Esso Highlands Limited

Papua New Guinea LNG Project

Environmental and Social Management Plan
Appendix 2: Air Emissions Management Plan

PGGP-EH-SPENV-000018-004

CONTENTS

TABLES

ATTACHMENT

1.0 OBJECTIVES

Esso Highlands Limited (Company) has developed this Air Emissions Management Plan as part of its Environmental and Social Management Plan (ESMP).

The objectives of the Air Emissions Management Plan are to:

1. Control emissions to atmosphere to below harmful levels
2. Optimise equipment to reduce greenhouse gases.

The Air Emissions Management Plan should be read in conjunction with other Company plans:

- Waste Management Plan
- Hazardous Materials Management Plan
- Erosion and Sediment Control Plan
- Raw Materials Management Plan.

2.0 LEGAL AND OTHER REQUIREMENTS

Legal and other requirements applicable to this plan are identified in Attachment 1**.**

3.0 SURVEYS

No surveys are required for the Air Emissions Management Plan.

4.0 MANAGEMENT AND MONITORING

Table 1 presents a summary of the potential environmental impacts related to air emissions, together with mitigation and management measures to avoid or reduce these impacts.

Contractor shall develop an Air Emissions Management Plan, which will, as a minimum, incorporate the measures described in Table 1 but shall not be limited to these measures.

Due to differing scopes of work and work locations, not all management and mitigation measures in the Air Emissions Management Plan are applicable to all Contractors. Company's Environmental and Social Mitigation Register defines which management and mitigation measures are applicable to each Contract scope of work.

In Table 1, any mitigation and management commitments that were contained in the PNG LNG Project Environmental Impact Statement (EIS) are identified by a code commencing with an 'M' in the 'Mitigation Item Reference Number' column. Some mitigation measures have been reworded to provide further clarity or more detailed information regarding required measures. In these instances, the code is displayed in italics, and these reworded measures supersede what is in the EIS.

Other mitigation and management commitments required by Company are identified in Table 1 with a code commencing with an 'A'.

Monitoring required as part of the Air Emissions Management Plan is also described in Table 1.

Contractor shall develop site-specific procedures for the monitoring program, to be agreed by Company.

Table 1: Management and Monitoring

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Source of Impact	**Potential Impact and Relevant Management Plan Objective†**	**Mitigation and Management (Design Feature/Specific Measure)**	**Mitigation Item Reference Number**	**Monitoring**	**Monitoring Frequency**	**Responsibility**
Dust from cleared/disturbed areas causing increased particulate matter loads/concentrations	Dust emissions creating nuisance and aesthetic and health impacts on humans. (Objective 1)	Contractor shall develop an Air Emissions Management Plan.	*M42*	Verification	Ongoing	Contractor
		Limit erosion and dust effects of soil and spoil.	*M32*	Verification	Ongoing	Contractor
		Control speed limits via posted speed limit signs on project unsealed roads and pipeline RoWs (as required) and keep vehicles to marked trafficable areas that will be maintained in a damp and compacted condition, where practicable.	*M34, M111, M178*	Verification	Ongoing	Contractor
		Stabilize exposed areas susceptible to wind erosion using industry good practice measures such as water (non saline), agglomerating agents, temporary grass/hydromulch or mulch where appropriate.	*M45*	Verification	Ongoing	Contractor
		Use cleared vegetation where practicable for dust control and reinstatement.	*M17*	Verification	Ongoing	Contractor
Air emissions from fuel combustion and storage	Reduced air quality with consequent community and project nuisance (Objective 1)	Select construction equipment based on industry good practice.	*M172*	Verification	Ongoing	Contractor
		Locate fixed and mobile equipment (e.g., generators) with consideration of local people (generally at a minimum distance of 500 meters from residences or other sensitive receptors, except where otherwise agreed by Company).	*M177*	Verification	Ongoing	Contractor
		Service diesel-powered equipment regularly.	*M44, M176*	Verification	Ongoing	Contractor
		Maintain construction vehicles and	*M33*	Verification	Ongoing	Company and

