	1.0122
Iso pentane	72.15	0.2725	3037	0.2631	0.2859
n-pentane	72.15	0.1583	0.1544	0.1512	0.1436
n-Hexane	86.18	0.0076	0.0788	0.0071	0.0743
PC6A*	84.79	0.0959	0.0066	0.0894	0.0062
PS1A*	109.65	0.0405	0.0015	0.0413	0.0017
PS2A*	157.92	0.000	0.0000	0.0001	0.0000
PS-1*	112.06	0.0007	0.0088	0.0007	0.0103
PS-2*	159.29	0.000	0.0000	0.0000	0.0000
PS1S*	126.58	0.0005	0.0000	0.0005	0.0000
PS2S*	143.80	0.0002	0.0000	0.0002	0.0000
PS3S*	168.23	0.0001	0.0000	0.0001	0.0000
PS4S*	209.03	0.0000	0.0000	0.0000	0.0000
H2O	18.02	0.0051	0.0052	0.0051	0.0051
C7-C7*	125.00	0.0000	0.0020	0.0000	0.0021
C8-C9*	149.00	0.0000	0.0001	0.0000	0.0002

Nomenclature

Pseudo-Component	NBP	MW	Liquid density	Tc	Pc	Vc	Accentricity
	°C		kg/m3	°C	bara	m3/kg mole	
PC6A*	65.43898926	84.78900146	693	239.1750122	32.63600098	0.349999994	0.254000008
PS1A*	115.3839966	109.6500015	739	296.9649902	28.19300049	0.441000015	0.319999993
PS2A*	192.9129883	157.9160004	786	377.75802	22.04100098	0.625999987	0.451000005
PS3A*	277.1339966	226.2019958	824	457.4209839	16.81599976	0.88499999	0.615999997
PS4A*	366.717981	326.3129883	859	536.6440063	12.77	1.218000054	0.825999975
PSA5*	475.6839844	512.0440063	900	629.9300171	9.475999756	1.661000013	1.131000042
PS-1*	118.7210022	112.0579987	716	293.0569702	26.23699951	0.469999999	0.358999997
PS-2*	190.0729919	159.2910004	758	366.3000122	20.705	0.647000015	0.486000001
PS-3*	270.4179932	228.3970032	793	441.4560181	15.74099976	0.90200001	0.647000015
PS-4*	357.6949707	332.6239929	827	517.6219727	11.75199951	1.241999984	0.856000006
PS-5*	469.9560181	543.4660034	869	612.0520264	8.352999878	1.661000013	1.177999973
PS1S*	134.5450073	126.5770035	693	254.5970093	17.64099976	0.582000017	0.643000007
PS2S*	142.3839966	143.802002	702	259.9740234	16.725	0.602999985	0.649999976
PS3S*	154.421991	168.2330017	714	265.3609863	16.555	0.63499999	0.657000005
PS4S*	186.5769897	209.0339966	743	270.8020264	16.23300049	0.725000024	0.663999975
PS5S*	278.607019	264.6119995	792	449.5052734	15.77599976	1.041000009	0.671000004
PS6S*	404.264978	379.17099	847	571.4300171	11.59199951	1.583999991	0.949000001
C7-C7*	145.3273254	125	725	317.4833008	23.25321289	0.534884274	0.420488149
C8-C9*	187.0205627	149	755	358.5332886	20.29509888	0.639025211	0.49972266

Pseudo Component definition: is a non-library or hypothetical component, which can be pure components, defined mixture, undefined mixture, or solids by which we can modify the library of thermodynamic values to characterize any substance none defined in the library of chemicals.

- **page 43: Elimination of H2S**

The gas from Nawara, pre-treated at the CPF (Nawara concession, Governorate of Tataouine) was treated by adopting the Amine absorption system. This process has eliminated the removal of traces of H2S that would possibly be present in the raw gas.

For this reason, we will not have for a removal of H2S phase in the treatment process that to be adopted in the gas treatment unit of Ghannouch.

4. **The definitive processing method for the removal of mercury (page 43)**

The process of Mercury removal would be based on an absorption unit (filters in the form of cartridges) that would be able to process 2.7 MSCMD of raw gas.

The foreign supplier will take care of the replacement and recovery of saturated cartridges that will be exported to the country of origin. He will also be responsible for collecting the waste generated during the operation of Mercury removal.

5. **Fate of residual gas (page 52)**

No residual gas is expected at the GTP. The process will allow recycling of the generated gas.

The unit is designed so as to cause no continuous flaring. Only a short-term emergency flaring or maintenance purposes would be allowed.

Residual emissions of combustion equipment shall comply with the Decree No. 2010-2519 of 28 September 2010 setting the limit values at the source of air pollutants from stationary sources.

6. **The fate of mercury-contaminated waste, condensates and solutions used for the removal of CO2 (page 53)**

The mercury removal will be done at the GTP of Ghannouch; recovered waste will be taken care of by the supplier of filters, who will also be in charge of replacing the cartridges and collecting the used ones.

Therefore no effluent will be contaminated by mercury at the level of the gas treatment unit in Gabes.

Waste contaminated with condensate will be collected, transported and treated by a certified company.

To ensure product compliance with the specifications of sales gas in Tunisia, the carbon dioxide CO2 will be reduced to the rate of 2% mol per amine unit located in the centre of the CPF pretreatment which will be built near the site of the Nawara-1 well in southern Tunisia. No emission of CO2 in the atmosphere is planned in the region of Gabes.

7. Agreement of ONAS for connecting the unit to the Public sewerage network (page 51- 52 - Appendices 4 and 5)

The Industrial Real Estate Agency AFI is committed to the treatment of storm water and sanitary sewage and implementation of a manhole or a connection box and the installation of separate systems for the drainage of rainwater and wastewater. The specifications and the agreement for the purchase of the land are attached to this assessment (Appendix 4).

The amounts of waste water, including the sanitary one (maximum 100 inhabitants equivalent), resulting from treatment and rain will be collected and treated separately in the said centre and in accordance with the standards in force.

A request for prior approval for connecting the gas treatment unit to the ONAS network was filed; the discharge is appended to this report (Appendix 5).

The final approval of ONAS depend on the drainage network plans to be prepared in the detailed engineering phase estimated around six months.

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Acronyms and abbreviations

ANGed: Agence Nationale de Gestion des Déchets

ANPE: Agence Nationale de Protection de l'Environnement

AfDB African development Bank

Barg: Relative pressure

CES: Complexes des Eaux du Sud

CI: Continental Intercalaire

CO2: Carbon dioxyde

CRDA: Commissariat Régional au Développement Agricole (CDRA)

CT: complexe Terminal

DGE: Direction Générale de l'Energie

ESS: Environnemental and Social Assessment

ETAP: Entreprise Tunisienne des Activités Pétrolières

LPG: Liquefied petroleum gas

LNG: Liquefied natural gas

INM: Institut National de Météorologie

INS: Institut National des Statistiques

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

MSm^3: million standards of m^3

NOx: Nitrogen oxyde

O3: Ozone

ODS: Office du Développement du Sud OMV:

OMV Österreichische Mineralölverwaltung

NGO Non Governmental Organization

PEES: Environmental and social assessment Procedures

RMC: Regional member country

PM10: *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

SNDP: Société Nationale de Distribution du Pétrole

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

STEG: Société Tunisienne D'Electricité et de Gaz

SOx: Sulphur oxide

TESCO: Tunisian Engineering and Services Company

Executive Summary

As part of the development of the Nawara concession, OMV (Tunesien) Production GmbH plans to build a gas treatment unit in the industrial zone of Gabes to process the gas conveyed through a pipeline from the Nawara field (governorate of Tataouine).

OMV has obtained the approval of the DGE concerning the Development Plan (Appendix 1).

The EIA of the above project is developed in accordance with Article 6 of Decree 2005-1991 of 11 July 2005 concerning the Environmental impact assessment and it determines the unit categories subject of the environmental impact assessment and the categories of units subject to the terms of reference.

The unit will be constructed in two phases; the first will allow designing a unit with a treatment capacity of 2.7 MSCMD of gas aiming at producing butane, propane, sales gas and condensate.

The second phase will develop a second train to treat 7.3 MSCMD of gas and produce the same products.

The final products, produced in the treatment plant (sales gas, propane, butane) will be conveyed respectively to STEG and SNDP through steel export lines respectively sized 20”, 6” and 4” from the Gabes gas treatment plant. Condensate will be stored in tanks.

The gas treatment unit will be located in the Ghannouch industrial area (Governorate of Gabes).

Site selection was done taking into account economic, environmental and industrial parameters.

Indeed, OMV has opted for the Ghannouch industrial area by adopting the principle of industrial ecology and after studying other options that have proven not feasible at all levels because they have security, environmental and economic risks.

The justifying factors for this choice are:

The site, dedicated to industry is already developed and will allow the unit to be connected to different networks such as electricity, potable water, sewerage...

- The proximity to customers (STEG and SNDP) which allows the transfer of the final products (sales gas, propane, butane and condensate) through pipes that have a reduced length to minimize environmental and safety risks.

- Minimize environmental and safety risks that would be caused by the construction of four export pipelines from the Nawara concession to transport the final products.

- Centralized storage as the SNDP will ensure the storage of final products. An agreement between OMV, Tunisia and SNDP has already been signed.

- The reduction of investment costs on the various concessions connecting to the project infrastructure.

- The proximity of port structures.

The table below shows a comparison between the impacts that would be caused in the industrial area of Ghannouch and in the Nawara concession.

Table1: Comparative table of impacts to the Ghannouch industrial area and Nawara concession.

	Ghannouch industrial area	**Nawara concession**
Environment and safety risks	Minimal risks given the proximity of clients (STEG and SNDP) as this proximity will allow the transfer of the final products (sales gas, propane, butane and condensate)	High risks caused by the construction of four export pipelines from the Nawara concession (370 km) to transport the final products
Centralized storage	Vicinity of SNDP that will ensure the storage of final products. An agreement between OMV, Tunisia and SNDP has already been signed	Construction of a storage area
Site laying out	The site, which is industry-oriented is already developed and will allow the unit to be connected to different networks such as electricity, sewerage	Desert area that requires development work for the installation of the gas treatment unit
Investment costs	Reduced costs in view of the construction of a single pipeline of 370 Km, no need to build a storage area, and no development work near port structures...	High Costs in view of the construction of four 370 km pipelines , construction of a storage area, site development works

services network and utilities	Use of existing utilities on site ONAS, SONEDE, STEG, Civil defence…	Unavailable public utilities (ONAS, SONEDE, STEG, Civil defence…)
Proximity of port structures.	Available	Unavailable

The gas, being supplied through a 370 Km long pipeline, would undergo a pre-treatment at the CPF (Nawara). It will be treated at the gas treatment unit (GTP governorate of Gabes).

The treatment process will be adopted based on the Elimination of Mercury by using filters. This method will not cause any damage to the environment of the unit.

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

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

1. Introduction / Justification of the EIA

A. Introduction

OMV (Tunesien) Production GmbH plans to implement the Nawara Concession development Project which includes the following components:

- Nawara concession Developpement, which is the topic of another EIA;

- Gas Pipeline construction which is the topic of another EIA;

- Gas treatment plant construction which is the topic of the present report. This plant will be located in Ghannouch (Governorate of Gabès) and will provide commercial gas, propane, butane and condensate to be distributed to the STEG and SNDP.

The purpose of this Environmental impact assessment is to identify and assess the potential impacts of the gas treatment unit 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 EIA will develop the following items:

- The introduction of the client and the actors
- The legal and institutional framework for hydrocarbons and gas in Tunisia
- Project detailed description
- The initial status 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 of the GTP construction project to the National Agency of Environmental Protection.

B. Project justification

B1. Socio-economic factors

Nawara concession Developpement project is encouraged by Tunisian laws that encourage the development of natural resources especially in the energy sector.

Indeed, this type of project tends to increase the potential of exploiting national energy resources which will have a direct and indirect impact on the regional and national economy.

The gas treatment unit construction project is part of the development program for the production of propane, butane and sales gas from the gas produced in the Nawara field in South Tunisia.

The gas treatment will allow to:

- Develop national natural resources;
- Meet national energy needs;
- Develop industry

The location of this unit in the industrial area of Gabes will create additional job opportunities especially since the OMV project seeks to recruit the local workforce.

B2.Technical factors

The proposed Nawara concession development will allow the recovery of gases produced in the Nawara field. These gases are conveyed through a pipeline whose route has been rigorously selected, to the gas treatment unit in Gabes where they will be treated in a proper manner before being distributed to the relevant companies namely SNDP and STEG.

The gas treatment unit is based on a simple and effective technology.

B3. Environmental factors

The gas treatment unit will be located in an industrial area, as this will allow preventing the harmful effects to the biophysical environment.

Facilities and various operations will be made in accordance with applicable Tunisian codes and regulations namely:

- ✓ The Code of Hydrocarbons.
- ✓ The Water Code and NT106-02 dealing with water discharges.
- ✓ The Law No. 96-41 of 10 June 1996 dealing with the management and the storage of waste.

- ✓ The Decree n ° 2000-1339 of 10 October 2000 dealing with Hazardous Waste.
- ✓ The Decree No. 2002-693 of 1 April 2002 on the terms and conditions of the oil recycling and used filters.
- ✓ The Law No. 2007-34 of 4 June 2007 pertaining to air quality.
- ✓ NT 109.14 (1988) dealing with liquid hydrocarbons - Rules of the development and exploitation of deposits of liquid hydrocarbons of 1st and 2nd category.
- ✓ NT109.15 dealing with liquid hydrocarbons - Rules of the development and exploitation of deposits of liquid hydrocarbons of 1st and 2nd category, with global fictitious capacity of no more than 1,000 cubic meters

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 around10.000 bbl/d.

