ENVIRONMENTAL AND SOCIAL REQUIREMENTS FOR CONTRACTORS: ANNEX 01 – AIR QUALITY, GREENHOUSE GASES AND ENERGY EFFICIENCY

ROVUMA LNG PROJECT

MZLN-EL-RBENV-00-0001

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1. PURPOSE AND SCOPE

This document is one of a series of topic-specific supporting annexes contained in the overarching document: Environmental and Social Requirements for Contractors: Environmental and Social Management System (ESMS).

These annexes define the processes that need to be followed and the control measures that must be applied to ensure the delivery and approval of a topic-specific Contractor Implementation Plan (CIP) and other implementation deliverables ahead of commencing activity.

Where the final design basis or execution strategy has not been determined and alternatives exist, an analysis of alternatives (taking environmental and social (E&S) factors into account) shall be undertaken. This analysis shall be based on an accurate characterisation of the local setting using up-to-date baseline data and an assessment of the risks and impacts related to each alternative.

Where the project base case has already been determined, additional baseline information may be required to inform an up-to-date / site-specific E&S risks and impacts evaluation. This evaluation may result in a refinement of control measures relative to the local conditions and licensing requirements.

1.1. Objectives

The overall objective of this document is to set out all the E&S requirements that need to be fulfilled in order to prevent and manage potential E&S risks and impacts associated with a) air emissions; and b) achieve energy efficiency by implementing reasonably practicable energy efficiency solutions.

1.2. Scope

For the purposes of this document Air Quality, Greenhouse and Energy Efficiency covers the land-based facilities and activities, as well as nearshore marine vessel activities, in all project phases that generate combustion emissions (such as gas turbines, incinerators, flares, diesel engines), fugitive emissions (methane and volatiles) and/or which demand power (such as power generation, operation of buildings and LNG and support processes) where energy efficiency controls can reduce emissions of greenhouse gases. Emission controls for land-based and marine transportation are also covered in Road Traffic and Transport and Marine Operations annexes respectively. Design and installation of incinerators is covered under Waste Management.

This document does not cover impacts on the project from climate change (e.g. sea level rise, temperature increases).

This document follows the overall Scope definition outlined in the E&S Management System Requirements for Contractors described in Section 2.2 of that document.

1.3. Linkage to Other Contractor Requirements

This document is an overarching document which is supported by a number of topic-specific annexes. It also needs to be read in conjunction with Section D (Scope of Work) and Section F (Coordination Procedure) to provide a holistic view of E&S requirements.

This document should be read specifically in conjunction with Road Traffic and Transport Annex, Marine Operations Annex and Waste Management Annex.

1.4. Background Context

The project has chosen to be self-sufficient in power generation for both the construction and operations phase and no power will be taken from the Mozambican electricity grid.

For the operations phase, power (electricity) generation and power for gas compression will be provided by gas turbines using gas produced by Area 4. Additional significant sources of emissions in the operations phase are assumed to be process heaters, thermal oxidizers, waste incinerator, marine vessels (including LNG and condensate carriers) and fugitive emissions from piping systems, compressor seals and tank seals.

For the construction phase, it is assumed that the power demand (electricity) is likely to be much lower than operations with the main draws on electricity being buildings and area lighting and the running of electrical equipment. It is assumed that the power will be provided by mobile generators running on diesel fuel. The main emission sources in construction are likely to be from diesel-powered generators, marine vessels, the waste incinerator, mobile equipment, and transport emissions.

The Environmental Design Basis specifies general requirements for air emissions, plus sets numerical emissions limits and ambient air quality standards. The emissions inventory within the Anadarko / Eni EIA (2014), was written using the Pre-FEED project description - i.e. combined Area 1 / Area 4 development and a single Operator. The emissions inventory and related air dispersion modelling focused on emissions in the operations phase. The project basis has now changed with two operators constructing and operating simultaneously. Because of this, additional work is required to quantify and assess air emissions in the construction and operations phase.

1.5. E&S Risks and Potential Impacts

Table 1-1 outlines the E&S risks and potential impacts identified to date associated with Air Quality, Greenhouse and Energy Efficiency. This table is meant to provide insight to the risks and potential impacts which are possible and a guide for additional assessment activities required by Section 2.1 of this document. It also provides a reference to the control measures tables (Table 2-3).

