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Updating of Environmental Impact Assessment for Nawara Concession Development Project - Condensate Pipeline Construction Project

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Project :Updating of Environmental Impact Assessment for Nawara ConcessionDevelopment Project - Condensate Pipeline Construction Project

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This work has been undertaken in accordance with the Integrated Management System of EAM.

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ACRONYMS & ABREVIATIONS

ANGed	Agence Nationale de Gestion des Déchets
ANPE	Agence Nationale de Protection de l'Environnement
CPF	Central Processing Facility
CRDA	Commissariat Régional de Développement Agricole
EAM	Environmental Assessment and Management
EIA	Environment Impact Assessment
EPCI	Engineering, Procurement, Construction and Installation
INM	Institut National de la Météorologie
FEED	Front End Engineering Design
INS	Institut National de la Statistique
ONAS	Office Nationale de l'Assainissement
EMP	Environemental Management Plan
GIS	Geographic Information System
ODS	Office de Développement du Sud
ROW	Right Of Way
SOTULUB	SOciété TUnisienne de LUBrifiants
STEG	Société Tunisienne de l'Electricité et du Gaz

NON-TECHNICAL SUMMARY

Introduction

OMV (Tunesien) Production GmbH. proposes to install and operate a condensate export pipeline from its Central Processing Facility (CPF) located in Nawara field to TRAPSA pumping station n°3 (SP3).

OMV (Tunesien) Production GmbH. is a subsidiary of the OMV AG, considered as Austria's largest listed industrial company. In Exploration and Production, OMV is active in 17 countries in five continents.

With reference to the Decree no. 2005-1991 of July 11th, 2005 relating to environmental impact assessment, the proposed project is considered as an "Oil and natural gas transport equipment" and requires an Environmental Impact Assessment (EIA).

With reference to Article 9 of this Decree, the National Environmental Protection Agency (ANPE) has a period of three months (3 months) from receipt of the EIA report to notify its decision of opposition to the realization of the project, and upon expiration of this deadline, the approval is tacit for the realization of the project.

Project Overview

The development project consists in the construction and operation of Nawara CPF, a condensate export pipeline and a gas export pipeline. This EIA is focused on the condensate export pipeline. The two other project components will be the subject of two separate environmental impact assessments.

The Nawara CPF will be designed to provide separation, treatment and stabilization of the wells fluids (Nawara-1, Rytma-1, Fella-1, Khouloud-1, Benefsej-1, Benefsej Sud-1, Souroure-1, Ahlem-1 and Ahlem-2). The condensate will be exported via the existing TRAPSA oil pipeline to the La Skhira oil terminal close to Gabes. The wet gas will be exported to a tie-in point of the joint STGP facilities from where it will be pumped via a gas pipeline to Gabes and treated in a dedicated LPG extraction facility.



The 10 km 6" pipeline will be buried with the nominal burial depth of 0.8 m to top of pipe. It will be externally coated with three polyethylene or polypropylene anticorrosion coating layers. A cathodic protection will be provided to the pipeline. The pipeline will be equiped with appropriate tools to record pressure, temperature and flow at both ends. The gathered information will be assessed and analysed using calculation tools to identify any leakage on the pipeline. In addition, regular survey patrols driving along the pipeline right of way will be planned in order to detect any abnormal activities or damages.

The pipeline will extend from Nawara CPF to TRAPSA pumping station n°3 (SP3).

The pipeline will be clearly marked with marker stations at intersection and crossing points.

The study phase includes the Front End Engineering and Design (FEED) which was initiated in the beginning of 2013. Detailed engineering studies started in November 2013 and will be followed by material and services tendering, equipment ordering and procurement. The condensate pipeline installation is planned for February 2015 and will last approximately one year.

The project design and the pipeline route selection were based on environmental

sensitivities, economic considerations of pipeline construction costs and spatial extent.

The design, construction, operation and maintenance of the pipeline comply with national and international standards and guidelines.

The contractor will develop construction camps to accommodate 300 people for the workforce engaged in construction activities.

The construction of the pipeline requires water, power and fuel. The normal operations will not require any utility.

Existing Environment

The description of existing environment is based on scientific literature and relevant documents related to the study along with data collected from field survey.

For the purpose of this project, a Geographical Information System (GIS) was constructed to provide a central information resource where environmental and socioeconomic sensitivities were placed into geographical context.

In terms of climatology, the study area is classified as Mediterranean bioclimate of inferior Saharian stage with cool winter.

The wind regime is dominated by the frequent presence of sirocco. The annual average number of days of sandstorms is 30 days. It varies from 1 to 6 days. The highest number of windy days was recorded during the spring season (March-April-May) with 19 days of sandstorms.

The study area is located in the Dahar which is a wide plateau constituted of Cretaceous outcrops with altitudes varying from 300 to 550 m.

The soils of the study area are fragile and they are affected by wind erosive processes.

The Continental Intercalaire aquifer is the main water resource of the study area.

The vegetation of the region is typically Saharian, being little diversified, sporadic and presents a very low density. The associated fauna is adapted to the drastic conditions of the area. Avifauna is essentially represented by a variety of migratory bird species.

As for socio-economic conditions, the study area is underpopulated and undeveloped. It mainly consists of the military personnel at the frontier post of Borj El Khadra.

Transhumance and pastoral activities are the main livelihood income of the local communities.

Impacts Assessment

The impacts assessment methodology is based on the appreciation of an indicator which constitutes the significance of the impact. This indicator gives a judgment on the importance of the gains and losses for the natural and human components related to the proposed activities. The established judgment represents the integrated result of three components, including <u>the intensity</u>, <u>the extent</u> and <u>the duration</u> of the impact.

A great effort was provided for the selection of the pipeline Right Of Way (ROW) in order to reduce the project's impacts on the biophysical and human environment. In fact, route selection for the pipeline route was based on the following general criteria: minimize the length of the pipeline, minimize crossing of roads or water courses, minimize the impact on the environment and avoid when possible and maintain a minimum safe distance from existing infrastructures.

The impact on the biological environment, the water resources and the soil is very low in view of the absence of flora or fauna of particular ecological interest and considering the precautions and measures to be taken by OMV in order to assure the safety and to preserve the environment.

During construction phase, several liquid, gaseous and solid wastes will be generated. They will be subject to specific management plans allowing to reveal the potential of a reduction at the source, a re-use, a recycling, a material or energy valuation and disposal means. The project will be beneficial to local service companies.

No operational environmental negative impact could be expected during the pipeline operation phase. However, high economic impact is supported by the generated gains arising from the oil production.

Prevention of accidents is an integral part of operational procedures and mitigation measures presented in this report. The involvement of such measures demonstrates the commitment of OMV towards the preservation of the environment.

Taking into account the environmental description, predicted levels of interaction and the extent of mitigation measures presented in this report, it is thought that the condensate export pipeline project is environmentally acceptable.

1.0 GENERALITIES

1.1 Introduction

This report has been prepared for OMV, which intends to install and operate a condensate export pipeline from its Central Processing Facility (CPF) located in Nawara concession to TRAPSA pumping station n°3 (SP3).

With reference to Decree 2005-1991 of July 11th, 2005, related to the environmental impact study, the proposed project falls within Annex 1 (Category B 16 – Oil and natural gas transport equipment projects). As such, it requires an EIA (*Article 2*) intending to:

- ✓ Describe the project;
- ✓ Analyse the relevant features of the existing environmental baseline;
- ✓ Identify and assess the potential environmental impacts of the project;
- ✓ Recommend mitigation measures to reduce, minimise or avoid adverse impacts of the project on the environment;
- ✓ Outline the Environmental Management Plan.

With reference to Article 9 of this Decree, the National Environmental Protection Agency (ANPE) has a period of three (3) months from receipt of the EIA report to notify its decision of opposition to the realization of the project, and upon expiration of this deadline, the approval is tacit for the realization of the project.

1.2 Study Scope

This study describes the project characteristics in particular those, which could have potential impacts on the environment. The significance of the potential impacts is determined according to appropriate criteria. Mitigating measures are also described in order to reduce the identified significant impacts.

The scope of this work is based on the following reference documents:

- ✓ Decree no. 2005-1991 dated 11 July 2005 relative to the Environmental Impact Assessment;
- ✓ Terms of reference set up by ANPE for Oil and natural gas transport equipment projects;
- ✓ Contract between OMV and EAM for the preparation of the Environmental Impact Assessment.

1.3 Report Structure

The report is organised as follows:

- Chapter 2: Summarises the main regulatory texts governing the environment and the oil and gas transport activities ;
- Chapter 3: Introduces the involved parties in the project ;
- Chapter 4: Provides a detailed description of the project;
- Chapter 5: Describes the existing environment with a focus on the components which could be affected by the project ;
- Chapter 6: Explains the methodology of the impacts assessment ;
- Chapter 7: Identifies and evaluates the potential impacts which may result from the condensate pipeline construction and operation ;
- Chapter 8: Recommends mitigation measures to avoid, reduce or offset the adverse impacts to the environment ;
- Chapter 9: Constitutes the environmental management plan of the project.

1.4 Project Justification

This justification concerns the technical, environmental and socio-economic aspects of the construction and operation of the condensate export pipeline.

1.4.1 Technical Aspect

The condensate produced in Nawara CPF will be transported via a dedicated pipeline. Such transport mean is considered as reliable common practice in the oil and gas industry worldwide.

The bedding shall not contain any rock, clay, organic materials or other material that may damage the pipeline coating.

A hydrotest will be undertaken to prove the integrity of the pipeline and to ensure that there are no defects which could result in a leak occurring during its operation.

1.4.2 Environmental Aspect

From an environmentally perspective, the project presents the following advantages:

- ✓ A safe transportation mean : compared to other transportation means such as trucks, the pipeline reduce to minimum the uncontrolled risks of spills and the associated impacts ;
- ✓ An optimum land management: the pipeline route will follow the defined pipeline ROW which minimize the land occupation and the associated disturbances to biophysical environment. In fact, the selected ROW will go along the existing tracks;

✓ Best operating conditions: the condensate export pipeline provides better operating conditions as it does not require significant maintenance and human intervention. Besides, it doesn't rely on weather condition and climatic hazard. Moreover, the pipeline will be equiped with appropriate tools to record pressure, temperature and flow at both ends. The gathered information will be assessed and analysed using calculation tools to identify any leakage on the pipeline.

1.4.3 Socio-economic Aspect

In general, the construction and operation of the pipeline contribute to sustain the Tunisian hydrocarbons infrastructures development. In particular, it allows the capacity increase of the domestic exploitation and transportation of produced oil. Besides it may contribute to the development of marginal oil fields in the area and therefore, increase the potential of oil exploitation and enhances the potential for development of energy resources of the country.

2.0 **REGULATORY COMPLIANCE**

In addition to its Corporate Environmental Policy and Best Practice for Oil and Gas Industry, OMV is committed to conduct its operations in line with national regulations and international agreements to which Tunisia is a signatory.

2.1 Tunisian Legislation and Standards

The main regulatory texts relating to the environment and petroleum activities are summarized as follows:

- ✓ Law no. 66-27 dated 30 April 1966, relating to the promulgation of the Labor Code and all the texts which have amended and completed it, including Law no. 96-62 dated 15 July 1996 and Law no. 2007-19 dated 2 April 2007.
- ✓ Law no. 75-16 dated 31 March 1975, relating to the promulgation of the Water Code, as amended by Law no. 2001-116 dated 26 November 2001. The Water Code contains various dispositions managing, safeguarding and valorizing the public hydraulic domain. According to the terms of article 109 of this code, it is illegal to let flow, discharge or throw away into the public hydraulic domain any residual waters as well as waste or substances susceptible of affecting the public health or the good use of these waters for potential usage.
- ✓ Law no. 82-60 dated June 30, 1982 for carrying out, laying and operation of the pipelines of public interest intended to the transportation of gaseous, liquid or liquefied hydrocarbons, as modified and completed by the law n° 95-50 of June 12, 1995.
- ✓ Decree no. 85-56 dated 2 January, 1985, relating to the organization of waste disposal into the environment. It fixes the conditions concerning the regulated or illegal waste disposal into public areas.
- ✓ Order of the Minister of Industry and Trade of September 17th, 1987 approval of the Tunisian standard NT 109.02 related to safety of structures transporting liquid hydrocarbons.
- ✓ Law no. 88-20 dated 13 April 1988, as modified by the Law no. 2005-13 dated 26 January 2005, Relating to revision of recasting the Forest Code, which includes the set of special rules applying to forests, esparto surfaces, pasture land, forest occupied land, national parks and reserves, wild fauna and flora, in an effort to ensure their protection, conservation and rational exploitation as well as to guarantee that the

users legally exercise their rights.

- ✓ Law no. 88-91 of August 2nd 1988, relating to 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, the operators who impact the environment or whose activities cause environmental pollution through solid, liquid or gaseous waste are required to eliminate, reduce or eventually recover the discharged matters as well as to repair the resulting damages. The National Environmental Protection Agency (ANPE) is allowed to go to court and defend any case in order to restore any damages to public properties.
- ✓ 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 bodies (marine public domain, hydraulic public domain and public sewer network). This standard contributes to the adequate application of decree no. 85-56 of January 2nd, 1985 relating to the regulations of the waste disposal into the receiving environment.
- ✓ Law no. 90-56 of June 18th, 1990, concerning the encouragement of exploration and production of petroleum hydrocarbons in Tunisia.
- ✓ Decree no. 90-2273 of December 25th, 1990 defining the internal regulation of the ANPE inspectors.
- ✓ Law no. 94-35 of February 24th 1994, relating to the Patrimony Code of Archaeology, History and Traditional Arts. In case of accidental discovery of sites, concerning prehistoric or historic ages, arts or traditions, the developer is required to immediately inform the corresponding services of the Ministry in charge of Patrimony or the closest regional authorities in order for them to inform the concerned services, within a period not exceeding five days. The specialized authorities will take all the necessary measures of preservation by themselves or if needed the supervision of the undergoing works.
- ✓ Order of the Ministry of National Economy of December 28th, 1994, relating to the homologation of the Tunisian standard NT 106.04 concerning the limit values and guideline values of pollutants into the ambient air.
- ✓ Law no. 95-73 of 24 July 1995 defining the natural public marine domain (sea shore, lakes, lagoons and sebkhas in natural communication with the sea, continental shelf,

exclusive fishing zone, exclusive economical zone,..) and the artificial public marine domain (harbours, sea ports, fortresses,..).

- ✓ Law no. 96-29 of 3rd April 1996, instituting a national plan of urgent intervention for the fight against accidents of marine pollution. Within the article 22, it has been specified that the managers of the trade ports, the leisure ports, the petroleum terminals and the production and prospection platforms, must establish specific intervention plans in case of low intensity pollution within the ports installations and nearby the platforms.
- ✓ Law no. 96-25 of 25 March 1996 creating the International Centre for Environmental Technologies of Tunis with a mission to acquire, adapt and develop new technologies, promote ecotechnologies and their production, strengthen national capacity and develop scientific knowledge necessary for the elaboration and implementation of appropriate environmental techniques specific to national and regional needs in the perspective of sustainable development.
- ✓ Law no. 96-41 of June 10th 1996, relating to waste and control of its management and elimination. The waste products are classified according to their origin as domestic waste or industrial waste and according to their characteristics as dangerous, non-dangerous or inert waste. The hazardous waste management modes are regulated. The list of hazardous waste is fixed by Decree no. 2000-2339 of October 10th, 2000.
- ✓ Law no. 97-37 of June 2nd, 1997 instituting the rules relating to the transport by road of hazardous materials to avoid risks and damages likely to affect persons, goods, and the environment. Hazardous materials are divided into 9 classes. The list and definition of materials of each class that could be transported by road are determined by decree.
- ✓ Law no. 99-93 of August 17th, 1999, as modified by the Law no. 2002-23 of February 14th, 2002 and the Law no 2004-61 of July 27th, 2004 promulgating the Hydrocarbons Code which defines the judicial regime of preliminary exploration activities, exploration, the search and the exploration for hydrocarbons, as well as the equipment and the installations pertaining to the execution of these activities.
- ✓ Decree no. 2000-967 of May 2nd, 2000, fixing the geographical coordinates and the summits reference numbers of the elementary perimeters constituting the hydrocarbons blocks.

- ✓ Law no. 2001-14 of January 30, 2001, stating simplification of administrative procedures in relation to the authorisations delivered by the "Ministère de l'Environnement et de l'Aménagement du Territoire" in the domain of its competence.
- ✓ Decree no. 2002-693 of 1st of April 2002, fixing the conditions and modalities for lubricants and used filters recovery, in an effort to ensure their rational management and to avoid any discharge to the environment.
- ✓ Decree no. 2005-1991 of July 11th, 2005 relating to the Environmental Impact Study. Oil and natural gas exploration and transportation projects are subject to the environmental impact procedure.
- ✓ Decree no. 2005-2317 of August 22nd, 2005, relating to the creation of the "Agence Nationale de Gestion des Déchets", ANGed. With reference to the article 8 of this decree, the Agency prepares the specifications and the authorizations files of relating to waste management in accordance with the regulation in force and follows-up their execution. In addition, the Agency inspects the registers and logbooks that must be held by the professional establishments and the enterprises in charge of the collection, transportation, elimination and recovery of wastes.
- ✓ Decree no. 2005-2933 of November 1st, 2005 establishing the remit of the Ministry of the Environment and Sustainable Development (Ministère de l'Environnement et du Développement Durable, MEDD), which includes the requirement that the Tunisian government respects international environmental agreements.
- ✓ Decree no. 2005-3079 of 29 November 2005 establishing the list of hazardous materials which are transported by road under the mandatory supervision and with the accompaniment of security units.
- ✓ Decree no. 2005-3395 dated 26 December 2005, fixing the conditions and the modalities for collecting used accumulators and batteries.
- ✓ Order of the Minister of the Environment and Sustainable Development dated 23 March 2006, relating to the creation of a hazardous waste treatment unit and reception, storage and transfer centers.
- ✓ Order of the Minister of Agriculture and Hydraulic Resources dated 19 July 2006, fixing the list of rare and endangered wild fauna and flora.

- ✓ Law no. 2007-34 dated 4 June 2007 relating to the air quality.
- ✓ Decree no. 2010-2519 of 28 September 2010 fixing the limit values at source of air pollutants from stationary sources.
- ✓ Order of the Minister of Agriculture dated 11 September 2012, relating to the organization of hunting for the season 2012-2013.

