



Non-Technical Summary

KOC Drilling Operation- SAIPEM S.p.A RIG 5946 January 2021

January 2021

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Introduction

This Non-Technical Summary Report provides an overview of the main environmental & social findings from the Environmental & Social Impact Assessment (ESIA) study considering all phase of Drilling Project in KOC. The content of this non-technical summary report is summarized below:

- Section 1 gives Non-Technical Summary Report of KOC Onshore Drilling comprehensive ESIA
- Section 2 provides a Non-Technical Summary Report of SAIPAM SPA Kuwait Drilling Rig 5946

It is important to note that this non-technical summary report does not, and is not intended to, convey all the information relating to the aspects and impacts of the Project. Its intention is to present key information, describe the main findings and conclusions, enabling the reader to understand the significant environmental effects of the Project without needing to refer to the detailed Environmental and Social Impact Assessments study report.

Non-Technical Summary Report of KOC Onshore Drilling ESIA Project overview

Kuwait Oil Company (KOC) is state owned company operates under the umbrella of Kuwait Petroleum Corporation (KPC). KOC scope includes exploration, drilling and production of oil and gas in the State of Kuwait. KOC represents one of the pillars of the national economy in the State of Kuwait, and one of the largest global oil companies. KOC contributes to high revenues enabling Kuwait to implement development programmes at all levels. KOC has developed its 2030 vision, mission and institutional capacity in line with the national vision of Kuwait.

KOC has developed Integrated Assets Plans (IAPs) to achieve an increase and enhancement of Crude Production Capacity. Under the IAPs framework and via this project, Drilling of New Wells in South East Kuwait Asset During 2017-2022, KOC intends to drill a cluster of new oil and gas wells in South east Kuwait (SEK) with the aim to increase the production capacity. The project will also contribute to the overall SEK production target. The environmental permit for the project is needed by March 2018 to maintain KOC production plan as scheduled.

M/S. Wataniya Environmental Services Company (WES) has conducted the ESIA, as a class "A" approved Environmental Consulting Firm approved by Kuwait Environment Public Authority (KEPA). The project scoping report was completed and submitted to KEPA on December 2017 and approved on January 2018. The ESIA report has been prepared in accordance with the ESIA system in the State of Kuwait Decree 2/2015, as well as KOC procedures. The ESIA process was carried out during November 2017 to February 2018. The ESIA scope covers drilling and associated activities and will not entail production stages.

Environmental & Social Baseline Conditions

Land Use/Cover

Project specific land use and land cover map generated using GIS and Remote Sensing Technology. It has been produced to provide instant information on landuse and land cover in the project area

and its vicinity. The project proposed well locations spread over large area, where the land cover in the project site and its vicinity is mainly inland sabkha, active sand sheet and rugged sand sheet. All the wells are located within SEK oil fields and the land use in the project site is only KOC oil fields and its development and production facilities.

Surface Geology

Kuwait's desert can be divided into four physiographic provinces: Al-Dibdibba gravelly plain; southern desert flat; coastal flat; and coastal hills (Khalaf et al., 1984). Major geological surface features at the project site consist mainly of Holocene aeolian sand deposits, with frequent undifferentiated Far and Ghar formation, lower diddibah formation. The general geology maps shows Far and Ghar Formations, Active Sand Sheet and Marine Sand features at the project area.

Topography

The land surface of Kuwait is flat and slopes gradually north-eastward with an average gradient of about 2m/km. A site-specific topographic map for the study area has been generated. The map shows that elevations in the project area vary from 45 m to the most northern side to more than 110 m above sea level to the most eastern side. In general, the project site varies in its topographical levels. By comparing the elevations at almost similar well location, the elevations at the same drilling areas is almost flat with some changes in the levels of 10 m in average level.

Geomorphology

The project geomorphologic map of the study area shows that smooth sand sheets dominate the project area with less presence of active sand sheets.

Ambient Air Quality

KOC operates several Ambient Air Quality Monitoring Stations in KOC different oil operational areas covering all oil facilities. Six months ambient air quality monitoring data provided by KOC has been used to describe ambient air quality at project area. All the assessed parameters were found within the limits set in Decree 8/2017 except Ozone and Sulphur Dioxide.

Ambient Noise Measurements

Noise level measurements have been conducted at five locations, where monitoring has been conducted for a continuous period of 24 hrs. Locations have been selected close proximity to the main sensitive receptors. Measurements of noise level have been found to be lower than ambient noise criteria set out by KEPA regulations (Decision 8/2017).

Soil Quality

Soil samples have been collected from the different locations in order to assess soil quality at the project site. Samples have been analyzed mainly for contamination indicator parameters. Results show that almost all analyzed parameters are under criteria set by KOC's remediation standards.

<u>Lithology</u>

The lithological features of the SEK well drilling locations comprise Dibdibah formation, fars and Ghar formation and aeolian sand formations. The Dibdibah Formation in Kuwait consists of all beds above the fossiliferous horizons of the Lower Fars Formation except for Recent deposits. The formation is composed of sands and gravels with minor clay and gypsiferous sandy clay beds. The beds show poor to medium stratification and in places the sands are cemented by calcium carbonate and gypsum. The upper part of the formation consists of coarse gravels deposited in sheets and

trains. These gravels are composed of metamorphic and igneous rock debris. The lithology of Ghar formation consists of current-bedded coarse-grained to pebbly sandstones which show a nodular sugary weathering surface. Some of the sandstones are firmly cemented and calcareous, and a few green clay beds are scattered through the section. (Source: Geology of the Arabian Peninsula, Kuwait, USGS Publication).

Sand Encroachment

Kuwait is classified into 3 sand movement zones: high, medium and low. Site specific sand movement map has been generated based on Kuwait classification provided by Sand movement of Kuwait in (Beatona, 2010). Sand encroachment map shows the project proposed wells fall under Low exposure to sand encroachment except 4 wells located within western side of SEK area which will require mitigation measures to be in place during drilling activities according to article (47) of law number 42/2014.

Protected Areas

The nearest protected area to the proposed SEK well drilling project site is Al-Qurain Hill Natural Reserve which is located at a distance of 9.78 km towards south of the proposed well locations and Umm Gudair protected area which is located at 26 km in South west of the project site.

Terrestrial Ecology

Terrestrial ecological survey was conducted on February 2018. The result in the present study showing the average percentage cover at the Burgan oil field was (7%) per meter square, meanwhile, the average percentage cover at the Magwa oil field was (39%) per meter square. There was no fauna observed in the proposed project location during the survey.

Roads Networks & Site Access

The project site is connected to main areas in Kuwait through main roads such as Sulibiya Road (604) to the south west, 212 to the North, 7th Ring road to the North, 306 road towards South East, 304, Magwa road (51) to South West and Al Artal military road. In addition, there is a network of paved and unpaved roads serving the project site. The rig itself will not use public roads but will use rig rods with rig roads crossing the public roads.

Surrounding Resident Community

The project will be implemented in Burgan and Magwa oil fields. The wells to be drilled for SEK area are all located well within KOC fence boundary. The direct surrounding community includes mainly oil production community, with different oil facilities, offices and on-site labor camp. The major nearest township is Ahmadi which is at a distance of 5.2 km east to the project site, Kabd area at 11.74 km towards south west direction and Sabah Al Ahmad residential area at a distance of 12.5km towards south direction. To the West side of the oil field, Ahmed Al Jaber Air Base is located with the nearest point to the field of about 9.67 Km.