Table 1-1: A Guide to Activities, Consequences, Risks and Potential Impacts

Activity	Potential Consequence	Risks And Potential Impacts
Process Plant with combustion emissions (e.g. Turbines)	Combustion Air Emissions (SO_X, NO_X, particulates, CH_4, CO_2) Energy Consumption	Degradation of ambient air quality (P1) Contribution to total country GHG emissions (P2) Consumption of non-renewable resource (NR4)
Routine / Emergency Operation of Flare System		
Operation of Machinery		
Operation of Vehicles and Vessels		
Burning of Materials		

Activity	Potential Consequence	Risks And Potential Impacts
Storage and Loading of LNG Vessels	CH4 Emissions	Degradation of ambient air quality (P1) Contribution to total country GHG emissions (P2)
Painting and Coating	VOC Emissions	Degradation of ambient air quality (P1)
Refrigeration and Firefighting	HCFC Emissions	Ozone depletion (P3) Contribution to total country GHG emissions (P2)
Operation of Buildings	Energy consumption GHG's (indirect)	Contribution to total country GHG emissions (P2)

2. REQUIREMENTS

2.1. E&S Assessment and Evaluation and CIP Development

As discussed in the overarching Environmental and Social Requirements for Contractors: Environmental and Social Management System (Section 2), due to the further refinement of the design since the EIA was prepared, and due to the Project seeking finance (which requires compliance with the International Finance Corporation (IFC) E&S requirements), it is anticipated that additional E&S assessment will be required for some topics which may result in the addition or refinement of E&S controls specified to date. This assessment, as outlined in the overarching ESMS document, includes three stages:

- Stage 1: Analysis of Alternatives
- Stage 2: E&S risk and impact evaluation of the project base case and refinement of control measures
- Stage 3: CIP development (based on the refined control measures).

For Air Quality, Greenhouse and Energy Efficiency, all 3 stages are required.

Stage 1 – Assessing Alternatives to Develop a Project Base Case

The requirements outlined in Table 2-1 must be completed in order to assess alternatives and determine the Project base case.

Table 2-1: Process for Analysis of Alternatives

Step	Specific Requirements	Responsibility
1	Prepare an energy efficiency / GHG reduction study for the operations phase, leveraging the Optimisation work, to determine whether design options can deliver energy efficiency gains. This study could include turbine type and configuration etc. Understand the trade-off of air quality vs energy efficient where relevant. No additional E&S baseline data is required for this study.	Company
2	Select final design basis considering the outcome of the energy efficiency study. Justify deviations from the most efficient / lowest GHG option.	Company
3	Identify opportunities for energy efficiency / GHG reduction in the construction phase and implement those that are deemed reasonably practicable. Document results in an energy efficiency / GHG reduction report.	Contractor

Stage 2 – Assessing the Project Base Case and Refining Control Measures

Once the project base case has been determined, the actions outlined in Table 2-2 are required in order to refine the preliminary E&S control measures outlined in Section 2.2.

Table 2-2: Process for Risk and Impact Assessment of Project Base Case

No	Specific Requirements	Responsibility
1	Update construction and operations phase air emissions inventories with level of detail sufficient to inform E&S air quality risk/impact assessment. For construction emissions, include vessels and road transport as well as onsite sources of emissions.	Contractor
2	Once the project base case and inventories are defined, determine if additional baseline ambient air quality data is needed.	Company
3	If required, collect additional (more detailed) environmental and social baseline information: *Environmental:* ambient air quality at environmentally or socially sensitive receptors (pre-project); ensure final baseline data characterizes seasonal variability and includes a comprehensive meteorological data set for dispersion modelling.	Company
4	Carry out onshore / nearshore dispersion modelling results (or equivalent data characterizing emissions attributable to Area 4 onshore/nearshore facilities and activities) for operations to determine potential impacts on air quality / potential to exceed air quality standards. Ensure assessment is informed by AERMOD (v18081 or newer) dispersion modelling results.	Contractor
5	Refine air emissions cumulative ambient air quality impact assessment as required.	Company
6	Assess whether the design and / or execution strategy needs to be modified or optimised in the light of knowledge gained from steps (3) (4) and (5).	Contractor
7	Assess whether there are sufficient / appropriate design and execution control measures in Table 2-3 to mitigate the identified impacts and risks and update if necessary and refine as necessary.	Contractor
8	Document results including a summary of the project description (final design basis or execution strategy), summary of the environmental and social baseline, risk / impact assessment method, results of the risk / impact assessments, the proposed list of refined control measures to be applied. There should be one report for the construction phase and a second report for the operations phase. .	Contractor

Stage 3 – Contractor Implementation Plan

The Contractor shall develop a CIP which outlines how they propose to implement the control measures in the Table 2-3 (including any proposed additions or refinements as applicable to the update and finalisation of the design and execution strategy), and how they propose to implement the management system requirements (as outlined in the E&S Management System Requirements for Contractors) which relate specifically to the topic of this document, in a way that conforms to E&S requirements. The CIP shall include the refined control measures developed in Stage 2.

