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ADNOC

Non-technical Executive Summary FEED Environmental Impact Assessment (EIA) report of RLNG

CONTENTS

ABBREVIATIONS

ADNOC	Abu Dhabi National Oil Company
ALARP	As Low As Reasonably Practicable
BAP	Biodiversity Action Plan
BOG	Boil-Off Gas
CALPUFF	California Puff Model
CEMP	Construction Environmental Management Plan
CO	Carbon Monoxide
CWMP	Construction Waste Management Plan
EDGs	Emergency Diesel Generators
EIA	Environmental Impact Assessment
ELARD	Earth Link and Advanced Resources Development
ENVID	Environmental Impact Identification
EPC	Engineering, Procurement, and Construction
ERP	Emergency Response Plan
FEED	Front End Engineering Design
GHG	Greenhouse Gases
HSEIA	Health, Safety, and Environmental Impact Assessment
LDAR	Leak Detection and Repair
LNG	Liquefied Natural Gas
MES	Monaco Engineering Solutions
MMOs	Marine Mammal Observers
MOCCAE	Ministry of Climate Change and Environment

TPA	Million Tonnes Per Annum
NO2	Nitrogen Dioxide
OGMP	Oil and Gas Methane Partnership
O&G	Oil and Gas
PEMS	Predictive Emission Monitoring System
PPE	Personal Protective Equipment
PSV	Pressure Safety Valve
RLNG	Ruwais Liquefied Natural Gas
SO2	Sulfur Dioxide
UAE	United Arab Emirates

1. INTRODUCTION

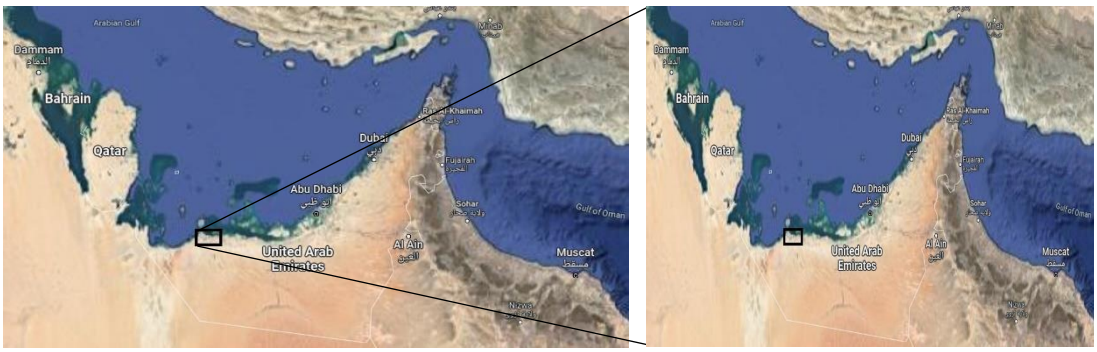
The ADNOC Ruwais LNG FEED Project aims to establish a two-train, near net-zero electrically driven LNG facility, catering to international markets. The project is strategically located adjacent to the Ruwais Refinery West in the UAE, covering approximately 2 million square meters within the Ruwais Industrial Area.

This report provides an executive summary of the FEED EIA study conducted for the RLNG Project. It is based on project information obtained from the ENVID study, along with surveys and monitoring studies that represent existing environmental conditions. The report includes summary of both qualitative and quantitative assessments of the anticipated environmental impacts associated with the project.

1.1 PROJECT LOCATION AND SCOPE OF WORK

The project is located adjacent to the Ruwais Refinery West, UAE, comprising approximately 2 million square meters within the Ruwais Industrial Area. The feed gas for the project will be supplied from the Habshan gas processing plant. Overall project location is shown in Figure 1 below:

Figure 1: Project Location



The RLNG Project comprises of the following works:

- Gas liquefaction via 2 x 4.8 MTPA electrically driven LNG trains.
- Common facilities including LNG storage, BOG handling, flare, refrigerant storage, and buildings.
- Utilities to support the facilities including import power from the national grid.
- Marine facilities for LNG export and bunkering.

1.2 OBJECTIVE OF THE EIA

This Environmental Impact Assessment (EIA) report aims to confirm that environmental impacts from the project are not significant and to propose mitigation and monitoring measures to manage the identified impacts.