Table 1: Management and Monitoring						
Source of Impact	**Potential Impact and Relevant Management Plan Objective†**	**Mitigation and Management (Design Feature/Specific Measure)**	**Mitigation Item Reference Number**	**Monitoring**	**Monitoring Frequency**	**Responsibility**
		equipment in order to limit emissions, and remove from service any equipment from which emissions are visibly excessive.				Contractor
Greenhouse gas emissions from inefficient fuel burning equipment.	Increased greenhouse gas emissions. (Objective 2)	Select construction plant and equipment based on industry good practice.	*M172*	N/A	N/A	Contractor
		Maintain construction vehicles and equipment in order to limit emissions (including noise), and remove from service any equipment from which emissions are visibly excessive.	M33	Verification	Ongoing	Company and Contractor
Greenhouse Gas Emissions	Vegetation Clearance (Objective 2)	Estimate greenhouse gas emissions resulting from vegetation clearance.	*M114*	Calculation	Post clearance	Company
Air emissions from industrial waste incineration.	Impairment of ambient air quality. (Objective 1)	Design high temperature incinerators commensurate with proposed waste inventories.	A8	CO and Temperature	See Table 2	Contractor
		Prepare Operating Procedures for temporary incinerators to be utilized during construction. Operating Procedures shall detail operational and monitoring/record keeping criteria (see Table 2).	A9	Verification	Prior to construction	Contractor
Air emissions from landfills	Impairment of ambient air quality. (Objective 1)	Develop and implement appropriate measures to control the accumulation and migration of landfill gases.	A10	Verification	Ongoing	Contractor

† See Section 1.

4.1 Incineration

Temporary incinerators utilized during construction shall be of dual combustion chamber design and shall provide for at least one second retention time at a minimum temperature of 850ºC in the secondary chamber.

Operational and monitoring/record keeping criteria applicable to the temporary incinerators are shown in Table 2.

Operating Procedures shall be established to address these requirements and incineration records shall be maintained.

Table 2: Temporary Incinerators: Operational and Monitoring Criteria

Parameter	Operating Criteria	Monitoring and Record Keeping
Temperature (at the exit of the secondary chamber)	850 - 1200 ºC	Continuous temperature monitor
Residence time (in the secondary chamber)	Equal to or more than 1 second	N/A
Waste Type	No restricted waste (see exceptions below)	Waste incineration records (waste type)
Waste Feed Rate	Per Vendor recommendation	Waste incineration records (feed rate)
Condition of Waste Bed	N/A	Waste incineration records (visual inspection at each burn cycle)
Stack Emissions	No black smoke or ash	Waste incineration records (visual inspection). Note: Emissions of black smoke or ash indicate corrective action required.
Fuel Consumption	N/A	Waste incineration records (fuel consumption)
Equipment Inspection & Maintenance	Per vendor recommendation	Waste incineration records (inspection and maintenance)

With the exception of health care waste and oily debris (oil filters, oily rags etc), no restricted waste (see Waste Management Plan PGGP-EH-SPENV-000018-006 for waste classifications), shall be incinerated in the temporary incinerators.

A temporary incinerator shall not be utilized for the incineration of health care waste or oily debris where the specification of the incinerator does not allow for a minimum temperature of 850ºC in the secondary chamber.

A temporary incinerator shall not be utilized for the incineration of health care waste or oily debris where the specification of the incinerator does not allow for a minimum retention time of one second in the secondary chamber, unless the temperature in the secondary chamber is equal to or greater than 850ºC.

Where health care waste is incinerated in the temporary incinerators, it shall be processed separately from other wastes. Ash from health care waste burn cycles shall, unless otherwise demonstrated through testing, be treated as a restricted waste and shall be stabilised and disposed of at the HWMA or LNG Plant landfill.

Incineration of restricted waste (with the exception of health care waste and oily debris as discussed above) in the temporary incinerators shall be on an exception basis and requires prior Company approval.