2.2 International Conventions

The Tunisian environmental legislation extends to the following international conventions:

- ✓ Convention on the conservation of the migratory species belonging to the wild fauna, adopted in Bonn on 23 June 1979 (ratified by the Law no. 86-63 dated 16 July 1986).
- ✓ Convention for the protection of the ozone layer, Vienna 22.03.85 (adherence of Tunisia by the Law no. 89-54 of March 14th, 1989).
- ✓ Protocol on substances that deplete the ozone layer, Montreal 16.09.87 (adherence of Tunisia by the Law no. 89-55 of March 14th, 1989).
- ✓ United Nation Convention on Biological Diversity signed by Tunisia in Rio de Janeiro on June 13th, 1992 and ratified on May 3rd, 1993;
- ✓ United Nations agreement concerning the climate changes signed in 1992, during the Earth summit in Rio. Tunisia, having ratified such an agreement on July 15th, 1993, is required to communicate to the conference parties, all information relating to the national inventory of green house effect gases (GES), to the GES attenuation action plan and to the adaptation against negative effects of the climate changes;
- ✓ Convention on the Conservation of European Wildlife and Natural Habitats of Europe concluded in Berne on 19 September 1979. This agreement was designed to ensure the conservation of flora and fauna and their natural habitats. Appendix II provides a list of species for flora and fauna which the Contracting Parties shall ensure the conservation (Ratified by Tunisia January 12th, 1996 and entered into force on May 1st, 1996).
- ✓ Kyoto protocol to the United Nations Framework Convention on Climate Change strengthens the international response to climate change, adopted in Kyoto on the December 10th, 1997 (adherence of Tunisia by the Law no. 89-54 of June 19th, 2002);

- ✓ Stockholm Convention on persistent organic pollutants (POPs) adopted on May 22nd, 2001 and approved by Tunisian Law no. 2004-18 of March 15th, 2004. POPs are chemicals that remain intact in the environment for long periods, become widely distributed geographically, accumulate in the fatty tissue of living organisms and are toxic to humans and wildlife. POPs circulate globally and can cause damage wherever they travel. In implementing the Convention, governments will take measures to eliminate or reduce the release of POPs into the environment.
- ✓ Agreement on the Conservation of Migratory seabirds (AEWA) of Africa-Eurasia. The agreement came effectively in force on 1 November 1999. Tunisia has ratified this agreement on 1st October 2005.

3.0 PRESENTATION OF THE INVOLVED PARTIES

3.1 Presentation of the Operator

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OMV is an integrated, international oil and gas company with three core business segments: Gas and Power (G&P), Refining and Marketing (R&M) and Exploration and Production (E&P).

3.1.1 Gas and Power

OMV integrated Gas and Power (G&P) business segment operates across the entire gas value chain. OMV have long-proven partnerships with major gas suppliers to assure stable supply to our markets and also produce gas at our own fields. With 2,000 km gas pipeline network as well as gas storage facilities with a capacity of 2.4 bcm, OMV is a major contributor to security of supply in Austria and beyond. Additionally, it is driving the Nabucco gas pipeline project, which will also increase Europe's security of supply. The Central European Gas Hub (CEGH) is the most important gas trading platform on the gas routes from East to West and also operates a gas exchange. The gas hub in Baumgarten is Central Europe's largest gas distribution node for Russian gas.

3.1.2 Refining and Marketing including petrochemicals

OMV operates refineries in Schwechat (Austria) and Burghausen (Southern Germany), both with integrated petrochemical complexes. Together with the Petrobrazi refinery (Romania) and 45% stake in Bayernoil (Southern Germany), these give a total annual processing capacity of 22.3 mn t (450,000 bbl/d). The retail network consists of approx. 4,500 filling stations in 13 countries including Turkey. With strong retail brands, high quality non-oil business (VIVA) and an efficient commercial business, we have a leading position in the market.

3.1.3 Exploration and Production

OMV is successfully exploiting its core assets in Romania and Austria and has a wellbalanced International portfolio. In 2011, OMV's oil and gas production was 288 kboe/d and its proven reserves were about 1.13 bn boe at year-end. More than two-thirds of its production comes from Romania and Austria –the remainder from a growing international portfolio. Oil and gas account for around 50% each of overall production.

3.1.4 OMV in Tunisia

Tunisia has an important place in the history of OMV, as it was the location of E&P's first international exploration and production project in 1971. Since then, Tunisia has become an important part of the company's North Africa core region with the acquisition of Preussag's international business in 2003, which held seven exploration and production licenses in the country.

Tunisia offers a stable economic climate and excellent growth opportunities, and is a vital source of potential future growth especially in natural gas. OMV's activities are currently focused on drilling and infrastructure development in the Ghadames Basin in the south of the Country and on exploration and field redevelopment in the Gulf of Gabes. Net production in Tunisia is around 12,000 bbl/d.

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 acquired Shell's remaining interest in 1990.

In 2003 OMV acquired the international assets of Preussag Energie which were comprised of TPS 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 66 m. The field was developed with a platform complex and an offloading vessel in 1974, which makes it the first offshore development in Tunisia. Current Ashtart production is around 10,000 bbl/d.

The TPS fields, one offshore and 4 onshore, are located in the vicinity of Sfax and Kerkennah Island. The oil production of around 5,000 bbl/d is treated and collected at two stations from where it is transported to storage and offloading facilities in La Skhira.

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

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

In November 2009, OMV commenced a five-well drilling campaign in Jenein Sud and, early 2010, was granted the Nawara production concession, (50% OMV, 50% ETAP (Tunisian State Oil Company). Development work is on-going and includes the construction of field infrastructure and the STGP, which will facilitate the transportation of gas from the south to Gabes and on to the Tunisian domestic market.

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

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

The figure below shows OMV Tunisia assets in Tunisia



Figure 3.1 OMV Tunisia assets in Tunisia

OMV applies its group-wide standards and best-practice principles in health, safety, environment and quality on a continuous basis for all activities in Tunisia. OMV strive to engage their neighbors and all stakeholders and to minimize the impact on the environment and to enable sustainability in the sensitive areas of operations.

3.2 Presentation of the Contractors

In addition to OMV involvement in the project as the operator, this project will require the intervention of various contractors and service companies for the design, installation, construction and set up of the pipeline.

All engineering will be carried out by engineering companies. The construction of the pipeline will be performed by a highly experienced international company. Local companies will also be involved under the responsibility and supervision of the contractor.

3.3 Presentation of the Consulting Company

Environmental Assessment & Management "EAM s.a." was contracted by OMV to prepare the environmental impact assessment for the proposed project in line with the reference terms drawn by the ANPE for the Oil and natural gas transport equipment.

EAM has completed in excess of 400 Environmental Impact assessments for exploration

and production in oil and gas, power and chemicals.

EAM was granted the ISO-9001: 2008, ISO 14001:2004 and OHSAS 18001:2007 certifications (Integrated Management System) for the following activities: Environmental Impact Assessment, Hazard Assessment and Management of contaminated sites. These certifications demonstrate EAM's overall commitment to client satisfaction, provided by the efforts, perseverance and interest of all its personnel, and supported by the initiative and creative impetus of the management officers.

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4.0 **PROJECT DESCRIPTION**

4.1 Project Framework

The development project consists in the construction and operation of Nawara CPF, a condensate export pipeline and a gas export pipeline. This EIA is focused on the condensate export pipeline. The two other project components will be the subject of two separate environmental impact assessments.

The Nawara CPF will be designed to provide separation, treatment and stabilization of the wells fluids (Nawara-1, Rytma-1, Fella-1, Khouloud-1, Benefsej-1, Benefsej Sud-1, Souroure-1, Ahlem-1 and Ahlem-2). The condensate will be exported via the existing TRAPSA oil pipeline to the La Skhira oil terminal close to Gabes. The wet gas will be exported to a tie-in point of the joint STGP facilities from where it will be pumped via a gas pipeline to Gabes and treated in a dedicated LPG extraction facility.

The 10 km 6" pipeline will be buried with the nominal burial depth of 0.8 m to top of pipe. It will be externally coated with three Polyethylene or polypropylene anticorrosion coating layers. An impressed current cathodic protection will be provided to the pipeline (cf Appendix I Plan of Development and Appendix II Project Approval by General Directorate for Energy).

4.2 Pipeline Route Selection

Route selection for the pipeline route was based on the following general criteria:

- \checkmark Minimize the length of the pipeline;
- ✓ Minimize crossing of roads;
- ✓ Minimize the impact on the environment;
- ✓ Avoid when possible and maintain a minimum safe distance from existing infrastructures.

It is worth noting that a big effort was provided for the selection of the pipeline Right Of Way (ROW) in compliance with the above criteria. The selected route will significantly save land management and therefore significantly reduce the project's impacts on the biophysical and human environment. The selected ROW will go along the existing tracks.

4.3 Project Location

The Nawara CPF is located approximately 20 km west of the Libyan border. The pipeline takes start from the projected Nawara CPF then follows the defined pipeline right of way.

Administratively, the project area falls within the delegation of Remada (Sector of Borj El Khadra), Governorate of Tataouine (see Figure 4.1 Administrative Map of Study Area).



Figure 4.1 Administrative Map of Study Area

4.4 Project Planning

Two main phases characterise the installation of the proposed pipeline; an engineering phase and a construction phase.

The study phase includes the Front End Engineering and Design (FEED) which was initiated in the beginning of 2013. Detailed engineering studies started in November 2013 and will be followed by material and services tendering, equipment ordering and procurement. The condensate export pipeline installation is planned for February 2015 and will last approximately one year. Details of construction and operation of the proposed pipeline are as follow:

- ✓ Engineering (288 days) 17/4/2014 25/12/2015
- ✓ Supply (365 days) 3/7/2014 25/11/2015
- ✓ Construction (289 days) 11/2/2015 21/3/2016
- ✓ Test and commissioning (112 days) 26/11/2015 29/4/2016

4.5 Basic Data

4.5.1 Oil Characteristics

The export condensate specifications applicable to the condensate are given in Table 4.1.

Property	Units	TRAPSA	Nawara
1 0		Requirement Design Basis	
Reid vapour pressure (RVP)	Bara	0.78	< 0.4
Salt in crude	mg/litre	< 20	< 20
BS&W	v/v %	< 1.0	< 0.1
Residual H ₂ S	ppm (wt)	n/a	< 15
Elemental sulphur	%	Very low	Very low

4.5.2 Pipeline Characteristics

Condensate will be transported via 10 km pipeline to the TRAPSA pumping station n°3 (SP3). The design data of the pipeline are given below:

(i) Design Data

- Diameter :	6 inches
- Material :	API 5L Gr X52 / L360 PSL2
- External coating :	3 layers of polyethylene or polypropylene
- Design code (standards) :	NT 109.02 (Safety of structures for liquid hydrocarbons
	transported by pipelines) and
	ASME B31.4 : Pipeline transportation systems for liquid
	hydrocarbons and other pipelines
- Design Pressure :	94 Barg
- Test pressure :	141 Barg
- Design Temperature :	-25 / 85 °C
(ii) Maximum Flow :	10,000 bpd
(iii) Operating Conditions:	40.3 – 72 barg @ 20°C to 40°C

4.5.3 Leakage Detection System

The pipeline will be equiped with appropiate tools to record pressure, temperature and flow at both ends. The gathered information will be assessed and analysed using calculation tools to identify any leakage on the pipeline. In addition, regular survey patrols driving along the pipeline right of way will be planned in order to detect any abnormal activities or damages.

4.6 Pipeline Construction

4.6.1 Generalities

The construction of the pipeline is presented as an assembly line composed of specific activities and forming a linear construction sequence. The route is usually divided into several elementary sections; each will be executed by a specialized team. All teams are equipped with the appropriate equipment and moving along the route at an average speed that corresponds to that of work progress.

This procedure involves a large special tool. The equipment related work includes laying operations mainly graders, cranes, excavators and trucks. In addition, several workshops will be needed such as welding and civil work.

The project will involve staff with sufficient knowledge of regulatory requirements to achieve a guaranteed pipeline in accordance with applicable regulations.

The pipeline and the various facilities will be designed, constructed and operated in compliance with applicable requirements. These are intended to prevent accidents and malfunctions of the pipeline and to ensure adequate protection for people. The usual procedure for installing a pipeline includes layout of the work area, excavation, preparation of pipes, laying pipes, hydrostatic testing and site restoration. Details of these steps are presented below.

4.6.2 Working Area Layout

To carry out different activities, it is necessary to clean out a sufficiently large work area around the pipeline route, as well as access tracks to ensure smooth transition from construction equipment and transportation.

The clean out consists mainly of a leveling of the area in order to properly set up the equipment and install the pipeline itself. The work strip will be cleared of any obstructions. It will be the same for the access tracks to allow movement of machinery and equipment necessary without any discomfort.

4.6.3 Excavation

The trenches will be completed using all-terrain excavators and rock breakers. The depth of the trench must present a good cover over the pipeline. Digging 'U' trenches will be achieved by getting a trench slightly deeper at the ridge and gradually deepening the trench in the vicinity of the crossing roads, and water courses.

4.6.4 Pipeline Preparation

The pipes are transported to the site and stored in an area designed for that purpose. Pipes will be protected to avoid runoff and contact with water to prevent corrosion. Before their installation, they are aligned along the pipeline route to undergo various treatments.

Firstly, some sections will be folded if necessary to follow the contour of the trench. They are then aligned and welded by arc welding. The welding operation is an important step and governs the pipeline strength and quality. In addition, the overall progress of construction is virtually linked to the forward speed of the first welding phase.

The pipeline is then placed on brackets along the edge of the trench for inspection. The welds are subjected to full NDT, including X-ray examination, ultrasonic examination and Magnetic Particle Inspection (MPI) as identified by the Welding and NDT Specification. Any defect is repaired (if necessary welding can be removed and the operation repeated). Once the welds validated, they will be coated with a protective layer. The other checks are carried out visually and are designed to detect manufacturing or coating defects and any defect or scratch that can be dangerous later.

After carrying out all the necessary repairs, the pipeline is covered with a corrosion protective layer. This first protective measure will be enhanced by a cathodic protection.

The import of radioactive material will be used in non-destructive test of welds, requires the prior authorization of the Ministry of Interior, Public Health, Industry and Transport. The inspection agency shall provide a certificate of importation and use of the radioactive source. The radioactive source is transported in sealed containers of B (U) type specially designed to limit radioactive radiation.

On arrival at the port or airport, agents of the National Centre for Radiation Protection shall check the tightness of the container.

Prior delivery to the site, the radioactive source is transferred to a sealed container and placed in a vehicle equipped with flashing lights, beacon signaling danger and MSDS. The order of Interior and Transportation ministers dated 18 March 1999 sets the model for MSDS related to the transport of hazardous materials by road and instructions that must include particularly:

- ✓ The denomination of the substance and its class (radioactive material Class 7 in accordance with Article 13 of Law No. 97-37 of 02/06/1997);
- \checkmark The nature of hazards presented by the material;
- \checkmark The general guidelines to be applied in case of an accident or incident;
- ✓ First Aid;

 \checkmark Identity, address and phone and fax number of the sender.

A copy of the MSDS should be posted in the vehicle cab in a visible and easily accessible location.

All weld defects will be repaired (if necessary welding can be removed and the operation renewed). Once validated, welds are covered with a protective layer. Other visual verifications are carried out to detect manufacturing or coating defects or any fault or scratch that could be dangerous later.

Finally, once the necessary repairs have been completed, sandblasting and pipeline cleaning procedures start prior to a coating with a Polyken protective layer against corrosion. The first anti-corrosive measures will be strengthened by an impressed current cathodic protection system.

4.6.5 Pipeline Coating

Pipes shall be supplied with an external coating which shall consist of:

- ✓ A layer of hard polymeric base adhesive;
- \checkmark A three layers of high density polyethylene or polypropylene compound.

The three layer polyethylene or polypropylene coating system shall be suitable to withstand the maximum operating temperature of 85°C. The minimum thickness of final coating shall be 3 mm.

4.6.6 Pipeline Laying and Trenches Backfilling

Prior to the pipeline laying, it is necessary to ensure that it will not experience physical damage once installed, consequently, the trench is dried and cleaned. If the trench bottom is rocky, it will be filled with sand, sand bags or screened excavated soil.

The pipeline installation is carried out by a crane equipped with slings. Then the trench will be backfilled with the excavated material. It is also necessary to pay attention to the material used and if necessary use padding to protect the pipeline from rocks. The basement will be carefully compacted around and over the pipe. It should be noted that to preserve the soil, backfilling operations are never performed using topsoil.

In some particular cases, it is necessary to strengthen protection. If the pipeline goes under a road, concrete slabs will be placed over to protect from the vehicles loads and ensure uniform distribution of the load through the slab and soil, without being directed to the pipeline.

4.6.7 Crossing the Tracks

The pipeline route crosses two tracks. During the crossing of these infrastructures the pipeline will be buried at an optimal security depth and will be cased (see Figure 4.2 Cross Section of the Pipeline Crossing Tracks). To minimize traffic disturbance, warning signs and safety barriers will be installed. In addition, supervisors and guards will be hired to organize the traffic and ensure safety and smooth flow of traffic during day and night. All the preventive measures will be taken to avoid causing damage to tracks crossings.

4.6.8 Hydrotest

Before commissioning, the pipeline will be subject to a hydrostatic test in accordance with the technical specifications required to check the integrity and rigidity of the pipeline.

Prior to the hydrostatic testing, it is necessary to carry out an internal cleaning of pipes using a cleaning pig. The scraping is a cleaning process that removes dirt, welding rods, stones, debris and other foreign bodies. During scraping, it is necessary to provide "scraper stations" for sending and arrival. These stations will be connected to the scraper ends by flanges to allow inspecting the pig at the arrival.

The water used to accomplish the hydrotest will be supplied from water well existing in Nawara concession whose drilling approval is going on with agricultural and hydraulic authorities. This water will have the same physico-chemical characteristics as the drinking water. It will be mixed with a corrosion inhibitor and an oxygen scavenger.

Sections between two successive valves will be subjected for at least six hours to resistance test at 120 % of the nominal service pressure.

The scrapers can clean the pipeline and control the water quantity introduced into the pipeline.

The water quantity required to fill the pipeline is estimated at 182 m^3 .

Assumed to be contaminated with welding debris and possibly grease and sand, this water will be removed in evaporation pits.

After hydrostatic testing, the pipeline will be wiped to remove any residual water by injecting air or gas. Once the pipeline is dry, it will be purged with nitrogen before commissioning.



Figure 4.2 Cross Section of the Pipeline crossing Tracks

4.6.9 Restoration

At the end of operations, the area will be restored to its initial state. After restoration, debris and surplus will be sent to approved landfills. The access tracks will be saved for later use during the operation phase for periodic inspection.

4.7 Base Camp

The contractor will develop construction camps to accommodate 300 people for the workforce engaged in construction activities. Two base camps will be erected along the pipeline route. The first one will be established near the CPF and the second near the tie-in-point TRAPSA. These locations were chosen in order to minimize land take, personnel and engines shifting and facilitate supplies.

Base camps will be equipped with specific medicines for treatment of different illnesses and the necessary equipment to handle an emergency.

4.8 Access to the Area

The project area is accessible through the existing roads and tracks leading to the project site (see Figure 4.3 Road Map of the Study Area).



Figure 4.3 Road Map of the Study Area

4.9 Utilities

The construction of the pipeline requires water, power and fuel. The normal operations will not require any utility.

4.9.1 Water

Aquifer water will be supplied from water well existing in Nawara CPF.