2.2. E&S Control Measures

The control measures in Table 2-3 have been defined ahead of the site-specific risk / impact evaluations defined in Section 2.1. The Contractor shall apply these or seek agreement to apply a refined list, with justification for all changes based on the outcomes of assessments described in Section 2.1.

Where these requirements originate from the Anadarko / Eni EIA (2014), henceforth called the EIA, the EIA section reference is included. Similarly, the Government-approved Environmental Management Plans (EMPs) references are included for those relevant controls. As noted in the overarching ESMS requirements document, a number of additional controls have been identified as being required to meet lender expectations. As such, the EIA / EMP controls have been supplemented by good practice design and control requirements where practicable and appropriate, however, where any overlap is present, the EMP (and EIA) commitments should be considered paramount over good practice guidance in the hierarchy of adoption of such controls.

Table 2-3: E&S Control Measures

ACTIVITY / SOURCE OF POTENTIAL IMPACT	CONTROL MEASURE	IMPACT / RISK BEING ADDRESSED	SOURCE			NOTES
			EIA	EMP	Other	
Overarching Requirements						
General	Comply with the Air Quality Standards and Guidelines set out Table 12.1 of the LNG EIA, or any superseding Standard or Guidelines agreed with MITADER.		EIA 12.2.2	Area 4 AQ 2		**Captured in the EDB**
Design Requirements						
Process Plant	Investigate the feasibility of changing turbine technology to reduce SO_2 emissions or stack height to reduce ambient concentrations of SO_2.	P1, P2, P3	EIA 12.2.2	Area 4 AQ 1		
	Ensure gas turbine generators and gas turbine compressor drives are equipped with Good International Industry Practice NO_x controls.	P1, P2, P3			A	
Process Plant	All major combustion sources (excluding stand-by generators) shall have stack sampling ports accessible for isokinetic sampling at a location free of cyclonic flow during performance tests. Stack sampling locations shall adhere to US EPA 40 CFR 60 Method 1 "Sample and Velocity Traverses for Stationary Sources."	P1, P2, P3			A	
Storage and Loading LNG	All LNG storage tanks will be of full-containment design, or full-integrity design, in accordance with Good International Industry Practice.	P1, P2, P3	EIA 14.5.1	Area 4 UE 32		
	Facilities shall include vapor recovery equipment to recover and reprocess vapors generated from LNG storage tanks and LNG export vessels during LNG loading.	P1, P2, P3			A	

	Design the facility to minimise fugitive emissions.	P1, P2, P3	EIA 12.3.2	Area 4 AQ 11		
Flare	Facilities shall include an emergency detection and shutdown system.	P1, P2, P3	EIA 14.5.1			
Refrigeration and Firefighting	Do not select equipment that relies on CFCs, HCFCs, halons, 1,1,1-trichloroethane, carbon tetrachloride, methyl bromide or HBFCs.	P1, P2, P3			A	
Machinery and Equipment	The contractor will select and use best available technology to the extent practical to contribute towards electricity savings and thereby reduce the overall operational carbon footprint of the Project.	P1, P2, P3	EIA 12.3.2	Area 4 AQ 10, LNGMT AQ 8, MOF AQ 8, Shared AQ 8		
	Select low emission machinery and equipment based on good international industry practice. Opt for equipment designs that meet best practice standards (e.g. BAT) where these are established.	P1, P2, P3			A	