Impacts & Mitigation

The project activities will be associated with positive as well as negative potential environmental and social impacts. The key positive impact of the project is national economic growth supporting the country development plans in all levels, in addition to identifying new employment opportunities. KOC has adopted spacing and management systems to avoid or reduce all the environmental and social impacts of its projects. The project environmental and social impacts are controlled by KOC management procedures. In addition, KOC has developed procedures to respond to the environmental and social impacts during abnormal and emergency operating conditions to minimize the impacts to minimum possible levels. The potential environmental negative impacts of the projects are emissions to air, high noise levels, land contamination and ecological impacts. The potential social impacts of the project are gatch material resources consumption and stress on public potable water supply if needed during the drilling. There is no anticipated public community negatively affected by the project. The below sections provide details on the impacts and mitigation measures.

Mitigation by Drilling Pad Sitting

Site selection of the drilling location and executing the works outside the zone of influence is understood to have significant positive reduction of the environmental and social risks of the project activities. KOC has adopted sitting procedures in order to avoid/minimize the environmental and social impacts of the well location.

Well Control & Blowout Prevention

During drilling, incidents such as rig explosions and well blowout could occur, which would have severe and immediate impacts on the environment and surrounding areas, as well as social impacts including risk to on-site human resources and KOC reputation. Risks may include groundwater contamination, oil spillages leaking into ground surface and gas releases to the atmosphere, fatal or injuries of labors. Risks and impacts associated with these kinds of accidental spills apply to both drilling and production of the onshore lifecycle.

To avoid well blowout, the drilling rig is equipped with well control set of equipment. The well control equipment set is an important part of the drilling rig equipment. The main purpose of well control equipment is to control the wellhead pressure during the operations, prevent any blow out hazard effectively, and ensure safe operations.

Emissions to Air

During drilling operations, the emissions to air vary depending on the drilling operating conditions, normal or emergency operating conditions. During normal operating conditions, the anticipated emissions to air are dust emissions, vehicles and equipment exhaust emissions, temporary flaring emissions and burn pit emissions resulted from burning of the drilling fluids. During emergency operating conditions and well blow out, emissions to air are significant and cause degradation of ambient air quality within the zone of influence.

Cold Toxic/Sour Venting

Well Control & Blowout Prevention is the normal control adopted to prevent such incident. Well ignition is the mitigation action followed in KOC in case of catastrophic wellhead failure, toxic/sour venting occurred, and all well safety controls measures are lost. Well ignition may be required to remove a threatening H₂S hazard in order to ensure workers and public safety. The ignition criteria assessment and procedures are provided in KOC Well Ignition Procedure.

Flaring & Burn Pit Emissions

As per the Well Program, Oil & Gas is flowed during well testing in all exploratory wells, Jurassic Gas wells and some of the Development Drilling wells, where the well fluids are invariably flared in Flare pit. Flaring is a safe option relative to cold venting during well testing or other operations due to

associated toxic and flammable properties. Flaring of gasses, however, releases its combustion products along with unburnt gases that are classified as greenhouse gasses and degrade the ambient air quality. Temporary mobile flaring system may be required during drilling and well testing works. The mitigation measures proposed are mainly:-

- 1. Implement/follow KOC procedures for sitting and safe distance procedures (Drilling Works Sitting)
- 2. Flare pit design
- 3. Green flaring to achieve acceptable targets
- 4. Using H2S scrubbers to reduce H2S concentrations in the atmosphere during flaring operations.

Dust Emissions

Trenching, backfilling, movement of vehicles, excavation and other earth works during the drilling and supporting activities are the anticipated activities which might have potential for dust emissions. Dust emissions controls are proposed such as dust suppression and some site practices.

Equipment & Vehicles Emissions

Equipment and vehicles exhaust emissions are also anticipated during the drilling activities. Emissions anticipated are PM, NOx, CO, CO2, un-burnt hydrocarbons (HC) and Volatile Organic Compounds (VOCs). The drilling machinery shall be standard models and the equipment and vehicles shall have standard exhaust pipes. The emission rates of pollutants are controlled through proper engine maintenance and tuning. NOx emissions control shall be applied to power generation equipment. All emissions rates from fixed sources and vehicles emissions shall comply with executive bylaw decision number 8/2017.

Drilling Noise

Equipment used for site preparation, and transportation will generate noise levels. In addition, drilling operations will generate higher noise levels than ambient criteria. Sources of noise during drilling entail rigs, generators, pumps, compressors, workshops, engines, etc. Implementation of applicable KOC procedures including safe distances requirements would effectively reduce the ambient noise levels to acceptable limits. Noise is best mitigated by distance. The further from receptors the lower the impact. The second level of noise mitigation is direction. Directing noise generating equipment away from receptors greatly reduces associated impacts. Timing also plays a key role in mitigating noise impacts. Scheduling the more significant noise generating operations during daylight hours provides for tolerance that may not be achievable during the evening hours.

Ecological & Biological Impacts

The result in the terrestrial ecological survey shows that the average percentage cover at the Burgan oil field was (7%) per square meter; meanwhile, the average percentage cover at the Magwa oil field was (39%) per meter square. This is may be due to that most land at Magwa filed covered by water bodies encouraging the plant to survive and grow. Five species were identified at 19 locations. Given the site vegetation cover, the magnitude of the impact is expected to be medium.

At some locations, the drilling may lead to clear or degrade existing vegetation cover. Mitigation measures include requirements for mitigation measures as set out by KOC Management of Wildlife Habitat procedure. In addition, prior drilling ecological surveys, habitat enhancement program and management of chemicals and waste and site restoration would be preferred.

Land Contamination

Land contamination from drilling operation is mainly anticipated from different types of solid and liquid waste streams anticipated during drilling activities. The key waste streams that anticipated causing land contamination are:-

- 1. Disposal of OBM cuttings
- 2. Disposal of WBM cutting
- 3. Disposal of dead volume of the drilling mud
- 4. Disposal of sewage waste from rig site office and rig camp
- 5. Soil contamination at flaring and burn pits areas
- 6. Accidental spill of mud and chemicals
- 7. Accidental spill of fuel
- 8. Accidental leak from the machinery and equipment
- 9. Office and domestic waste

In the future drilling works, there will not be any OBM cuttings pits. KOC has constructed and operated and two OBM cuttings treatment plants. The first plant is located at West Kuwait and is used to treat OBM cuttings resulted from drilling works at West Kuwait and South East Kuwait Assets. The second plant is located at North Kuwait and is used to treat OBM cuttings resulted from drilling works at North Kuwait asset. Thermal Desorption Technology is used in West Kuwait OBM cuttings treatment plant. Sewage waste generated from rig site office and camp are treated by Package Sewage Treatment Plant. The sewage wastewater is to be treated up the quality meets Table 5 of decision 12/2017.

Drilling and Technology (D&T) Directorate Waste Management Plan has set a comprehensive approach for the management of all types of waste which are anticipated from drilling works as shown in the below table.

Waste management current practice in D&T directorate, Waste Management Plan (April 2017)		
Generated Waste	Management Strategy	
Non-Hazardous Waste	Sent To approved Waste Handling Facility	
Hazardous Waste	Approved Waste hauler with Waste Manifest	
OBM Cuttings	OBM Cutting Treatment Plant	
WBM Cuttings	Stored in Pit and later on backfilling	
Sewage	Packaged Sewage Treatment Plant	
Domestic Kitchen waste	Approved Waste Hauler to Main Waste collection	
Laundry waste	Packaged Sewage Treatment Plant	
Used Kitchen Oil	Recycling by Kuwait Lube Oil Co	
Used Engine Oil	Recycling by Kuwait Lube Oil Co	

NORM Management during Drilling Operation

Naturally Occurring Radioactive Materials (NORM) are present at various concentrations in the Earth's crust and can be concentrated and enhanced due to the processes involved with the recovery of oil and gas. Uncontrolled processes and activities associated with the elevated levels of NORM that can contaminate the environment as well as pose a health risk to working force in KOC. NORM is managed by Implementation of NORM Management procedure that will enable KOC to prevent all employees from the occupational illnesses that may be the outcome of potential

exposure to NORM. The procedure covers the safe storage and transportation of NORM contaminated materials / equipment / wastes in KOC.