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

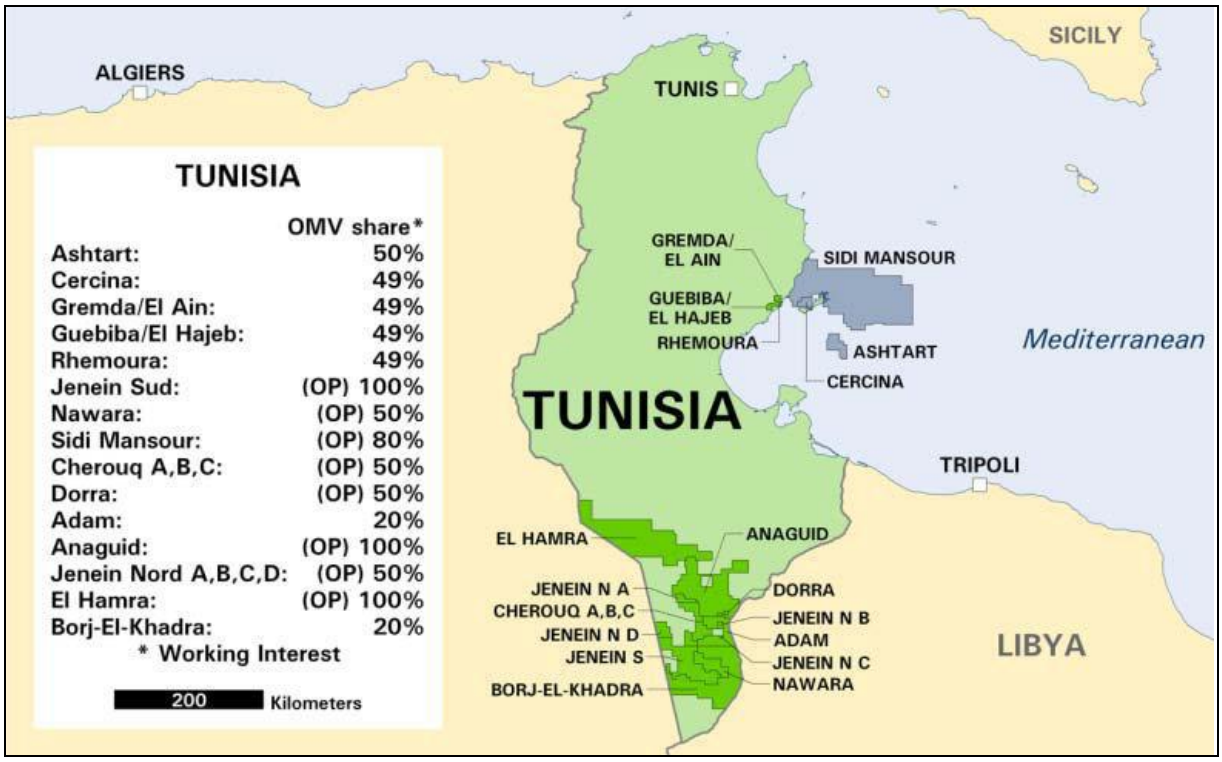


Figure 1 : OMV activity fields in Southern Tunisia.

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 Engineering 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 treatment unit manufacturer.

The gas treatment plant contractor has not yet been determined at the date of preparation of this study.

The commitments mentioned in this study appear in the specifications of this project and OMV will supervise these commitments.

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

The contractors must respect all environment, health and safety standards and guidelines and will abide by the recommendations proposed by the EIAs.

Project legal and institutional framework

1. Legal and institutional framework

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

- Law no. 75-16 of March 31st, 1975, enacting the Water Code that contains various provisions governing, safeguarding and valuing 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 fuel in the form of gas or liquid.

- Law no. 88-20 dated 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 eligible 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 incentives for exploration and production of fuels.

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

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

- 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. 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. 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.

- Law No. 2007-34 of 4 June 2007 pertaining to air quality. Plant operators are required before starting the operation phase to equip their factories with non-polluting equipment and cleaner technologies to prevent and reduce air pollution. Users of these plants must not allow an overshoot of standard thresholds.

- 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. 2002-335 of 14 February setting the threshold values of consumed water, which, when exceeded, impose technical inspection of equipment, labor and production methods in relation to water use, as well as the conditions of appointing experts, and the nature and frequency of inspection.

- 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 n ° 2004-2144 of 2 September 2004 on the conditions established for each consumer energy company to carry out a regular energy audit.

- 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 ensuring 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.

- Decree No. 2006-2687 of 9 October 2006 laying down the conditions for the creation and operation of facilities at risk.

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

- Order of the Ministry of Agriculture and Water Resources of September 15, 2009, on the organization of hunting during the 2009-2010 seasons.

- Order of the Ministry of Industry, Energy and Small and Medium Enterprises of 8 August 2009 stipulating the conditions of operating tanks of liquefied flammable gas.

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

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

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

- Order of the Ministry of Industry, Energy and Small and Medium Enterprises of 15 November 2005 establishing the list of hazardous facilities. Referring to the item 2504 of this list, the gas treatment unit is classified in category A.

- 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.

- Standard NT 109.14 (1988) relating to liquid fuels - development and operation rules for the deposits of liquid fuels of 1st and 2nd class.

- NT 109.15 standard on liquid fuels - development and operation rules for the deposits of liquid fuels of 1st and 2nd class., with a global fictitious capacity of no more than 1,000 cubic meters

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.

- 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 1967 relating to the rules of construction and Operation of treatment plants for petroleum, derivatives and residue.

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 phase the requirements and the responsibilities related to the environmental assessment of the various phases 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 environment factors;

- Operations of the Bank 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 prefers to adopt 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 the levels of Internal responsibilities
- Institutional support and capacity building for RMCS
- Public consultation and information dissemination
- Setting up Partnerships
- Compliance evaluation and follow-up

Project presentation

1. Project site, assessment area and time frame

1.1 Project site

a- Classification of the area in the urban development plan

The gas treatment unit will be installed on a land belonging to the Ghannouch industrial area, governorate of Gabes.

Figure 2 : Gas treatment plant situation.

b- Roads, travel paths and infrastructure

The Ghannouch industrial area is served by an important road infrastructure facilitating the movement of means of transportation for industrial products as well as the access to the various plants available there. It is also equipped with a railway designed for the transportation of various goods.

The site of the gas treatment unit is accessible by the great P15 ring road which connects El Metwiya to Bouchemma and Gabes and then taking the secondary road to the industrial area of Ghannouch. East of the unit we can find the Ghannouch freight trains unit.

Figure 3 : Road infrastructure.

1.2 Assessment area

The proposed treatment unit will treat the gas produced and transferred from Nawara concession in southern Tunisia through a 370km long pipeline. It will produce butane, propane, sales gas and condensate.

This unit will be located on an industrial land in the Ghannouch industrial area Governorate of Gabes.

1.3 Time frame

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

Table 2 : Projected Implementation schedule

phase	Duration	Starting date	Ending date
Engineering	263 days	09/04/2014	10/04/2015
Supply	415 days	22/05/2014	23/12/2015
Construction	355 days	21/11/2015	31/03/2016
Tests and commissioning	112 days	26/11/2015	29/4/2016

a- Construction phase

This phase includes the design of the unit, the preparatory work, construction and installation of equipment to be used during the operational phase.

During the preparatory work, a geotechnical survey was conducted to test the mechanical resistance of the field, and the location of the unit.

Figure 4 : Coring works on the site of the projected gas treatment plant (photo taken on April, 18th 2013 at Ghannouch)

Site development and construction of the gas treatment unit include the following activities and works:

- Vehicles traffic and transportation of construction materials and equipment;

- The preparation and construction of access roads;

- Site preparation (stripping of vegetation, excavation, site clearing, earthworks);

- The development of areas for the storage, stockpiling and disposal of loose soil, rubble and construction waste;

- The implementation of the runoff network, the potable water network, wastewater system and electrical network;

- The civil engineering and construction of the premises;

- The installation of heavy equipment.

b- Operation phase

The unit will be built in two phases; the first will allow designing a unit of processing capacity of 2.7 MSCMD of gas aiming at producing butane, propane, sales gas and condensate.

The second phase will develop a second train to process 7.3 MSCMD of gas and produce the same products.

This extension will be subject to an environmental impact assessment after confirmation of feasibility and profitability studies.

The table below shows the amounts of the final products obtained at the GTP after treatment of gas:

Table 3 : Daily production of the gas treatment unit (2.7MSCMD for the first phase).

Product	Unit	Maximum quantity
Propane	**T/d**	**230**
Butane	**T/d**	**220.**
Sales gas	**MSCMD**	**2.45**
Condensate	**T/d**	**30**

The estimated life cycle of this unit is 25 years.

c- Abandonment phase

The abandonment phase should be the subject of a separate impact assessment study.

At the end of the period of operation of the unit, the abandonment of facilities will be made in accordance with the legislation in force and the available technologies and practices to take into account all the parameters needed to regain the site to its original state without causing damage to the surrounding environment.

2. PROJECT DESCRIPTION

2.1 Project general description

As part of the development of the Nawara concession, the transfer of gas from the Nawara Field in Southern Tunisia will be made through a pipeline along the 370 km between the Nawara processing centre to the gas treatment unit in Gabes.

This unit will process 2.7 MSCMD from the Nawara field with an initial pressure equal to 48 barg and an output pressure of 35 barg (at treatment unit) to produce sales gas, butane, propane and condensate which will be shipped via pipelines respectively to STEG and SNDP.

2.2 Detailed Project description

a- Location of the unit

The gas treatment unit (Figure 5) is in a plot of 35 hectares located in the industrial area of Gabes (Governorate of Gabes).

This zone is located between the towns of Bou Chemma and Ghannouch and it is near to several factories such as Chemical Group unit of Gabès, Maintenance Group, Sagaz, Ben Hammouda Company, Gabès Tiles Company, Gabès Concrete Company, Gabès Cable Company, STEG turbines…

A preliminary ground plot is provided with this report (Appendix 2).

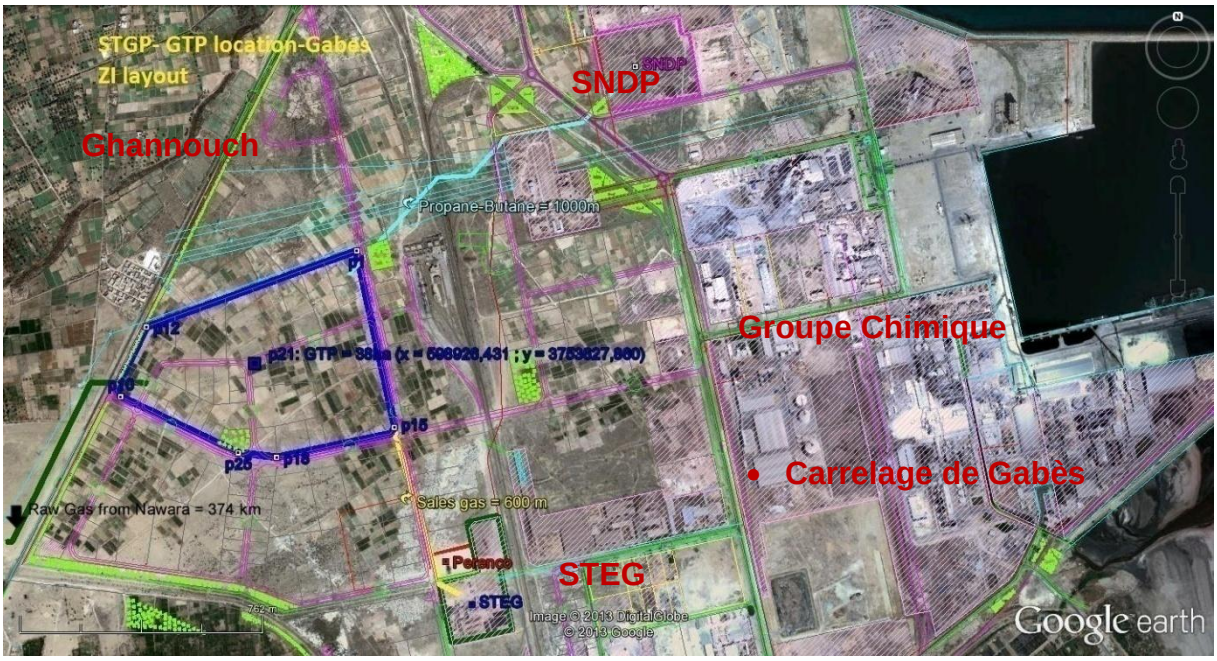


Figure 5 : Gas treatment plant location and neighborhood.

b- Equipment

The gas treatment unit comprises the following units:

- Inlet facilities

- Molecular sieve for water dehydration

- Mercury removal

- Commercial gas compression
- LPG recovery (cooling system)
- LPG Fractionation (Depropanisassions, Débutanisation)
- LPG export pumps
- Export flow fiscal metering
- Liquid product storage

The gas treatment unit should include the following utilities:

- Flare and blowdown system
- Fiscal metering system
- Fuel gas system
- Service water system
- Potable water system
- Open drain system
- Disposal of treated oily water
- Instrument and service air system
- Sanitary effluent treatment system
- Fire and gas system
- Firewater system
- Main electrical power generation and distribution system
- Emergency electrical power generation system

The basic block diagram of the GTP is attached to this study (Appendix3).