4.9.2 Power

One 125 KVA-power generator will be used to provide the electricity required for base camp and equipment.

4.9.3 Fuel

Diesel is required to supply the camps power generation system, vehicles and construction equipment. Diesel will be trucked to the base camp by a fuel tanker of 10,000 liters from the existing gas station in Remada and stored in tanks with a total capacity for 30 m^3 . Daily diesel consumption is about 1000 liters.

Oil tanks will be located far from workplace, habitations, open fire, ignition, and other causes of heating. A trench waterproofed with a polyethylene or polypropylene membrane will delimit the fuel storage area to avoid the contamination of underground water with the hydrocarbons in case of a leakage.

4.10 Safety

4.10.1 Communication

All necessary and efficient communication means will be available for work needs and workforce safety.

4.10.2 Medevac

The base camp will be equipped with specific medicines for treatment of different illnesses and the necessary equipment to handle an emergency.

4.10.3 Contingency Plan

Emergency procedures to cover all foreseeable emergency situations will be available, documented and displayed.

The contingency plan includes medevac, fire fighting and man lost search.

4.10.4 Training

A safety meeting will be held at the beginning of the work with all the crews. Work Procedures and first aid training will be explained during this meeting.
5.0 EXISTING ENVIRONMENT

The baseline analysis of the study area has been based on the bibliography and on certain collected field data.

For the needs of environmental analyses, all the environmental and socioeconomic sensibilities were set in their geographical context by a Geographic Information System (GIS).

5.1 Physical Environment

5.1.1 Weather Conditions

With reference to the scale of Emberger (1955), and given the weather characteristics, the study area as part of the southern Tunisia is classified as Mediterranean bioclimate of Saharian inferior stage with cool winter (see Figure 5.1 Bioclimatic Map of the study area).



Figure 5.1 Bioclimatic Map of the Study Area

5.1.1.1 Temperature

The temperature, being variable with the season, is characterized by great amplitudes reflecting the continental aspect of the study area. As such, during the summer, July is the hottest month with an absolute maximum temperature of 50.1°C. Whereas, during the winter, January is the coldest month with an absolute minimum temperature of - 2.4°C. The average annual temperature at El Borma is 22.6°C and the average minimum

temperature is 4.3°C in January and the average maximum temperature is 41.7°C in July.

Table 5.1 Average, absolute Minimum and Maximum Temperatures Recorded at the

Mois	J	F	Μ	Α	Μ	J	J	Α	S	0	Ν	D
Average Min T°C	4.3	5.7	10.5	14.7	19.5	22.7	25.4	25.3	22.6	18.0	11.1	6.5
Average Max T°C	17.3	19.3	25.3	29.4	33.5	38.5	41.7	40.8	36.6	31.4	23.7	18.5
Average T°C	10.8	12.5	17.9	22.0	26.5	30.6	33.5	33.1	29.6	24.7	17.4	12.5
Absolute min T°C	-2.4	-1.5	2.1	6.0	10.1	12.4	18.5	20.0	14.4	8.2	1.5	-2.2
Absolute max T°C	26.9	31.9	38.7	40.6	44.6	47.2	50.1	47.3	45.8	40.2	37.0	30.6

El Borma met station during the Period from 2000 to 2009

Source: INM., 2000-2009

The absolute minimum temperature recorded during the period 2000-2009 is -2.4°C, recorded on January 7th, 2005. While, the absolute maximum temperature is 50,1°C and recorded on July 26th, 2005.

5.1.1.2 Rainfall

Rainfall is very irregular with an annual average of approximately 51,4mm over the period 2000 -2009. Rainfalls are occasionally affected by disturbances of Saharian origin related to north-east fluxes. Rainfall is generally characterised by a low intensity events. The highest intensity was 19.6 mm and occurred mainly during autumn. A monthly average rainfall recorded at El Borma met station is presented in table 5.2.

Table 5.2 Monthly Average Rainfall Recorded at the El Borma met station during the Period

20001	-2009
20001	-200

Pluv. (mm) 5,7 3,4 9,8 3,1 4,9 0,3 0,0 0,0 1,8 14,6 3,2 4,5 51,4	Mois	J	F	Μ	Α	Μ	J	J	Α	S	0	Ν	D	Total
	Pluv. (mm)	5,7	3,4	9,8	3,1	4,9	0,3	0,0	0,0	1,8	14,6	3,2	4,5	51,4

Source: INM., 2000-2009

In El Borma, and during the period 2000-2009, the monthly rainfall recorded was 61.3 mm in October 2006.

5.1.1.3 Evapotranspiration

The dry season duration (6 to 9 months) and the frequent exposition of the region to dry winds increase considerably the potential of evapotranspiration, reaching 1119 mm in Remada and worsen the hydric deficiency.

5.1.1.4 Winds

Wind roses for the winter and autumn periods at El Borma monitoring station are presented in figure 5.2. These wind roses show that the dominant winds tend to be from

the west and east during the winter period and from the east, north-east and south-east during the autumn.

South-west winds tend to be associated with a significant temperature increase. This warm wind tends to operate as a limiting factor on the occurrence of many plant and animal species in the area.



Source: INM., 2000-2009



The south-west and north-east winds, due to the abrasive silicon and quartz grains carried by these winds, also result in damage to vegetation in the area.

DD	1-5 m/s	6-10 m/s	11-15 m/s	>=16 m/s	Total
Ν	3.0	0.8	+	+	3.8
NNE	3.7	1.3	0.1	+	5.1
NE	3.7	2.1	0.1	0.0	5.9
ENE	4.3	3.2	0.2	0.0	7.7
Ε	11.4	5.8	0.3	+	17.5
ESE	5.5	1.9	0.1	0.0	7.5
SE	4.8	2.0	0.1	+	6.9
SSE	3.8	1.6	0.1	+	5.6
S	3.6	1.5	0.1	+	5.2
SSW	2.9	1.0	0.1	+	4.0
SW	2.2	0.9	0.1	+	3.2
WSW	2.4	1.4	0.2	+	4.0
W	4.8	2.3	0.2	+	7.3
WNW	2.1	0.7	0.1	+	2.8
NW	2.6	0.6	0.1	+	3.3
NNW	2.1	0.6	+	+	2.7
Total	62.9	27.7	1.9	0.1	92.6

Table 5.3 Wind Speed at El Borma station (2000-2009)

Source: INM., 2000-2009

5.1.1.5 Sandstorms

Sandstorms are very common in the study area. The number of days of sandstorms per month is given in table 5.4.

Table 5.4 Monthly number of sandstorm days in El Borma for the period 2000-2009

Month	J	F	Μ	А	Μ	J	J	Α	S	0	Ν	D	Total
Nbr. of days	1	2	5	6	6	2	1	1	2	1	1	2	30

Source: INM., 2000-2009

The annual average number of days of sandstorms for the period 2000-2009 is 30 days. It varies from 1 to 6 days. The highest number of windy days was recorded during the spring season (March-April-May) with 19 days of sandstorms.

5.1.2 Hydrology

The natural conditions within the study area are characterized by a very low and irregular rainfall and by a hydrographical network having an intermittent flow. The surface waters are scarce or even negligible and the flow is endorheic.

5.1.3 Hydrogeology

Surface waters are rare even absent (cf. Appendix V Core drills in the study area). The Continental Intercalaire of the Dahar is the only water resource in the study area (see Figure 5.3 Hydrogeological Map of the Study Area). This aquifer is subdivided in two parts : the Dahar eastern piedmont of C.I and the Dahar western piedmont of C.I. It covers an area of 600 000 km² extending over the south of Tunisia and the south of Algeria.

The upper aquifer of the Continental Intercalaire having an average thickness of 131 m, is of interest to all the domain of the extreme South of Tunisia. The groundwater flow is towards the West and the Northwest.

During the year 2008, the global exploitation of this aquifer was 10.2 Mm³/year and its recoverable reserves are about 28.4 Mm³/year (DGRE, 2008).



Figure 5.3 Hydrogeological Map of the Study Area

5.1.4 Geomorphology

The study area is located in the geomorphologic set of Dahar characterized by its outcrops. The Dahar is a wide plateau made up of Cretaceous outcrops and divided by many thalwegs generally oriented East to West and ranging in altitude from 300 to 550 m.

This dry land develops at the west and towards the south, having a purple and arid ribbon, sometimes 100 km wide. It is slowly inclined towards the Erg Sands at the West and ends at the East in a form of Djebels (often very abrupt ledge) over the oriental plains of El Ouara and of Jeffara, whose altitude varies between 100 and 200 m and slowly descend in the direction of the sea.

5.1.5 Geology

All the sedimentary series which constitute the relief of the region belong to the Secondary era. They pass from the Upper Cretaceous to the Upper Silurian and descend into two directions at the west and the South west.

The upper Cretaceous constitutes the Dahar skeleton: It is made of limestone and marls. The medium and lower Cretaceous rise on the oriental front of Dahar: they are made of dolomites and sandy clay beds (see Figure 5.4 Geological Map of the Study Area).



Figure 5.4 Geological Map of the Study Area

During the Cretaceous sedimentation, the source rocks reached the maturation depth. The migration of hydrocarbons to the reservoir rock (Acacus formation) was favoured by the general tilting of the platform down to the southwest.

Moreover, Triassic and Paleozoic sandstones are a productive area. The exploration was dense in the western central sector, near the large field of the El Borma. The northeast,

the east and the far south zones are less explored and still have good potential, especially for the Paleozoic targets such as the Devonian, the Carboniferous and the Ordovician which are currently producing oil and gas in Algeria and Libya (Ben Ferjani A. *et al.*, 1990).

5.1.6 Pedology

The soils of the study area are fragile having a very coarse texture because of the dominance of quartz and silica crystals. The wind erosive processes affect these easily movable materials, which allow their transport over long distances.

In case of deflation, the soil is locally made of "fech fech" which are dusty gypsum based formations having a shallow and tender crust (Coque, 1962).

According to the soil map, the study area is covered mainly by immature soils (see Figure 5.5 Soil Map of the Study Area).



Figure 5.5 Soil Map of the Study Area

5.2 Biological Environment

The very marked dryness of the climate and of the soil avoids the installation of vegetation and animal settling process. This results into a low biological diversity. The number of animals and vegetation species remains in these situations low compared to the rest of the arid zone.

5.2.1 Flora

Dahar vegetation has hardly ever been studied, barring Houérou's works (1959-1969). In terms of plant life, the region was classified by Ferchichi (1997) as a transition area between the Mediterranean flora and Saharian-Arabian flora.

In terms of plant communities, the following ones were identified by Houérou (1959):

- ✓ Plant community of *Anthyllis sericea* ssp. *henoniana* and *Gymnocarpos decander*;
- Plant community of Arthrophytum schmittianum var. prostratum and Arthrophytum scoparium var. scoparium;
- ✓ Plant community of *Helianthemum confertum* var. *brachypodum* and *Calligonum comosum;*
- ✓ Plant community of *Calligonum azel* and *Calligonum arich*;
- ✓ Plant community of *Aristida pungens* and *Gensita saharae*;
- ✓ Plant community of *Ephedra* ssp. *alenda* and *Cornulaca monacantha*

Dahar is generally marked by a steppe cover with predominance to the West (along the eastern Grand Erg) of psammophilous species (*Helianthemum confertum*, *Oudneya africana*, *Calligonum comosum*...) and to the East (along Matmta Mountains) of xerophilous species (*Gymnocarpos decander*, *Helianthemum kahiricum*, *Artemisia herba-alba*). Depressions are marked by predominance of psammophytes such as *Retama raetam*, *Aristida pungens*, *Calligonum comosum*, *etc*.

Salt depressions are very rare in this region. Sandy or powdery limestone or gypsum Regs are covered with sparse vegetation where *Traganum nudatum* and *Cornulaca monacantha* are dominant.

Thanks to a relatively congenial milieu, Wadis and spraying areas house a rich and varied vegetation, mostly *Tamarix sp., Retama raetam, Pennisetum elatum, Aristida pungens, Calligonum comosum*, etc.

According to the phyto-ecological, les associations végétales qui peuvent se trouver dans la zone d'étude sont : l'association à *Helianthemum confertum var brachypodum* et *Calligonum comosum* et l'association à *Salsola zygophylla* et *Traganum nudatum variante à microphyllum* (see Figure 5.6 Phyto-ecological Map within the Study Area).



Figure 5.6 Phyto-ecological Map within the Study Area

5.2.1.1 Description of the main existing species

The main existing species within the study area are listed in the paragraphs below:

Anthyllis sericea subsp.Henoniana

This is a shrub up to 70 cm high, with woody and branched stems and silvery leaves of 3 to 5 leaflets. The flowers (capitulum of 3 to 10 flowers) are colored white pale pinkish. This species comes into vegetative activity after the first autumn rains. It blooms from late winter and fruiting begins in April.

It is abundant in the desert steppes mainly on calcareous and gypsum soils. It appears in the lower arid, but is especially common in the Saharian zones. From edaphic point of view, the steppes of Antyllis henoniana occupy low depth crusts of limestone and gypsum regs, shallow, overlain by a sandy loam skeletal soil or by sand (sailing wind or barkanes).

It is widespread in all the Dahar where it reaches Lorzot and Jneïen in the south. This plant is moderately palatable. It is however suspected to cause, a disease for camels known as "Krafft" when ingested at the flowering period.



Photo of Anthyllis sericea subsp.Henoniana

Calligonum polygoides subsp.comosum

This species belongs to the Polygonacean family. Its vernacular name is Arta and is known in English as haired Calligone. It is the most typical phanerophyte in the Saharian region. It can reach up to 2 metres in height. The bark is whitish, especially during the time when leaves begin to fall. The leaves are small in size and scale-like. Its biological cycle is marked by a very short-lived vegetal growth stage (February-May). The reproduction stage ends in June. The fruits, achene-form, bear several series of hairs.

The species is commonly found in the entire Saharian region, with the exception of the Grand Erg Oriental. It occupies the runoff deep and sandy alluviums in the South and the sand dunes. Its presence has been recorded in Mechhed Salah, Remada, Borj Bourguiba and in all Dahar.

It is an excellent grazing species, especially in spring. It also plays an important role in the quicksand fixing. Its wood is very much appreciated.



Photo of Calligonum polygoides subsp.comosum

5.2.2 Fauna

The specific diversity of vegetation and the vegetation cover are the factors influencing the diversity and the density of the existing animals. The animal species of the study area are linked to the existing plant communities.

5.2.2.1 Terrestrial Fauna

As in the case for the rest of the saharian zone, the wild fauna encountered in these zones is known for its adaptation to the ecological characteristics of this zone. The encountered species are few in number but ecologically well adapted to the natural conditions of the site. As such, for example, the lack of water points for animal consumption does not affect the biology of the animal species except during the summer season. This season however is characterized sometimes by very high temperatures causing the suffering to death of many species, in particular the gazelles.

The dune gazelle (*Gazella leptoceros*) whose color corresponds to sand's one (adaptation of these species to the site characteristics) is the most encountered mammal in the region. Other mammals such as the wolf, the jackal and the fox exist in this zone. Their nutrition is based on dead sheep and cows pasturing in this region, as well on gazelles.

Among the rodents, the Thomas's gundi and the jerboa are the most abundant animals, in particular within the visible galleries in the Dahar formation level.

The reptiles in the saharian zones are very dangerous to mankind, because of their

poisonous character. We stress in this case on the abundance of vipers with horns or sand viper, being extremely dangerous species. Another characteristic reptile of the study area must be mentioned. It is the sand boa (Eryx jaculus), which is also dangerous, just like the Naja (Naja haje). The desert varanus (gray varanus) is similarly a frequent species in the study area. Other inoffensive or less dangerous reptiles, in particular lizards, exist also in the zone.

The insects constitute another particularity of these saharian zones. Their abundance reflects the high density of scorpions and spiders.

5.2.2.2 Avifauna

Within the study area, the ornithological community is significantly diverse. For all seasons, a hundred migratory and sedentary species were inventoried which represents the quarter of the total Tunisian richness (see Appendix II). This community is composed of sixty continental species, thirty waterbirds and some Raptors (Isenmann *et al.*, 2005). Further, the study area is important for migratory birds during autumn and spring seasons. It's regarded as a bird migratory bridge linking African and European continents. It is also a very important area for some breeding Passeriformes.

Some bird species characterize the Southern Tunisia as *Tadorna ferruginea*, *Chlamydotis* undulate, Cursorius cursor, Charadrius morinellus, Pterocles alchata, Bubo ascalaphus, Caprimulgus aegyptius, Alaemon alaudipes, Chersophilus duponti, Ramphocorys clotbey, Ermophila bilophaa and Scotocerca inquieta.

5.2.2.3 Protected Species

According to Article 7 of the order of the Minister of Agriculture and Environment dated September 11th, 2012, relating to the organization of hunting activities during the season 2012-2013, hunting, destruction, capture, selling, buying, hawking and detention of the following species are prohibited by the law at all times :

- Mammals: stag, gazelles, buffalo, serval, mouflon with cuffs, lynx, cheetah, hyena, fennec, porcupine, bats, white hedgehog, Thomas's gundi, wildcat, otter, seal, saw, young wild boar and all young wild mammals.
- ✓ Birds: African Bustard Chlamydotis undulata, Greater Flamingo, stork, Slenderbilled Curlew, Marbled Teal, White-eyed Pochard, Purple Gallinule, Corn Grex, Shag Cormorant, Audouin's Gull, Eurasian spoonbill, night and diurnal bird of prey, eggs, nests and clutches for all wild birds.
- ✓ *Reptiles and amphibians*: land, sea and freshwater Tortoises, desert lizard, tail whip,

chameleon and frogs.

The export, the import and the transit of all the wild fauna species including any of their parts (mammals, birds, reptiles, amphibians, molluscs, insects, arachnids and annelids) are prohibited except upon a special authorization of the General Director of Forests. The naturalization of the wild fauna species is submitted to the specifications approved by the decree of minister of the agriculture dated 28 March 2001.

5.3 Human Framework

5.3.1 Population

The study area is located in the sector of Borj El Khadra, delegation of Remada within the governorate of Tatouine. This delegation covers 27,830 km² which is 70.4% of the governorate of Tataouine. The Remada delegation has 9,977 inhabitants (INS, 2005) with a population density of approximately 0.25 inhabitants/km².

According to the results of a census conducted by the National Statistics Institute in 2004, the population of the Borj El Khadra sector is 83 inhabitants grouped in 19 houses and 19 households (INS, 2005). It principally consists of the military personnel at the frontier post of Borj El Khadra. The low population is due principally to the location of this sector within the Tunisian Sahara and the associated harsh desert conditions.

The area is also occupied by shepherds who are generally found in the area on a seasonal basis. They are generally not included in the census noted above and the exact size of this population is unknown.

5.3.2 Economic Activity

5.3.2.1 Demography

The study area is located in the sector of Borj El Khadra, delegation of Remada within the Governorate of Tatouine.