UXO Management

Unexploded Ordnance (UXO) material is managed by KOC Procedure for Handling of Explosive Materials, Substance and Explosive Ordnance Disposal (EOD).

Seismic & Sand Encroachment Hazards

Data collection and review of the project baseline maps showed that the project is exposed to seismic and sand encroachment natural hazards. Seismic hazards are expected and would have impacts on the project activities. However, given applicable KOC management procedures, impacts can be mitigated and controlled. KOC has developed design guidelines that take seismic hazards into account during project design.

Four wells are exposed to high sand encroachment hazard. Sand encroachment mitigation measures guidelines are suggested to comply with article (47) of the environmental protection law 42/2014. Protection installations are common in Kuwait with different interventions based on the industry. To control sand movement in desert dune environment engineering measures could be used. The aim of introducing engineering measures is to increase surface roughness and/or by increasing the threshold velocity that is required.

Surrounding Community

All the proposed wells are located in SEK oil fields. Therefore, direct surrounding community includes mainly oil production community, with different oil facilities, offices and on-site labour camps.

Stakeholders Consultation

Stakeholder consultation has been conducted through an ESIA questionnaire, which has been prepared by WES, and distributed to KOC employees, being identified as the social receptors. The questionnaire has been setup to introduce the project scope and accordingly get feedback from respondents on environmental and social aspects of the projects. The main focused areas and respondents feedback are Economic impacts, Potential environmental impacts, Relation between the project advantages and disadvantages, Most critical environmental issues and Respondent's suggestions or recommendations. Respondents agree that this project will help to boost Kuwait Economy by increasing production of crude and gas for export, refinery feed and internal use (power plants) and expected to create direct employment opportunities in O&G, in addition to indirect opportunities such as in transportation sector. Most respondents agree that the project potential environmental impacts would entail ambient air quality (during well testing flaring) including GHG, dust generation, local increase of noise level, resource consumption (water, gatch, fuel, energy, etc.), contamination of drilling site (land/soil) due to leak/spill and improper handling of drilling mud/cutting, waste & wastewater disposal including hazardous wastes, generation of sewage water, impact to public road and transportation, habitat disturbance and fragmentation, radio hazards, loss of plant biodiversity. Most respondents agree that the key environmental issues are likely to be management of drilling mud cuttings, oil spills, and management of wastes including hazardous wastes. Minor respondents claim that the most critical issues are workers HSE, and well blow out. 100% of respondents have confirmed the advantages of the project are more than its disadvantages. All recommendations have been covered in this ESIA.

Impacts on Groundwater Aquifer Resources

During drilling, water will be needed for various operational activities including drilling. Therefore, KOC intends to source water from existing groundwater resources. Impacts on the groundwater consumption have been assessed to be low because the daily use is estimated low compared to the field production rate. Additionally, the targeted groundwater field aquifer is brackish to saline. However, water conservation measures are applicable by KOC.

Gatch/Material Fill Consumption

Gatch material will be required for a variety of construction purposes including soil replacement, well padding, etc. According to current environmental regulations in the State of Kuwait, new quarries are required to be issued approvals from Environmental Supreme Council, KEPA as well as Kuwait Municipality. Therefore, KOC will manage the provision of this quantity from KOC Assets approved gatch pits. KOC enforces strict mitigation measures to manage gatch resources from existing gatch quarries within the KOC assets. According to the procedure, any new gatch extraction pit will require Complete ESIA.

Other Natural Resource Consumption

During drilling phase, resources such as construction raw materials including sand, steel, cement, fuel and quarry materials will be utilized. Using of natural resources for drilling is fundamental and cannot be avoided. On the other hand, these resources are non-renewable. KOC maintains Management of Energy and Resources Procedure to efficiently manage natural resources.

Stress on Public Landfills

Part of the project domestic or municipal waste (non-hazardous waste) will be transported off-site to nearby municipal landfills. KOC management strategy for Non-Hazardous Waste and domestic kitchen waste involves disposal to approved Waste Handling Facility via approved Waste Hauler to Main Waste collection. The impact on using public landfill has been found low. However, quantity of the waste sent to the landfill shall be minimized as low as possible.

Stress on Public Potable Water Supply

During drilling phase, potable water will be required for drilling as well as workforce involved in the project to meet their daily personal consumption needs including drinking, food and other purposes. Therefore, the project may source water from potable water resources if the available groundwater quality does not meet the drilling water criteria. The estimated required daily water quantity will be in the order of 4,370 m³. Water conservation measures are the best applicable approach to reduce water consumption impacts arising from using public portable water.

Stress on Public Roads & Traffic Impacts

Drilling activities will be carried out within South East Kuwait oil fields and are not anticipated to cause any major traffic interruption. However, drilling will require the supply of cement, mud, water, fuel and other materials; transportation of wastes to landfill, transportation of OBM to treatment facilities, labor transport, etc. which will be carried out by different vehicles and trucks which will use public roads. The project site is connected to main areas in Kuwait through main roads such as Sulibiya Road (604) to the south west, 212 to the North, 7th Ring road to the North, 306 road towards South East, 304, Magwa road (51) to South West and Al Artal military road. In addition, there is a network of paved and unpaved roads serving the project site. On the other hand, during rig move use of public roads will only be limited to road crossings. Works, however, will be carried out in accordance with KOC procedures to minimize traffic impacts. As part of the public roads

design requirements, Kuwait Ministry of Public Works (MPW) road design consultants and contractors have to co-ordinate with KOC to identify its requirements including rig crossing locations and specifications.

Visual Impacts

The proposed project sites spread over a large area of Land in South East Kuwait. All wells locations are not closely adjacent to any urban areas or populated centers. However, installation of drilling rigs will cause temporary visual impacts where rigs could be visible from far distance of up to 3 km. Visual impacts would result from erecting of rigs and its physical presence at the rig site. Cumulative visual impact would result setting up more rigs in close by areas. Mitigation measures, therefore, would involve the time management of activities to reduce the overall visual impacts.

Contingency Management Plan

During drilling and associated activities, contingency management plan is needed to prepare for and respond to emergency scenarios. The below list of KOC HSEMS procedures provides for Crisis Preparedness and Management procedures for the emergency operating scenarios:

- KOC.EV.005 Chemical Spill Cleanup Procedure
- KOC.GE.022 Inland Oil Spill Contingency Procedure
- KOC.GE.025 KOC Crisis Management Plan
- KOC.GE.026 KOC Corporate Emergency Response Plan
- KOC.GE.041 KOC Fire Safety Management
- KOC.PS.019 Guidelines for Escape, Evacuation and Rescue Assessment (EERA)
- KOC.GE.039 Well Ignition Procedure

Environmental Management & Monitoring Plan

An Environmental Management and Monitoring Plan is provided in ESIA to provide a link between the mitigation measures provided and the integration of such measures during the drilling and associated works. It summarizes the anticipated impacts of projects and provides details on the mitigation measures, responsibilities and scheduling to mitigate these impacts, monitoring and reporting.

Conclusion

The project objective is increasing the oil and gas production in state of Kuwait that will contribute to implementation of the state development programs at all levels. Project environmental and social impacts assessed according to the guidelines of Decision 2/2015 for ESIA guidelines in state of Kuwait. Environmental mitigation, management and monitoring measures recommended. As overall, during normal operating conditions, the implementation of the environmental mitigation, management and monitoring measures would reduce the environmental and social impacts of the project to acceptable levels. Also, KOC HSEMS procedures are found comprehensive and enough to control the project environmental and social impacts. During emergency operating conditions, environmental and social impacts cannot be avoided. However, KOC has crisis preparedness and management procedures that can reduce the impacts to lowest level possible.