2.3 Gas treatment Process

Raw gas is not delivered in the same condition of extraction. It must be treated to provide gas compliant to the specifications required by the clients.

Gas must be dry in transport conditions of temperature and pressure; it must be void of water or hydrocarbons and be cleared of acid or toxic components such as H2S.

c1. Preliminary treatment phase at the Nawara CPF

- **CO_2 Removal**

An amine based process is selected for removal of CO2 from the process gas. Bulk removal of CO2 is achieved most effectively by use of a tertiary amine with a promoter to accelerate the reaction with CO2. A generic process for gas treating is preferred to allow solvent to be procured competitively.

The CO2 removal unit will be installed on a slip stream considering the small quantity of CO2 to be removed from the gas to meet the export gas specification of less than 2 vol%.

- **Water/Condensate Separator**

Liquids from the Inlet Separator drain to the Water / Condensate Separator. The Water /Condensate Separator also receive liquid from the Cold Separator in the hydrocarbon dewpointing system. Gas is issued at the reduced pressure and is compressed back to the gas treating pressure and returned upstream of the CO2 removal unit.

Liquids are separated into aqueous and hydrocarbon phases. Water is drained to the evaporation pits whilst condensate is fed to the Stabiliser.

Connections shall be provided downstream of the Water/Condensate Separator for a desalter (electrostatic coalesceur, centrifuge or hydrophobic cartridge filter depending on condensate physical properties and production rate when need for desalting arises) after formation water breakthrough from the reservoir. Note that this is not expected until year 10 of production according to the Pre-Feasibility Study.

- **Gas dehydration**

Gas separated in the train associated to rich gas will be dehydrated using a Glycol dehydration unit which includes a TEG Column and TEG regeneration unit.

The Glycol dehydration unit, which will be used to dehydrate gas separated in the train associated to lean gas, will include a TEG column, a TEG regeneration unit and posterior compression to meet the STGP specifications.

Wet natural gas flows through an inlet separator or scrubber to remove all liquid and solid impurities. Then, the gas flows into and upward through the contactor where it is contacted counter-currently and dried by glycol. The dried gas finally passes through a gas/glycol heat exchanger and then into the Gas dew Point Control section of the plant.

Reconcentrated or lean glycol enters the top of the contactor where it flows downward from tray to tray and absorbs water from the rising natural gas. The wet or rich glycol leaves the absorber and flows through a coil in the accumulator where it is preheated by hot lean glycol. After the glycol-glycol exchanger, the rich glycol enters the stripping column and flows down the packed bed section into the reboiler. Steam generated in the reboiler strips water from the liquid glycol as it rises up the packed bed.

The water vapour and desorbed natural gas are vented from the top of the stripper.

The hot reconcentrated glycol flows out of the reboiler into the accumulator where it is cooled by heat exchange with rich glycol. Finally the lean glycol flows through the glycol/gas exchanger and is pumped back into the top of the contactor.

Gas cooling is to be achieved by installing a Gas / Gas Heat Exchanger downstream of the Amine Absorber Column which cools the wet gas using cold gas from the Cold Separator.

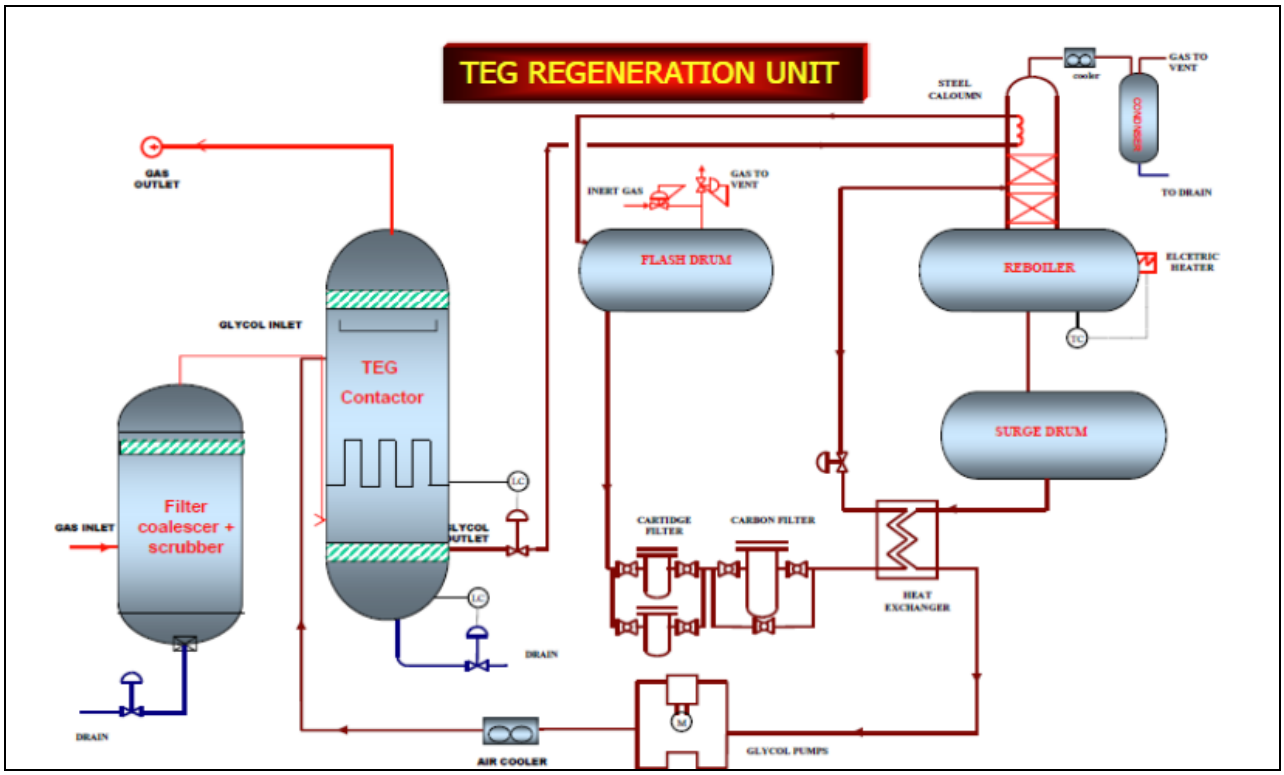


Figure 6 : Dehydration unit

- **Condensate stabilization**

Condensate separated in three-phase separators and LNG recovered in Mechanical Refrigeration Package will be stabilized using two Stabilizer Columns operating in parallel.

Stabilized condensate is cooled down to ambient temperature prior to storage. A 5000 bbl storage tank with fixed roof is considered for the purpose.

Condensate will then be pumped at 70 bar through a 6" pipeline to the TRAPSA pipeline using a centrifugal pump. The tie-in point is approximately 11 km from Nawara oilfield.

- **Produced Water Treatment and Disposal**

Produced water is collected from different sources (inlet separators, scrubbers, etc.) and fed to the closed water treatment system with a corrugated plate interceptor.

Treated water (total hydrocarbons less than 20 ppm) will be routed to an evaporation pit whilst recovered condensate is sent back to the inlet separator

c2. Treatment phase at the Ghannouch GTP

The gas from Nawara, pre-treated at the CPF (Nawara concession, Tataouine Governorate) was treated by adopting the Amine absorption system. This process has allowed the removal of traces of H2S that would possibly present in the raw gas.

For this reason, we will not have to remove H2S in the treatment process to be adopted in the gas processing unit of Ghannouch.

At the level of this unit (Ghannouch), treatment will be primarily based on the process of Mercury elimination.

Indeed, some metal substances such as mercury exist in the form of trace quantities in natural gas.

The presence of Mercury, even in the form of trace may cause corrosion problems particularly in aluminium exchangers used in liquefaction processes.

In the case of the Nawara gas concession, the rate of Mercury could attempt 70ng/m3.

The GTP is designed to handle gases with a mercury content that can attempt 100 ng / m3.

The process of Mercury removal is based on an absorption unit (filters in the form of cartridges) that would be able to treat 2.7 MSCMD of raw gas.

The foreign supplier takes care of the replacement and recovery of saturated cartridges that will be exported to the country of origin. He will also be responsible for collecting the waste generated during the operation of Mercury removal.

Once processing is complete, the recovery of LPG would be provided by a first train that would be capable of producing 2.45 MSCMD of sales gas.

Once treated, LPG will be separated and sales gas will be compressed to be delivered respectively SNDP and STEG.

2.4 Utilized resources

a- Raw materials

The raw material is composed of the raw gas that comes from the Nawara concession in southern Tunisia.

The amount of the raw material received in the GTP is about 4.4 MSCMD.

The following table shows the characteristics of associated gas from the Nawara concession:

Table 4 : Composition of gas at the inlet of the GTP

Components	MW	Light composition summer	rich summer components	Components light winter	Components rich winter
Nitrogen	28.01	0.3299	0.4620	0.3299	0.4621
Carbon dioxide	44.01	1.8004	1.8010	1.8005	1.8006
Methane	16.04	88.4009	83.5799	88.4199	83.6011
Ethane	30.07	5.3849	7.5409	5.3860	7.5430
Propane	44.10	2.4131	4.1910	2.4144	4.1918
Isobutene	58.12	0.4786	0.8558	0.4804	0.8600
n-Butane	58.12	0.6109	1.0085	0.6101	1.0122
Iso pentane	72.15	0.2725	3037	0.2631	0.2859
n-pentane	72.15	0.1583	0.1544	0.1512	0.1436.
n-Hexane	86.18	0.0076	0.0788	0.0071	0.0743
PC6A*	84.79	0.0959	0.0066	0.0894	0.0062
PS1A*	109.65	0.0405	0.0015	0.0413	0.0017
PS2A*	157.92	0.000	0.0000	0.0001	0.0000
PS-1*	112.06	0.0007	0.0088	0.0007	0.0103
PS-2*	159.29	0.000	0.0000	0.0000	0.0000
PS1S*	126.58	0.0005	0.0000	0.0005	0.0000
PS2S*	143.80	0.0002	0.0000	0.0002	0.0000
PS3S*	168.23	0.0001	0.0000	0.0001	0.0000
PS4S*	209.03	0.0000	0.0000	0.0000	0.0000
H2O	18.02	0.0051	0.0052	0.0051	0.0051
C7-C7*	125.00	0.0000	0.0020	0.0000	0.0021
C8-C9*	149.00	0.0000	0.0001	0.0000	0.0002

Table 5 : Nomenclatures des pseudo-components

Pseudo-Component	NBP	MW	Liquid density	Tc	Pc	Vc	Accentricity
	°C		kg/m3	°C	bara	m3/kg mole	
PC6A*	65.43898926	84.78900146	693	239.1750122	32.63600098	0.349999994	0.254000008
PS1A*	115.3839966	109.6500015	739	296.9649902	28.19300049	0.441000015	0.319999993
PS2A*	192.9129883	157.9160004	786	377.75802	22.04100098	0.625999987	0.451000005
PS3A*	277.1339966	226.2019958	824	457.4209839	16.81599976	0.88499999	0.615999997
PS4A*	366.717981	326.3129883	859	536.6440063	12.77	1.218000054	0.825999975
PSA5*	475.6839844	512.0440063	900	629.9300171	9.475999756	1.661000013	1.131000042
PS-1*	118.7210022	112.0579987	716	293.0569702	26.23699951	0.469999999	0.358999997
PS-2*	190.0729919	159.2910004	758	366.3000122	20.705	0.647000015	0.486000001
PS-3*	270.4179932	228.3970032	793	441.4560181	15.74099976	0.90200001	0.647000015
PS-4*	357.6949707	332.6239929	827	517.6219727	11.75199951	1.241999984	0.856000006
PS-5*	469.9560181	543.4660034	869	612.0520264	8.352999878	1.661000013	1.177999973
PS1S*	134.5450073	126.5770035	693	254.5970093	17.64099976	0.582000017	0.643000007
PS2S*	142.3839966	143.802002	702	259.9740234	16.725	0.602999985	0.649999976
PS3S*	154.421991	168.2330017	714	265.3609863	16.555	0.63499999	0.657000005
PS4S*	186.5769897	209.0339966	743	270.8020264	16.23300049	0.725000024	0.663999975
PS5S*	278.607019	264.6119995	792	449.5052734	15.77599976	1.041000009	0.671000004
PS6S*	404.264978	379.17099	847	571.4300171	11.59199951	1.583999991	0.949000001
C7-C7*	145.3273254	125	725	317.4833008	23.25321289	0.534884274	0.420488149
C8-C9*	187.0205627	149	755	358.5332886	20.29509888	0.639025211	0.49972266

Pseudo Component definition: is a non-library or hypothetical component, which can be pure components, defined mixture, undefined mixture, or solids by which we can modify the library of thermodynamic values to characterize any substance none defined in the library of chemicals.

b- Human Resources

b1. Construction phase

The construction of the unit and the installation of equipment require the use of (500) five hundred people.

During this phase, OMV is committed to recruiting local staff (workers).

b2. Operation phase

During the operational phase, 50 people will perform the various activities developed within the unit.

OMV is committed to recruiting local staff.

The unit should be operating 8520 hours / year.

c- Energy requirements

c1. Construction phase

During the construction phase, we will need water (drinking water and domestic water needs for the workers) and electricity (for operating equipment and unit lighting) which will be supplied respectively by SONEDE and STEG.

c2. Operation phase

During the operational phase, the electricity will be produced at the processing unit.

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

Gases will be transferred via gas pipeline from Nawara concession to the Gas Treatment plant at Gabès.