According to the results of a census conducted by the National Statistics Institute in 2004, the population of the Borj El Khadra sector was 83 inhabitants grouped in 19 houses and 19 households (INS, 2005). It mainly consists of the military personnel at the frontier post of Borj El Khadra. The low population is largely due to the location of this sector within the Tunisian Sahara and the associated harsh desert conditions.

The area is also occupied by shepherds who are generally found in the area on a seasonal basis. They are generally not included in the census noted above and the exact size of this population is unknown.

5.3.2.2 Active Population

The distribution of the active population by branch of activity in the delegation of Remada, and the governorate of Tataouine is given in table 5.5.

		Governorate of Tataouine	Delegation of Remada	% of the delegation of Remada
Economic	Number of active population 15 years and more	50 228	2779	-
Activity	Activity rate %	47,7	42,4	-
	Agriculture and Fishing	15198	595	25,1
opulation aged :anch of activity	Manufacturing	1974	174	7,3
	Mining and Energy	833	87	3,7
ve p y bi	Building and public work	4944	280	11,8
ctiv e b	Trade	9065	322	13,6
ution of a	Transport and Communication	9574	871	36,8
	Education and Health	294	38	1,6
trik ears	Other services	41882	2367	100
Dis 5 ye	Undeclared	50 228	2779	-
1	Total	47,7	42,4	-

 Table 5.5 Distribution of the Active Population by Branch of Activity

Source: ODS., 2010

The number of active people aged 15 and more is 2779 and the activity rate is 42.4% in the delegation of Remada.



Figure 5.7 Distribution of Active Population by Branch of Activity within the Delegation of Remada

According to figure 5.7, mainly three sectors absorb the active population within the delegation of the study area (Remada) which are the administration/education and health branch (36.8%), followed by the agriculture sector (25.1%) and finally the services

branch (13.6%).

According to the field survey, the working population in the hamlet of houses within Borj El Khadra region is 20 persons, among them 4 are unemployed.

5.3.2.3 Unemployment

The table 5.6 presents statistics of the unemployed persons aged 15 years and more and the rate of unemployment in the delegation of Remada, the governorate of Tataouine and in Tunisia.

Region	Number of unemployed 15 years and more	Unemployment Rate
Delegation of Remada	412	14.8%
Borj El Khadra sector*	4	-
Governorate of Tataouine	8,347	16.6%
Tunisia (2011 statistics)	704,900	18.3%

Source: ODS., 2010

* According to field survey, (EAM, February 2012)

5.3.3 Socio-economic Activities

The main socio-economic activity in the governorate of Tataouine and particularly Borj El Khadra sector is agriculture and mainly breeding.

5.3.3.1 Agriculture

The agricultural area in the governorate of Tataouine is 1,706,991ha and the main crops are cereals, gardening, legume and arboriculture. The land use in Borj El Khadra region is based mainly on vegetables and fodder crops.

Land use in the study area is presented in figure 5.8 (see Figure 5.8 Land Use in the Study Area).

Tables 5.7, 5.8 and 5.9 present the distribution of agricultural lands with their use as well as the distribution of dry and irrigated crops.

Region	Agricultural Area	Pastures	Forests	Non Agricultural Area	Total
Remada	30.000	780.000	398	810.398	2.105.609
Governorate of Tataouine	200.000	1.500.000	7.747	1.707.747	2.181.445

Table 5.7 Distribution of Land Use (ha)

Source : ODS., 2010



Figure 5.8 Land Use in the Study Area

Table 5.8 Distribution of Arable Land (h	a)
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Region	Cereals	Gardening	Legume	Arboriculture	Total
Remada	6	232	-	3,860	4,098
Total Governorate of Tataouine	2,192	766	27	51,600	54,584

Source : ODS., 2010

Type of crop	Region		Cereal	Legume	Vegetables	Fodders
	Delegation of	Area (ha)	200	-	-	-
Ŋ	Remada	Production (T)	70	-	-	-
Ō	Governorate of	Area (ha)	870	27	14	-
	Tataouine	Production (T)	322	62	62	-
р	Delegation of	Area (ha)	12	-	232	950
Irrigate	Remada	Production (T)	63	-	4,513	285,000
	Governorate of	Area (ha)	188	-	765	365
	Tataouine	Production (T)	1,930	-	14,735	7,330

Table 5.9 Distribution of Irrigated and Dry Annual Crops (ha)

Source : ODS., 2010

Type of crop	Region		Olive trees	Dates	Almond trees	Pomegrenate trees	Fig trees	Other
Irrigated	Delegation of Remada	Area (ha)	2,065	-	186	-	207	-
		Production (T)	420	-	15	-	-	-
	Governorate of Tataouine	Area (ha)	44,355	145	1,584	-	1,710	1
		Production (T)	557	-	100	-	60	-
Dry	Delegation of Remada	Area (ha)	614	103	140	64	64	241
		Production (T)	506	15	40	35	170	580
	Governorate of Tataouine	Area (ha)	1,607	230	261	304	199	732
		Production (T)	1,029	30	100	410	310	1,330

Table 5.10	Distribution	of Irrigated	and Drv	Arboriculture
1 4010 5.10	Distribution	or mingutou	und Dry	1 II O OI I Culture

Source : ODS., 2010

5.3.3.2 Livestock Breeding

Transhumance and pastoralism are considered to be the livelihood income of the local population.

Dahar is known to be a grazing area. It is used by herds of dromedaries and small ruminants (ovine and goats) from neighbouring regions.

(i) Breeding of Dromedaries

The dromedary is a species adaptable to the harshest living conditions. It contributes to the valorisation and preservation of desert expanses marked by a thin vegetal cover and an extremely fragile ecosystem. In good years at least 50% of the national camel herd head during the springtime toward the Sahara and Dahar.

Table 5.11 Evolution of the Number of Camels in the Governorate of Tataouine

Years	1890	1930	1990	1998	2009
Number	3,100	9,860	16,000	20,000	25,000
1 (units of	5,100	,000	10,000	20,000	20,000

(1890 - 2009)

Source : ODS, 2009

Due to the mobility of animals between the study area and the breeding "residence rounds", it is difficult to identify a specific round (grazing duration, sanitary prophylaxis) and assess Dahar own production.

The strategy of transhumance toward the Saharian rounds and Dahar seems to be a key component in the way camel breeding is conducted in the south of Tunisia.

The beginning and end of transhumance are further determined by the behaviour of animals; they prefer to go grazing in depressions looking for tender vegetation. Camel raisers shun certain rounds and choose milder and less windy destinations.

(ii) Breeding of Small Ruminants

The study of the various zoo-technical aspects of the breeding of small ruminants was conducted on the basis of the result of a survey of shepherds and data collection from the CRDA of Tataouine and the regional development departments.

Transhumance is a very old practice in Dahar round. It extends over a period of six months each year. It begins after the first autumn rainfalls and lasts in late spring. Watering locations determine the destination of transhumance.

Table 5.12 Estimation of the Number of Ovins and Caprins (× 1000 heads) using the Dahar

Gouvernorat	Ovins	Caprins	Total
Tataouine	298	232	530
Others	162	139	301
Total	460	371	831

The entire herds in the governorate of Tataouine are considered as using Dahar. The herds of small ruminants are made up of goats and ovine. An average herd is composed of 54 % of goats and 46 % ovine.

Livestock in the delegation of Remada consists of 60 000 head of sheep, 36,000 heads of goats and 1,800 heads of camels (ODS, 2009).

Within the Borj El Khadra sector, there are only 300 heads of livestock (200 cows and 100 sheep).

5.3.3.3 Tourism

Saharian tourism is being promoted at the national level. Indeed, the difficulties of the sector result from several factors of which the main are the accessibility of the sites, the improvement of the lodging and the rehabilitation of the access roads and the sites attraction such as Ksours and the Islamic and Roman ruins.

The study area is part of a military zone; therefore, its access is subject to a Desert Pass issued by the Governor of Tataouine.

With the difficult access and complete absence of settlements, the study area does not constitute a touristic zone.

5.3.3.4 Underground Resources

The largest underground resource is obviously oil, especially in the regions of El Borma, Makhrouga, El Arich, Chouech Essaida, Ech-Chouech, Oued Zar, Hammouda, Adam and Waha, which provide the major part of the Tunisian oil production (cf. Figure 5.9 Infrastructure Map of the Study Area).



Figure 5.9 Infrastructure Map of the Study Area

5.3.4 Cultural and Archaeological Patrimony

Based on the available current knowledge, no single important cultural or archaeological site exists within the study area (see Figure 5.10 Archaeological sites within the study area). In case of discovery of artefacts from the pre-historical or historical ages, arts or traditions, the operator will be asked to immediately inform the services in the ministry in charge of the patrimony or the nearest territorial authorities who will in turn inform the services in charge within a maximum of five days. The authorities in charge will take all necessary conservation measures and will ensure themselves, if necessary, the supervision of the in-process works.



Figure 5.10 Archaeological Sites within the Study Area

5.3.5 Protected Areas

No natural protected areas or National Parks exist within the study area.

5.3.6 Landscape

It is a desert landscape characterized by the presence of outcrops of Dahar and regs.

6.0 PREDICTION AND ASSESSMENT OF ENVIRONMENTAL IMPACTS

The adopted methodology in the evaluation of the impacts of the condensate export pipeline construction and operation is based on the appreciation of a synthesis indicator which constitutes the <u>significance</u> of the impact. This indicator gives a judgment on the importance of the gains and losses for the natural and human components of the environment related to the proposed activities. The established judgment represents the integrated result of three components, including <u>the intensity</u>, <u>the extent</u> and <u>the duration</u> of the impact.

Figure 6.1 graphically presents the main process allowing the impact evaluation.



Figure 6.1 Procedure of Impact Evaluation

6.1 Intensity

The impact intensity shows the relative significance of the consequences attributable to the observed alteration of a component. It compiles the social and the ecosystem value of the component along with the anticipated disturbance degree of this component.



The combination of the disturbance degree and the value assigned to the component allows obtaining three levels of impact intensity: high, moderate and low.

- ✓ *High*, when the impact highly modifies the quality or significantly limits the usage of a component presenting a main interest and exceptional qualities, whose conservation or protection are subject to a formal legislation or a general consensus ;
- ✓ *Moderate*, when the impact reduces the quality or the usage of the component having a certain social value and/or recognizable qualities without necessarily compromising

its integrity;

✓ Low, when the impact modifies only in a little manner the quality, the usage or the integrity of an environmental component whose interest and quality do not constitute any growing concern.

6.2 Extent

The impact extent stands for the range or the spatial coverage of the effects generated by the intervention on the site. This concept refers either a distance or a surface over which the observed modifications felt by a component or else by the proportion of population being affected by these modifications.

The three levels, being considered in quantifying the impact extent are:

- ✓ *Regional extent*, when the impact affects a wide space or many components, being located within an important distance of the project or being felt by the whole population or by a large proportion of the population of the study area ;
- ✓ Local extent, when the impact affects a relatively limited space or a certain number of components located inside, nearby or at a certain distance from the project site, or when it is felt by a limited proportion of the population in the study area (i.e. a village);
- ✓ *Pinpoint extent*, when the impact affects only a very limited space or a component being located inside or nearby the project site, or it is felt only by a limited number of individuals of the study area.

6.3 Duration

The impact duration indicates its time extent, defined as being the period of time during which the imposed modifications will be felt by a component.

The used method distinguishes the following impacts:

- *Permanent*, whose effects are felt in a continuous manner during the service life of the equipment or even beyond ;
- ✓ *Temporary*, whose effects are felt during a limited time period, generally corresponding to the construction period.

6.4 Significance

The interaction between the intensity, the extent and the duration allows to define the significance level of the impact affecting a components affected by the project. Table 6.1

presents the grid for determining the impact significance. This presents five significance levels varying from very high to very low, considering the three determining factors of the impact: the intensity, the extent and the duration.

Intensity	Extent	Duration	Significance	
	Degional	Permanent	Very high	
	Regional	Temporary	High	
II: al	Legal	Permanent	High	
nigii	Local	Temporary	Moderate	
	Dimesint	Permanent	High	
	Pinpoint	Temporary	Moderate	
	Designal	Permanent	High	
	Regional	Temporary	Moderate	
Madarata	Logal	Permanent	Moderate	
Moderate	Local	Temporary	Low	
	Dimesint	Permanent	Moderate	
	Pinpoint	Temporary	Low	
	Degional	Permanent	Moderate	
	Regional	Temporary	Low	
Low	Legel	Permanent	Low	
LOW	Local	Temporary	Very Low	
	Dinnoint	Permanent	Low	
	Phipoint	Temporary	Very Low	

Table 6.1 Grid for Determination of Impact Significance

In case the significance of the impact is considered moderate or high, the operator is inclined to consider, in the design phase, measures of control and / or mitigation to eliminate or reduce the impacts to acceptable level.

7.0 DISCUSSION AND ASSESSMENT OF ENVIRONMENTAL IMPACTS

This section of the report consists in debating potential impacts of the project in relation to the biophysical and socioeconomic environments. The discussion of potential impacts aims to assess these impacts qualitatively to establish the necessary measures required for their mitigation.

In the following we provide a description, analysis and evaluation of potential impact on biophysical environment that may occur during each stage of the project, such as:

- ✓ Construction phase;
- ✓ Operation phase, and;
- ✓ Decommissioning.

7.1 Impact of Pipeline Setting Up

The following sections cover the impacts associated to the offshore and onshore facilities installation. These impacts are regrouped in two categories as follows:

- ✓ Impacts linked to pipeline setting up;
- ✓ Impact of Hydrotest fluids discharge.

A great effort was provided for the selection the pipeline Right Of Way (ROW). The selected route will significantly maximize land management profitability and therefore significantly reduce the project's impacts on the biophysical and human environment.

7.1.1 Impact on the Biological Environment

The works inherent to the construction and pipelaying of the pipeline and the camps establishment cause a reduction of the vegetation cover and a destruction of a certain number of animal burrows. Besides flora disturbance, the movement of rolling stock and personnel along the pipeline route will also temporarily disturb the nearby fauna. Birds as well as mammals capable of moving long distances could find refuge in other similar sites. Only local populations represented by a few species of insects, reptiles and rodents will be affected.

Given that the area of construction and pipelaying activities constitutes a small part of a vast uniform area in terms of fauna and flora, and considering the absence of sensitive species in the study area that could potentially be damaged by these activities and the fact that the loss or the temporary decrease in population density does not modify the ecological balance, the impact intensity is considered low.

Because of the local extent and the limited duration of the construction and pipelaying activities, the impact significance is judged *very low*.

7.1.2 Impact of Excavating and Trenching

Pipeline construction activities such as clearing, grading, trench excavation, backfilling, and the movement of construction equipment along the ROW may impact soil resources such as:

- Clearing removes protective vegetative cover and exposes the soil to the effects of wind which increases the potential for soil erosion ;
- ✓ Grading, spoil storage, and equipment traffic can compact soil, reducing porosity and percolation rates and increasing runoff potential. Soil compaction destroys soil structure, reduces pore space and the moisture holding capacity of the soil, and then increases runoff potential;
- ✓ Construction activities can affect soil fertility and facilitate the dispersal and establishment of weeds.

In addition to erosion and compaction, construction activities such as grading, trenching, and backfilling can cause mixing of soil layers. Mixing of topsoil with subsoil changes the topsoil chemical and physical properties and lowers its fertility.

Contamination from spills or leaks of fuels and lubricants from construction equipment could also have an impact on soils. This impact is expected to be minor, because of the typically low probability, volume, and extent of spills or leaks generated by pipeline construction projects.

To minimize impact on soils associated with the project, OMV will develop a construction plan that addresses the special issues adapted to construction in an arid environment.

Given the mitigation measures, the short duration (temporary), the local extent and the relatively flat morphology of the area, the significance of the impact is *very low*.

7.1.3 Impact on Soil and Groundwater

The chemical composition of soil and therefore its quality can be damaged by uncontrolled releases or spills of oil, lubricants, hydrocarbons and other pollutants. Pollutants resulting from spills and releases can stay for long time in soils and can affect their ventilation, their fertility, carbon-nitrogen ratio and the organic matter cycle. These can lead to soil physic-chemical properties alteration which can effect vegetation as well as the surface and the groundwater quality. Besides, this may lead to the limitation of the safe use of groundwater resources.

However, the risk of groundwater contamination is unlikely because all the preventive

measures will be included in contract terms with contractors. All locations where spills could occur will be equipped with the appropriate containment facilities. In addition, OMV will put systems in place to prevent soil contamination and will provide spill cleanup equipment and material. Any contaminated soil will be collected and sent to an approved treatment contractor.

Given the low probability risk of contaminants leak or spill, the limited duration of work, the local extent of the impact and the sensitivity of groundwater, the relative importance of impact is therefore considered *low*.

7.1.4 Impact on Air Quality and impact related to GHG Emissions

During the construction phase, most of the atmospheric emissions should arise from fixed and mobile equipment (trucks, bulldozers, conveyers, forklift trucks and other machineries) and power generation sources. The atmospheric emissions will also be produced by the machines used for the site preparation and by the trucks transporting materials and heavy equipments to the site. Atmospheric emissions are moreover increased by the traffic of the vehicles used by the personnel working on site and by various operators reaching the site. That will be mainly constituted of NO_x , SO_2 , CO, CO_2 and dust.

On the other hand, while construction involves demolition, digging, trenching, excavation, embankment, and stockpiling, atmospheric emissions should include significant fugitive emissions of dust and particles.

The parameter influencing the volume of emissions is the number, type, age of vehicles and engines used and the duration of the work. However, OMV is committed to plan the work, to shorten the duration and will ensure that the equipment meets international standards and remain regularly maintained. The work will be programmed and implemented according to the related rules of the best practices and will be adapted to specific conditions in the study area.

Atmospheric disturbances depend on prevailing weather conditions (winds, sunshine, humidity). Indeed, dust and gaseous pollutants are subject to atmospheric reactivity and especially aerodynamic processes that promote their dispersal over long distances and thus, will reduce their contents in ambient air.

This impact will therefore be particularly low, given the absence throughout the pipeline route of potentially sensitive human receptors (schools, high density urban area, etc.). The impacted area by air emissions will be local. The construction period is considered temporary. Therefore, the significance of the negative impact of pipeline installation work on the ambient air quality is considered *very low*.

Similarly, because negligible amounts of CO_2 are emitted into the atmosphere, the limited duration of work, the regional extent of the area potentially affected and the absence of sensitive receptors, the significance of impact of contributing to increased GHG concentrations is *low*.

7.1.5 Impact of Discharge of Hydrotest Fluids

The pipeline hydrotest is an important measure before commissioning. It involves filling the pipeline with fresh water after being degassed and filtered for performing the tests of strength and hydraulic sealing under the conditions set by the standard NT 109.02.

The hydrotest will be carried out using mainly fresh water.

It is important to note that hydrotesting of the pipeline is an important measure for avoiding and minimising risk associated with potential accidental releases of hydrocarbons. It is in itself a required preventive and mitigation measure.

Assumed to be contaminated with welding debris and possibly grease, this water will be removed in watertight evaporation pits.