The objectives of the EIA study are to:

- Identify and evaluate key environmental and social impacts and measures for mitigation monitoring plans for the Project to ensure environmental impacts are mitigated and managed at As Low As Reasonably Practicable (ALARP).
- Ensure efficient use of resources.
- Propose recommendations with assigned responsibilities to ensure the project activities do not pose any “Significant” environmental impacts and the Project is designed in compliance with the ADNOC Standard’s requirements.

2. LEGAL FRAMEWORK AND STANDARDS

The environmental legislative and regulatory framework in the UAE, particularly relevant to ADNOC, includes numerous laws, international conventions, and Management Action Plans. The Ministry of Climate Change and Environment (MOCCAE) oversees these frameworks. The key law is Federal Law No. 24 of 1999, which mandates environmental protection across the UAE by controlling pollution, conserving natural resources, and protecting human and ecological health. ADNOC, under Article 94 of this law, self-regulates aspects like environmental permits, monitoring reports, and waste management for the O&G sector. However, activities within ADNOC concession areas still must comply with Federal Law No. 24’s emissions, waste discharge limits, soil and flora protection regulations. Additionally, Local Law No. 8 of 1978 outlines the need for entities to prevent operational damage to individuals, properties, and natural resources, emphasizing the prevention of air and water pollution. Federal Decree-Law No. 11 of 2024 on the Reduction of Climate Change Effects is a UAE law that mandates companies and authorities to manage and reduce their greenhouse gas (GHG) emissions, taking effect on May 30, 2025. The law requires a mandatory Measurement, Reporting, and Verification (MRV) system for all GHG emissions and requires entities to develop and implement climate change mitigation and adaptation plan. In addition to complying with these regulatory requirements, the project adheres to all HSE standards established by ADNOC and aligns

with its management frameworks. The legislative framework and internal standards collectively ensure that the project is executed in full compliance with prevailing environmental laws and company specific practices.

3. SUMMARY OF FINDINGS

The EIA report has been prepared in compliance with the ADNOC's HSEIA standards and in accordance with regional and national regulations to address impacts associated with the LNG facilities. This ensures that potential impacts, both direct and indirect, are identified, assessed, and mitigated effectively during the project design, implementation, and operation phases.

The following activities have been carried out for the project and study results are summarized herewith.

3.1 ENVID STUDY

The development of the EIA report followed a systematic approach, starting with an ENVID workshop to identify potential environmental impacts emphasizing design considerations, administrative controls, and monitoring measures. The workshop findings categorized potential environmental impacts related to operations and maintenance into planned and unplanned impacts. Of the identified consequences:

- Planned impacts were primarily classified as Medium and Low, with no High impacts and only one rated as High-Medium.
- Unplanned impacts were also predominantly medium and Low, with two classified as High-Medium

These results highlight a manageable environmental risk profile, with most impacts considered moderate or minor. Recommendations from the workshop have been addressed to mitigate risks effectively. Actions initially planned for reassessment, have been transitioned to the EPC contractor to align with the evolving project scope ensuring that critical environmental aspects are comprehensively managed.

In addition, subsequent assessments were carried out to address data gaps and obtain project-specific baseline information, on soil, groundwater, and marine environment.

3.2 SOCIAL IMPACT ASSESSMENT SCREENING STUDY

The Social Risk Screening study was performed as a team-based workshop and carried out in accordance with the worksheet format and standard guideword approach provided in the Social Risk Management Standard. The output of the workshop is used to develop a Social Impact Assessment Screening report and inform the scope of Social Baseline Studies, Social Impact Assessment and Management Plans as well as External Stakeholder Engagement Plan (ESEP). The project has been classified as “Medium” risk during the workshop.

3.3 ENVIRONEMTAL BASELINE CONDITIONS

Requirements for additional information on marine ecology, soil and Groundwater quality have been determined during scoping phase to update the EIA study. Baseline monitoring and surveys proposed were implemented.

Baseline soil and groundwater surveys were conducted to address data gaps and establish environmental conditions within the project development area.

For soil, nine samples were collected from multiple locations from/within main development area. These samples were analysed in accordance with relevant regulatory standards. The results confirmed compliance with all applicable soil quality criteria, indicating no exceedances.

Groundwater sampling was carried out at five designated locations during the same period, following standard procedures to ensure representative results. Analysis confirmed compliance with all applicable groundwater quality standards with no significant concerns or exceedances identified.