Final products, commercial gas, butane and propane will be delivered respectively to the STEG and SNDP via export lines. Condensate will be stored in tanks in order to be sold.

Equipment must be designed in accordance with applicable standards.

Tables below present the final products characteristics:

Table 6: Characteristics of the sales gas.

Description	Unit	Specifications
Inert	%mol	<6.5
CO2 contained	%mol	<2.0
H2S contained	mg/Nm^3	<7.0
Mercaptan (RSH)	mg/Nm^3	<15.0
Total sulphurs S	mg/Nm^3	≤50
CS2+	% mol	<14.5
Water	ppm	≤80
Water dew point at Pmax = 75barg	°C	≤-10
Hydrocarbons dew point at Pmax = 75barg	°C	≤-5
Gross calorific value	Kcal/Nm^3	9300-10228
Wobbe index	Kcal/Nm^3	11961-12640
Pressure Product delivered to the STEG	barg	50-75 (max)
Temperature Product delivered to the STEG	°C	10-50

Table 7 : Butane characteristics

Description	Unit	Specifications	Test method
Absolute pressure of the vapour 50°C	bara	≤7.0	04.81/ D 1267
Odour		Typical	
Sulphide compounds		Doctor Test	NT04.83/D2420
Specific gravity at 15°C	Kg/l	≥0.0559	NT 04.19/ D 1657
Specific gravity at 50°C	Kg/l	≥0.513	NT 04.19/ D 1657

Water		Absence of water decantation	
Corrosion, Cooper range (3H at 50°C)		Classification / Designation 1b	NT 04.84/ D 1838
Evaporation		Final boiling point (95% Evaporation) ≤2°C	NT 04.85 / D1837
Residue	%vol	0.05%	NT 04.86/ D 2158
Pressure Product delivered to the SNDP	barg	11.5 (max)	
Temperature Product delivered to the SNDP	°C	50 (max)	

Table 8 : Propane characteristics.

Description	Unit	Specifications	Test method
Absolute pressure of the vapour at 37.8°C	bara	8.3≤ Pv ≤ 14.4	NT 04.81/ D 1267
Absolute pressure of the vapour at 50°C	bara	11.5≤ Pv ≤ 19.3	NT 04.81/ D 1267
Odour		Typical	
Sulfide compounds		Doctor Test	NT 04.83/ D 2420
Sulfur content	%wt	0.005%	NT 04.89/ D2784
Specific gravity at 15°C	Kg/l	≥ 0.502	NT 04.19/ D 1657
Specific gravity at 50°C	Kg/l	≥ 0.443	NT 04.19/ D 1657
Water		Not detected with the Cobalt bromide test	NT 04.90 NF M41.004
Corrosion, Cooper range (3H at 50°C)		Classification / Designation 1b	NT 04.84/ D 1838
Evaporation		Final boiling point (95% Evaporation) ≤15°C	NT 04.85/ D1837

Pressure Product delivered to the SNDP	barg	20 (max)	
Temperature Product delivered to the SNDP	°C	50 (max)	

Table 9 : Characteristics of the stabilized condensate

Description	Unit	Specification
RVP at 37.8°C		
summer	Psia kPa	12.1 (Max) 83.0 (Max)
Winter	Psia kPa	12.1 (Max) 83.0 (Max)
Free water	ppm	<500
Mercaptan content (RSH)	ppm	As a product
Pressure at GTP Loading Point	barg	To be determined by the Contractor
Temperature at GTP Loading Point	°C	55 (Max)
Vapour pressure at 50°C	Bar	1.45
Butane Content	%	0.5

The storage of Propane and Butane will be provided by the customer in Gabes. It must be done in accordance with Tunisian standards.

The layout of the storage tanks must consider:

- The easy access to the fire-fighting equipment ;
- Environmental, safety and health factors.

Tanks are set in a manner to avoid product intrusion in case of reversal in the processing area.

The floating roof tanks use to store condensate aims to reduce emissions

4. Means of transportation

a. Construction phase

The layout of the space of movement within the plant will be studied in order to organize the internal traffic. Thus, the separation of off areas is necessary to ensure mobility and safety of employees and the factory

This plan will be integrated in the layout plan during the construction stage.

b- Operational phase

The raw material supplying is ensured by the gas pipeline connecting Nawara concession (Tataouine) to the gas treatment plant (Gabès).

The transfer of the final product to the STEG and SNDP will be ensured by separated export lines.

Domestic waste will be collected and transported by the relevant departments to the nearest landfill.

5. Balance sheet

During the first stage, the plant will ensure the production of2.45 MSCMD of sales gas and associated liquid products (butane, propane and condensate) from a volume of 2.7 MSCMD of gas transferred via gas pipeline from Nawara concession.

The table below presents the final products quantities in the second stage for 7.3 MSCMD:

Table 10 : Final products quantities.

Commercial gas	9.1 MSCMD(maximum capacity)
Propane	696 t/d (maximum production)
Butane	336 t/d (maximum production)
Condensate	40-60 bbl/d

6. Control, waste disposal and effluent treatment

6.1 Construction phase

- **Waste water**

Generated sanitary wastewater will be discharged into a septic tank to be emptied regularly. At the end of the works, the pit will be backfilled.

- **Solid waste**

Solid waste is constituted by food waste, construction waste (rocks, packaging...) scrap.

This waste will be collected selectively.

Construction waste and household waste will be transported to the nearest landfill.

Recyclables (plastic, paper ...) will be transferred to companies authorized by the MEDD.

Scrap will be collected to be sent for scrap companies approved by the MEDD.

- **Atmospheric pollution**

Engines and construction activities produce smoke and dust emissions.

Vehicles and machines are regularly maintained in specialized stations.

The areas of work will be watered at a frequency of 2 times a day to fight dust emissions.

6.2 Operation phase

- **Water discharge**

Sanitary wastewater will be discharged into the ONAS sewerage network.

Rainwater will flow into drains constructed during the construction of the unit and collected in storm drains.

Process water will be collected in a closed drain for a treatment that allows the reduction to 10 ppm of total hydrocarbon content.

The Industrial Real Estate Agency AFI is committed to the treatment of storm water and sanitary sewage and implementation of a manhole or a connection box and the installation of separate systems for the drainage of rainwater and wastewater.

The specifications and the agreement for the purchase of the land are attached to this assessment report (Appendix 4).

The amounts of waste water, including the sanitary one (maximum 100 inhabitants equivalent), resulting from treatment and rain will be collected and treated separately in the said centre and in accordance with the standards in force.

A request for prior approval for connecting the gas treatment unit to the ONAS network was filed; the discharge is attached to this report (Appendix 5).

The final approval of ONAS depend on the drainage network plans to be prepared in the detailed study phase estimated around six months.

- **Solid waste**

Waste contaminated with condensate will be collected, transported and treated by a licensed company.

Solid waste (food waste, plastic bags, bottles, batteries ...) will be selectively collected and transported to the nearest landfill or sold for the purpose of subsequent recycling.

- **Atmospheric pollution**

No residual gas is expected at the GTP. The process will allow recycling the generated gas.

The unit is designed so as to cause no continuous flaring. Only a short-term emergency flaring or for maintenance purposes would be allowed.

Residual emissions of combustion equipment shall comply with the Decree No. 2010-2519 of 28 September 2010 setting the limit values at the source of air pollutants from stationary sources.

To ensure product compliance with the specifications of sales gas in Tunisia, the carbon dioxide CO2 will be reduced to the rate of 2% mol per amine unit located in the centre of the CPF pretreatment which will be built near the site of the Nawara-1 well in southern Tunisia.

No emission of CO2 in the atmosphere is planned in the region of Gabes.

- **Hazardous waste**

The condensate will be transferred by road to TRAPSA or by pipeline to STEG.

OMV is committed to communicating to the ANPE the final transfer mode of the condensate.

The mercury removal will be done at the GTP in Ghannouch; recovered waste will be taken care of by the supplier of filters, who will also be in charge of replacing the cartridges and collecting the used ones.

Therefore no effluent will be contaminated by mercury at the level of the gas treatment unit in Gabes.

7. Accidents, risks/ Follow up and control

During the land development and construction operations phases, as well as during GTP 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:

- Work accident while handling machinery during construction
- Negligence in operation during handling or operating of raw materials and final products;
- The exhaust gases from various operations
- Negligence of manoeuvres during the various sequences of tasks.
- Gas leak, or broken pipe or rupture or anomaly in facilities operation
- Gas leak or burst pipes during the evacuation of final products
- Breakdowns and sudden Failure of machines.
- A risk to public health can possibly threaten people in the vicinity of the unit in case of a serious leak or fire triggering.
- Risk of leakage of condensate during its transfer (either by road or by pipeline).
- An environmental risk is also likely if fire occurs. Causing internal burns to the lungs and airways. The smoke carries heat (hot gas and particles) and thus causes a rise in temperature in the facilities where it spreads and can also lead to triggering another fire, away from the initial one.
- Risk of inhalation of toxic gas or chemicals
- Soil contamination due to leakage of liquid chemicals (methanol, glycol, ...);
- Fire hazard due to handling of flammable products
- An explosion would also be likely when the smoke charge with unburned gas is mixed with air. The compounds of smoke are not only in the air but also in the solid residues of fire which may present a risk of contamination of water and soil.

- Solid waste generation (domestic, industrial, construction materials ...)

This kind of accident can be prevented by:

- Equipping the facilities with portable fire extinguishers as well as each service vehicle, and a reserve of sand or soil of at least 300 m3

- Developing a system of drainage and retention capacity "sufficient" for the fire water (unspecified capacity)

- Providing multiple access points to facilitate rescue services.

- Sensitizing workers and employees about the danger of handling some products

- Wearing adequate personnel protective equipment (breathing mask, eye mask, gloves, overalls, ...)

- The establishment of signposts to remind workers about the various safety and proper handling of products and machines.

- In case of transfer of the condensate by pipeline, a regular monitoring of the pipeline should be made.

- In the case of a transfer by road, the means of transport must meet the technical requirements of transport and specific equipment requirements. Regular maintenance of the truck must be ensured. A safety data sheet must be completed at delivery and at reception of the condensate in order to ensure monitoring if needed. Signalling by label must be provided and displayed on the driver cabin and on the container to indicate the nature of the cargo. The driver must have a valid medical certificate certifying his ability to practice this job.
The staff responsible for loading / unloading must be continuously trained.

Natural environment

1. Analysis of the initial state of the layout site and its environment

1.1 Description of the natural environment

a- Geology

The geology of Gabes is not uniform; it includes morphological-structural domains including various sedimentary sequences that have a variation of features and thickness.

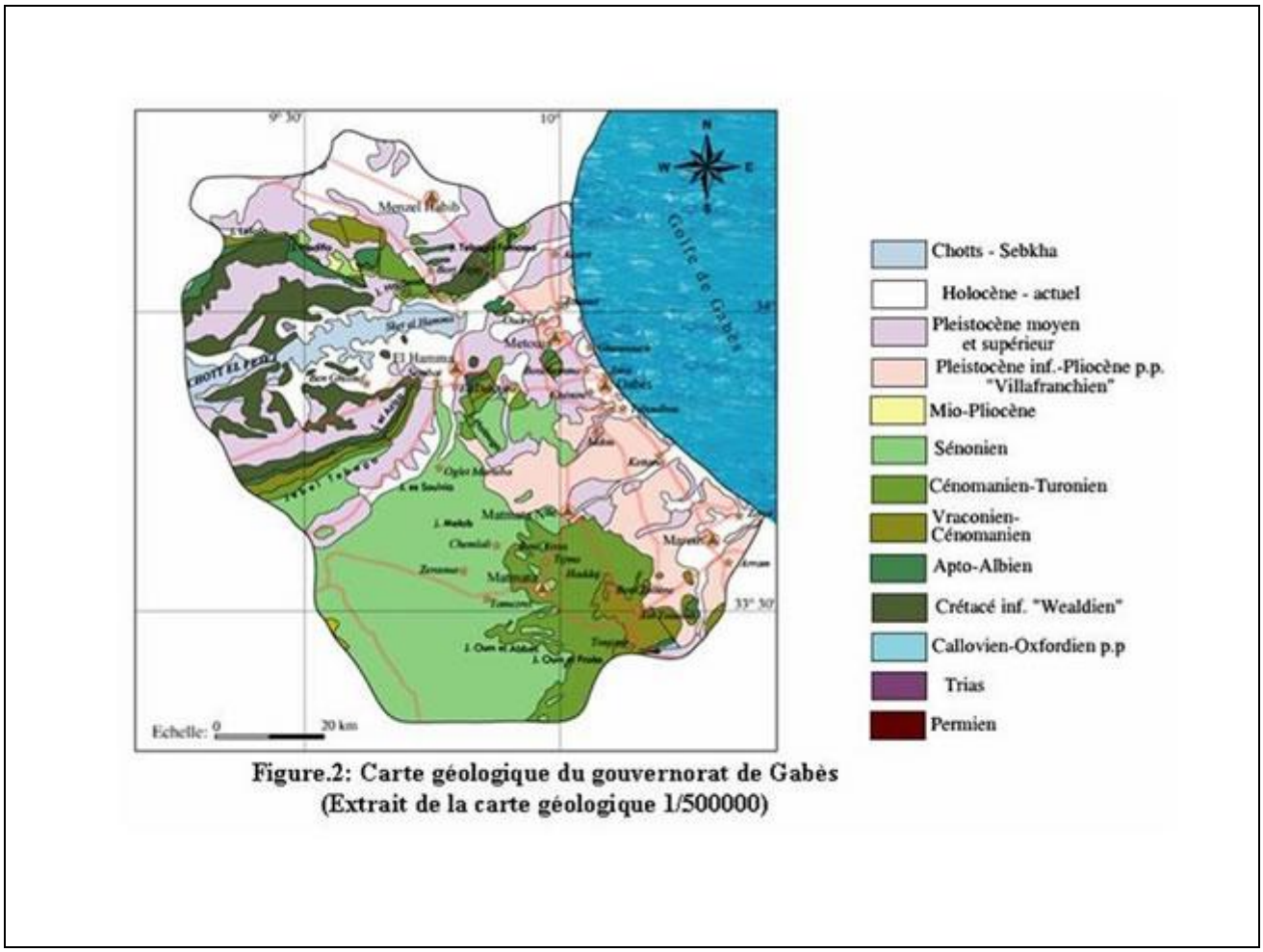


Figure.2: Carte géologique du gouvernorat de Gabès
(Extrait de la carte géologique 1/500000)

Figure 7: Geological map of the governorate of Gabes.