SAIPEM S.p.A KUWAIT DRILLING PROJECT

RIG 5946

NON-TECHNICAL SUMMARY

1. PROJECT DESCRIPTION

Saipem Kuwait Branch is a branch of Saipem S.p.A Company leader in providing engineering, procurement, project management, and construction services with a preference for large-scale offshore and onshore projects.

Saipem has been awarded from Kuwait Oil Company for Drilling Operations in the State of Kuwait a contract for two heavy land Rigs 3000 HP (RIG 5913 & RIG 5946) for five years plus one year optional on deep well locations.

Rig 5913 spud on the first well on 15 January 2017 on Well number UG 251 in West Kuwait.

Rig 5946 spud on the first well on 6 October 2017 on Well number UN 0131 in North Kuwait.

Scope of work RIG 5913/Rig 5946

Saipem provide drilling rigs, equipment and camps as per the specification in the contract, to carry out drilling and workover operations including mobilization and commissioning of the rigs,

equipment and camps at first well location or other location to be specification by Superintendent's Representative.

Rig's Camp & Site Location / Operation Area

Different allocation within the listed below area at the rigs movement:

No	Area of Kuwait:	Operation areas:
1	North Kuwait	Abdali, Sabriyah, Raudhatain, Ratqa, Bahra, Mutriba fields, Umm Al-Aish, Umm-Niga,, West Abdali, Al-Dhabi, Liyyah, Ladira, North West Raudhatain, Se Ratqa, Bubiyan or any other development or exploration well location in this Area
2	South East Kuwait	Ahmadi, Arifjan, Burgan, Magwa, Wafra fields, Mina Al-Ahmadi, Mina Abdullah, Khashman or any other development or exploration well location in this Area
3	West Kuwait	Minagish, Dharif, Kra Al-Maru, Abduliyah, Al-Rahiya, Umm-Gudair fields, South MinagishUmm-Roos, Kahlulah or any other development or exploration well location in this Area

Drilling Project activities

The following are the activities carried out at rig site:

Drilling Works:

- 1. Drilling location preparation (carried out with involvement of an approved third-party company)
- 2. Rig move and third party (carried out with involvement of an approved third-party company)
- 3. Rig Up Operation

- 4. Drilling Operations (carried our under-Client program requirements)
- 5. Rig Down Operation

Supporting Works:

- 1. Drilling Crew Accommodation Camp
- 2. Saipem Site office activities

Client (KOC) is in charge of providing the facilities below to the rig and managing the services related to the Subcontractors and Service Providers that are working under Client's responsibility.

In this regard, Client is responsible to provide the listed, but not limited to:

Management of the hazardous (chemical) wastes and not-hazardous wastes produced by the Subcontractor and the Service Providers that are directly working under Client.

Therefore, all the activities, services and facilities that are managed and executed by Client are, in consequence, out of the scope of analysis of this document.

2. ENVIRONMENTAL AND SOCIAL ASPECTS

In this section are described the environmental and social aspects related to drilling projects, their potential impacts and mitigation measures.

The key potential environment and social impacts associated with the drilling project are:

•	Emissions to air Soil contamination Noise	•	Flora and Fauna Consumption of natural resources	•	Public health and traffic safety Community health and
•	Waste production & management Water consumption			•	safety Occupational health and safety Other Socio-Economic Impacts

The identification and assessment of the environmental and social aspects and their impacts are taking in consideration the following operating conditions:

1. Normal operating conditions: activities and equipment that are operating under normal condition

and in accordance with management plan

2. Emergency situations (e.g. blowout; fire; exposure to H2S emissions)

The impacts are assessed and address:

a. Direct environmental and social aspects, as activities on which the company may expected to have an influence and control.

b. Indirect environmental and social aspect, as actual or potential activities over which the company may have influence, but not direct control.

Saipem SpA Kuwait drilling provides services as drilling contractor to KOC (Kuwait Oil Company) therefore the risk assessment and resulting mitigation measures are based on national legislative requirements and the additional Client HSE system requirements.

Potential environmental and social (including community and occupational health and safety) impacts have been identified and mitigation measures have been implemented as per Saipem Environmental Management system and Environmental Impact register developed for Saipem Drilling rigs.

3. SUMMARY OF ENVIRONMENTAL POTENTIAL IMPACTS, MITIGATION AND MANAGEMENT MEASURES

3.1. EMISSIONS TO AIR

Emissions to air are generated during various phases of drilling operations, in normal and emergency conditions. During normal operating conditions, the anticipated emissions to air are dust emissions, vehicles and equipment exhaust emissions.

3.1.1 Emissions generated by vehicles and equipment

Air emission generated by vehicles and equipment are mainly related to the combustion of fuel, mainly diesel, as energy source. The potential negative emissions from diesel engines (NOx and SOx) are regulated and minimized by the implementation regular maintenance activity and fuel control through sampling activities.

Project roads are monitored and controlled by speed cameras. Moreover, Saipem's vehicles have an internal speed monitoring system to alert in case of speed exceeding.

3.1.2 Dust Generation

Dust is generated during the rig move operations, movement of vehicles, rig up and rig down operation, and rig site preparation activities. Several control measures are implemented in order to reduce dust generations, like spraying of water on the ground prior activities that might generate dust and vehicle speed reduction.

Vehicles shall respect local and Rig/Project speed limit (60KPH) so as to reduce both noise and dust. Personnel and material transportations shall be planned and optimized in order to reduce emissions and traffic

3.1.3 Emissions generated in emergency situations

During emergency operating conditions like well blow out, emissions to air could be significant. Saipem has different control measures in place to prevent such incidents, like Emergency Response Plans, BOP regular testing and periodic emergency drills.

3.2. SOIL CONTAMINATION

Soil contamination might be the result of a spill, which could be related to an operational error or to an incidental event occurred during drilling operations or as result of an equipment failure (e.g vehicle transport).

Typical occurrences of spills are mainly related to the following incidental events:

Diesel spills from refuelling, overfilling or connection/disconnection incidents.

Oil spills from equipment and vehicles maintenance (oil leaks while changing oil, engine coolant leaks while changing or adding coolant, etc.).

Hydraulic oil spill resulting from a split hydraulic hose or failed connector (moderate pressure, low volume lines, etc.).

Oil/diesel spills due to improper handling of drums and improper storage of them.

Drilling fluid leaks from tanks, pumps or other associated equipment within the closed loop circuit system.

Spill prevention measures include:

Identification of pollutants and implementation of spill control measures as operating practices, inspections and monitoring of facilities.

Regular maintenance schedule of machinery and equipment containing substances that could cause a spill.

Training on environmental protection issues to ensure that all workers are familiar with spill response procedures.

Moreover, an Emergency Response Plan and a Spill contingency plan are in place to address the accidental spills.

3.3. WASTE MANAGEMENT

Drilling activities as well as support activities produce waste which require adequate storage areas, waste segregation and disposal.

3.3.1 Waste segregation on site

In order to facilitate and improve recycling activities, waste will be collected separately in adequate bins dispatched in all working/generation areas. clear signboards are posted on the bins in all working/generation areas for promoting a best segregation of wastes. The following colour code system is applied:

Type of waste	Color code
Hazardous wate	Red container
Domestic / assimilated waste	Green container
Special waste	Blue container
Organic waste	Black container

3.3.2 Waste disposal and treatment

Licensed facilities are used for disposal of waste, including hazardous waste, and they are defined and approved prior to the commencement of drilling site preparation and operations.