Considering the short duration of discharge, the local extent and the quality of the hydrotest fluid, the impact significance will be *very low*.

7.1.6 Socioeconomic Impacts of the Construction Phase

The proposed project will directly employ up to 300 people during the construction phase. Besides, most of the socio-economic impacts of the project are significantly positive especially on specific service sectors and in term of work supply. However, economic profits are modest with regards to the limited number of jobs and the short duration of the construction phase.

Consequently, the positive socio-economic impact intensity will be moderate, with local extent and short duration. The significance of this positive impact will, therefore, be *low*.

7.2 Operational Impacts of the Pipeline

Selection of the site for the pipeline route was based on environmental sensitivities, economic considerations of pipeline construction costs and the extent that the site is being utilized for other activities such as land management. Therefore, no operational negative impact could be expected during the operation phase of this project. However, general types of hazard to persons, infrastructure and the environment could occur through operation and maintenance of the pipeline, such as an oil spill.

Depending on the release size and duration, thermal radiation levels may be of sufficient magnitude to cause fatal injury to people and structural damage to buildings and equipment and spillage may result in environmental damage.

These releases are likely to be primarily associated with:

- Mechanical failure, for example, due to corrosion, erosion, excessive stress, fatigue, object impact or collision;
- ✓ Human error, for example, due to system failure, inappropriate maintenance, or inadequate supervision and task planning.

Releases due to human error will be minimised by adequate training of all personnel and the application of work control procedures including a Permit- to-Work system.

Therefore, according to mitigating measures undertaken by the operator, the impact significance is *very low*.

7.3 *Pipeline Maintenance*

The pipeline maintenance activities generate large quantities of wax and hydrocarbon residues at pig receiver. These residues classified as hazardous wastes can contaminate the land at receiving facilities. However, OMV has planned adequate facilities to collect these residues. This waste will be transported toward a specialized and authorized center for treatment and disposal in conformity with the legislation in force.

Given the short duration of the impact of its local extent and the absence of sensitive receptors within the residues reception area, the significance of the impact will be *very low*.

7.4 Socioeconomic Impact of the Operational Phase

Although the pipeline is not a labour intensive facility, during operations, the proposed project would provide some employment opportunities (skilled workers). The national revenue will increase by way of direct and indirect taxes, duties, etc. The Tunisian oil and gas infrastructure development will get an impetus with this growth and will provide a significant boost to the energy sector.

The high impact intensity is supported by the generated gains arising from the oil and gas production. The significance of the impact is considered *very high*, reflecting the long-term positive effects of the project on the national economy.

7.5 Growth-Inducing Impacts

It is recognized that the availability of a new means of hydrocarbons transportation may be a contributing factor in stimulating economic growth and could result in the development of additional oil/gas production facilities. Additional processing capacity would be available, which could potentially accommodate future projects growth in the southern regions.

7.6 Decommissioning Impact

Decommissioning will be carried out at the end of the pipeline life, in accordance with prevailing legislation and industry best practicable technology available at the moment. As well as throughout any stage of this project, the overall approach applied to achieve straightforward decommissioning has been to give priority to designing the facilities and planning work activities in such a manner to avoid generation of hazards or environmental impacts.

All activities will be improved with such a manner to cause a minimum disturbance especially to the biophysical receiving environment. Therefore, necessary precautions and measures would be taken by OMV during decommissioning operations, such as:

- ✓ Informing and meetings with relevant regional and national authorities;
- ✓ Take use of the high-performance, useful and suitable specific machines and manage the nature of works in order to reduce work duration, noise and atmospheric emissions;
- ✓ Choice of the adequate period of works;
- ✓ Inform relevant regional and national authorities;
- Elaborate procedural guidelines and provide equipments for clean up any and all fighting pollution as well as treating any existing pollution discovered at some stage in decommissioning.

The timing and activities undertaken during decommissioning will not be finalised until closer to the end of field life. Detailed decommissioning plan will be prepared and submitted to the relevant authorities prior to commencement of activities (Hydrocarbons Code). This plan will be prepared within 12 months at least prior to beginning. Proposed decommissioning phase duration are likely to extend over 6 to 12 months.

Decommissioning stage will be subject to an independent Environmental Impact Assessment (EIA).

The impact significance of facilities decommissioning will be *very low*. This is supported by the short duration and local scope of work and the precautions and measures to be taken by OMV during abandonment actitivities.

8.0 MITIGATION MEASURES

In developing the safeguards and mitigation measures, priority emphasis has been placed on selecting alternatives and designing facilities to avoid potential sources of environmental impact. Where it has not been possible to completely avoid potential for environmental impact, the likely effectiveness of proposed safeguards and mitigation measures have been identified.

OMV will apply safeguards and mitigation measures to ensure that all significant environmental effects associated with the proposed project will be avoided, reduced or compensated. Such measures should be consistent with the principles of ecologically sustainable development and in compliance with Tunisian legal requirements and OMV HSE guidelines.

The resultant impact level during the course of the development is determined to a large extent by safeguards and mitigation measures, both technological and managerial, that have been incorporated into several activities.

A comprehensive Environmental Management Plan (EMP), based on the ISO 14000 series principles, will be implemented to provide a systematic and structured approach to environmental management. This EMP is presented and discussed within Chapter 9, it involves a series of actions and a system of procedures to ensure health, safety and environmental protection.

The following section provides a description of the proposed safeguards and mitigation measures to be implemented in order to address these impacts for each phase of the project. The description covers the following activities associated with the current project:

- ✓ Construction phase;
- ✓ Operation phase, and;
- ✓ Decommissioning.

8.1 Mitigation Measures for the Construction Phase

For each phase of the project, the main measures to eliminate, reduce or offset environmental and socio-economic impacts that could arise during the construction period or continue beyond will be presented in the following sections.

Mainly safeguards and mitigation measures proposed for the pipeline construction will be related to:

✓ Atmospheric emissions and dust;

- ✓ Noise reduction;
- ✓ Soil and groundwater protection;
- Protection of soil stability, prevention of erosion and preservation of natural drainage means;
- ✓ Fauna and flora protection;
- ✓ Respect of socio-cultural traditions;
- ✓ Solid waste management.

Those topics will be described later in this section with the specific mitigation measures including:

- ✓ Specific mitigation measures for the pipeline construction;
- ✓ Minimisation of temporary construction campsites impacts;
- ✓ Providing equipment for fighting pollution;
- ✓ Decommissioning of construction phase.

8.1.1 Control of Contractors' Policy (CCP)

This policy should be prepared in support of the EMP to ensure that contractors adopt safe working practices and environmental measures in compliance with relevant statutory requirements and OMV's Management Standards and Guidelines. It covers all construction work carried out by contractor and sub-contractors employed on OMV contracts.

Contractor compliance will be assessed through a combination of site inspections and formal audits. Site inspections in the form of a walkthrough will be employed by OMV HSE personnel to assess management procedures adopted. Non compliance with the Code of Practice (or the policy) and other relevant statutory guidelines may result in immediate termination of the contract.

An audit programme developed as part of the EMP will monitor and evaluate implementation and compliance with the CCP. The audit will include auditing of the site procedures as well as reporting and documentation. All observed non-compliances will be reported to the Project Manager, and corrective actions including solutions and preventive actions will be taken.

The inspection and auditing results will be documented and used to indicate areas of noncompliance to allow for corrective measures to be implemented using an Action Tracking System.

OMV shall ensure that this policy and appropriate records are monitored and reviewed on

a regular basis.

8.1.2 Atmospheric Emissions and Dust

Given the desert and arid character of the area, the various stakeholders will be asked to:

- ✓ limit work activities to only daylight hours;
- ✓ the use of engines and equipment during construction phase must respect international standards, in particular the recommendations of the European Union relating to the following permitted acoustic power levels:
 - 108 to 114 dB (A) for hammers and manual cement compactor;
 - 106 to 108 dB (A) for cable hydraulic lifting, loading machines, etc.

For atmospheric emissions and dust, key mitigation measures are:

- ✓ abatement of dust emission from stored materials, using covers, screens, water spraying, etc.;
- ✓ Dust emission from stockpiles, tracks or other fugitive sources will be avoided by water spraying ;
- ✓ Regular maintenance of the onsite mobile equipment and machines;
- ✓ Planning of the construction material supplies and the waste discharge in order to reduce dust emissions and taking care of the specific arid climatic conditions of the area in the qualification of works and the choice of equipment.

8.1.3 **Protection of Water Resources**

Being executed in a desert area known for its limited and scarce water resources, the project raises a number of issues related to water. It is therefore recommended that a *Water (Use, Treatment and Disposal) Management Plan* is prepared. Key elements of the plan should include the following:

- ✓ Minimization of water use;
- ✓ Disposal; and
- ✓ Inspection, auditing and reporting.

All personnel will be trained to reduce water usage and prevent its waste. No additional waste (non-sanitary) will be discharged to the wastewater system. Oily waste and other liquid hazardous wastes will be collected separately whenever possible for recycling or disposal in an appropriate licensed facility.

8.1.4 Site Restoration

OMV will define the final destination of land after work completion: restoration, land turned back to their previous original status. Work will be limited to the pipeline ROW.

8.1.5 Fauna and Flora Protection

OMV shall minimise disturbance to flora and fauna. Hunting by OMV workforce and/or contractors and sub-contractors will be prohibited.

8.1.6 Minimisation of Temporary Construction Campsites Impacts

OMV shall define precisely the number and location of workers campsites, and the number of people accommodated. Campsites will be correctly managed in order to prevent any damage to the environment:

- ✓ Land occupation for campsites setting will be minimised ;
- ✓ Water intake for camp consumption will be sized and designed in order to avoid any detrimental effect on the local resource, and any conflict for freshwater demands ;
- ✓ Prohibit any storage and manipulation of hazardous substances;
- ✓ Black and sewage waters will be properly drained by a dedicated network and collected by septic tanks for treatment before being discharged, with respect to the national standard NT 106.02.
- ✓ Domestic waste will be managed according to the Waste Management requirements and collected into appropriate bins before elimination. Waste resulting from campsites clean up will be transported and disposed properly in accordance to the waste management plan;
- ✓ Site restoration: At the end of the construction phase the campsites shall correctly cleaned up, all waste is removed, and sites are restored to their previous status.

8.1.7 Decommissioning of Construction Phase

After construction phase OMV shall ensure that area (access, campsites, etc.) is correctly cleaned up :

- \checkmark No waste is remaining ;
- ✓ Permanent runoff drainage system is controlled as useful operational;
- The pipeline route map with appropriate co-ordinates will be provided by OMV and submitted to several relevant authorities.

8.2 Mitigation Measures for Operation Phase

Upon completion, OMV will communicate to the relevant authorities the exact location of the condensate export pipeline. The operational phase does not require significant interventions except the usual measures of security and maintenance and regular inspection of equipment. The pipeline will be equiped with appropriate tools to record pressure, temperature and flow at both ends. The gathered information will be assessed and analysed using calculation tools to identify any leakage on the pipeline.

Regular inspection of pipeline will ensure that it is protected throughout the duration of the operation phase. Similarly, this will allow timely detection of any leakage of oil and thereby control the risk of pollution. In addition, regular inspection will cover the entire route of the pipeline and will include observations of the state and nature of habitats and species that regenerate or proliferate along the pipeline route.

In addition, the pipeline and related equipment will be equiped with warning signs and will be subject to regular inspection and monitoring under the supervision of OMV HSE.

Waxy and oily residues recovered at pig trap will be properly managed in accordance with the law no. 96-41 dated June 10, 1996, while giving priority to recycling and recovery procedure.

8.3 Mitigation Measures for Decommissioning Phase

Decommissioning will be carried out at the end of the field life, in accordance with prevailing legislation and industry best technology and practices available at that time. A detailed decommissioning plan will be prepared and submitted within 12 months at least to the relevant authorities prior to commencement of decommissioning activities. The plan should comply with Tunisian regulation in force and oil and gas industry best practices. The pipeline will be flushed, plugged and left in situ.

9.0 ENVIRONMENTAL MANAGEMENT PLAN

9.1 Introduction

The Environmental Management Plan (EMP) aims to describe the measures, actions and means that will be implemented to eliminate or reduce to acceptable levels the significant impacts of the proposed project on the biophysical and socio-economic components as identified in the EIA. More specifically, the EMP should ensure:

- ✓ Protection of personnel's health and safety and prevention of environmental hazards;
- Compliance with the standards, regulations, know-how and best practices along with the use of appropriate technologies;
- Carrying out works according to principles of sound management and use of appropriate equipment and good practices;
- ✓ Inclusion of environmental risks monitoring and control measures, and the establishment of prevention and mitigation means in case of events that may present hazards to the health and environment.

The Environmental Management Plan of the proposed project is divided into eleven sections:

- 1. Impacts register;
- 2. Waste management plan;
- 3. Risk management plan;
- 4. Environmental monitoring;
- 5. Capacity-building and staff training;
- 6. Vehicles traffic plan;
- 7. Local recruitment plan;
- 8. Environmental communication;
- 9. Sites restoration plan
- 10. Environmental audit;
- 11. Cost of the EMP.

9.2 Impacts Register

Based on the findings of the EIA, national and international standards and best practices, the Impacts Register summarizes:

- ✓ Potential adverse impacts of the project on the environment;
- ✓ Mitigations for identified impacts;
- ✓ Responsibility for implementation and monitoring of adopted mitigation measures.

Project Phase	Potential negative impacts	Mitigation measures	Responsibility	Cost (US\$)
	Air pollution	 Use machinery and equipment of recent design, compatible with all modern standards in terms of emissions of gaseous pollutants. Use covers for dusty loads. Use water sprays to prevent airborne dust (maximizing recycling opportunities). Use wheel washers to prevent transfer of mud to public roads. Prevent "black smokes": ensure all vehicles engines are well maintained. Switch off engines when not in use. 	EPC Contractor	Included in the project cost
tion phase	Noise nuisance	 Use low noise engines and machines where practicable, to comply with the international standards. Install compressors, generators etc., as far as possible from workers' camps and offices. Use of silencers and other acoustic barriers if the noise thresholds are exceeded to prevent noise nuisance. Workers will use hearing protection wherever required. 	EPC Contractor	Included in the project cost
Constructi	Traffic disturbance and risk of pipeline failure	 Impose speed limits. Use crash barriers to separate pedestrians from vehicles in high risk areas. Schedule road traffic movements to avoid noise sensitive periods, periods of high pedestrian risk and maximum background traffic movement. Install temporary road signage and lighting. Schedule any disruptive works to coincide with periods of low road traffic and in liaison with relevant local authorities. Use machinery and techniques most suited to complete any disruptive works in the shortest possible time. Where necessary, arrange temporary traffic diversions. Take appropriate measures to restore the affected area following completion of crossing construction. 	EPC Contractor	Included in the project cost

Table 9.1 Impacts	Register	of Pipeline	Installation	and Operation
1	0	1		1
Soil Disturba	nce \checkmark Before starting excavation activities, establish sufficiently detailed			
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Terrestrial impacts	 ecological, topographic and photographic records to judge the state of the quality of any remedial action required post construction. Avoid removal of existing vegetation where possible Use existing tracks as much as practical and restrict all vehicle access to designated routes. All construction personnel involved in site preparation shall be trained to observe the defined site boundaries. Designate permanent and temporary storage areas. Coordinate delivery/installation logistics in order to minimize amount of pipe storage space required. 	EPC Contractor	Included in the project cost	
	✓ Follow the defined pipelines ROW as closely as possible.			
Water Pollut	 Forbid disposal of lubricating oils, diesel fuel, etc. to the ground. Transfer used oils and lubricants by SOTULUB approved transporters. Appropriate containment facilities, clean-up equipment and materials will be in place to prevent site contamination and spill cleanup. Refuelling areas should be sealed with concrete and subject to strict control. 	EPC Contractor	Included in the project cost	
Impact on Health & environm	 Post-installation, clear ROW and surrounds of all rubbish, debris, and surplus/defective construction materials. Make appropriate provisions for the collection of wastes from the pipeline construction site, with the fundamental objective of keeping hazardous, inert industrial and domestic wastes separate. Establish a general policy of "waste minimisation" in the following order of priority: Reduce production at source; Reuse in the same process; Recycle for use elsewhere. 	OMV or contractor	125 000	
	 ✓ Only use disposal as the final option, and by incineration with energy recovery if feasible. ✓ Establish a "consignment notes" system to ensure wastes transferred to subcontractors are properly transported and disposed of off-site in 			

	 the manner intended by company. ✓ Ensure waste handling arrangements are sufficient for the entire length of the pipeline 		
	 Provide suitable waste containers (with lids) at all major points of waste production. Forbid disposal of wastes by any other method than this on-site service. Provide suitable sanitary facilities for workers during pipeline installation.Do not store pipe outside designated lay down areas. Erect perimeter security fence and appropriate warning notices. Forbid access to unauthorized people.Elaboration of Health and safety procedures at project site. Elaboration of an "Emergency Response Plan" Provision of medical (first aid, equipment care, drugs, etc.), and communication and transportation means. Provision of firefighting equipment. Provision of Oil spill response equipment. 		
	✓ Staff training in the Health, Safety & Environment aspects. ✓ Display of instructions and markup of the project area		
Ecological disturbance	 Follow the defined pipelines ROW as closely as possible. Follow the defined pipelines ROW as closely as possible. Provide crossing points (unexcavated plugs) at locations deemed necessary to allow for access for vehicles, people, animals and water. Stockpile topsoil and subsoil separately, neatly, avoiding contamination, and replace accordingly. Import material for padding in preference to removal from the ROW. Where appropriate, plough to break-up and loosen all compacted soil when the construction work is finished. Seek beneficial uses for the excess excavated soils, on or off-site. If not possible, ensure disposal is to an approved site. Restore original contour of the land following backfilling. Take all reasonable measures to reinstate disturbed areas to the original condition. Where required, install drainage system with the aim of reducing soil erosion by rain water runoff. 	EPC Contractor	Included in the project cost

	Pollution: leaks/minor spillages Accidents: visibility	 ✓ Install appropiate tools to record pressure, temperature and flow at both ends of the pipeline. ✓ Carry out regular survey patrols driving along the pipeline right of way in order to detect any abnormal activities or damages. ✓ Install warning signs and posts as per the pipeline installation specification. 	OMV	10 000
Operation Phase	Waste: Arrival of wax and hydrocarbon residue at pig trap	✓ Ensure adequate measures are in place for the collection, transfer, processing and/or disposal of the residue.	OMV	10 000
	Impact on Health, Safety & environment	 ✓ Elaboration of Health and safety procedures at project site. ✓ Elaboration of an "Emergency Response Plan" for the operation phase including : firefighting plan, oil spill response plan, Medevac, etc. ✓ Staff training in the Health, Safety & Environment aspects. ✓ Display of instructions and markup of the project area. 	OMV	20 000
Decommissioning Phase	Soil contamination & Noise Nuisance	 ✓ Facilities abandonment following the rules of art and in accordance with the legislation in force to prevent any soil contamination. ✓ Compliance with instructions for cleaning and treatment of any pollution found during facilities decommissioning phase ✓ Sites restoration as close as possible to their original state. 	OMV	10 000

9.3 Waste Management

9.3.1 Liquid Waste

Liquid wastes generated during the condensate export pipeline installation are classified into three categories:

- ✓ lubricants and Used Filters;
- ✓ Sewage;
- ✓ Hydrotest fluids.