From south to north we can distinguish:

- Matmata Mountains and the Jeffara plain of collapse :

The mountains of Matmata correspond to the northern end of the chain of Dahar which runs from the Matmata region in the north to the Tunisian-Libyan border in the south.

It is an alignment of monoclinal structures slightly leaning towards the West and neatly shaped by erosion, generating remarkable cuestas.

The Jeffara plain of collapse extends from the base of the Matmata cuestas to the Mediterranean coast and is not characterized by the extension of a quaternary modelling with a succession of alluvial fans upstream, vast erosion glacis that are sealed by limestone or gypsum crusts, and floodplains downstream, before reaching the quaternary marine and dune formations on the coastline.

- The cuestas of the Kébili-Tebaga chain

The Kébili Tebaga chain stretches from the Gabes El Hamma region to the level of Souk Lahad Oasis. The eastern end of this chain is part of the Governorate of Gabes which represents the southern fallout of large El Fadjej anticline. It corresponds to a monoclinal represented by a long massive and homogeneous cuesta, formed in the Upper Cretaceous series. The ridge is formed by the Turonian carbonates while a valley cut into the Cenomanian series is observable, while being increasingly wider from east to west. At the base lies the vast depression of El Fajjej, bound on the north by the anticlinal chain of Cherb

- Depression of Chott el Fajjej: Eastern end of the Cherb chain

Chott El Fajjej is the most easterly of the great Tunisian chotts. It occupies an anticlinal ridge located at a low altitude (20 to 25m) and corresponding to an elongated anticlinal valley. It stretches over 50km long and 4 to 5 km wide. It is overhung to the north by the anticlinal Cherb chain. At the southern border, extensive erosion glacis extend and connect directly to the cuestas of the Kébili-Tebaga chain. To the west, the Chott El Fajjej connects directly to the Chott el Jerid to form a vast area of salty Sebkhas.

- Pleated reliefs Zemlet El-Beida Aidoudi

The Governorate of Gabes also houses the pleated reliefs of Zemlet Jebel el Beida Aidoudi and Chebket Bouloufa These are anticlinal structures close to the EW and NE-SW direction arranged obliquely to the average E-W orientation of the Cherb chain. Their southern sides are warped and spilled and cut by a network of ravines that flow into the Chott El Fadjej. They are characterized by numerous faults and flexures of E-W to N-W and S-E to N-S orientation.

b- Geomorphology

Geomorphology changes and it consists of regional expansion loess. Structures are crossed by talweg and ravines. Dolomitic limestones form plateaux in the shape of cuestas with steep slopes.

Geomorphologic formations are particularly visible in Matmata-El Hamma reliefs. 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 extensions. 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 dolomite 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 of accumulation, between Gabes and Oued Akarit, sliced by 10 meter high oueds, extends from Djebel 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 silt 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 the Tebaga 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

The Gabes region belongs to the upper arid bioclimatic level with mild winter influenced by the Mediterranean climate. Between two different currents, in the South the Saharan one and in the East the Mediterranean one, this area undergoes

significant variations from one year to another, causing drought and flooding episodes.

- Temperatures

The average monthly temperature calculated over a period of 3 years are around 21 ° C, ranging from 10 ° C in January (the coldest month) at 29 ° C in July and August (the hottest months).

Table 11 : Average temperatures (in °C)

	J	F	M	A	M	J	J	A	S	O	N	D	Avrg
2006	10.2	12.7	16.6	20.2	23	25.5	28.8	29.2	26.7	24.7	19.4	15.1	21
2007	15.2	16.7	17.1	19.5	24	27.5	27.4	29.2	27.9	24	16.	12.9	21.52
2008	12.6	12.7	16.1	19.4	23.3	24.9	29.1	28.6	27.2	22.6	16	11.1	20.3

An agricultural campaign was conducted in 2009-2010 in Southern Gabes unit which results are displayed in the table below:

Table 12: Average monthly temperatures during the crop year 2009-2010.

Unit	**2010**				**2011**							
Southern Gabes	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**March**	**April**	**May**	**June**	**July**	**August**
	24.4	19.6	13.8	10.7	9.2	11.5	14.0	17.1	21.3	24.4	28.3	28.2

Source : ODS (2010)

Wind

In the study area, the dominant winds blow from continental and maritime sectors:

- The West / Southwest wind direction represents the continental sector;
- The East / Northeast wind direction represents the maritime sector.

During winter, winds from the western sector prevail.

The origin of these winds can be explained, firstly, by the passage of disturbances and secondly by mild to moderate continental winds.

In the month of March continental and maritime winds strike a balance. From April to June, the winds of the maritime sector become more frequent compared to the frequency of continental winds.

During summer, the prevailing winds are blowing from the south-eastern sector. The fall season is marked by the gradual return of westerly winds.

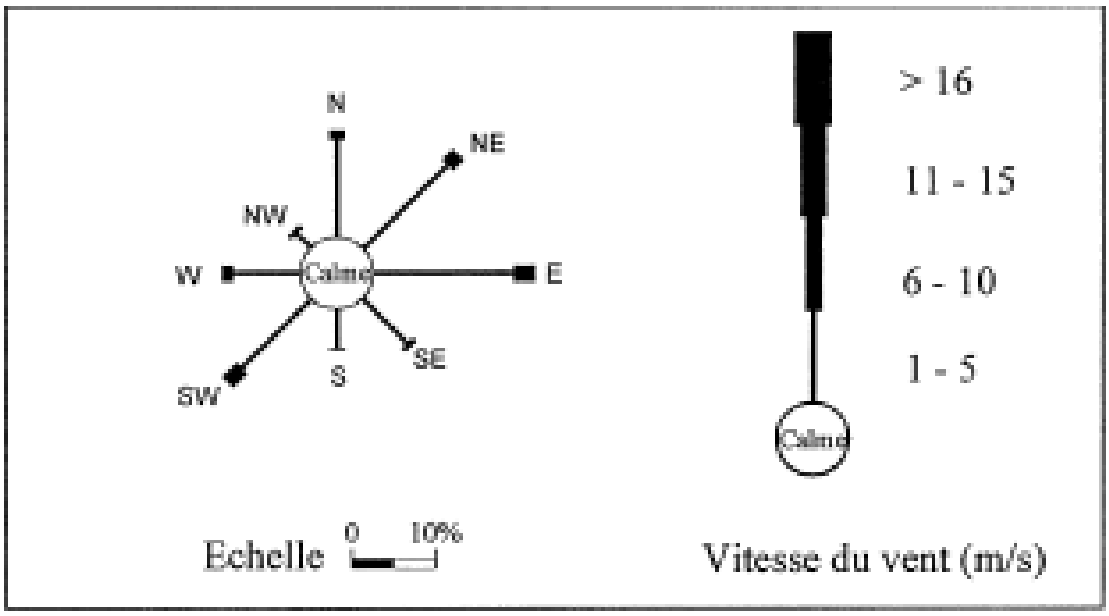


Figure 8: Wind compass in the study area

The following table shows the main characteristics of wind, blowing in Gabes and evapotranspiration measured at the Southern Gabes unit.

Table 13 : Wind and evapotranspiration in Gabes

Unit	Maximum speed m/s	Minimum speed m/s	Evapotranspiration per day (mm)	Total evapotranspiration (mm)
Southern Gabes	0.9 October	0.4 June	4.4	1568.1

Source: ODS, 2010

Rainfall

Rainfall in the region of Gabes varies from one year to another. They can range between two extremes, from 130 to 399 mm.

Approximately 90% of the annual rainfall occurs between October and April. The maximum intensity in the rain can reach 110 mm / h. The average number of rainy days is 42 days per year.

Table 14 : Average rainfall (in mm)

	J	F	M	A	M	J	J	A	S	O	N	D	Som.
2006	16.51	20.83	1.77	10.42	83.06	2.54	0	3.81	92.96	7.11	71.37	88.91	399.29
2007	0	31.23	65.28	43.95	1.02	7.62	0	0.51	0	135.89	5.08	40.63	331.21
2008	6.61	0.76	2.79	9.15	1.52	1.27	0.51	0	12.95	1.02	77.73	16.51	130.82

Relative humidity

The values of the relative humidity during the last three years are comprised between 57 and 67%.

In winter, humidity is relatively high because of rain and low temperatures.

Table 15 : Average relative humidity (%)

	J	F	M	A	M	J	J	A	S	O	N	D	Avrg
2006	72.5	65	55.2	66	66.3	64.1	64.9	68.1	63.4	63.1	62.6	74.1	65.44
2007	64	60.7	64.8	79.9	64.5	64.8	63.9	63.9	67.6	65.8	59.5	75.4	66.23
2008	73.6	68.8	60	60.2	54.2	52.9	48	51.7	49.8	59.4	54	60.4	57.75

d- Hydrology

In the Governorate of Gabes, the hydrographic system is developed and catchment basins are represented by monoclinal geological structures.

e- Hydrogeology

- Gabes oasis

The Gabes Oasis occupies a funnel-shaped low sector that is open to the sea This catchments basin of Gabes Wadi is located between the alignment of hills forming the Dkhilet El Gouatna Jebel and the sea.

The development of oasis activities in Gabes depends closely on the availability of groundwater in the region.

The irrigation water of this oasis comes from the Northern Gabes water table that is part of a large hydraulic system: the Jeffara water table. This is a confined groundwater which artesian level is at a depth exceeding 30 m.

The water goes through a complex network of faults, the most important extending from Ouedhref to Mareth. This gives an alignment of several sources over a strip of 5 to 6 km from the coastline forming a natural outlet of the water table.

The Gabes groundwater table is housed at two levels: Senonian limestones located between 100 and 150 m deep and sandy formations of the Mio-Pliocene that are positioned between 40 and 100 m depth. The two water tables are superimposed and interconnected aquifers.

Most often the Mio-Pliocene sands lie directly on the Senonian limestones. Thus, the pressurized water migrates upwardly following the dislocations through limestone and sand. It reaches the surface, due to artesianism, giving way to outbreaks (water springs). The Gabes oasis is located in the southern part of the water table compartment of Northern Gabes. Indeed, a fault which perpendicular to the coast and to the great fault of Ouedhref-Mareth constitutes the threshold separating the two compartments of the Jeffara water table. The Gabes Wadi springs constitute natural outlets of the Northern Gabes water table.

- Southern Gabes

The coastal water table of Southern Gabes is part of the multi-layer water table system of Northern Jeffara. It is formed by Quaternary age alluvial and detrital sediments and by sandy clay deposits dating back to the Mio-Pliocene age.

The groundwater table of southern Gabes is the oldest operating water table in Gabes. Although it has good hydrogeological and hydrochemical characteristics, the table is increasingly solicited.

The greatest densities of shallow wells are located in the region of Kettana and Mareth.

The uneven distribution of water use in the area causes a hydrodynamic and hydro chemical imbalance as well as the risk of intrusion of marine waters in case of an advanced operational phase.

The following table illustrates the various water resources:

Table 16 : Water resources

Sources	Resources Mm3 / year	Operation Mm3 / year	Number of wells	Number of equipped wells
Underground water:	185.4	157.9	3700	2265
Water tables	24.4	23.9	3265	2115
Deep water tables	161	134	435	150
Runoff water	44	9	0	
Used water	17	3	0	
Total	246.4	169.9	3700	2265

Source : Commissariat Régional au Développement agricole, 2011

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 gross colluviums of the slope.

The different types of soil are:

- Raw soils (unsophisticated soils) are erosion soil (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. Thus, lithosoils and regosoils are developing on relief: That is the case of El Hamma, Matmata.

g- Air quality

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.

The control unit of the air quality installed in Gabes in 2007 does not provide accurate and complete results

An evaluation of the different results published by the National Agency for Environmental Protection 'in the 2008 annual report and monthly report for 2009 published by the National Monitoring Network of Air Quality. The average concentrations of air pollutants are given in the tables below. The obtained averages allow a comparison with the threshold values set by the Tunisian Standard NT106-04 and guidelines set by the World Health Organization (WHO).