Generated waste	Disposal and treatment
Non-hazardous waste	Transported by approved 3 rd party company with waste manifest. Sent to approved landfill.

Hazardous waste	Transported by approved 3 rd party company with waste manifest.
OBM cuttings	Under KOC control
WBM cuttings	Under KOC control
Sewage	Treated on site by Bio-cube, sent to landfill (pit)
Domestic Kitchen waste	Transported by approved 3 rd party company. Sent to approved landfill.
Medical waste	Treated as hazardous waste and sent with waste manifest. Disposed through British Medical Center.
Used engine oil	Removed by approved 3 rd party company
Used kitchen oil	Removed by approved 3 rd party company
Laundry waste	Treated by Bio-cube
Chemical Waste	Under KOC control

Saipem implemented Waste Management Policies & Procedures (46-PLN-HSE-002) to ensure proper waste generated by site activities.

Additionally, training and awareness of personnel on waste management and segregation is carried out on rig site.

3.4. WASTEWATER

The water generated from human activities and drilling rig activities before discharge is treated to meet the quality limits provided for by Kuwait legislation.

Domestic wastewater is diverted and collected goes thru a BioKube filtration unit and then the treated water is stored inside a waste pit at the Rig and Camp. Once pits are full, the wastewater is pumped out and disposed through licensed companies

Drilling wastewater flow is managed and collected by Rig's drainage systems into wastewater tanks. Once tanks are full, drilling wastewater is transferred to an authorized waste service provider and consequently disposed of

3.5. NOISE

Equipment noise is generated by the movement of heavy vehicles during site preparation and rig move.

During drilling operations, sources of noise are associated to rig equipment and machineries such as generators, pumps, engines, workshop activities, etc.

Since Rig generally operates far from terrestrial sensitive environmental receptors it is not expected a significant environmental impact in terms of environmental noise to the local environmental receptors.

Surveys will be carried out to monitor the level of noise and the possible impact over the workers welfare and health and safety.

3.6. WATER CONSUMPTION

The rig consumes water both for the domestic use of personnel on site and for general services. Due to the rig location the water used for domestic use is provided periodically by a truck, while the water for general services is subsoil water extracted from water wells.

To reduce water consumption and water usage efficiency several periodic environmental campaign and environmental awareness events are organized on site.

3.7. RESOURCES EFFICIENCY (FUEL, ENERGY, WATER)

Resource Efficiency is related to the use of resources like energy, fuel, water and construction materials, along with the recovery and reuse of waste.

Periodical environmental campaigns and environmental awareness events with personnel are organised on site, in order to incentive good practice behaviours in terms of resources consumption.

The consumptions of fuel, electricity, water and raw material are regularly tracked and reported through Saipem Environmental Data Management System

3.8. CONSUMPTION OF RAW MATERIALS

The main raw material consumed in the offices is paper, used for administrative procedures.

All the employees are encouraged to a more conscious use through promotion measures such as:

printing only when necessary, using the double-sided printing option as the default setting

maximize the use of soft copy and prefer it to paper prints, and optimizing the archives on the network to avoid unnecessary printing;

recycling of paper waste.

Due to the low quantity of paper used on site, the impact of this environmental aspect is considered low.

Nevertheless, Saipem promotes the protection of natural resources and periodical Environmental campaigns are launched and implemented on site.

3.9. FLORA AND FAUNA DISTURBANCE

Since the site is located in a desertic area and there are no particularly protected areas for flora and fauna in its proximity, the evaluation of environmental aspect can be considered low.

Disturbance of terrestrial flora and fauna is reduced as lowest as possible since all the environmental protection and preservation practices are in place. Special focus shall be given to:

- The prevention measures to avoid any oil spill out of Rig's border
- Control measures to avoid discharging any polluted water into local water surface;
- Reduction of environmental noise.

Furthermore, the usage of supply transporters shall be reduced as low as reasonable possible so as to minimize the impact on the local habitat.

4. SUMMARY OF SOCIAL POTENTIAL IMPACTS, MITIGATION AND MANAGEMENT MEASURES

4.1 PUBLIC ROADS AND TRAFFIC SAFETY

Rig move is carried out in the approved rig roads in KOC field. The public roads may be partially affected during the rig movement operations. The rig equipment movement is coordinated with KOC so to ensure that the public roads and traffic safety are impacted as minimum as possible. Prior rig move is obtained the authorisation from KOC.

Saipem Kuwait implemented driving procedures and carries out defensive driving training courses for its personnel and contractors. Additionally, the drivers are requested to comply with posted speed limits and, as appropriate, further reduce speed when travelling sites on unpaved surfaces to reduce dust creation.

The program of transportation is prepared and coordinated with KOC, ensuring that adequate measures are implemented, and permits are obtained.

4.2 COMMUNITY HEALTH AND SAFETY

The public and community health and safety could be affected by the traffic, noise, air emissions produced by drilling activities or in case of emergency conditions.

For all the above-mentioned situations, Saipem Kuwait developed and implemented a management system of health & safety, implementing measures aimed at mitigating the hazards and reduce the risks on public health and safety.

4.3 OCCUPATIONAL HEALTH AND SAFETY

The drilling project operations works give rise to occupational, health and safety risks to workers, including contractor personnel involved in supporting activities. Saipem Rig HSE management system includes Health and Safety provisions in accordance with the KOC Requirements and the Government Law on the Safety and Health at Work. The management system foresees an adequate workforce management, implementation & enforcement of Saipem code of ethics, provision of health surveillance & healthcare access for all workers.

4.4 WORKERS WELFARE

On Saipem drilling projects all workers are provided with adequate accommodation conditions, with respect of the international and legal norms. Periodical inspections (weekly) are carried out by the Medical personnel and HSE to ensure that the hygiene standards are respected and properly complied.

Social Aspect Description	Possible positive impact
Employment	Employment opportunities for local personnel.
Training and development	Training opportunities for all personnel (including local) contributing to improvement of competency and enhance professional skills. International environment which allow transfer of know-how.

4.5 OTHER SOCIO-ECONOMIC ASPECTS

5. ENVIRONMENTAL MANAGEMENT SYSTEM

Saipem Kuwait SpA Drilling developed and implemented an HSE system which in line with Saipem HSE systems and ISO 14001 standards. The HSE procedures are in place for the whole duration of the project.

The Rig HSE Performances is monitored and assessed against goals and stated objectives defined in the annual Rig HSE plan.

Rig HSE management system adopts the established Saipem Corporate HSE management System, procedures, practices, and processes for the collection of the environmental performance data and for what concern the monitoring of the environmental performance through:

• Periodic monitoring: collection of environmental data as per Saipem Corporate Standards

• Incident and reporting analysis: analysis of the environmental accident and high-potential near misses;

• Audit system: implementation and follow-up of an audit program.

Through the above systems, the Rig environmental performance is tracked and under control so as to be able to set up proper actions and program to improve the Environmental Management System.

6. CONTINGENCY MANAGEMENT PLAN

During drilling and associated activities, contingency plan is required to be prepared for and respond to emergency scenarios. The following are the Saipem Kuwait drilling project HSE procedures for Emergency and Crisis management

Saipem Emergency response plan (Doc no. 46-PLN-HSE-008)

Saipem Hydrogen Sulphide Safety Contingency Plan (Doc. No. 46-PLN-HSE-010)

Saipem Spill contingency plan (Doc no. 46-PLN-HSE-003)

Saipem Well side Specific Emergency Plan (doc no 46-PLN-HSE-011)

Covid-19 emergency response plan

Additionally, on rig site specific control measures are implemented to respond to emergency scenarios:

- IWCF Certification Training
- Rig emergency drills
- Regular H2S/SCBA training
- Fire , H2S & SO2 awareness for employees
- Emergency contact details of rig within 1300 meters radius

7. STAKEHOLDERS ENGAGEMENT

Stakeholder Engagement process is functional to achieving Saipem Kuwait drilling projects objectives. A direct engagement with stakeholders is an opportunity to create understanding about

the operations/project activities among those it will likely affect it or influence, and to learn how these, the external parties, view the operations and the related risks, the impacts, and the opportunities.