9.3.1.1 Used Lubricants

In order to reduce the soil contamination risk, no tune ups of any mobile equipment will be allowed on site during the construction phase. The lubricants changes and the used filters of fixed equipment on site will be recovered in special containers and delivered to SOTULUB. A register will be maintained by the contractor in order to facilitate the traceability of these waste products in conformity with the Decree no. 693-2002 of April 1st 2002. The maximum quantity recovered during the pipeline construction phase is estimated at 3000 liters.

9.3.1.2 Sewage

During the construction of pipelines, the personnel present on site will include up to 300 people. The sanitation waters are estimated at 50 l/day/person, therefore a maximum of 15 m³/day. These effluents are admitted into the public sewage piping according to the standard NT 106.02. They will be evacuated by sump-pit towards Tataouine wastewater treatment plant.

9.3.1.3 Hydrotest Fluids

The pipeline hydrotest involves filling the pipeline with fresh water which has the same physico-chemical characteristics as the drinking water for performing the tests of strength and hydraulic sealing under the conditions set by the standard NT 109.02.

The water quantity required to fill the pipeline is estimated at 182 m^3 . Assumed to be contaminated with welding debris and possibly grease, this water will be removed in evaporation pits.

Both evaporation pits used for storage of this water will be watertight (permeability $<10^{-7}$ cm/sec) with a capacity of 9600 m³ each (80x80x1.5 m).

The design of evaporation pits shall take into account the following requirements:

✓ A liner will be installed so that the bottom and sides of the pit have a coefficient of permeability of no greater than $1 \ge 10^{-7}$ cm/sec.

- ✓ The materials for the liners will be selected after evaluation of the water quality to be contained. Liners will be of sufficient strength and thickness to maintain the integrity of the pit.
- ✓ Careful installation measures (e.g. careful siting, berms) will be adopted to prevent natural surface drainage from entering the pit or breaching during heavy storms.
- ✓ Measures will be taken to prevent access by people, livestock and wildlife (including birds) to evaporation pits.
- ✓ At decommissioning, or at the completion of operations, the evaporation pit contents will be disposed of after testing and in accordance with the waste management plan. The pit area will be reinstated to its original state.



Evaporation Pit

9.3.2 Solid Waste

The generated solid wastes during the pipelaying activities will be subject to specific management plans allowing to reveal the potential for reduction at the source, a re-use, a recycling, a material or energy valuation and for estimating the elimination means.

Three types of solid wastes will be generated during the construction phase: household waste, industrial detritus, and inert waste.

9.3.2.1 Household Wastes

Estimated at 1 kg per person per day, these wastes could be separated in organic wastes which will be evacuated towards Tataouine public discharge and valuable or recyclable wastes such as cans, PET or PEHD bottles, cups, packaging films and bags, which will be delivered to the Ecolef recycling centre in Tataouine or to companies authorised by ME for waste collection or recycling.

9.3.2.2 Industrial Wastes

They include metallic scrap, cables, plastic material, insulation material, lumber, used spare parts, unremunerated packaging, etc. These wastes will be entrusted to companies authorised by ME for waste collection or recycling.

It is to notice that industrial wastes may contain hazardous waste which must be managed in conformity with the law no. 96-41.

Moreover, after use, the inspection agency of the pipeline welds must reapply to export the radioactive waste to the same exporting country. The radioactive source will be returned in the same conditions of storage and transport than those for imports.

9.3.2.3 Inert Wastes

In this category, we include the wastes from the demolition or construction works, which will mainly have a mineral nature and which will not be contaminated by dangerous substances.

9.3.3 Air Emissions

The air emissions during the construction will be mainly generated by the traffic of vehicles used by the personnel working on site or reaching the temporary workshops of various operators, by the machines used for the site preparation and by the vehicles delivering the material and heavy load equipment.

9.3.4 Noise Emissions

Noise pollution is generated by onsite machines and equipment, installation works (welding, grinding, cuttings, etc.), traffic related to equipment and personnel transport and commissioning tests of several components of the pipeline.

The contractor and its subcontractor will be responsible for the control of noise levels caused by their activities within the following limits (Table 9.2).

Hours	1hour dB L _{A10}	1hour dB L _{A1}
07h00 - 19h00	65	70
19h00 - 22h00	55	60

Table 9.2 Admissible Noise Level Limits during the Construction Phase

9.4 Emergency Response Plan

The pipeline installation presents risk of oil spills from construction engines. Prevention of incidents is an integral part of operational procedures of the contractor who will develop a specific plan for emergency response covering all exceptional situations that may arise on site. Sufficient quantities of products, equipment to cope with pollution and fire and emergency resources needed to give first aid to accident victims are also provided.

OMV emergency response plan will be prepared by involving internal and external experts.

Finally, it is important to note that OMV has contracted a liability insurance to cover risks of damages caused to third parties estates because of his activity including notably the risks of damaging the environment.

9.5 Environmental Monitoring

Environmental monitoring is necessary to gauge the impact of operations on the site. By implementing appropriate plans with sufficient detail, it is possible to minimize and control waste generation, limit physical disturbances, and operate in a responsible manner. The environmental monitoring program will be implemented by the field crew consistent with the requirements of the Environmental Management Plan and including among others the monitoring of waste generated by the work and keeping a record book for waste tracking.

9.6 Capacity-building and Staff Training

Staff training is an essential step to ensure the smooth implementation of the condensate export pipeline installation and prevent all risks and nuisances which may affect the various components of the environment. The personnel engaged by the contractor should be aware of aspects relating to Health, Safety and Environment, and to site specifications and risks involved. A mandatory training program will be implemented by the contractor and supervised by OMV HSE manager to ensure the protection of personnel, facilities and environment in accordance with the regulations in force.

9.7 Vehicles Traffic Plan

This plan will include all actions to control the speed, itinerary, traffic schedules and application of penalties in case of violation, for all engines and vehicles involved in work such as vehicles, ambulances and trucks.

9.8 Local Recruitment Plan

The local recruitment plan will identify and maximize job profiles that can be fitted with local people. It aims to define the mechanism and localities of recruitment and develop a system for monitoring staff.

9.9 Documentation & Environmental Communication

The environmental management process must be accompanied by monitoring tools designed to document and communicate the results of the implemented plans between the staff and the various responsibility levels involved in the project. Among these tools, reports, minutes and periodic official communications produced by the various involved parties which allow to document the undertaken actions, the non-compliance cases and measures taken to adjust them.

The following table outlines the different stakeholders' responsibilities in the preparation of documents and communications.

Author	Addressee	Frequency	Situations Description
Contractor	OMV	Start of works	Presentation of training and HSE programs for review and approval
Contractor	OMV	Weekly	Waste management report
OMV	ANPE	End of work	Environmental report
OMV	ANPE	Abandonment of facilities	Abandonment report

Table 9.3 Guidelines for Communication

9.10 Site Restoration

The site restoration will be executed as follows:

- Take the required measures to restore the affected areas following the installation of the pipeline;
- \checkmark Leveling the ground in order to restore the site to its original state;
- ✓ After completion, clear the pipeline route of all trash, debris and excess materials.

9.11 Environmental Audit

Environmental audits shall be carried out in accordance with ISO 19011 – Guidelines for Quality and Environmental Management Systems Auditing.

Environmental internal audits are undertaken by persons independent of the work being audited. Environmental audits are carried out against OMV standards (policies, guidelines, procedures etc.) and Tunisian Environmental Regulations to assess environmental management performance in the area of air, water and noise emissions, waste, etc.

A schedule of environmental audits will be developed and will ensure that at least the following elements of the Environmental standard are audited:

- ✓ Implementation of mitigation measures;
- ✓ Waste management plan;
- ✓ Emergency response plan;
- ✓ Environmental monitoring;
- ✓ Capacity building and staff training plan;
- ✓ local recruitment plan;
- ✓ Vehicles traffic plan;
- ✓ Documentation and environmental communication;
- ✓ Site restoration.

9.12 Cost of the EMP

The project cost is estimated at 3.5 MM\$. Costs associated with the Environmental Management Plan are estimated at US\$ 150 000 assigned as follows:

✓	Staff and HSE consultants fees	20,000 \$
✓	Used oil recovery and transfer to SOTULUB for regeneration	15,000 \$
✓	Waste transportation to authorized landfills	10,000 \$
✓	Safety equipment and signaling	40,000 \$
✓	Preparation of the emergency response plan	20,000 \$
✓	Oil spill response equipment	25,000 \$
✓	Site restoration and rehabilitation	10,000 \$
✓	Miscellaneous	10,000 \$

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Appendix I Plan of Development



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1. Introduction

The original Plan of Development (POD) for the Nawara Concession was submitted to ETAP for approval on 20 February 2009 reflecting the status of the G&G evaluation as of December 2008. On this basis the Nawara production concession was granted in February 2010. ETAP decided to take their maximum share of 50% in the development JV. The aim of the original development scenario was to assure a gas delivery rate of 1.33 million m3/day through the South Tunisian Gas Project (STGP) gas transportation and treatment facilities for the domestic gas market.

In early 2011 OMV acquired all assets from Pioneer in South Tunisia. With this transaction OMV also gained additional capacity access to the STGP. Since the associated gas volumes to be recovered from the Pioneer oil assets were found to be not sufficient to fill the STGP capacity, it was decided to increase the Nawara plateau production rate to utilise the entire capacity share in the STGP. After extensive sub surface study work it has been concluded that an increase of the sales gas plateau rate to 2 million m3/day is sustainable with the discovered and prospected volumes in the Nawara concession.

Consequently, the design capacity of the Central Processing Facility (CPF) was increased to <u>2.7</u> <u>million m3/day raw gas</u>, which includes 10 % shrinkage for the LPG extraction and a 20% spare capacity to ensure the plant availability as per the envisaged sales gas contract.

An amendment to the POD ("Amendment #2"; attached as Appendix 4) describing these design changes was approved by ETAP and issued to DGE in mid-2012 together with the request to upgrade the market reservation to 2 million m3/day.

As of July 1 2012, OMV took over the coordination of the STGP consortium from eni (Steering Committee resolution dated 12 July 2012). The framework agreement governing the activities of the STGP consortium expired with end 2012 and eni opted not extending the agreement. This decision is documented in a final Steering Committee resolution from February 7, 2013 and a letter from eni dated 31 January 2012.

In the meantime the market reservation over 2 million m3/day has been granted to the Nawara Concession by DGE (letter dated 13 February 2013). Despite the fact that STGP had been given market access by STEG of 4 mn scm/d at Gabes (letter STEG dated 28 February 2008), no concessions other than Nawara have applied for a market reservation to utilize this STGP market access. This and the fact that eni had left the STGP Consortium led the Nawara JV decide to integrate the STGP facilities into the scope of the Nawara concession development to ensure the Nawara gas is developed efficiently for the benefit of all stakeholders.

2. Scope Changes to Original Development Concept

Following changes are applied to the original development concept to facilitate the integration of Nawara and STGP in a cost and schedule efficient way.

The <u>field facilities within the NAWARA Concession required to pre-treat raw gas and condensate</u> <u>will remain widely unchanged to the original concept</u> as described in the previous POD and its amendments. The installation of the water treatment unit and the Mercury removal filters have been deferred to the time when they become really required.

Export for the pre-treated rich gas was originally foreseen via a 24" gas pipeline from the Nawara Concession to the STGP inlet facilities in Hamouda ("Hamouda Receiving Station"). Since no other concessions than Nawara will provide gas into the pipeline for the foreseeable time, and the STGP Consortium is dissolved, the Hamouda Receiving Station will not be built but be replaced by a standard valve station.

The former <u>Nawara export pipeline to Hamouda will be extended to a length of 370 km from the outlet of the Nawara CPF to Gabes</u>. The discharge pressure at the CPF will be 47 bar and the arrival pressure in Gabes 35 bar. The pipeline routing will be along the previous STGP West route parallel to the existing Trapsa oil pipeline and STEG gas and liquid pipelines from El Borma to Gabes. The new pipeline will be able to transport up to 10 mn scm/d of gas without intermediate

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compression, and thus will provide additional transportation capacity to cater for potential future gas discoveries or associated gas from oil discoveries in South Tunisia. This additional capacity will be made available to any upstream concession on a tariff basis and under the condition that they have to deliver gas at required inlet conditions as specified in the Basis of Design for Upstream Concessions document. The key specifications are: Water dew point -12 degC, HC dew point +10degC, CO2 content < 2%vol and a delivery pressure from the Nawara concession of 47 bar. The upstream concession(s) has to cover also any investments for additional compression requirements for the Nawara concession resulting from the higher pressure regime in the pipeline. Tie in points for third party gas delivery will be provided at any of the eleven valve stations along the pipeline route. The design pressure of the pipeline will be 111bar to accommodate the later capacity increase and associated compression.

In Gabes the rich gas will be treated further in a <u>"fit for Nawara purpose" Gas Treatment Plant</u> (<u>GTP</u>) of 2.7 million m3/day inlet capacity to produce commercial products: gas, propane and butane as per their respective specifications and stabilized light condensate. Commercial gas will be delivered to STEG gas grid at Gabes at 76 barg, the LPG products (propane and Butane) will be delivered to STIR via the SNDP storage facilities at Gabes.

In addition to Hydrocarbon processing, the GTP will also function as the control centre for the pipeline operations.

The Nawara CPF was initially planned as a standalone development. Following the acquisition of Pioneer assets in South Tunisia in early 2011, the project scope has been revised in order to maximise the synergies with the existing Cherouq facilities and the future oil developments by OMV in South Tunisia. A central operations, maintenance and infrastructure site will be built to provide services to OMV operated assets in South Tunisia and potentially also to Nawara. Details of this hub concept are described in chapter 6.

As mentioned already in Amendment #2, the project scope also includes the <u>completion of three (3)</u> <u>wells</u> which were drilled during the appraisal phase but were not completed yet. These are Ritma-1, Kholoud-1, Banefsej-1.

Furthermore, three (3) of the previously completed wells require re-completion since the completion was damaged by severe sand production during the well testing phase. The new completion design and workover concept has been presentd to ETAP and was already approved in late 2012. The concerned wells are Nawara-1, Ahlem-1 and Sourour-1.

Two (2) wells are ready for production already now without any further intervention. These are Fella-1 and Ahlem-2.

Further details about the facilities scope are given in chapter 6 of this amendment.

3. Operations and Maintenance Philosophy

All Operations and Maintenance (O&M) activities for the entire integrated system, Nawara CPF, Pipeline and GTP will be undertaken by one Production Operator who will be agreed and staffed by the Nawara JV partners.

The O&M philosophy for the Nawara CPF has been developed to support the design intent of optimized manning level based on a common and shared infrastructure and maintenance hub in Waha (warehouse, workshop, logistics, accommodation, etc.). It is envisaged that during commissioning and initial operations period the Nawara facilities will be manned until stable operating conditions are established. For this purpose a temporary camp will be provided in Nawara. Then the facility should be operated under the Optimally Manning concept, where the optimum number of people is employed in order to warrant safe operations and achievement of availability targets as required by the GSA.

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As mentioned above, the GTP will also function as the control centre for the pipeline operations. This means that operations and maintenance of the 370km export pipeline will be managed and conducted from the GTP in Gabes.

4. Legal & Fiscal Frame of the Investment in NAWARA

The revised Nawara POD by integrating the former STGP facilities pipeline in this development plan, is considered to be under the legal and fiscal regime of the NAWARA Concession (each 50% share ETAP and OMV). This approach is consistent with existing laws and contracts and according current known legislation. It also allows the JV to go ahead with the development of the NAWARA Concession and bring the gas to the Tunisian customers as scheduled and without the necessity of further commercial negotiations.

Nawara will build the gas export pipeline to Gabes under article 75 of Hydrocarbons Code accommodating a capacity of up to 10 mn scm/d although Nawara would need only a capacity of 2.7 mn scm/d. This represents a significant pre-investment for the Nawara titleholders with an uncertain return since the availability of future gas discoveries in south Tunisia to fill the remaining capacity is highly uncertain at this point in time. Article 113.3 of the Hydrocarbons Code as modified by the law no. 2008-15 allows the titleholder to build and tax deduct an investment reserve up to 20% of it's taxable results on an annual basis in order to finance the setting up of pipelines. This tax incentive will allow OMV to commit in this amendment no. 3 of the PoD to the pre-investment in the oversized gas pipeline as well as to the oil export pipeline from the Nawara Concession to the Trapsa pipeline.

Any tariff charges to third party users of the pipeline from Nawara to Gabes (11 valve stations will be availbale along the pipeline for tie in) will be treated as income of the Nawara Concession. Same will be the case for thrird party use of any spare capacity in the GTP. The tariff will be determined in accordance with the terms of Article 82 of the Hydrocarbons Code and will be subject to DGE approval. Specifically, the tariff charge calculation will have to consider the development and operating costs of the facilities, a minimum economic lifetime of 15 years, the fiscal regime of the Nawara Concession and a rate of return for the investors of 10%.

Fiscal metering stations will be installed by the upstream concessions following the design specification as developed by the former STGP consortium. Their location shall be at the transfer point of wet rich gas streams into the pipeline (for the case of the Nawara concession, this will be at the outlet of the Nawara CPF).

Fiscal sales metering stations will be installed at the custody transfer points of sales products (i.e. at the GTP outlet for sales gas and LPG products).

5. Agreements required

In order to achieve the above described targets, the JV requested support from the Tunisian Government in obtaining right of way along the west route to Gabes and all other regulatory approvals required to build the pipeline.

The JV also asked the Government to protect the execution of the NAWARA/STGP development from adverse impacts resulting from strikes, sit-in's, and similar activities to the largest extend possible.

Notwithstanding that no formal confirmation for the above has been received by the government, it is the mutual understanding of both, the investors and the government, that such support and protection will be granted by the government when this Amendment # 3 of the Plan of Development will be approved and OMV & ETAP commit to the development of the facilities accordingly.

The following agreements need to be executed for the proposed concept:

- 1. Approval of NAWARA Amendment # 3 to POD (ETAP & DGE)
- 2. Gas Sales Contract NAWARA STEG

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- 3. Propane, Butane products Sales Agreements NAWARA STIR
- 4. LPG Storage Agreement NAWARA SNDP
- 5. Crude Transportation Agreement NAWARA TRAPSA
- 6. Waha Infrastructure Hub Service Agreement Cherouq Concession Holder

Furthermore, an agreement has to be reached about the operatorship of the facilities. Due to the nature of the Nawara – STEG Gas Sales Contract ("ship or pay" "take or pay" regime), it is mandatory that the Nawara CPF, the pipeline and the GTP at Gabes will be operated by the same entity controlled by OMV & ETAP in order to avoid any conflict of interest.