Table 17 : Hourly, monthly and annual average concentrations of air pollutants (Annual Report, 2008)

Receptors	Pollutants µg/m^3							
	PM_{10}		SO_2			NO_2		O_3
	24h	1y	3h	24h	1y	1h	1y	1h
Gabès	-	-	1462	294	26	78	13	146
NT106-04	260	80	1300	365	80	660	200	235
WHO (2005)	50	20	-	20	-	200	40	-

Table 18 : Hourly and daily average concentrations of air pollutants (Annual Report, 2009)

	Pollutants µg/m^3					
	PM_{10}	SO_2			NO_2	O_3
	24h	3h	24h	1y	1h	1h

August 2009	295	304	123	26	136	72
September 2009	127	114	38	80	35	115
October 2009	223	132	55	-	265	274.
November 2009	231	26	8		154	-
NT 106-04	260	1300	365		660	235
WHO (2005)	50	-	20		200	-

The concentrations of SO2 (measured in 3h) exceeded the thresholds of the NT106-04 in 2008. A second overrun of NT106-04 was recorded in August and October 2009 respectively for PM10 and O3. Compared to thresholds set by the WHO, the values of PM10, SO2 and O3 were by far exceeded.

h- Fauna

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-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 erection site of the gas treatment unit is located in the Ghannouch industrial area where no human craft or household activity could be observed. Therefore, no particular fauna or protected species could be observed.

i- Flora

Flora is widely affected by the arid climate. Disseminated vegetation is depending on soil quality.

Thanks to ‘jessours’, 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.

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...

The installation of the unit site is planned in a developed industrial area, where there is no special or protected species of flora.

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, gazelles, buffalo, serval, Barbary sheep, lynx, cheetah, hyena, fennec fox, porcupine, bats, white hedgehog, gundi, wildcats, otters, monk seal, mares, sows, boars and small of all wild 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.

No protected area is in the vicinity of the proposed unit.

1.2 Landscape

The gas treatment unit is located in the industrial area of Gabes (Governorate of Gabes). It is located between the towns of Bou Chemma and Ghannouch and borders several plants such as Gabes Chemical Group, the Group maintenance

Sagaz, Ben Hammouda society, society Retleg Concrete, Tile Company of Gabes, Gabes Concrete Company, Cable Company Gabes, STEG power plant...

1.3Description of the human, socio-economic and cultural environment

The governorate of Gabès is located in the south east of the country and covers a surface of 7 175 km^2, representing 4.4 % of the country total surface. It housed in 2012 a population of 367 500 inhabitants. Its county town is Gabès.

Located 365 kilometres away from the capital, the governorate is bordered by the governorate of Sfax to the North, by the governorate of Mednine to the south, by the Mediterranean Sea to the East with a coastline that extends over 80 kilometres, and by the governorates of Kébili et Gafsa to the west. The governorate covers ten delegations, ten municipalities, nine rural Councils and 73 imadas. We find there three types of regions.

a- Background data

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

- An Important human potential.

b- Socio-economic data

The governorate economy relies, like all governorates that face the Mediterranean, on agriculture and fishing. The governorate is one of the richest fishing areas in Tunisia.

In the industrial field, the Governorate displays a park that concentrates mainly chemical industry (phosphate processing with the production of phosphoric acid, and di-ammonium phosphate and dicalcium phosphate) and agrifood.

Exchanges take place thanks to the marina, which has eleven wharves and twenty berths. In 2000, its traffic was estimated at 4 000 000 tons. Manufacturing industries

employ 41.5 % of the active population, the tertiary sector employs 35.5 % and farming 23 %.

There are three industrial areas: Gabès, Métouia-El Aouinet and El Hamma.

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

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.

1.4Historic and archaeological sites

The gas treatment unit is located in the industrial area of Ghannouch. The developed area is far from any historical monument that is typical to Gabes.

In case of a discovery (archaeological remains, artistic or traditional objects) during the construction, laying and burial phase of the GTP, 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.

2. Sampling campaign

As part of the development of the study of Environmental Impact of the construction of the gas treatment unit in Ghannouch, a sampling campaign for water, groundwater and soil, as well as the characterization of ambient air and the initial condition of the site was conducted on April 18, 2013 at Ghannouch.

Sampling and analyses were provided by GreenLab and L2A laboratories.

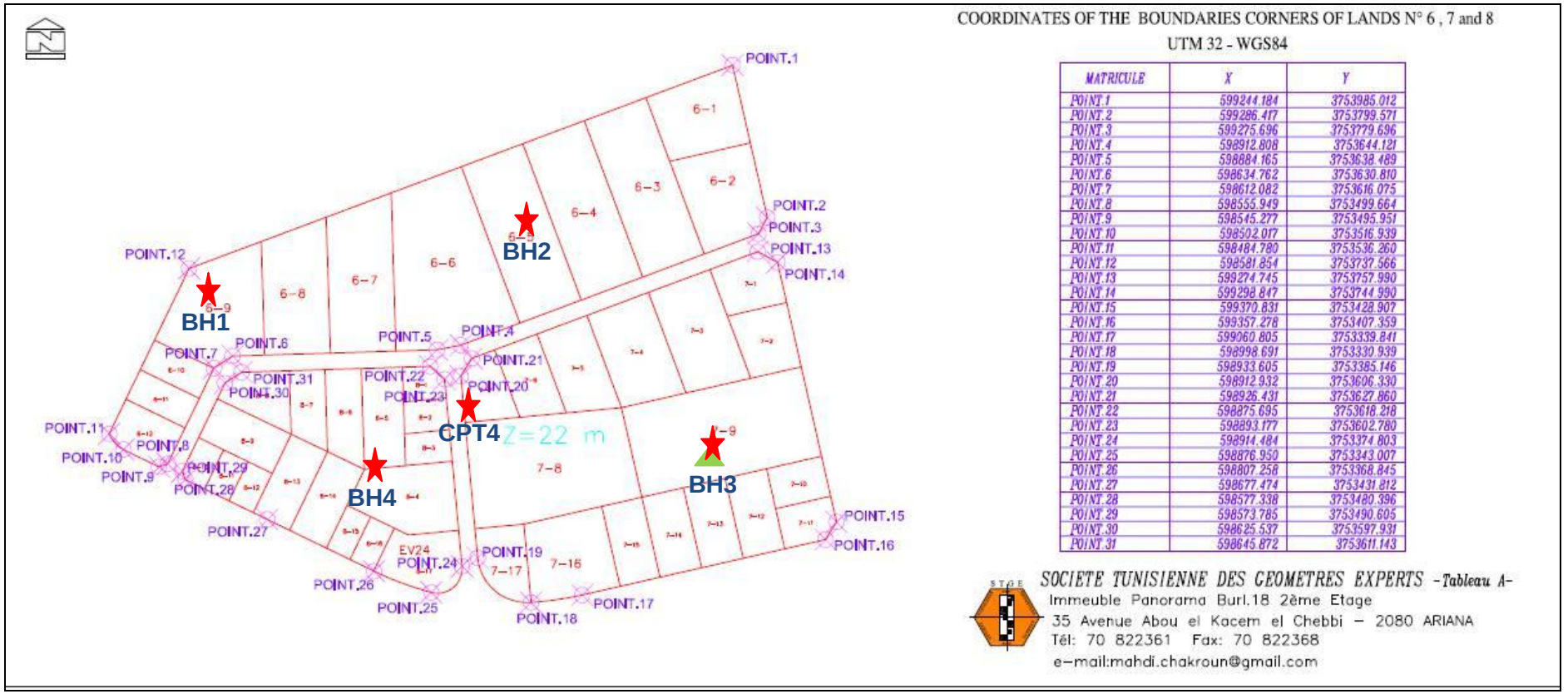
Figure 11 shows the distribution of the sampling points on the site of the proposed unit. The photos below were taken during this campaign.

3. Sampling

a- Soil samples

Soil samples will be provided from cores taken on site as part of the geotechnical survey conducted by the Geoconseil laboratory. The depth reached is 30m and the number of piezometers is 5.

Figure 7 : Drill core (BH1)



COORDINATES OF THE BOUNDARIES CORNERS OF LANDS N° 6 , 7 and 8

UTM 32 - WGS84

MATRICULE	X	Y
POINT.1	599244.184	3753985.012
POINT.2	599286.417	3753799.571
POINT.3	599275.696	3753779.696
POINT.4	598912.808	3753644.121
POINT.5	598884.165	3753638.489
POINT.6	598634.762	3753630.810
POINT.7	598612.082	3753616.075
POINT.8	598555.949	3753499.664
POINT.9	598545.277	3753495.951
POINT.10	598502.017	3753516.939
POINT.11	598484.780	3753536.260
POINT.12	598581.854	3753737.566
POINT.13	599274.745	3753757.990
POINT.14	599298.847	3753744.990
POINT.15	599370.831	3753428.907
POINT.16	599357.278	3753407.359
POINT.17	599060.805	3753339.841
POINT.18	598998.691	3753330.939
POINT.19	598933.605	3753385.146
POINT.20	598912.932	3753606.330
POINT.21	598926.431	3753627.860
POINT.22	598875.695	3753618.218
POINT.23	598893.177	3753602.780
POINT.24	598914.484	3753374.803
POINT.25	598876.950	3753343.007
POINT.26	598807.258	3753368.845
POINT.27	598677.474	3753431.812
POINT.28	598577.338	3753480.396
POINT.29	598573.785	3753490.605
POINT.30	598625.537	3753597.931
POINT.31	598645.872	3753611.143

SOCIETE TUNISIENNE DES GEOMETRES EXPERTS -Tableau A-
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35 Avenue Abou el Kacem el Chebbi – 2080 ARIANA
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e-mail:mahdi.chakroun@gmail.com

Figure 8 : Distribution of sampling points

★ : Characterization point of the ambient air quality

▲ : Water Sampling point

BH : Boring wells

CPT : Test point by static penetration

A sample of 1m depth taken from each of the five piezometers will be sufficient.

The sampling will be done according to ISO 5667.

The samples will be put in a total solution in accordance with the French standard NF X 31-147.

The table below shows the parameters to be analyzed and the methods to be adopted:

Table 19: Parameters and analytical methods.

Parameters	Method	Reference
HAP	- Extraction by Soxhlet after lyophilization -Gas chromatography coupled to mass spectrometry	PT-MO-PH-GO-01
Aluminum, Cadmium, Copper, Cobalt, Iron, Zinc, Nickel, Manganese, Chromium, Arsenic, Selenium, Lead, Tin	Total dissolution by acid attack	NT ISO 11885 (2007)
	Atomic emission -ICP	
Mercury	Total dissolution by acid attack	Perkin Elmer (2008)
	Atomic Emission with hydrides system	
hydrocarbons Index	- Liquid extraction/ solvent liquid - Gas chromatography	NF EN ISO 9377-2 (2000)
Radioactivity	Gamma spectrometry (Ge H.P detector)	Subcontracting C.N.R.P Ministry of Health

b- Water samples

The water is pumped from a well drilled by the Geoconseil laboratory.

The sample was taken according to ISO 5667 reference.

The table below lists parameters for analysis:

Table 20 : Parameters and analytical methods.

Parameters	Method	Reference
pH	Electrochemistry	NF T 90-008 (2001)
Conductivity	Electrochemistry	NF EN 27888 (1994)
Dry residue	Gravimetry	NF T 90-029 (2002)
DCO	Titrimetry	NF T 90-101 (2001)
DBOn	Electrochemistry, dilution method Adding nitrification blocking agents 5 days Incubation	NF EN 1899-1 (1998)
Nitrates, chlorides, sulfates, fluorides	Ion Chromatography	ISO 10304-1 (2007)
TA-TAC	Titrimetry	NF EN ISO 9963-1 (1996)
Sodium- Potassium	Flame emission spectrometry	NT ISO 9964-3 (1193)
Calcium	Titrimetry	NF T 90-016 (1984)
Hardness	Titrimetry	NF T 90-003 (1984)

Magnesium	Computation: Hardness-Calcium	-
Aluminum, Cadmium, Copper, Cobalt, Iron, Zinc, Nickel, Manganese, Chromium, Arsenic, Selenium, Lead, Tin	Atomic emission Spectrometry ICP	NT ISO 11885 (2007)
Mercury	Atomic emission spectrometry (ICP-OES) coupled to a hydrides-generating system	Perkin Elmer (2008)
Oils and grease	Extraction with an organic solvent	Rodier, 8th edition (1996)
Hydrocarbons index	- Liquid extraction/solvent liquid - Gas chromatography	NF EN ISO 9377-2 (2000)
total coliforms	Filter membrane	ISO 9308-2 (1990)
Radioactivity	Gamma spectrometry (Ge H.P detector)	Subcontracting the C.N.R.P Ministry of Health

c- Characterization of the ambient air

The characterization of the ambient air quality has been performed on five spots distributed over the site of the proposed unit.

Figure 9 : Measurements of ambient air parameters (near BH3).

The following table outlines the various parameters to be analyzed:

Table 21: Parameters and analytical methods.

Parameters	Method	Reference:
Dust PM10	Sampling on a fiberglass filter and gravimetric analysis	NF X 43-023
Sulphur dioxide SO2	Sampling by bubbling through a hydrogen peroxide solution and analysis by ion chromatography	NF X 43-011 ISO 10304
Nitrogen oxyde NO2	Electrochemical measurement using a direct	UL Std 61010-1

	reading tool	RSST-30-B
Fluorine and F Fluorine compounds	Sampling by bubbling through an alkaline solution and analysis by ion chromatography	OSHA method reference JD.110 ISO 10304
Hydrogen Sulphide	Electrochemical measurement using a direct reading tool	RSST-7-B UL Std 61010-1

4. Outcome of the analyses

Details of the results of the analyses are presented in the appendixes to this study (Appendices 6, 7 and 8).

These results will serve as benchmarks when the follow up of these parameters or some of them will be made during operation of the unit and after the site is abandoned.

Impacts assessment

1. Direct and indirect environmental impacts analysis

1.1 Construction phase

The site development and the construction of the gas treatment unit involve the following activities and works:

- Machines and transport traffic of construction materials and equipment.