The Stakeholders engagement process' main purpose is related to getting and maintaining the license to operate in the country, and also involves identifying and consulting stakeholders; building external and internal understanding and trust; allowing the company or project to better integrate into the local social, economic and environmental context.

Saipem Kuwait drilling stakeholder's engagement strategy aims to ensure that stakeholders expressed needs and expectation are fully reflected in the Saipem drilling projects HSE performance programs, legislative compliance, HSE awareness campaigns, compliance with client operational performance and HSE requirements.

Saipem Kuwait drilling stakeholders are those who have an interest and influence over the drilling projects outcomes, and includes: Client, employees, vendors of goods and services, governmental authorities, business partners.

Stakeholders engagement plan for Saipem Kuwait Drilling projects was prepared in line with Saipem Management system Guideline (MSGGR-GROUP-STK-001) and ISO 14001 requirements.

The document is supporting the Saipem Kuwait drilling projects to manage the company strategies related to stakeholder's engagement and management of their needs and expectations for the whole duration of the project. The plan and strategies of engagement are revised annually, based on the stakeholder engagement strategies results, feedbacks received, changes in the context and/ or stakeholders' expectations.





Non-Technical Summary

KOC Feed Pipelines to New Refinery Project (NRP)

January 2021

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ACRONYMS

EIA	Environmental Impact Assessment
eMISK	Environmental Monitoring Information System of Kuwait
EMP	Environment Management Plan
FG	Fuel Gas
HSSEMS	Health, Safety, Security and Environment Management System
KEPA	Kuwait Environment Public Authority
KIPIC	Kuwait Integrated Petroleum Industries Company
КОС	Kuwait Oil Company
LPG	Liquefied Petroleum Gas
LSFO	Low Sulphur Fuel Oil
MAA	Mina Al-Ahmadi
MEW	Ministry of Electricity and Water
NMHC	Non Methane HydroCarbons
NRP	New Refinery Project
NTS	Non-Technical Summary
PAH	Polycyclic Aromatic Hydrocarbons
P&MS	Pumping & Metering Station
SPT	Standard Penetration Test
STF	South Tank Farm
TDS	Total Dissolved Solids
UNFCCC	United Nations Framework Convention on Climate Change
USEPA	United States Environmental Protection Agency
ZOR	Zour Oil Refinery

1. INTRODUCTION

1.1 Purpose and Content of the Non-Technical Summary (NTS)

This NTS provides an overview of the main environmental findings from the Environmental Impact Assessment (EIA) during the Engineering, Construction, Commissioning and Operating phases of the Project. The content of the NTS is summarized below:

- Section 1 gives an introduction of the project background, its regulatory context and standards, and the project Environmental Impact Assessment;
- Section 2 provides a summary of the project, project location and scope and assessment of alternatives;
- Section 3 outlines the baseline conditions;
- Section 4 focuses on the environmental impacts and mitigation measures;
- Section 5 gives the conclusion.

It is important to note that this NTS does not, and is not intended to, convey all the information relating to the aspects and impacts of the Project. Its intention is to present key information, describe the main findings and conclusions, enabling the reader to understand the significant environmental effects of the Project without needing to refer to the detailed assessments.

1.2 Project Background

Kuwait Integrated Petroleum Industries Company (KIPIC) is building the Zour Oil Refinery (ZOR) in the AI-Zour area of South Kuwait. The '*KOC Feed Pipelines to New Refinery Project* (*NRP*)' project provides the necessary crude feed-stock and fuel gas (FG) to the ZOR refinery and transports finished products Low Sulphur Fuel Oil (LSFO) and Liquefied Petroleum Gas (LPG) from ZOR to the Mina AI-Ahmadi (MAA) Refinery.

Kuwait Oil Company (KOC) has awarded the Contract #17052456 titled "KOC Feed Pipelines for New Refinery Project (NRP)" to Saipem S.p.A to carry out the scope of works including detailed design, site surveys, procurement, supply, installation, pre-commissioning, commissioning, staff training, handover of the facilities and assistance in performance testing as per the Contract requirements.

1.3 Regulations and Standards

The Kuwait Environment Public Authority (KEPA) is the lead government agency in the State of Kuwait responsible for the environment and its mandate revolves solely around environmental management and protection. Environment Protection Law No. 42 of 2014 as amended by Law 99 of 2015 and its Executive Regulations and Decisions are the prevailing environmental legislation in Kuwait.

In addition, the project complies with KOC's own Health, Safety, Security and Environment Management System (HSSEMS) procedures. The State of Kuwait has also signed and ratified a number of international environmental conventions including the three so-called Rio environmental conventions and the Kyoto Protocol of the United Nations Framework Convention on Climate Change (UNFCCC).

1.4 Environmental Impact Assessment (EIA)

Item 14 of Article-7 of the Environmental Protection Law no. 42/2014 amended by 99/2015 states the following:

"Preparing a system for environmental impact assessment of the different projects in the State of Kuwait, and developing the necessary guidelines and procedures, as well as giving its firm opinion prior to the approval of their execution by the concerned authorities."

As per KEPA requirement, an Initial Environmental Impact Assessment (IEIA) study was conducted by Bureau Veritas in July 2013 and submitted to KEPA. KEPA has reviewed the report and issued its opinion on the requirement for a final and detailed EIA study. The Final EIA report has been prepared by Bureau Veritas in August 2018 prior to construction of the project as per the recommendations of KEPA on the IEIA report.

1.5 Project Resource Requirements

The peak direct manpower requirement for this project is approx. 3,600. During operation phase, the project will require operating manpower at the Pumping & Metering Station (P&MS) facility and the other areas during maintenance activities.

The land take for the pipeline route is acquired based on the right of way. The majority of the land take is from KOC. In addition, at other areas the land has been acquired from KNPC / KIPIC and other government sectors. The pipelines are buried below ground level as per KOC procedures.

Various types of civil construction materials are required for construction and commissioning of the project including fresh water, gatch, concrete blocks, scaffolding materials, etc. Procurement is done through local & international suppliers as and when required.

Construction equipment and machinery is deployed at the construction site by local contractors. This includes cranes, welding machines, gas cutters, water pumps, compressors, trailers, pick-up trucks, boom trucks, vacuum tankers, diesel tankers, water tankers, man lifts, power generators, passenger buses, commuting sedans and ambulance.

The fresh water requirement includes approximately 5,000 m³ for construction works, plot preparation, concrete curing and miscellaneous requirements. Approx. 22,000 m³ is required for hydrotesting, which will be met from external suppliers (MEW) / KOC brackish water supply. The average demand for potable water is approx. 156 m³/day.

The power required during the construction stage is provided by the Contractor through portable power generators at site as and when required. During the operation stage, the facilities are connected to the nearest MEW power supply facilities.

2. PROJECT DESCRIPTION

2.1 Project Location

The route for the feed pipelines is parallel to the existing pipeline corridor from Ahmadi to Al-Zour (Project EF/1760). The pipelines start from Mina Al-Ahmadi (MAA) Refinery / South Tank Farm (STF), and end at the Zour Oil Refinery (ZOR). The pipeline corridor crosses various roads, desert area, and Sabhka land area. The total width of the pipeline corridor varies from 260 to 350 m. The total length of the pipeline corridor varies between 50 and 60 km. In addition, a Pumping and Metering Station (P&MS) is located at Al-Ahmadi to pump the crude feedstock to ZOR. The overall project location map is provided in the below Figure 1.