Due dates for above agreements are as per the attached integrated schedule.

6. Facilities Development Details

6.1 Nawara CPF

Subsequent to the initial POD and its amendments # 1 and # 2, further engineering studies have been undertaken to define the basic concept for Nawara Development.

A brief summary of finalized selected concept is given below.

- i. Gathering system from the 8 wells (Nawara-1, Ahlem-1, Ahlem-2, Sourour-1, Ritma-1, Fella-1, Khouloud-1, Benefsej-1)
- ii. Central Processing Facilities located in Nawara for:
 - a) Inlet manifold and test separator
 - b) Condensate/Gas/Water Separation
 - c) Gas Dehydration
 - d) Gas Sweetening
 - e) HC Dew pointing
 - f) Condensate Stabilization
 - g) Condensate Storage
 - h) Produced water system
 - i) Gas and Condensate Metering Units
 - j) Utilities
- ili. Condensate Export pipeline (6" approx. 10 km) to TRAPSA.

The CPF will be sized for the plateau production rate which corresponds to the current market reservation to be contracted with STEG (2.0 mn Sm3/d sales gas for Nawara Concession). The CPF plant design capacity will have a 10% margin for gas shrinkage due to processing in Nawara and Gabes and an additional 20% margin to cater for the take or pay clauses provided in the Gas Sales Agreement.

One single gas train is considered for rich and lean gas respectively. The design will consider all flexibility requirements for wide operational envelope for different lean and rich gas composition mixtures.

The Nawara CPF has been designed based on following production data.

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		Operating Rate	Design Capacity
Gas Production	mn Sm3/d	2.2	2.7
Condensate Production	bpd	5,000	7,000
Peak liquid Production***	bpd	7,500	9,450
Sales Gas Rate (in Gabes)	mn Sm3/d	2.0	2.5

The battery limit of the CPF is on the upstream side the Flow vale of the well X-mas tree and on the down stream side the outlet flanges of fiscal metering stations for rich gas into the main pipeline and condensate into the TRAPSA pipeline. The gas export pressure at battery limit is 47 bar.

The CPF location has now been fixed at near Nawara-1 wellhead resulting from extensive studies carried out during pre-feasibility phase of the project.

6.2 Pipeline Nawara to Gabes

The pre-treated Gas in Nawara CPF will be routed via a 370 km buried gas pipeline to the Gas Treatement Plant in Gabes where it will undergo deep refrigeration in order to bring it to the sales gas specification.

The main Pipeline will include:

- 370 km of 24 ", 111 bar design pressure, Carbon steel pipeline; the pipeline is designed for a capacity of 10 MSCMD with an arrival pressure of 35 bars at Gabes GTP inlet.
- 370 km of single mode fiber optic cable, 48 core, including SDH network and telecom equipment allowing transport of process controls, safety, voice and video data;
- Pipeline SCADA system and leak detection equipment;
- 11 x Line Valve Stations 24" (LVS) every 30 km, equipped with photovoltaic supplies, E&I equipment, CCTV, F&G, etc.;
- ESDVs 24" down stream Nawara CPFand up-stream GTP Gabes;
- Impressed current cathodic protection (ICCP) stations along the pipeline (currently, every 60 km);
- 24" Pig Launcher up-stream the pipeline located in the boundary limit of Nawara CPF and Pig Receiver at GTP entrance (Gabes);

Tie-in of any potential future gas discoveries or associated gas from oil discoveries will be made to the closest line valve station where provisional tie-ins arrangements (both piping and fiber optic) are provided.

6.3 Gas Treatment Plant in Gabes

At the Gas Treatment Plant (GTP) the rich Nawara gas will be treated to produce 2.0 mn Sm3/d sales quality gas and associated LPG and condensate products to their respective required specifications.

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In a first treatment step the gas will be cooled down with a mechanical gas refrigeration unit to establish the sales gas specifications as agreed in the Gas Sales Agreement. The gas will then be compressed and exported to STEG.

The liquid byproduct from the refrigeration unit (C3+) will be fractionated in dedicated columns to produce commercial Butane, Propane and a small amount of stabilized condensate.

The GTP plant will include:

- a) Inlet Separation
- b) Gas Refregeration
- c) De-Ethanizer Unit
- d) De-Propanizer Unit
- e) De-Butanizer Unit
- f) Sales gas Compression
- g) Sales Gas Fiscal Metering Unit
- h) LPG products Pumping units to SNDP
- i) LPG products Fiscal Metering Units
- j) Utilities (taking into consideration waste heat recovery)

The GTP will be designed based on:

-	·····	Operating Rate*	Design Capacity**
Sales Gas Production	mnSm3/d	2.0	2.5
Propane production	tons/d	63	114
Butane production	tons/d	65	110

Note:

* based on the average simulated volumes from the 100% Lean and 30% Lean/70% Rich mix

**based on simulated volumes from the 30% Lean/70% Rich gas mix

The upstream battery limit of the GTP is the inlet flange of the inlet slug catcher. Here the gas arrives at 35 bar. The down stream battery limits are the outlet flanges of fiscal sales gas and LPG product meters. Sales gas shall be exported at 76 barg.

6.4 Infrastructure Hub Waha

After the Pioneer acquisition it was proposed to develop a common Infrastructure and O&M Hub close to Waha in order to maximize synergies between all OMV operated assets in South Tunisia.

This infrastructure will be capable of providing a central control room, living and working spaces, and transportation support. The site will also be able to deliver operational support such as maintenance services, warehousing and common IT/communications systems.

Tiaret airport situated close to Nawara shall be upgraded to be capable to receive commercial aircrafts operating in country (such as the ATR 72 used by SITEP for El Borma) This will allow to maximize synergies, lower air transportation operating expenditure while still supporting both Waha and Nawara safe operations.

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Aim

In light of the lower expectations in recovery and field life time from the STOD (South Tunesian Oil Development) project the concept was adjusted to be executed in 2 phases.

Phase 1 to be initiated already in 2013. Scope is to build a permanent camp and facilities in Waha (Cherouq Concession) to replace the current rented camp. In addition the airstrip in Tiaret (close to the TRAPS SP3) will be upgraded together with the road link between Tiarat and Waha. For start up and during the first year of production from Nawara, a temporary camp will be provided at Nawara location. The planning and execution of the Waha infrastructure upgrade is currently being supported by the project team but not part of the NAWARA project scope.

Phase 2 will be initiated after the first year of Nawara production. A decision will be made whether Nawara can be operated remotely from Waha or not. In the first case the Waha Infrastructure Hub will be expanded to accommodate the Nawara needs. In the latter case, the Nawara temporary camp will be replaced by a permanent one. The exact extend of the infrastructure required to support Nawara will be decided only after the first year of production during which the infrastructure will be provided by means of temporary, rented facilities. The expansion of infrastructure will form a new project all together and thus, the required funds for building a permanent camp in Nawara or upgrading the Waha infrastructure facilities are not part of the current Capex estimate. However, Opex for rental facilities (either from a contractor or from Waha) are included. All services Nawara will receive from the Waha Hub will be charged out through tariff payments. Refer to Agreement #6 in Chapter 5 of this amendment.

7. Community Relations and Social Responsibility

The development will be undertaken as per the structured approach of OMV community relations practices. OMV has conducted several social initiatives for the south of Tunisia in the past and is committed for the future (about one (1) million TDN for medical setup improvment at Tataouine hospital, cleaning equipment for Tataouine municipality, National Guard housing upgrade, Kembout water tank renewal, Automechanic shop, etc...).

OMV followed a clear and transparent process to derive community relation projects. The approach is as follows

- 1. Identification of stakeholders (project affected people, NGOs, governments, etc.)
- 2. Public consultation & disclosure of information
- 3. Assess & evaluate environmental & social impacts in all project phases
- Necessary actions to manage the environmental & social impacts, e.g. health, safety & environment, action plan

The project has conducted a social baseline and needs assessment study on 2010 and is currently updating and extending its scope to cover Gabes and the STGP route areas. The environmental and social risk/opportunity is assessed as per the guideline of the IFC (International Finance Corporation member of the Wold Bank Group) and the African Development Bank (ADB) terms of references for community consultation, public disclosure, compensation and resettlement.

The goal of OMV and ETAP is to foster local content development and job creation. These requirements are already translated in the contracting strategy. EPCC tenderers shall demonstrate a commitment to maximise Tunisian content in, as a minimum, the form of Tunisian Contractors and Suppliers. Failure to demonstrate a genuine commitment to employing Tunisian companies will result in a disqualification. The JVP strive particular interest to the employment and capacity building in the South of Tunisia. A vocational training initiative in Tataouine to improve employability of local people in various industries has been lunched in 2012 with a budget totaling 6 million TDN. Further a wide consultation with local stakeholder and social society; training topics such as entrepreneurial skills, qualified welding, HSSE, and English language skills have been selected. The sponsorship project will last for 2 years and it is expected that the National Professional Training Agency will ensure sustainability in the future.

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Amendment #3

8. Capex, Opex and Economic Analysis

8.1 Input Assumptions

CAPEX : The total capital expenditure for the execution of the development scope starting May 2013 until first gas is USD 814 mn to be invested over the next three years (2013/2014/2015). After first gas, additional captal expenditures of USD 287 mn are required for drilling 23 additional wells and installation of Front End Compression at the CPF inlet. Underlying cost estimates are class 2 for CPF and pipeline and class 4 for GTP. Cost Details are listed in below table.

All Figures in USD million, 100%.

	2013	2014	2015	2016+	Total Field Life
CPF Nawara & upstream	36.1	144.9	144.9		325.9
24" Pipeline Nawara-Gabes	130.4	95.9	43.3		269.6
GTP and Compression Gabes	10.0	73.2	73.2		156.4
Work overs	0.0	14.3	17.3		31.6
Owner Cost	6.3	12.0	12.0		30.3
Future wells (23) and tie ins			_	255.6	255.6
Future FEC				31.0	31.0
Total	183	340	291	287	1100

Note: Nawara CPF includes a cost escalation for market increase of USD 39.2 mn.

OPEX: The estimated annual operating expenses during Plateau production are listed below. All Figures in USD million, 100%.

Opex – Nawara CPF	23.3
Opex - Pipeline and GTP	6.6
Escalation	3.8
Total annual Opex for the whole project	33.7

PAST COST: The past exploration cost spent on drilling and testing of 9 wells and engineering studies for the development projects is 194.7 USD.

PRODUCTS: The production profile for sales gas remained unchanged from the profile as provided in Amendment #2. Total estimated gas sales will be 510 bcf over a period of 25 years. Plateau length is estimated to be around 17 years.

The production volume for condensate has been increased slightly from 11 to 13.5 mn bbl to refelect the additional condensate recovery due to the deep cooling in the GTP.

The daily LPG production (and thus the total LPG recovery) has been reduced by 45% to reflect the lower recovery efficiency of a Mechanical Refrigeration versus the previously selected Turbo Expander technology and the leaner gas composition from the Nawara gas only versus the previous mix. Thus, the overall LPG recovery over 25 years dropped from 19 mn boe to 10.5 mn boe.

The above Capex estimate is based on a deterministic cost estimation methodology and includes contingencies for market price escalations and technical contingency (for scope which is not

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100% defined yet). It does not i risks, as identified in the project	nclude contingency to cover for prob risk register.	abilisticly determined proje
8.2 Economic Results		
A summary of economic Key pe	rformance Indicators (KPI's) is provid	led in appendix 2.

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Appendix II Project Approval by General Directorate for Energy

République Tunisienne Ministère de l'Industrie **** Direction Générale de l'Energie DIPH/RB

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DESTINATAIRE : Mr Le Directeur Général OMV								
<u>N° FAX</u> :	70 168 201/202 71. 162. 555							
	Mr Le Président Directeur Général de l'Entreprise Tunisienne d'Activités Pétrolières							
<u>Nº FAX</u>	: 71 285 280							
DATE	: 21 Mai 2013							
<u>№ FAX</u> : <u>№ FAX</u> <u>DATE</u>	OMV 70 168 201/202 74. 162. 555 Mr Le Président Directeur Général de l'Entreprise Tunisienne d'Activités Pétrolières : 71 285 280 : 21 Mai 2013							

EXPEDITEUR	: Direction Générale de l'Energie
<u>Nº FAX</u>	: 71 787 804
REFERENCE	: DPPH
NOMBRE DE PAGE (Celle-ci incluse)	: 2

: Concession Nawara - Avenant n°3 au plan de développement. **OBJET**

: Votre lettre en date du 8 Mai 2013 <u>REF.</u>

D Securite

Par lettre en date du 8 mai 2013 déposée à la Direction Générale de l'Energie le 17 mai 2013 vous m'avez transmis pour approbation, deux exemplaires de l'Avenant n°3 au Plan de développement de la concession d'exploitation des hydrocarbures « Nawara ».

En réponse, j 'ai l'honneur de vous informer que la dit avenant n°3ne soulève pas d'objection de notre part tant qu'il n'est pas contraire ou incompatible avec les dispositions du Code des Hydrocarbures et des règlements priz pour son application.

Toute fois Nous vous rappelons qu'en ce qui concerne la constitution des réserves de réinvestissement prévue à l'article 113 du code des hydrocarbures pour le financement des dépenses des canalisations de transport du brut et du gaz de la concession Nawara, celle-ci doit faire l'objet d'une demande détaillée comportant les modalités de la constitution des dites réserves et la concession à partir de laquelle seront constitués ces réserves pour le présenter pour examen au Comité Consultatif des Hydrocarbures.

Meilleures salutations Le Directeur Général de l'Energie DIRECTION GENERALE L'ENERGI d Ben Daly

Appendix III Core Drills in the Study Area



Project	:	Gootochnical Survey for N	awara Gathoring system and	CPE (CPE sita)	coring bore	holes N°	CPF - SC1
		Geolecinical Sulvey for N	awala Gathering system and	CFT (CFT Site)	Date :		08/2012
Site	:	Nawara-jnein south	Spud Date :	23/08/2012	cheked by	:	W. HAMZA
Client		OMV	Date :	23/08/2012	water level		Néant
Investigati	on :	Coring borehole	coring diameter :	coring diameter :		Y	Z
Crew chief :		Nizar	101 mm	Coordinates	601352	3430195	329

	Depth	Thikness	Lithologiy	Symbols	Samples	depthf		S.P.T. tests	
0	Depen	(m)			···· •	m/TN	N1	N 2	N1+N2
0							28	R	R
1			Fractured calcareous crust with witish gypsum .			1			
2	<u>2,00</u>	2,00			EI11	2			
	<u>2,50</u>	<u>0,50</u>	Beige to whitish clay tuff		(2,00 - 2,50)			5	5
3			sandy tuff crust with avosum			3	33	R	R
			sundy tan orașt witr gypsun		EI12				
4					(4,00 - 4,50)	4			
	<u>4,50</u>	2,50					R	R	R
5						5			
6					EI13 (6.00 - 6.50)	6			
7					(0,00 0,00)	7	R	R	R
8			yellow limestone.			8			
9						9	R	R	R
10					EI14 (9 50 - 10 00)	10			
					(3,30 - 10,00)				
11						11	R	R	R
12						12			
13	13.00	8.50				13	R	R	R
						13			
14			yellow limestone altenated with fine intercalations of micro conglomeratic marl .			14			
15	15.00	2.00				15	34	41	75
						-			



Project	:	Geotechnical Survey for N	lawara Gathering system and	CPF (CPF site)	coring bore	oring boreholes N°		
		Geotechnical Guivey for h	awara Cathering System and	orr (orr site)	Date :	ate: 08/201		
Site	:	Nawara-jnein south	Spud Date :	24/08/2012	cheked by	:	W. HAMZA	
Client	:	OMV	Date :	24/08/2012	water level		Néant	
Investigat	tion :	Coring borehole	coring diameter :	Coordinatos	X	Y	Z	
Crew chief :		Nizar	101 mm	coordinates	601412	3430251	328	

	Denth	Ethikness Lithology	Symbole samples		samples Depth		S.P.T.tests		
	Depth	(m)		symbole	sumpres	m/TN	N1	N 2	N1+N2
0						0			
1						1	29	R	R
1						-			
2			Calcareous with tuff and gypsum crust with		EI21	2			
			sandy intercalations beige to reddish.		(2,00 - 2,50)				
3							R	R	R
						3			
-					EI22				
4					(3,50 - 4,00)	4			
-									
_ 1	5.00	5.00					25	P	P
5 -	<u>- 5.00</u>	0.30	Sandy crust			5	25		
-	5.70	0.40	Calcareous crust			-			
6					EI23	6			
					(6,00 - 6,50)				
								-	
7						7	R	R	R
-									
						-			
8 -						8 -			
-									
9						9	R	R	R
			vellow limestone alterated with fine						
			intercalations of micro conglomeratic marl		EI24	-			
10					(9,50 - 10,00)	10			
-									
11							R	R	R
						11 -			
12						12			
-									
-						-			P
13 -						13	R	R	R
14									
14 1						14 -			
15 [∃]	15.00	<u>9.30</u>				15			
						-			



Project	:	Gootochnical Survey for N	awara Gathoring system and (CDE (CDE sita)	coring bore	holes N°	CPF - SC3
		Geolecinical Survey for N					08/2012
Site	1	Nawara-jnein south	Spud Date :	26/08/2012	cheked by	:	W. HAMZA
Client	1	OMV	Date :	26/08/2012	water level	:	Néant
Investigation : Crew chief :		Coring borehole	coring diameter :	Coordinatos	X	Y	Z
		Nizar	101 mm	Coordinates	601510	3430298	326

	Denth	thikness	Lithology	Symbols	samnles	depth	S.P.T. test		
	Depth	(m)		~	p	m/TN	N1	N 2	N1+N2
1					EI31 (1,00 - 1,50)	0 1 2	R	R	R
3			sandy tuff with gypsum crust with some calcareous intercalations		EI32 (3,00 - 3,50)	3			
4					F133	4	25	R	R
5	6,00	6,00			(5,00 - 5,50)	5	R	R	R
7	7.00	1, <u>00</u>	beige to yellowish sand with gypsum crust		EI34	7			
8	9.50	1 50	beige to whitish sandy and calcareous crust.		(1,00 - 1,00)	8	R	R	R
9	D.D.U					9			
10			.Sandy crust with calay and gypsum beige to yellowish			10	R	R	R
11	<u>11.00</u>	1.50	Sandy crust with clay locally oxydated beige to			11	R	R	R
13	13.00	<u>2.00</u>	greenish			13			
14			yellow limestone altenated with fine			14	27	33	60
15	1 <u>5.00</u>	<u> </u>				15			



Project	:	Gootochnical Survey for N	awara Gathoring system and (CPE (CPE sita)	coring bore	holes N°	CPF - SC4
		Geotechnical Survey for N					08/2012
Site	1	Nawara-jnein south	Spud Date :	27/08/2012	cheked by	:	W. HAMZA
Client	:	OMV	Date :	27/08/2012	water level		Néant
Investigati	on :	Coring borehole	coring diameter :	Coordinatos	X	Y	Z
Crew chief :		Nizar	101 mm	Coordinates	601351	3430298	326