The project is located within an industrial area characterized by existing noise sources, including industrial operations, vehicle traffic and other associated activities. A noise survey was conducted at representative locations during both daytime and nighttime periods. The survey results indicated that daytime noise level were compliant with federal noise standards and limit at most locations. Nighttime noise levels exceeded permissible limits at a few locations, primarily due external sources such as road traffic and localized activities in adjacent areas.

Marine ecological assessments have been conducted in the project area, and measures will be planned in place to ensure responsible environmental management. The EPC contractor will prepare a detailed habitat assessment to assess potential impacts and recommend mitigation measures to minimize

environmental impacts and ensure compliance with environmental regulations and support project commitments.

3.4 ENVIRONMENTAL IMPACT ASSESSMENTAND SOCIAL IMPACT ASSESSMENT

3.4.1 Air Dispersion Modelling Study

RLNG project facility adopts a “No continuous Flaring” philosophy, ensuring emissions are minimized during normal operations. Emission sources, including emergency flares and diesel generators, are limited to use in emergency scenarios only. Air dispersion modelling study, conducted in compliance with ADNOC standards, assessed key pollutants such as NO2, CO, SO2 and PM10 using the CALPUFF dispersion modelling system, in compliance with ADNOC air dispersion modelling standard. Results confirmed negligible air quality impacts during normal operations, with emissions primarily associated with emergency events. Potential impacts during the commissioning phase, will be addressed during EPC stage.

3.4.2 GHG Assessment Study

A GHG assessment has been prepared in accordance with ADNOC’s guidelines for GHG project management. The GHG assessment study evaluated scope 1 and 2 greenhouse gasses (GHG) emissions associated with the project to identify engineering and management measures to align with project target as ADNOC’s lower-carbon LNG project. The facility will utilize clean energy from its startup, resulting in zero scope 2 emissions. The majority of emissions are attributed to flaring during emergencies, followed by venting and negligible contributions from emergency generators, firewater pumps and fugitive emissions.

3.4.3 Marine Baseline Survey

Marine baseline surveys were conducted to evaluate ecological conditions in the project area using advanced and standardized sampling techniques. The results highlighted the need for sediment sampling to ensure safe disposal practices and evaluate sedimentation effects from dredging activities. Mitigation measures, such as habitat restoration, will be implemented as necessary to minimize impacts.

3.4.4 Noise Modelling Survey

The noise modelling study was conducted using the Sound PLAN Software (SoundPLAN 9.0). A 3-dimensional model was produced by defining the relative/absolute heights of the local ground surfaces, sources and any obstacles that may provide noise screening. 1/1 octave band spectral data for all

sources was used. The study confirmed that environmental noise levels during normal operations remain within permissible limits for sensitive receptors, with minor exceedances attributed primarily to high baseline noise levels due to existing traffic. Mitigation measures, including noise barriers, will be implemented to ensure compliance.

3.4.5 Social Impact Assessment

The Social Impact Assessment (SIA) has identified several potential social impacts associated with the Ruwais LNG Project. These impacts may be either routine (planned) or accidental (unplanned). The assessment was conducted according to the SRM standard, evaluating both direct and indirect effects on social receptors and other external stakeholders based on the severity and likelihood of these impacts.

During the construction phase, the social impacts include road traffic congestion due to workforce transportation, affecting other road users, as well as increased community health and safety risks from additional vehicles. Underwater noise generated from piling and dredging activities could disturb marine fauna and adversely affect tourism and fisheries. Additional concerns include noise generation from onshore and offshore piling works impacting sensitive receptors, increased navigational risk due to maritime exclusion zones and construction vessels, and potential inappropriate behavior of migrant workers.

In the operation phase, potential impacts include air quality pollutants, noise from flare operations, visual impacts from ground flare operations during emergencies that may have local impacts. Impact related to the increase of navigation compared to the regular vessel movements has been assessed.

Based on the SIA study, the overall unmitigated risk level is considered to be “Medium.” However, with the implementation of mitigation and monitoring measures, it is anticipated that the overall risk will be reduced to “Low.”

3.4.6 Other Environmental Components

- Illumination Effects: Potential concerns from ground flare illumination will be addressed through further studies in the EPC phase.
- Terrestrial Ecology: The project is located on reclaimed industrial land with no significant ecological impact anticipated.