Figure 1. Project location map

2.2 Project Scope

The 'KOC Feed Pipelines for New Refinery Project (NRP)' project comprises the following components and facilities:

- Feed and product pipelines;
- Pumping and Metering Station;
- Sectionalizing valves;
- Pig launchers and receivers;
- Pipeline portable flares;
- Fuel gas burn pit;
- Drip barrels;

- Corrosion monitoring;
- Cathodic protection;
- Thermal oxidizers;
- Instrumentation and Control Systems; &
- Electrical systems, etc.

During the operation phase, transportation of crude oil, FG, LSFO and LPG to and from the ZOR refinery will be carried out. In addition, all related components will be in operation to ensure safe working and transporting of the feeds and products. Operation of the various facilities and components includes the pumping and metering system, valves, pig launchers and pig receivers, controls and instrumentation, etc.

2.3 Alternative Assessment

The route map for the pipeline has been selected based on the proximity to the existing utilities and pipeline corridor while avoiding any interference and disturbance to the existing facilities. This also facilitates proper execution of tie-ins with existing facilities. A number of process safety studies have been conducted for the project to study the risks emanating from the project during construction / operation stages.

The 'No Go' alternative would preserve the existing environmental setting and current conditions at the project site. On the other hand, implementing the project will have some impact on the existing environment; however, the majority of these impacts assessed are temporary in nature and will occur over a short period only, i.e. during construction stage. By applying the recommended mitigation and recovery measures, most of these impacts will be either minimized or even eliminated. Considering the fact that the identified environmental and social impacts will be suitably mitigated, it has been determined that the 'No Go' option can be eliminated.

3. ENVIRONMENTAL BASELINE SURVEY

The environmental and social baseline data collection has been conducted in the context of the project's area of influence that represents the surrounding environment, which is likely to be affected by the Project. This includes Contractor's activities and KOC facilities that are directly owned, operated or managed (including by contractors) and that are components of the project, as well as unplanned but predictable impacts caused by the project and indirect impacts that affects ecosystem upon which the impacted communities' livelihoods are dependent.

3.1 Climate and Meteorology

Kuwait has a hyper arid desert climate, hot and dry. Typical average rainfall is 116 millimeters a year across the country. Minimum annual levels have been recorded as low as 31.3 millimeters while maximum annual rainfall has reached 242.4 millimeters. In summer months, average daily high temperatures range from 42 °C to 46 °C, with the highest-ever recorded temperature of 53.5 °C at Mitiriba meteorological station in the North West on August 3, 2011. The lowest temperature recorded was -4 °C at Kuwait City in January 1964.

3.2 Topography

The project is executed in the South Eastern part of Kuwait. Average site elevation at the P&MS area is 52 m above mean sea level. Site elevation of the pipeline route around the Shuaiba industrial area ranges from 87 m to 108 m. The Southern section of the pipeline route near the ZOR area ranges from 2 m to 20 m. The major land for the project falls under open desert area. The terrain at Ahmadi STF is observed as flat. The area near KOC STF area is surrounded by an industrial and refinery zone. The nearby urban settlements include East Al-Ahmadi and Fahaheel. Numerous camps including nomadic communities and contractor work camps would be noticed. Near Azzour area, some places are observed as Sabkha wet land. Sparse vegetation can be observed at the Sabkha land at the Southern portion of the pipeline route.

Land use for most of the project area as classified by Environmental Monitoring Information System of Kuwait (eMISK) is under 'Open areas / Desert areas'.

3.3 Soil

A soil investigation study was conducted at the project site at three (3) boreholes drilled to 10.0 m depth below existing ground level. Soil classification tests and standard Penetration Tests (SPT) were conducted at each location. In general, the soil is made up of inter layers of silty sand & clayey sand. The soil has strong reaction with dilute hydrochloric acid. Ground water can be encountered at the borehole in Al-Zour location at a depth of 1.5 m below ground level.

To characterize the soil quality, representative soil samples were collected at all three (3) borehole locations at a depth of 0.1 m below ground level. The analysis of the soil samples revealed that the soil is not contaminated by any past history of oil spills. Heavy metals viz., Arsenic, Beryllium, Boron, Cadmium, Lead, Chromium (Hexavalent), Mercury & Silver exist below detectable limits.

3.4 Hydrology

There are no permanent surface water catchments in the project area. During the rainy season, rainwater will be collected at some low depression areas but it will evaporate due to high evaporation rates and low soil permeability.

The project site does not fall under any ground water field as per the ground water field map of the State of Kuwait. Soil investigation shows that, ground water table can be found near Al-Zour area at a depth of 1.5 m below ground level. This might be due to the intrusion of seawater considering the close proximity to the shoreline. Results of ground water sample infer that Sulfide was found to exist below 0.1 mg/l. As a result of seawater intrusion, the Chloride content and the Total Dissolved Solids (TDS) was analyzed as 38,300 mg/l & 39,400 mg/l respectively.

3.5 Ambient Air Quality

Ambient air quality monitoring conducted at three (3) representative locations, using a mobile laboratory with online ambient air monitoring sensors, shows that all the pollutant concentrations are within the KEPA limits. Polycyclic Aromatic Hydrocarbons (PAH) exist below detectable limits at all the monitored locations.

Being a desert area, sandstorms are a common phenomenon in Kuwait, which induces heavy particulate matter suspension in the air for long hours to even a few days. This is the reason for high concentrations of particulates. Probable sources of Non-Methane HydroCarbons (NMHC's) in ambient air is from vehicle exhaust and Oil & Gas exploration / production activities.

3.6 Noise

Environmental noise levels monitoring conducted at three (3) representative locations, using Type 1 Sound Level Meter, shows that the baseline environmental noise levels (LA_{eq}) are within the standards as specified by KEPA for industrial limits.

The day time noise levels near location 1 (South Sabahiya) ranges from 63.17 dB(A) to 72.18 dB(A) with LA_{eq} of 66.17 dB(A). Noise sources include construction works near the monitoring site and traffic movement (road no. 30). At location 2, the day time noise levels ranges from 53.75 dB(A) to 58.64 dB(A) with LA_{eq} of 56.58 dB(A). The only source of noise includes the traffic noise generated from the nearby road no. 306 (Wafra road). At location 3, the day time noise level ranges from 64.50 dB(A) to 70.37 dB(A) with LA_{eq} of 67.93 dB(A). The elevated noise

levels were due to the high influx of vehicle movement along road no. 270 belonging to ongoing construction activities at the Al-Zour area.

3.7 Sabkha

The southern section of the pipeline route near Al-Zour area has Sabkha areas. Sabkha is an Arabic term commonly used to denote a salt flat, or a shallow depression. Sabkhas normally occur near sea level or at the underground water level. They usually are encrusted with a salt crust layer, the thickness of which depends on the location of the Sabkhas and the evaporation rate. Sabkhas are one of the prominent surface topographical features in the Kuwaiti coastal zone, occupying an area of about 769.4 km², equivalent to 4.3 percent of Kuwait's total surface area.

3.8 Ecology

The project area and surroundings have not been included under any of the protected areas nor are they included in the Biosphere Reserves / National parks of Kuwait. Proposed natural reserves at and around the ZOR refinery include Al-Khiran nature reserve. No fauna was identified along the pipeline corridor route and no endangered species were identified.

The Sabkha land is characterized by the spread of salt-tolerant plants that form nabkas, which have a significant role in fixing the sand, and reduce the impact of sand encroachment. At Al-Zour area there is presence of Arfaj (Rhanterium epapposum). No dense vegetation has been identified along the other sections of the pipeline route except near the P&MS area between road no. 30 & 40 where a palm tree plantation is located. At this location, a small portion of the trees is located in the pipeline corridor.