	Denth	thikness	Lithology	Symbols	Samples	depth	S.P.T. tests		
0	Depth	(m)		~,	p	m/TN	N1	N 2	N1+N2
1			calcareous tuff with gypsum crust beige to			0			
2	2.00	<u>2,0</u> 0	whitish.		El41	2			
3					(2,00 - 2,30)	3	19	22	41
4			alternatinon of sandy tuff with gypsum and limestone crust		El42 (4,00 - 4,50)	4			
5						5	22	R	R
6	<u>6.00</u>	4,00			EI43	6			
7					(0,00 - 0,50)	7	R	R	R
8					El44 (7,50 - 8,00)	8			
9						9	R	R	R
10			yellow limestone altenated with fine intercalations of micro conglomeratic marl .			10			
11						11	R	R	R
12						12			
13						13	R	R	R
14	14.20	8.20				14			
15	15.00	0.80	beige to greenish oxydated clay with locally m <u>a</u> rl			15	23	R	R



Project	1	Gootochnical Survey for N	awara Gathoring system and (CDE (CDE sito)	coring bore	holes N°	CPF - SC5
		Geotechnical Survey for N	awara Gathering system and t	off (off site)	Date :		08/2012
Site	1	Nawara-jnein south	Spud Date :	29/08/2012	cheked by	:	W. HAMZA
Client	1	OMV	Date :	29/08/2012	water level	:	Néant
Investigatio	n :	Coring borehole	coring diameter :	Coordinatos	X	Y	Z
Crew chief	1	Nizar	101 mm	Coordinates	601472	3430374	325

	denth	thikness	Lithology	Symbole	sampless	depth		S.P.T. tests	
0	ueptii	(m)		Symbole	sumpress	m/TN	N1	N 2	N1+N2
0	0,30	0,30	vegetal terrain			0 1			
1 -						1	18	19	37
						-			
2 -				\cap		2	23	R	R
						111			
							21	25	46
3 -						3 -		25	
				()					
4						4	24	R	R
						1		-	-
5						5	R	R	R
				7					
6 -				\sim	EI51	6			
					(6,00 - 6,50)	Ŭ			
							_		_
7						7	R	R	R
-				1		1			
8				0	E152				
0					(8,00 - 8,50)	8-			
			tine sand with tuff and gypsum locally calcareous with some alluvial intercalations		(, , ,				
9			beige to whitish			9	23	27	50
				~					
10				Q					
10 -						10 -			
11						11	21	23	44
10					EI53				
12 -					(12,00 - 12,50)	12			
1				1					
13				0		13			
					EI54				
14					(13,50 - 14,00)	14			
15	15.00	14.70				15			



Project	:	Controphylical Survey for Newers Cathoring system and CDE (CDE cite)				coring boreholes N°		
		Geotechnical Survey for I	echnical Survey for Nawara Gamernig System and GFT (GFT Site)				08/2012	
Site	:	Nawara-jnein south	Spud Date :	31/08/2012	cheked by	:	W. HAMZA	
Client		OMV	Date :	31/08/2012	water level	:	Néant	
Investigati	ion :	Coring borehole	coring diameter :	Coordinates	X	Y	Z	
Crew chie	f:	Nizar	101 mm	Coordinates	611420	3430374	325	

	Denth	Thikness	Lithology	Symbole	samples	depth	S.P.T. tests		
0	Depth	(m)		~,	~~~···	m/TN	N1	N 2	N1+N2
	0,30	0,30	reddish dune and silicious sand			0]			
-						-			
1						1	17	15	32
-								0.5	10
2						2	15	25	40
-									
=									P
3 -						3 -	28	R	R
-						-			
							R	R	R
4 -						4			
1						-			
5 -						5	22	23	25
-					FIGA	-			
6 -						6			
					(6,00 - 6,50)	-			
							24	26	10
7						7	24	20	40
-						-			
8					EI62				
0					(8.00 - 8.50)	8			
1					(0,00 0,00)	-			
9 -			beige to whitish fine sand with tuff ,gravel and			9	R	R	R
			gypsum locally calcareous						
10 -						10			
-									
						-	20	21	11
11 -						11 -	20	21	41
-									
12						10			
12						12 -			
					E163	-			
13					(12,50 - 13,00)	13			
-									
-							Р	Р	Р
14						14	R	ĸ	<u> </u>
-					- 104				
15					E164				
10 -	1 <u>5.00</u>	<u>14.70</u>			(14,50 - 15,00)	15 ¹			


Project	:	Gootochnical Survey for N	awara Gathoring system and (PE (CPE site)	coring bore	holes N°	CPF - SC7
		Geotechnical Survey for N	awara Gathering system and C	FT (OFT SILE)	Date :		09/2012
Site	1	Nawara-jnein south	Spud Date :	08/09/2012	cheked by	:	W. HAMZA
Client	1	OMV	Date :	08/09/2012	water level		Néant
Investigatio	on :	Coring borehole	coring diameter :	Coordinatos	X	Y	Z
Crew chief		Nizar	101 mm	Coordinates	601350	3430348	325

	Denth	Thikness	Lithology	Symbols	samples	depth		S.P.T. tests	
	Depth	(m)		5,	sumpres	m/TN	N1	N 2	N1+N2
1	<u>1,30</u>	<u>1,30</u>	reddish dune sand silicious and locally rocky			0	11	10	21
2			beige to whitish fracturated tuff with limestone locally gravel .		El71 (2,00 - 2,50)	2 3 4	42	R	R
5	5,50	4,20			EI72	5	R	R	R
6				4	E172 (5,50 - 6,00)	6			
7						7	R	R	R
9			beige to whitish fracturated tuff with limestone crust_locally alluvial.	0		9	R	R	R
10				0	El73 (10,00 - 10,50)	10			
11						11	R	R	R
12				~1	El74 (12,00 - 12,50)	12			
14				\checkmark		14	R	R	R
15	1 <u>5.00</u>	<u>9.50</u>				15			



Project	:	Gootochnical Survey for N	awara Gathoring system and (CPE (CPE sita)	coring bore	holes N°	CPF - SC8
		Geotechnical Survey for N	awara Gathering system and C	off (off site)	Date :		09/2012
Site		Nawara-jnein south	Spud Date :	09/09/2012	cheked by	:	W. HAMZA
Client	:	OMV	Date :	09/09/2012	water level		Néant
Investigati	ion :	Coring borehole	coring diameter :	Coordinatos	X	Y	Z
Crew chief	f :	Nizar	101 mm	Coordinates	601235	3430425	326

	Denth	Thikness	Lithology	Symbols	Samples	depth		S.P.T. tests	
•	Depth	(m)		551115015	Sumples	m/TN	N1	N 2	N1+N2
U						0]			
-									
1 -						1			
' -									
-			tuff lightly sandy beige to reddish			-			
2						2	23	25	48
- 3						-			
-					EI81				
3 -	<u>3.00</u>	<u>3,00</u>			(2,50 - 3,00)	3			
-				1					
3				\sim		-			
4 -			beige to whitish tuff with sand locally alluvial.			4	35	R	R
-				Λ		-			
-	5.00	0.00		U		-			
5	5 <u>,00</u>				EI82	5 -			
-					(5,00 - 5,50)	-			
						-	R	R	R
6 -						6			
-						-			
-									
/ -						7 -			
-									
8						•	25	R	R
						0			
-						-			
9 -			beige to whitish tuff with sand locally calcareous			9			
-			with gypsum lightly gravel.						
-					E183				
10					(9.50 - 10.00)	10	31	R	R
3									
-									
11 -					E184	11			
-					(11,00 - 11,50)				
						-	D	D	D
12 -						12			
-									
12									
						13 -			
-									
14						14	R	R	R
						14 -			
15 ^Ξ	45.00	10.00				15			
	1 <u>5.00</u>								



Project	:	Gootochnical Survoy for N	awara Gathoring system and	CPE (CPE sita)	coring bore	holes N°	CPF - SC9
		Geotechnical Sulvey for N	awara Gathering system and	CFT (CFT Site)	Date :		09/2012
Site		Nawara-jnein south	Spud Date :	10/09/2012	cheked by	:	W. HAMZA
Client	:	OMV	Date :	10/09/2012	water level		Néant
Investigati	ion :	Coring borehole	coring diameter :	Coordinates	X	Y	Z
Crew chief	f :	Nizar	101 mm	Coordinates	601383	3430513	327

	Denth	thikness	Lithology	Symbols	Samples	depth		S.P.T. tests	
0	Depth	(m)		~,		m/TN	N1	N 2	N1+N2
0	0,30	0, <u>30_</u>	. reddish dune siliceous sand.			0			
							10		10
1 -				\bigcirc		1	18	22	40
2				4		2	21	23	44
			. beige to whitish fine sand with tuff and	$\langle \rangle$					
2			gypsum locally alluvial.		EI91				
5				Λ	(2,50 - 3,00)	3			
				V			20		D
4						4	28	ĸ	ĸ
	4.80	4 50					_	_	
5	· <u>_</u> , <u>20</u>					5	R	R	R
			tuff with gypsum crust		EI92				
6 -	6,00	1,20			(5,50 - 6,00)	6			
7						_	25	27	52
1				Λ		1			
-				V					
8 -						8			
			beigg to whitib, find cand with tuff and gypsum		EI93				
9			and gravel locally calcareous with some alluvial		(8,50 - 9,00)	9			
			intercalations.	\bigtriangledown					
10						10	R	R	R
11						11			
					EIQ4				
				0	(11,50 - 12,00)				
12 -					,	12			
13						13	R	R	R
				\bigcirc					
14						14	R	R	R
15		0.00				15			
-	1 <u>5.00</u>	<u>9.00</u>		<u></u>		15 -			



Project	:	Gootochnical Survey for N	awara Gathoring system and (PE (CPE site)	coring bore	holes N°	CPF - SC10
		Geotechnical Sulvey for N	awara Gathering system and C		Date :		09/2012
Site	:	Nawara-jnein south	Spud Date :	12/09/2012	cheked by	:	W. HAMZA
Client	:	OMV	Date :	12/09/2012	water level		Néant
Investigatio	on :	Coring borehole	coring diameter :	Coordinatos	X	Y	Z
Crew chief	1	Nizar	101 mm	Coordinates	601135	3430637	328

	Denth	Thikness	Lithology	Symbols	samples	depth		S.P.T. tests	
0	Depth	(m)		551115015	sampres	m/TN	N1	N 2	N1+N2
0			reddish siliceous dune sand			0	15	17	32
2	2,00	<u>2,0</u> 0		 ۲	El101 (2,00 - 2,50)	2			
3	2.50	1.50	. beige to whitish fine sand with tuff and gypsum locally alluvial.	0		3	18	22	40
4	3, <u>50</u>	<u>1,20</u>				4			
5			beige to reddish tuff with clay and gravel			5	23	21	44
6	6,00	2,50		,	El102 (5,50 - 6,00)	6			
7						7	28	25	53
8 -				0		0			
9			beige to whitish fine sand with tuff and gypsum and gravel locally calcareous with some alluvial			9	25	R	R
10			intercalations	\bigcirc	EI103	10			
11					(10,00 - 10,50)	11			
12				0		12	R	R	R
13					E1104	13			
14				\triangleleft	(13,00 - 13,50)	14			
15	15.00	0.00				15	R	R	R
	1 <u>5,00</u>	<u> </u>							







	10	9	
	DUCTION GMBH -0000-ME-DRW-0002 REV 001.dwg -MF-DRW-0002 SH.1 of 1 REV001	MV (TUNESIEN) PRO FILE : NA-PEL-CPF-	and Pit CLIENT: CLIENT
т	of SITE NAWARA	AT	
	PIOT PIAN	OVERALL	eHole
	ORIGINAL DWG SIZE : A1	ofac 🏠	al Pit Petr
	PFTROFAC JOB NO · JU09570A		
G	JNAWARA		
	MF MF DAH DAH 20.03.2012 MF MF DAH DAH 30.02.2012 ORIG DRWN CK'D APP'D DATE	FOR REVIEW FOR IDC DESCRIPTION	A01 ISSUED
	ME ME DAL DAL 77 A 2019		
- די	METRES	0 SCALE BAR	1:12
	0000-ME-DRW-0001 FOR NUMBERING NARY AND PRODUCED FOR COST 3E FURTHER DEVELOPED DURING	RG. No.NA-PEL-CPF- SS AREA EQUIPMENT I PLOT PLAN IS PRELIMIN TION PURPOSES. TO E 2.	1. SEE I PROC 2. THS ESTIM PHASI
			V WATER FOLISHING, DEMIN WATER FO KING WATER TREATMENT, SEWAGE PUN E WATER TREATMENT PACKAGES
m	SS) - 0121 CHEMICAL INJECTION PACKAGE CHEMICAL INJECTION PACKAGE	ATMENT 0121-XX-117 OSING, 0121-XX-118	TER WATER PUMPS, CHLORINATION UNIT STORAGE TANK, PW PUMPS, PW RO TRI AGE, STERILISATION UNIT, CHEMICAL OF MATER POLICHING OFFINI WATER PI
	0122 V FUEL GAS KO DROM 0122 NITROGEN GENERATOR PACKAGE NITROGEN RECEIVER	012/-XX-098 NITROGEN UNIT - 0122-XX-620 0122-XX-630	RT GAS PIG LAUNCHER 3LE & DEMINERALISED WATER - 011 FER FILTERS, AQUIFER STORAGE TANK
	FUEL GAS HEATER HP FUEL GAS KO DRUM FUEL GAS FILTER/SEPARATOR	0127-XX-095 0127-XX-096 0127-XX-097	JENSATE RECYCLE PUMPS - 0402 RT GAS FISCAL METERING PACKAGE
	DIESEL FIREWATER JOCKEY PUMP DIESEL FIREWATER PUMP PACKAGE	ER 0104-XX-091 ER 0104-XX-092 0104-XX-093 FUEL GAS UNIT -	STAGE OFF-GAS COMP DISCH COOLEF STAGE OFF-GAS COMP SUCT SCRUBE STAGE OFF-GAS COMP STAGE OFF-GAS COMP DISCH COOLE
	- 0104 - 1004 - FIREWATER STORAGE TANK FIREWATER STORAGE TANK	BBER 0104-XX-089 FIREWATER UNIT - 0104-XX-089 0104-XX-090	- OFFAMIUN - OTOT STAGE OFF-GAS COMP SUCTION SCRU STAGE OFF-GAS COMP
	AIR COMPRESSOR PLANT AIR RECEIVER AIR DRIER PACKAGE	0115-XX-085 0115-XX-086 0115-XX-087	RT GAS/DRY GAS HEAT EXCHANGER GAS CHILLER
	UCSED DRAIN TRANSFER PUMP CLOSED DRAINS VESSEL CLOSED DRAINS VESSEL	0118-XX-083 0118-XX-083 0118-XX-084 INSTRUMENT AIR L	OL STORAGE TANK OL STORAGE TANK OL TRANSFER PUMPS OL STORAGE TANK HEATER
Т	DIESEL FILTER/COALESCER DIESEL STORAGE TANK DIESEL TANSFER PUMP	0108-XX-080 0108-XX-081 0108-XX-082	OL DRAINS VESSEL
	GAS TURBINE GENERATOR GAS TURBINE GENERATOR EMERGENCY DIESEL GENERATOR	0108-XX-074 0108-XX-076 0108-XX-079	NERATION COLUMN OL FLASH DRUM OL SURGE DRUM
	IST STAGE COMPRESSOR 2ND STAGE COMPRESSOR NI UNIT – 0108	0102-XX-0125 0102-XX-0126 0102-XX-0127 POWFR GENERATIO	OL/CLYCOL HEAT EXCHANGER OL CHARCOAL FILTER CIYCOL PIMP
0	- 0102 REFRIGERANT RECEIVER DRUM 1ST STAGE SUCTION DRUM	C00LING SYSTEM 0102-XX-0122 0102-XX-0123	105 GLYCOL AIR COOLER OL REGEN CONDENSER
	HEATING MEDIUM EXPANSION DRUM HEATING MEDIUM SUMP HEATING MEDIUM DUMP COOLER	0128-XX-070 0128-XX-071 0128-XX-072 0128-XX-073	CONTACTOR FILTER COALESCER CONTACTOR RT GAS/SWEET GAS HEAT EXCHANGEF T GAS KO DRUM
Т	SYSTEM - 0128 HEATING MEDIUM FIRED HEATER I/C HEATING MEDIUM CIRCULATION PUMP	HEATING MEDIUM (0128-XX-068 0128-XX-069A/B	E DRAIN VESSEL HEATER E DRAIN PUMPS
	LP FLARE KO DRUM LP FLARE KO DRUM PUMP LP FLARE STACK/TIP	0119-XX-063 0119-XX-064A/B 0119-XX-065	E STORAGE TANK E STORAGE TANK MIXER E TRANSFER DUMPS
	HP FLARE KO DRUM HP FLARE KO DRUM PUMP HP FLARE STACK/TIP	0119-XX-059 0119-XX-060A/B 0119-XX-061 0119-XX-062	E REGEN LEAN SOLUTION PUMPS 'OAM TANK E REGEN REBOILER
ω	LINE – 0Z03 EXPORT CONDENSATE PIG LAUNCHER T – 0119	0203-SP-1701 HP/LP FLARE UNI	IANICAL FILTERS
	ERING – 0202 CONDENSATE METERING PACKAGE	IMPS CONDENSATE METE	E REGEN REFLUX PUMPS E REGEN LEAN SOLUTION BOOSTER P
	CONDENSATE RUN DOWN COOLER - 0201 } CONDENSATE EXPORT PUMPS	0204-E-1207 EXPORT PUMPS - 0201-P-1211A/B	E REGEN STRIPPER COLUMN E REGEN CONDENSER E REGEN CONDENSATE DRUM
	ACE - 0204 CONDENSATE STORAGE TANKS	0109-E-1202 CONDENSATE STOF	E REGEN LEAN/RICH EXCHANGER
	CONDENSATE REBOILER CONDENSATE REBOILER CONDENSATE/CONDENSATE HEAT EXCH'R OFF-SPEC CONDENSATE RECYCLE PUMPS	0109-E-1205 0109-E-1205 0109-P-1213A/B	URY REMOVAL KIT E ABSORBER FILTER COALESCER I GAS COOLER
⊳	WATER/CONDENSATE SEPARATOR	0109-E-1201 0109-V-1202 0109-V-1202	4 4 E ABSORBER K.O. DRUM F ABSORBEP COLLIMN
	VAPORATION POND EVAPORATION POND PRODUCED WATER TREATMENT PACKAGE WISATION INIT - 0109	0110-XX-057 0110-XX-057 0110-X-2006	SEPARATOR 77 SFPARATOR
	UNIT FUR EXQUERMENT EFFN PINDS	WATER TREATMENT	(JEE UNVIRON INT I LE O MANIFOLD - HP & TEST HEADER