- Water and Sediment Quality: Design measures, including effluent routing and containment, ensure no routine discharge to marine environment..
- Waste Management: A waste management plan is in place to ensure safe collection, segregation, and disposal of hazardous and non-hazardous waste streams.
- Soil and Groundwater Quality: Mitigation measures prevent contamination from diesel storage and equipment operation.
- Resource Use and Traffic: The project will rely on public utilities, with no significant impact on existing infrastructure anticipated.
- The EIA underscores the project's commitment to sustainable development through robust mitigation measures and compliance with regulatory requirements. Further studies during the EPC phase will refine these measures to minimize envir006Fnmental impacts.

3.5 MITIGATION MEASURES AND MONITORING PLAN

The mitigation plan below has been developed in the FEED stage based on the available data. The study shall be further revalidated based on the updated design parameters during the EPC stage and the mitigation measures will be updated accordingly.

3.5.1 Air Quality and GHG emissions

The mitigation measures for the air and GHG emissions focus on minimizing the environmental impact during both construction and operational phases of the project. During construction measures include dust suppression techniques such as water spraying during high dust generating activities and the use of low-sulfur diesel fuel to reduce emissions. Regular maintenance of construction equipment and vehicles will ensure compliance with emissions standards, while machinery and vessels will be monitored for visible smoke. A closed system of for sewage collection and disposal will address potential odor issues, supported by routine maintenance of treatment facilities.

Infrastructure has been designed prioritizing international standards, and consider the use of high efficiency enclosed smokeless flares with a destruction efficiency of at least 98%. Flare systems will be placed downwind to sensitive receptors to minimize impacts on sensitive receptors and undergo routine maintenance. Preventive programs, such as leak detection and repair (LDAR), will be implemented alongside the use of energy-efficient systems. Infrastructure will also incorporate paved access roads to reduce dust. Odor controls units will be included in the sewage treatment plants as necessary.

The monitoring plan encompasses a comprehensive approach to emissions oversight. Regular flare flow monitoring during operations will be conducted as per ADNOC standard, with annual reporting of facility emissions also adhering to this standard. The plan includes a fugitive emission monitoring program, regular inspections for leaks, and the implementation of a PSV monitoring system alongside visual inspections for emissions. GHG emissions will be estimated and reported in with local and international standards, and methane emissions will be reported according to OGMP 2.0 criteria. The plan further complies with ADNOC Air Emissions Monitoring System (AEMS) requirements.

3.5.2 Marine Environment

The mitigation measures for the marine environment aim to address potential impacts on marine environment habitats and wildlife during construction and operational phases. During construction, measures include compliance with ADNOC and MARPOL standards for sewage management, ensuring proper disposal of bilge water and the use of environmentally friendly chemicals. Ships must have approved sewage treatment systems, and no discharge into the sea is permitted. Hydrotest procedures and surveys will be conducted to assess subsea facilities, and anchor mooring will follow ADNOC standards to minimize contamination. For marine habitats and wildlife, a Biodiversity Action Plan (BAP) will be developed if critical habitats are identified. Marine Mammal Observers (MMOs) will monitor marine life, and underwater noise surveys will be conducted to mitigate noise impacts.

During the operational phase, the same standards for liquid discharges and pollution control will apply, including the implementation of facility response plans, spill contamination measures, and regular inspections to prevent contamination. All discharges will be managed in compliance with environmental regulations to minimize impacts on the marine ecosystem.

3.5.3 Noise

To address noise emissions and vibrations during construction and operational phases, specific measures are outlined to mitigate potential impacts. During construction, noise-generating equipment will be equipped with acoustic hoods and operated within permitted noise levels, while idle equipment will be turned off to reduce unnecessary noise. Regular maintenance of machinery will ensure optimal performance and compliance with standards. Noise shielding measures and vibration controls, particularly during pilling activities, will also be applied as needed.

For the operational phase, noise management will involve Emergency Diesel Generators (EDGs) within enclosures and situating mechanical equipment away from plant boundaries. Noise barriers and modelling studies will guide mitigation efforts, while routine equipment maintenance and the use of Personal Protective Equipment (PPE) in high-noise areas will minimize risks. Logistics operations will be optimized, and vessel specifications will adhere to noise control requirements to further reduce disturbances.

Monitoring programs are designed to ensure adherence to mitigation measures by conducting regular noise assessments in compliance with ADNOC HSE standards. Additional monitoring will focus on cumulative impacts, ensuring that overlapping activities do not exceed allowable thresholds, while residual impacts will be continuously evaluated.