Buildings	The Project will reduce electricity consumption and GHG emissions from buildings using Good International Industry Practice (GIIP) as far as practical. Initiatives to be considered should include: 1. solar power: reductions in electricity use from buildings can be expected if all hot water is provided from water heaters and photovoltaic panels that can reduce fossil fuel-generated electricity; 2. insulation: well-insulated walls and ceilings will reduce temperature extremes within the buildings, leading to more comfortable living/working conditions and reduced air conditioning requirements; 3. lighting: use of natural light where possible, and compact fluorescent or LED lighting throughout the site will reduce the need for electricity generation; 4. cooling: use of energy-efficient air conditioners that use refrigerant gases with a low global warming potential (such as R134) 5. buildings (particularly offices): will be fitted with sensors, timers and control systems that allow lights and equipment to switch off or go onto standby when not in use (e.g. overnight).	P1, P2, P3, NR4	EIA 12.3.2	Area 4 AQ 4,5,6,7,8,9 Shared AQ 2,3,4,5,6,7 LNGMT AQ 2,3,4,5,6,7 MOF AQ 2,3,4,5,6,7		
Execution Requirements						
Energy Efficiency / GHG reduction report	Identify opportunities for energy efficiency / GHG reduction in the construction phase and implement those that are deemed reasonably practicable. Document results in an energy efficiency / GHG reduction report.	P1, P2, P3			A	
Energy Efficiency / GHG reduction	Optimization of transport logistics (e.g. equipment, products and people) and the use of energy- efficient vehicles and machinery and maintain them in good working condition to reduce fuel consumption.			Area 4 AQ 3, LNGMT AQ 3, MOF AQ 3, Shared AQ 3		Previously in Annex 6

Process Plant Storage and Loading LNG	The Project will implement leak detection and repair program for potential fugitive emissions from valves, flanges, seals and connectors associated with LNG processing and storage.	P1, P2, P3	EIA 12.3.2	Area 4 AQ 13	A	Commissioning
Machinery, Vehicles and Vessels	Use low sulfur fuels in plant, machinery, equipment, vehicles and nearshore marine vessels.	P1, P2, P3			A	
	Inspect, service and maintain all plant, machinery, equipment, vehicles and marine vessels in accordance with manufacturer recommendations.	P1, P2, P3			A	
	Remove from service and repair any plant, machinery, equipment, vehicles or marine vessels that emit dark smoke or strong odors for at least a continuous one-minute period after start-up.	P1, P2, P3			A	
	Shut down machinery, equipment, vehicles and marine vessels when not in use.	P1, P2, P3, NR4			A	
Vehicles and Vessels	Marine vessels used to import construction material shall use low sulfur fuel while operating in the nearshore area.	P1, P2, P3			A	
	Nearshore marine construction and support vessels shall comply with the applicable air emissions limitations prescribed in MARPOL 73/78.	P1, P2, P3			A	
Painting and Coating	For painting/coating operations, select low-VOC paints/coatings and shall avoid using paint stripping agents containing highly hazardous VOCs such as Methylene Chloride.	P1, P2, P3			A	
Burning of Materials	Do not undertake open pit burning apart from special circumstances subject to risk assessment and prior approval by Company.	P1, P2, P3			A	
	Do not burn cleared vegetation subject to options assessment and prior approval by Company. Options assessment is to consider the following hierarchy: reduce (avoid clearing where not necessary); reuse (suitable cleared material to be re-used by timber mills or communities); transform (e.g. mulching of cleared vegetation); and lastly disposal (e.g. burning).	P1, P2, P3, P12, NR4			A	
Air Quality monitoring	Contractor shall carry out ambient air quality monitoring according to Company provided Minimum Environmental Monitoring and Reporting Plan.	P1, P2, P3			A	

3. DELIVERABLES

The following deliverables are associated with Air Quality, Greenhouse Gases and Energy Efficiency. Contractor deliverables shall be submitted to the Company for Company approval.

Table 3-1: Summary of Deliverables

Section Reference	Deliverable	Responsibility	Deliverable Date
STAGE 1			
Table 2-1	Topic-specific Alternatives Analysis Report, which as a minimum includes: 1) Overview of E&S baseline relevant to the options assessment screening 2) Alternatives analysis review, including details of E&S risks and impacts evaluation, as well as other relevant drivers for the decision-making process 3) Final recommendation on the Project base case.	Company	To be advised on contract award
	Energy efficiency / GHG reduction report for Construction phase.	Contractor	To be agreed on contract award
STAGE 2			
Table 2-2	Topic-specific E&S Report, which as a minimum includes: 1) Definition of the approved Project base case 2) Updated/refined baseline description, as applicable to the base case 3) Updated E&S risks and impacts evaluations 4) Refined list of E&S control measures.	Contractor	To be agreed on contract award
STAGE 3			
Table 2-3	Topic-Specific CIP, which as a minimum includes: 1) Approved list of E&S control measures 2) Details of how the approved control measures will be implemented (including linkage to other Project plans and procedures, where necessary, to demonstrate the implementation of the E&S controls committed to) 3) Details of the monitoring, reporting and assessment.	Contractor	To be agreed on contract award