- The preparation and the development of access roads.

- Site preparation (stripping of vegetation, excavation, site clearing, Earthworks).

- The development of areas for the storage, stockpiling and disposal of loose soil, rubble and construction waste.

- The implementation of the storm water network, the potable water network, the sewage network and electricity network.

- Civil engineering and construction of the premises.

- The installation of heavy equipment.

a- Impacts on geology and soil

Planned activities won't have impacts on geology and soil because the implementation site is in an industrial zone yet arranged to receive such projects.

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

b- Impact on air quality

During the construction stage, the different operations of setting the plant will generate dusts.

The air quality will be, temporarily and slightly, affected by dusts and engines smoke (CO_2 produced by the engine fuel combustion).

This impact is temporary and minimal.

c- Waste water

Waste water generated during the construction stage is domestic water.

d- Impacts on fauna

The site is located in an industrial zone which is not sheltering protected fauna. Thus the different activities of construction won't impact on fauna.

e- Impacts on vegetal cover

The processing unit will be installed on an industrial land bare of any vegetation. There will be no impact on plant species.

f- Noise

During the construction phase of the unit construction machines produce noise during the day. The noise generated will be limited to the construction area of the unit, away from urban areas (land site for industrial purpose) and the staff working directly on site (workers, engineers, ...) will be equipped with protective helmets.

This impact is temporary and minor.

g- Visual Impact

Crowding and storage of construction materials in the disposal areas in the open air can cause an eyesore.

This impact is temporary and insignificant for the construction area is for industrial use.

h- Solid waste

Solid wastes generated by the construction phase are:

- Household garbage
- Construction waste (wood, brick ...)
- Batteries, barrels and empty containers

These wastes are collected, segregated and distributed to the appropriate companies to be recycled.

Household garbage will be deposited in the nearest landfill.

The impact of the solid waste is minimal and even inexistent.

i- Used oil

Oily waste will be generated by the construction engines.

They will be collected in tanks and forwarded to the SOTULUB to be recycled.

j- Impacts on infrastructure and buildings

The construction of the treatment unit will have no conflict with the existing infrastructure and buildings as the site is already arranged for industrial activities.

k- Impacts on road traffic

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

l- Impact on Safety and health

The negligence of the safety practice may cause accidents and disturb the activities.

Sensitive awareness of the different tasks of the construction and commissioning of various plant equipment is essential to ensure good behaviour.

This impact is minimal and unlikely.

1.2 Operation phase

a- Impacts on geology and soil

The operation of the gas treatment unit has no impact on the geology of the environment

A risk of leakage of oil or chemicals used in the treatment process may contaminate the soil. This risk is minimal in view of the maintenance procedures and controls planned by workers of the unit.

In case of transfer of condensate to STEG through the pipeline, the risk of accidental leakage does exist. This risk is minimal in view of the monitoring program for the status of the pipeline that will be undertaken by the unit environment officers.

In the case of transfer of condensate by road, a risk of a spill is likely during the loading / unloading of the material this risk is minimal as the means of transportation will be rigorously maintained on a regular basis.

b- Visual impacts

During the various operating processes of the unit, a visual impact may be generated by the storage of solid waste (garbage, empty drums ...).

This impact is negligible in view of the site nature and the small amount of waste stored while awaiting delivery to the appropriate companies.

c- Air quality

During operation, a possible release of gas may occur during maintenance operations.

This release is not common during the life-cycle of the unit and the quantity of released gas is very limited.

These releases are negligible and temporary compared to atmospheric emissions generated by other neighbouring industries such as the Groupe Chimique.

There is no impact on the air quality.

d- Cumulative impacts

The unit site is located in the industrial area of Ghannouch which already characterized by the existence of many plants (Groupe Chimique, Sagaz, Carrelage de Gabès…)

Discharges generated by the gas treatment unit (solid waste, liquid waste, occasional gas release) are negligible and temporary. Therefore, the gas treatment unit will not have a disturbing influence on its environment.

Due to the lack of the information about air quality in the industrial zone of Ghannouch, an environmental baseline (soil, water, air) was elaborated.

Overruns of standards occurred in this area. For that reason a study of air quality must be done regularly to monitor the concentration of pollutants in the vicinity of the unit.

e- Noise and vibration

During the operation of the unit, noise will be produced by power generator, electric motors, turbines, gas coolers.

There will be no permanent increase in noise that would bother the environment and workers.

f- Operation and maintenance waste

Operation activities will not generate particular waste.

Maintenance works generate lubricant oils, filters, batteries ... These will be sorted out and transported by the relevant departments for recycling.

Saturated filters generated by the process of mercury elimination will be collected and recovered by the supplier. No storage of filters is planned at the gas treatment unit.

g- Waste water

During operation, water waste will be sanitary or generated by gas process.
Sanitary water will be evacuated in the sewerage system connected to the sanitary system of the industrial area.

Water produced during the process will be treated.

h- Impacts on fauna

Gas processing wouldn't have any impact on fauna because all the operations will be done inside and will not generate any hazardous waste. Moreover, the establishment zone is arranged and doesn't shelter any protected species.

i- Impacts on flora

The site of the gas treatment unit is home to no protected flora. It is an area dedicated to industry.

j- Risks to the neighborhood

The main hazards associated with the operation of the gas treatment unit and which threaten neighbouring institutions are:

- Risk of explosion
- Fire Hazard
- Risk of asphyxiation

These risks arise from the fact that this industry uses gas and products that are hazardous to environment and to health.

These risks are threatening the safety of the neighborhood but safety measures and awareness campaigns to various risks that may be incurred should be regularly taken into account before, during and after each day's work.

k- Impacts on socio-economical activities

The gas treatment unit will be a new source of employment in the governorate of Gabes.

Indeed, this new unit will involve a number of managers and workers who will be in charge of the various operations related to treatment.

This impact will therefore be positive.

1.3 Abandonment phase

The abandonment phase should be the subject of a separate impact assessment.

At the end of the unit operation period, the abandonment of facilities will be made in accordance with the legislation in force and the available technologies and practices.

As with all phases of the project, the applied approach consists of ensuring that the design, construction, operation and abandonment of facilities will be made in a way allowing avoiding the generation of hazard or impact on environment.

The aim will be to abandon the site of the unit in a state as close as possible to its original status or to develop a green space that will be integrated in the future environment of the area.

2. Environmental impact assessment

a- 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 GTP. 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.

b- Impact certainty

Three impact 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 **unlikely** when we are not sure it will happen after its analysis

c- 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.

d- Type of impact

Positive*:* if it presents advantages to the surrounding environment

Negative: if it presents harmful impacts to the surrounding environment.

e- 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

f- 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..

Rectifiable: if Mitigation measures are defined in order to minimize partly or totally or even neutralize its effect.

3. Summary tables and impacts fact sheets

a) Construction phase

Table 18: Impacts during the construction phase

Environment	Environment components	Potential impacts	Impacts assessment				
			I	C	D	T	A
Physical environment	Land occupation	No Impact					
	Landscape	Visual impact due to the storage of construction materials	2	C	1	-	O
	Air quality	Dust	2	C	1	-	O
	Noise and vibration	Engines noise	2	C	2	-	N
	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	Contamination due to leakage of gear oil	1	E	1	-	O
Human and socio-economic environment	Employment	Creation of some jobs	3	C	3	+	
	Population	No impact					
	Urbanization	No Impact					
	Tourism	No Impact					
	Agriculture	No Impact					
	Commerce and industry	Fulfilment of the commercial and industrial sector (buying and selling construction materials ...)	3	C	3	+	

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 : non correctable
3 : major	E : little probable	3 : long		

b) Operation phase

Table 19: Impacts during the operation phase

Environment	Environment components	Potential impacts	Impacts assessment				
			I	C	D	T	A
Physical environment	Land occupation	No Impact					
	Landscape	No Impact					
	Air quality	Slight gas leak in case of emergency	1.	P	1.	-	O
	Noise and vibration	Engines noise	2.	C	2.	-	O
	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	Contamination due to possible leakage of oil, condensate or maintenance products.	1.	E	2.	-	O
Human and socio-economic environment	Employment	Job creation	3.	C	3.	+	
	Population	No Impact					
	Urbanization	No Impact					
	Tourism	No Impact					
	Agriculture	No Impact					
	Commerce and industry	Fulfilment of the industrial zone	3.	C	3.	+	

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 : non correctable
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 phase

Before starting work, the staff must be informed of all safety procedures and measures to protect the environment.

- ✓ Inform in advance the various members involved in the project (private owners, National Guard, SONEDE, STEG, ONAS, TELECOM ...) to organize and implement a good response when necessary.
- ✓ Update drawings and archives
- ✓ Include in the work specifications all operations related to waste management (cleaning, collection and removal)

During this phase, general measures should be considered so as to minimize or eliminate impacts on the various environmental elements.

a- Water resources protection

To avoid any possible contamination of water resources, it is necessary to:

- Develop the sewerage and rainwater network
- Ensure regular maintenance of equipment and machinery to prevent accidental leakage of lubricants and oil
- Treat produced water and construct drains sealed walls
- Ensure the collection and sorting of solid waste to be deposited in appropriate areas until their delivery to relevant departments.

b- Vegetal cover protection

The construction of the processing unit will be made in a dedicated industrial area. Therefore, vegetation is already negligible.

Mobilization of heavy equipment must be done in circuits arranged in advance and storage of materials will be in temporary storage areas.

Wastewater will be drained into the appropriate pipes fitted to prevent leakage to any existing species.

c- Dust and noise protection

During the construction of the unit, noise and dust will be inevitable.

To fight against dust, regular water spraying should be done at the frequency of twice a day (morning and evening).

Workers on site must be equipped with helmets to protect themselves against the uproar when threshold values are exceeded (70dB during the day and in the industrial area).

d- Waste management

Staff should be informed of the means and procedures to protect the environment by avoiding burning or piling waste.

Some measures should be taken:

- Selective collection of solid waste
- Waste storage in separate areas
- Regular transfer of waste to the nearest landfill
- Used Oil collection in metal drums and transfer to the appropriate company (SOTULUB) for recycling.
- Discharge of sanitary water through the pipes of the sewerage network.

e- Infrastructure protection

During this phase, the mobilization of transportation equipment and construction activities may affect neighbouring facilities or certain existing infrastructure (power poles, railways ...).

To avoid these nuisances, workers and drivers will be required to be more suspicious in handling gear and in mobilizing construction materials.

f- Road Traffic management

To avoid traffic jam, the movement of heavy trucks carrying construction materials should be avoided during the peak hours of the day. Resorting to the relevant authorities may become required in order to organize the road traffic.

g- Safety measures

During the construction phase, workers will be able to handle heavy and sometimes hazardous materials. For this reason, various operations must be governed by rules and instructions on site to ensure the safety of people on the existing site and the smooth running of tasks.

Workers must comply with regulations, traffic signs, safety measures and proper handling approaches.

1.2 Operation phase

a- Water resources protection

During the operational phase, sanitary wastewater generated by the staff will be evacuated through pipes connected to the sewerage network of the industrial area.

Rainwater will flow through drains and rainwater will be collected in storm drains.

However, the risk of contamination of water resources is possible in case of accidental release of hazardous material during gas treatment or by maintenance products.

Risk of accidental leakage of condensate during its transportation to STEG (in case of transportation through pipeline) is likely.

To avoid these risks, caution should be made when handling hazardous gases to prevent their accidental release.

A regular monitoring should also be made for the condition of the pipeline transporting condensate (when transported through the pipeline).

A plan for monitoring groundwater quality (referring to the analyses performed in the initial state of the site, see Appendix 7) will be established to ensure the water status.

b- Waste management

Waste water (sanitary water) will be discharged in pipes connected to the sewerage network of the Ghannouch industrial area.

Solid waste will be collected and sorted according to their nature and stored in appropriate areas in view of their transfer to the relevant departments for recycling.

Filters generated by the recovery of the mercury will be recovered by the supplier who will export them to their countries of origin.

Waste contaminated with condensate will be collected, transported and treated by a licensed company.

The transfer of condensate will be made by pipeline or by road through trucks carriers. OMV is committed to inform ANPE about the final transfer method to be adopted.

c- Safety measures

According to the legislation, any incident that is likely to cause disorder and insecurity must be reported immediately to the Energy General Department (DGE).

To mitigate or avoid incidents, OMV is committed to apply, but no limited to, certain measures:

- Periodic testing for gas leaks
- Monitoring of the status of the gas treatment unit
- Monitoring and measuring the electrical resistivity
- Regular cleaning of areas (condensate, solid waste, ...)
- Sensitizing the personnel and users of the working zones about the extent of the risks and about the measures to take in case of incident

- Inform the relevant authorities in case of major intervention in the unit.
- An Emergency plan should be prepared and approved by the authorities. Such a plan should identify actions to be taken in the case of death or injury or major accident.
- In case of an accidental pollution , an environmental diagnosis must be carried out
- A decontamination study must be prepared and submitted to ANPE.
- In case of transfer of the condensate by pipeline, a regular monitoring of the pipeline should be made.
- In the case of a transfer by road, the means of transportation must meet the technical requirements of transportation and specific equipment requirements. A regular maintenance of the truck must be ensured. A safety data sheet must be completed at delivery and at reception of the condensate in order to ensure monitoring if needed. Signalling by label must be provided and displayed on the driver cabin and on the container to indicate the nature of the cargo. The driver must have a valid medical certificate attesting to his ability to practice this job

To deal with professional problems, a monitoring system will be scheduled to raise staff awareness and to train them in safety and management capabilities.