3.5.4 Waste Management

Effective waste management plan during the construction and operational phases are critical to minimize the environmental impacts. In the construction phase, a “Reduce, Reuse, Recycle”(3Rs) will be adopted, particularly in worker accommodations, to promote waste minimization and recycling. A Construction Waste Management Plan (CWMP) will be implemented, ensuring that waste generation is reduced and managed appropriately. Waste segregation at source, proper transfer logistics, and a strict no-littering policy will be enforced. Approved vendors and facilities will handle domestic and hazardous waste in compliance with local regulations. Additionally, EPC contractors will provide clear documentation of waste disposal to ensure transparency and regulatory compliance.

During the operational phase, a comprehensive waste reduction and recycling program will be established, with regular waste collection carried out by licensed contractors. Waste handling will follow ADNOC-approved procedures, including adequate training for personnel and visual inspections of waste streams to ensure proper segregation. Specialized waste management procedures will address hazardous and non-hazardous materials, ensuring disposal aligns with local and regulatory standards. Continuous monitoring and adaptation of waste practices will ensure effective long-term waste management.

3.5.5 Soil and Groundwater

Mitigation measures to protect soil and groundwater quality have been developed for both construction and operational phases. During construction, pollution, prevention and control measures will be

implemented in line with ADNOC standard. These include using drip trays to prevent leaks, maintaining spill containment kits on-site, and securely storing chemicals. A CEMP will be also enacted to effectively manage solid waste and wastewater in compliance with applicable standards.

In operational phase, pollution control will remain focus through implementation of bunding around chemical storage areas to contain potential spill and the establishment of an emergency Response Plan (ERP) to ensure immediate and effective response.

Monitoring programs will include regular inspections of chemical and waste storage areas to identify and address any spills and leaks. Waste monitoring and audits will follow established waste management standards, including physical checks of drip trays and containment systems to detect and repair any damage promptly.

These programs will also address cumulative impacts by maintaining strict adherence to ALARP principles, ensuring that environmental impacts remain within acceptable levels. This approach ensures continuous improvement and adherence to environmental regulations during all phases of the project.

3.6 EIA AND SIA ACTION PLAN

A detailed action plan has been developed to implement the measures outlined in the EIA report. This plan will guide the EPC phase of the project, ensuring compliance with environmental standards and mitigating potential impacts effectively.

Key recommendations include closing all pending environmental assessments and integrating essential environmental studies into the project to improve the evaluation of potential impacts during construction and operations phases. Air dispersion and noise studies will be updated using refined methodologies to ensure accurate assessments based on site-specific data.

To address construction impacts, the action plan includes modelling studies to evaluate potential effects on marine habitats and sedimentation processes. Waste Management measures will be implemented through a dedicated CWMP and sediment quality assessments to ensure safe disposal practices. Efforts to further reduce GHG emissions during EPC phase are also prioritized.

During EPC phase, Traffic and lighting studies will be conducted to assess the impact on transportation and illumination, aiming to reduce disruptions to the environment and local communities as part of the Social Impact Assessment (SIA) plan. Community engagements from the FEED phase will continue through the EPC and Operations phases as outlined in the External Stakeholders Engagement Plan (ESEP).

This action plan provides a robust framework to address environmental considerations during the EPC phase. Regular updates will ensure alignment with regulatory requirements, support responsible growth and community well-being throughout the project lifecycle.

4. FINAL OVERVIEW

The EIA and SIA serve as a cornerstone in ensuring the proposed project is executed with a firm commitment to environmental and Social sustainability. By thoroughly evaluating potential impacts and introducing comprehensive mitigation measures, this assessment sets a precedent for protecting natural resources, preserving ecosystems and fostering community well-being.

The implementation of targeted mitigation measures and dynamic monitoring programs guarantees that environmental concerns-spanning air quality, soil, groundwater and marine ecosystems are effectively addressed. These proactive measures go beyond regulatory compliance, reflecting the project's dedication to achieving excellence in responsible growth.

In essence, the EIA represents more than just a regulatory requirement. It is a blueprint for a sustainable future. By adhering to the mitigation measures and action plan outlined in the report, the project positions itself to deliver enduring benefits, balancing economic advancement with preservation of vital natural resources.