3.9 Socio-Economic

The pipeline route is devoid of any permanent human settlements except for nomadic communities and construction camps for the ZOR project. Hence, major evacuation / resettlement / rehabilitation of people affected by the project is not involved in this project. The project site falls under the jurisdiction of Al-Ahmadi Governorate. Al-Ahmadi Governorate has a total population of 959,009 consisting of 20 residential areas including Fahaheel, Ahmadi, Sabahiya, Rigga and the district extends down south to Wafra and Al-Zour on the border with Saudi Arabia.

4. ENVIRONMENTAL IMPACT AND MITIGATION MEASURES

4.1 Impact Rating

The various environmental aspects and their impacts have been evaluated using the KOC recommended matrix. Both construction and operation stage impacts varied from 'Low' to 'Medium' impact level. To further reduce the environmental impact, a number of measures have been taken as described below.

4.2 Mitigation Measures during Construction Stage

4.2.1 Air Emissions

Air pollution due to generation of engine combustion emissions from construction machinery / equipment, temporary power generators and transport vehicles / trucks is mitigated by applying the following procedures:

- Sensitize drivers and machine operators to switch off engines when not in use;
- Regularly service engines and machine parts to increase their efficiency and reduce generation of exhaust emissions;
- Where feasible, use alternative non-fuel construction equipment.

4.2.2 Noise

Noise impact is an occupational hazard for the workers. The generated noise during construction can be considered as a direct non-cumulative impact with a short-term and reversible nature on any possible receptors on the site (people). The mitigation measures of noise impacts arising from the construction activities are considered as follows:

- Substitution of noisy equipment with others less noisy, whenever and wherever possible;
- Shut down all site engines, when the equipment or vehicle is idling or not in use;
- Install acoustic enclosures for power generators, and other construction machinery;
- Since workers are the main receptors of noise, they are advised to wear adequate ear protection (e.g. muffs, plugs).
- Noise levels emanating from machinery, vehicles and noisy construction activities (e.g. excavation) are kept to a minimum for the safety, health and protection of workers within the vicinity of the site.

4.2.3 Waste

Waste is managed and minimized at site in accordance with KOC HSSEMS procedures and KEPA Decisions. Temporary sanitation facilities are provided via a number of portable cabins. Wastewater is being collected using collection tanks and periodically disposed through KOC / KEPA approved waste management contractors using vacuum trucks.

4.2.4 Hydrotest Water

Hydrotesting occurs during the commissioning stage. This involves filling vessels, pipelines, tanks and piping with water. The hydrotest waste water would not be disposed of untreated. As per KEPA Decision, the measures to prevent pollution and control of hydrostatic test water include the following:

- Use the same water for multiple tests;
- Reduce the need for anti-corrosion and other chemicals;
- Reduce the water retention time of the equipment or the pipelines;
- If the use of chemicals is necessary, the least hazardous alternatives will be selected in terms of potential for toxicity, bioavailability, biological availability, bioaccumulation;
- Water discharged during abrasion and pre-test water is collected in HDPE lined disposal pit and is discharged only after a water quality test has been carried out to confirm and monitor the water quality parameters;
- Final disposal is arranged through KOC / KEPA approved waste management contractors.

4.2.5 Worker Risks and Hazards

Workers at the construction site may be exposed to various risks and hazards including slips, trips, falls, flammable and explosive substances, electrical shocks, dust, noise and vibrations, poor hygiene, fire, bruises and cuts, exposure to H₂S, chemicals, etc. The Contractor has implemented all necessary measures to ensure health and safety of its construction laborers during the construction activities in its Health, Safety and Environment Plan in accordance with the KOC HSSEMS procedures and standards for occupational health and safety.

4.2.6 Habitat

For habitat restoration, replanting of palm tree plantation has been implemented. Impacts from soil disturbance activities on the Sabkha area are mitigated by implementing appropriate spill management, avoiding dumping, preventing sand encroachment and by adopting best management practices. Top soil is preserved at site by segregating and re-instating the same after completion of works.

4.3 Mitigation Measures during Operation Stage

4.3.1 Air Emissions

Air emission control will be applied in accordance with KOC HSSEMS procedures. Best available technology will be used to control emission levels within KEPA limits and where practicable, continuous monitoring and alarm system will be provided for the flare packages and thermal oxidizers. Continuous monitoring of flaring will be done with international approved methods (USEPA). Regular maintenance will be done to reduce air emissions. Flares and oxidizers are designed to limit environmental impacts and are only used intermittently. The flares are elevated to ensure proper combustion of the inlet streams. The oxidizers are non-visible flame and smokeless and provisions are made for recording of all measured parameters with remote access to controls and alarms. The burn pit is lined with refractory, surrounded by a protective dyke, which minimizes the impacts on the soil / ground water and is located far away from roads and human settlement area located where prevailing winds will reduce fire / thermal hazards and smoke nuisance. Fugitive emissions will be controlled by regular maintenance. Personal exposure to fugitive emissions will not exceed occupational exposure limits as per KEPA standards. Operation specific procedures will be developed especially for emissions with high acute toxicity, e.g. H₂S.

4.3.2 Noise

Noise control measures will be implemented as per KOC HSSEMS procedures. Noise dispersion modeling of flare and oxidizer operation during maintenance case has shown that areas with noise level exceeding 85 dB(A) are observed only within 200 m from the flare location. Specific ear protectors will be used according to KOC standards and HSSEMS procedures for personnel working around noise sources during maintenance cases.

4.3.3 Hazardous Material

Uncontrolled release of hazardous materials may result from equipment failure associated with events such as manual or mechanical transfer between storage systems or process equipment. Spillage / Contamination of land will be avoided by prevention, or where avoidance is not practicable, controlling the release of hazardous materials, hazardous wastes, or oil to the environment. Spill response and containment equipment (for both hydrocarbons and chemicals) will be made available on site, as specified by relevant procedures and the operations spill response plan.

4.3.4 Environmental Monitoring

Besides the various mitigating recommendations and procedures for environmental control, environmental monitoring will be done on a periodic basis and will be reported to KEPA. This monitoring plan will act as a tool to assert the efficient operation of the mitigation measures adopted at the project. Monitoring and periodical reporting to KEPA will be done by KEPA approved environmental consultant once every six (6) months / annually or as recommended by KOC / KEPA.

4.4 Residual Impact Rating

The mitigation measures as described below have been applied to re-assess the 'Medium' impact levels. Implementation of the mitigation measures reduces the impact severity level from 'Medium' to 'Low' for all 'Medium' impacts.

5. CONCLUSION

It is evident that, upon successful commissioning and operation of the project KOC will be able to transport crude and products from / to the ZOR project.

The environmental impacts have been assessed based on KOC HSSEMS Procedures and applicable KOC standards considering all stages of the project.

An Environmental Management Plan (EMP) is being developed to ensure sustainability of the site activities from construction through to operation. The plan provides a general outlay of the activities, associated impacts, and mitigation action plans. Implementation timeframes and responsibilities will be defined.

An Environmental Monitoring Plan has also been framed and highlights some of the environmental performance indicators that should be continually monitored. Monitoring creates possibilities to call to attention changes and problems in environmental quality. It involves the continuous or periodic review of operational and maintenance activities to determine the effectiveness of recommended mitigation measures. Consequently, trends in environmental degradation or improvement can be established, and previously unforeseen impacts can be identified or pre-empted.

It is concluded that all the identified environmental impacts are reduced to the acceptable minimal level ('Low') by adopting suitable mitigation measures.

Due to the operational benefits from the project and the fact that the identified environmental impacts will be suitably mitigated, it has been determined that the 'No Go' option is eliminated.