Therefore, periodic maintenance and repair of machines if necessary would lead to a proper functioning and therefore would allow avoiding shutdowns and disruption of work. Monitoring of noise levels should be done regularly to detect abnormal noise sources.

Employees within the gas treatment unit should also be wearing a special coverall, a respiratory mask, a protective eye mask and gloves...

The work area inside the unit and the nature of activities impose special measures of protection and intervention in case of emergencies.

d- Fight against noise, dust and air emissions

To fight against dust, the soil should be sprayed with water twice a day.

Protection against noise is done by wearing a protective helmet inside the unit. The acoustic value set at a distance of 1m from the source of noise is 85 dB inside the work area.

The noise threshold value allowed in an industrial area is 70 dB (daytime and night). Noise can be mitigated through the use of sound abatement walls and ensuring regular maintenance of equipment and vehicles operating on the site of the unit.

Monitoring atmospheric emissions is done on a daily basis by measuring the emissions at the final products storage tanks and inside the unit.

Detection of gas leaks will also be provided by gas detectors of the infrared type that will be placed inside the unit and outside it according to the direction of the prevailing wind.

e- Fire-fighting

To avoid fire, abnormal gas concentration detectors and smoke detectors will be installed throughout the unit.

Some areas will be classified as hazardous or risky in view of the type of equipment to be installed there, the nature of activities to be performed or products that will be handled.

Equipments are designed to avoid electrostatic discharge in case of accident.

It is recommended to:

- Supply the facilities with portable fire extinguishers on site and aboard each service vehicle, as well as a reserve of sand or soil of at least 300 m3;

- Develop a system of drainage and retention capacity "sufficient" for fire water (Unspecified capacity).

- Design master points which will be indicated by signposts

- Providing multiple access points to facilitate rescue services.

- Educate workers for a better handling of hazardous substances and equipment.

- Establish an effective communication system to facilitate rescue in case of explosion or fire

2. Environmental management plan

The Environmental Management Plan (EMP) aims to describe measures, actions and resources that will be implemented to eliminate or reduce to acceptable levels the significant impacts of construction, installation and operation of the GTP on the biophysical and socio-economic environment, which were identified in this study.

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 GTP is divided into seven sections:

- 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 smooth functioning of the selected mitigation measures.

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

2.1 Environmental mitigation measures summary

Table 20: Environmental Mitigation measures

Phase	Main impacts		Mitigation measures	Party in charge	Frequencies	Cost
	Type, milieu	Magnitude				
Construction From 21/11/20114 to 31/03/2016	**Impacts on air quality:** - Dust emission by access tracks and vehicles. - Exhaust gas release of construction machinery. -Emission of particles from construction materials.	Medium	- Frequent water spraying of the soil and equipment access tracks. - Regular maintenance of construction equipment in authorized services units. - Coverage of construction materials by tarpaulins during transportation. - Preparation of space for the storage of construction materials.	Construction Company	Continuously	2.000/ Construction phase
	Increase of traffic and traffic disruption	Medium	- Use of appropriate equipment. - Ongoing Monitoring and Maintenance of construction machinery. - Limiting their traffic speed (25km / h). - Raising Staff awareness regarding	Construction Company	Continuously	-

			compliance with traffic rules and safety. - Development of a traffic plan to organize the road traffic			
	Impact of noise and vibration	Minor	- Select construction engines in good condition. - Protection of workers by helmets	Construction Company	Continuously	-
	Impacts on soil quality : Pollution by generated waste : - Household waste: - Industrial waste:	Minor	- Household waste will be collected in containers or garbage bags and removed periodically to the nearest sanitary landfill. - Recyclable waste such as plastics and cans will be delivered to companies authorized by the MEDD for the collection and recycling of waste. - Scrap metal and mechanical parts used will be delivered as and when they are generated to scrap dealers authorized by the MEDD. - Used batteries will be temporarily stored in a suitable place and then entrusted to specialized companies authorized by the MEDD for recycling. - Used oil filters will be collected in suitable containers, temporarily stored	Construction Company	Each day	15.000/ Construction phase

			and then entrusted to the SOTULUB or other specialized companies authorized by the MEDD for regeneration.			
	Deep water impacts: Pollution by infiltration of sanitary water	Minor	- Installation of pipes connected to the sanitary sewer network of the industrial area.	Construction Company	Continuously	-
	Impacts on health and human safety	Minor	- Limiting public access to the site. - Awareness of staff to ensure compliance with safety rules. - Wearing helmets, gloves and protective footwear, overalls and goggles by workers.	Construction Company	Continuously	5.000/ Construction phase
Operation 04/2016	**Impacts on air quality:** - Flue gases from the engines	Minor	- Optimal use and regular maintenance of equipment. - Using a powerful burner ensuring complete combustion. - Good maintaining the equipment in order to minimize the amount of gas surplus.	OMV	Periodic	5.000.

	Impacts on deep water: Pollution by infiltration of sanitary water or used oil	Minor	- Regular inspection of storage facilities, pipes, separator and blowout control equipment. - Used oils will be collected in suitable containers and then entrusted to the SOTULUB or other specialized companies authorized by the MEDD for regeneration. - The process waters will be collected in a closed drain for a treatment that allows the reduction to 10 ppm of the total hydrocarbon content.	OMV	Annual	20.000/year
	Impact of noise and vibration	Minor	- Provide the staff with a protection system against noise in areas where noise exceeds the level of 80 dB. - Enclosure of the equipment that entails large vibrations or noise beyond the standards and setting up of sound protection screens.	OMV	Continuously	5.000.
	Impacts on soil quality : Pollution by domestic and industrial waste.	Minor	- Household waste will be collected in containers or garbage bags and removed periodically to the nearest sanitary landfill. - The reusable or recyclable waste, such as plastics (. Bottles, cups, etc.) and metal cans will be delivered to	- OMV	Continuously - Each day	15.000.

			companies authorized by the MEDD for the collection and recycling of such waste. - Scrap metal and used mechanical parts will be delivered as and when they are generated to scrap dealers authorized by the MEDD. - Oil filters will be collected in suitable containers and then entrusted to the SOTULUB or to other specialized companies authorized by the MEDD for regeneration. - Used batteries will be temporarily stored in a suitable place and then entrusted to specialized companies authorized by the MEDD for recycling.			
	Accidental impacts: Fire or explosion - Eruption / venue Spill of flammable products and gas leak	Minor	- Installation of all means to fight against the fire in site. - Site development by a system of drainage of water fire. -Provide multiple access points to rescue - Train the staff in fire-fighting techniques. - Installation of sign posts.	- OMV	Continuously	100.000.

			- Regular inspection of storage facilities, pipes, separator and blowout control equipment. - Provide absorbents used for cleaning spills of flammable products. - Collection of flammable spills in appropriate sealed containers to be carried out by a firm authorized by the MEDD. - Construction of a bund wall to contain any spillage of diesel. - Respect distances between storage facilities and sources of ignition.			
Abandonment	**Impacts of site abandonment**		- Dismantling of all facilities and equipment. - Site cleanup and removal of construction debris to be evacuated to the nearest sanitary landfill. analyze water, soil and ambient air characteristics in order to detect and to correct any abnormality - Reinstatement of the site in its original status.	OMV	-	(to be defined in the project abandonment EIA)
					MEASURES TOTAL IN TD	**167.000**

2.2 Waste management

OMV advocates the use of the waste disposal strategy based on the principle of 3RVE subject to the local environmental regulations, and to the availability of resources to manage waste. These 3RVE are as follows:

Reduce	:	at the source;
Reuse	:	The waste as it is;
Recycle	:	Convert waste into a usable material;
Valorize	:	Material or energy from waste;
Eliminate	:	An unavoidable and ultimate waste which requires, then, a discharge 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.

2.3 Management of liquid waste

Different types of liquid waste will be generated by the construction and operation of gas treatment unit: sanitary wastewater, used oil, production water.

2.3.1 Sanitary Wastewater

Sanitary wastewater generated during the construction stage is about 4m^3/d. They will be collected in watertight pit (30 m3 of capacity).

The septic pit will be emptied and backfilled with natural soil. Sanitary wastewater will be recovered by vacuum-pit and transported by truck to the treatment plant ONAS.

2.3.2 Used oils

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 traceability of waste in accordance with the Decree No. 2002-693 of 1 April 2002.

2.4 Solid Waste management

Solid waste that can be generated by construction, installation and operation of the GTP may be of various kinds. However, we can divide the waste into three main 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.

2.4.1 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. "

2.4.2 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 authorized by the MEDD.

2.4.3 Hazardous waste

Hazardous waste generated during construction activities and installation of the GTP 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.

2.5 Management of waste gases

These emissions are generated by the combustion of fuels in vehicles and form fixed and mobile installations. Optimal operating, monitoring, and regular maintenance of those above, will help to minimize the effects of these emissions on the environment.

Table 22 : Summary table of waste and their management

Waste		Origin	Management method
Liquid waste	**Domestic used water**	Work team	ONAS network
	Treatment water	Gas treatment activities	They will be collected in a closed drain for a treatment that allows the reduction to 10 ppm of total hydrocarbon content.
	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 collectors approved by the MEDD under dispositive ECO-LEF.
		Waste contaminated by condensate generated by the treatment process	Collection, transportation and treatment by a licensed company
		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, waste associated with the process ...)**	Saturated filters generated by the mercury removal process	Recovery of cartridges by the supplier and export
		Mercury waste	Recovery of filters by the supplier and export
		Machinery, staff care,	-Selective collection and transfer to specialized companies licensed by the MEDD.
	- Machinery	-Vehicles and	Regular Maintenance

Atmospheric pollution	**exhaust gas** **- Dust emission**	construction machinery - working Track and construction works	of the machinery pump-out station - Spraying the tracks twice per day

2.6 Prevention and control against accidental pollution

2.6.1 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.

2.6.2 Struggle against 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.

2.7 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 nearest dump and removal of any remaining debris;
- The remains of hazardous waste will be transported off-site to be processed and disposed properly;

2.8 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 waste management generated by construction, installation and operation works of the unit and possession of a monitoring register for waste;
- 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).

2.9 Audit and Environmental Communications

The environment Officer who is in the staff will ensure the implementation of the actions highlighted in the environmental management program as well as environmental compliance with laws and national and international standards.

He will be responsible for implementing monitoring programs (monthly monitoring) and control overruns that can harm the environmental aspect of the unit.

Internal audits will be conducted and legal compliance audits will be established if necessary in order to ensure compliance with laws.
Training sessions on Health / Safety / Environment will be scheduled to allow employees to work in the best conditions and to be capable of handling the situation in cases of emergency.

2.10 Training

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

This training, which consists of technical, theoretical and practical guidance, is provided by the HSE.

2.11 Project Cost

The total project cost is estimated at (500 MTD) five hundred million Tunisian dinars.

3. Environmental follow-up and monitoring plan

Table 23 : Environmental follow-up and monitoring plan

Measures	Monitoring parameters	Source :	Sampling points	Means and methods used	Frequency	Responsible	Cost
Construction phase							
Dust monitoring	Particles in suspension	Machinery traffic and development work	In the work site and in the immediate neighborhood of the site.	Analysis by an approved laboratory	Twice during the construction phase	Contractor/OMV	2.000.
Monitoring of the sound level	Noise level in dBA	Machinery traffic and construction equipment	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	Collection and transfer to the	Food construction-	In the work site and in the	Site inspections	Every day	Contractor/OMV	3,000

monitoring	dump or to a company authorized by the MEDD	related waste (rocks, packaging, uprooted plants, ...) -batteries and scrap ...	immediate neighborhood of the site.	and monitoring forms			
Operation phase							
Gas leak monitoring		Different facilities and export pipeline (including the transfer of condensate by pipeline to the STEG)	In the processing unit and in the immediate vicinity of the site	Gas Leak detector	Twice per year	(OMV) Head of Safety and Environment	5,000
Monitoring of the condensate loading		Carriers trucks transporting condensate to TRAPSA	- Appropriate parking / loading area suitable	Regular monitoring of the condition of the carrier truck	At each loading		-
Infrastructure : Drainage system for Storm, sanitary		Drainage system for Storm, sanitary and fire-fighting	-	Resort to	Every		

and fire-fighting water		water		specialists	quarter		5,000
Equipment	Operating status and performance	-	-	-	Once every six months		-
atmospheric nuisance	-Monitoring of air quality measuring PM10, NO2, SO2 and CO2 and comparing analysis results obtained in the initial state.		Outside the site: the choice of the points must take into account the wind direction and location in relation to other polluting industries such as Groupe Chimique.	Make use of a certified laboratory	Twice per year		20,000
Noise nuisance	Sound level	The operation of certain equipment	Inside and outside the site	Sound-level meter	Once a year (inside and outside)		5,000
Water table quality	install 2 piezometers for the monitoring of groundwater quality	-	-	piezometers	Annual		2.000.

Soil quality	oil quality control campaign at a depth of 3 m	-	Site neighborhood	Analysis by a certified laboratory	Every 4 years		5,000

(-) Included in the cost of the GTP operation

4. 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.

APPENDICES

Appendix 1

Approval of the DGE for the Nawara Development Project Plan

Appendix 2

Preliminary ground drawing of the pilot study content

Appendix 3

Simplified block diagram of the facilities

Appendix 4

AFI letter confirming the acquisition of the land
AFI specifications

Appendix 5

Request for a Notification of connection to ONAS network (discharge)

Appendix 6

Results of analyses of soil samples

Appendix 7

Outcome of the water sample analysis

Appendix 8

Characterization of the ambient air