Incinerators burning restricted waste (other than medical waste or oily debris) shall be specified so as to meet the intent of the applicable emissions limits in US EPA 40 CFR Part 60 Subpart CCCC (Standards of Performance for Commercial and Industrial Solid Waste Incineration Units). Testing shall be undertaken during commissioning of the incinerator to demonstrate that stack emissions meet the required concentrations. Thereafter, monitoring of stack emissions for these parameters shall be undertaken periodically, but no less than annually.

In addition to the temporary incinerators to be utilized during construction, a high temperature incinerator is to be installed at the Hides Waste Management Area (HWMA). The HWMA incinerator is of dual combustion chamber design and is specified to allow a minimum retention time in the secondary chamber of one second at 950ºC.

Stack emissions from the HWMA incinerator shall meet the intent of the emissions limits in US EPA 40 CFR Part 60 Subpart CCCC (Standards of Performance for Commercial and Industrial Solid Waste Incineration Units). Monitoring of emissions from the HWMA incinerator shall be conducted for carbon monoxide (CO) and particulate matter (PM_{10}) via Continuous Emissions Monitoring System (CEMS). For the other applicable parameters of US EPA 40 CFR Part 60 Subpart CCCC, performance tests (stack sampling) shall be undertaken during commissioning. The performance tests shall be extended as necessary to gain representative emissions data for all anticipated waste compositions. Thereafter, monitoring of stack emissions shall be undertaken as necessary to enable CEMS calibration.

Incinerators onboard offshore pipelay vessels shall be designed and built to an approved standard as described in regulation 16(2) of MARPOL Annex VI and shall have IMO approved certificates. Such certificates shall be made available to Company upon request.

5.0 ROLES AND RESPONSIBILITIES

Contractor shall ensure sufficient resources are allocated on an ongoing basis to achieve effective implementation of the Air Emissions Management Plan.

Contractor's Air Emissions Management Plan shall describe the resources allocated to and responsible for the execution of each task and requirement contained therein, and shall describe how roles and responsibilities are communicated to relevant personnel.

Company shall ensure sufficient resources are allocated on an ongoing basis to achieve effective implementation of Company's responsibilities in the Air Emissions Management Plan.

6.0 TRAINING, AWARENESS AND COMPETENCY

Contractor shall ensure that all personnel responsible for the execution of the tasks and requirements contained within the Air Emissions Management Plan are competent on the basis of education, training and experience.

Contractor's Air Emissions Management Plan shall describe the training and awareness requirements necessary for its effective implementation.

Contractor's training activity associated with the Air Emissions Management Plan shall be appropriately documented by means of a training needs assessment, training matrix/plan and records of training undertaken.

Company shall ensure that all Company personnel responsible for the execution of Company's tasks and requirements in the Air Emissions Management Plan are competent on the basis of education, training and experience.

Company's training activity associated with the Air Emissions Management Plan shall be appropriately documented by means of a training needs assessment, training matrix/plan and records of training undertaken.

7.0 PERFORMANCE INDICATORS

Table 3 outlines performance indicators for measuring and verifying performance in relation to air emissions.

Table 3: Performance Indicators

ID #	Performance Indicator	Measurement	Internal Assessment Frequency	Relevant Management Plan Objective[†]
1	Compliance with emission criteria	Emissions Monitoring	Continuous emissions monitoring at HWMA for CO and PM_{10} HWMA Incinerator Performance Tests	1
2	Project maximises efficiency	Tonnes of CO_2 per tonne of fuel consumed	Quarterly	2
Performance Indicators are to be further developed and agreed between Company and Contractor				

[†] See Section 1.

8.0 REPORTING AND NOTIFICATION

Contractor's monthly report to Company shall include:

- Number and results of verification inspections prescribed in Table 1.
- Results of monitoring as prescribed in Section 4.0
- Estimation (calculation) of greenhouse gas emissions
- Performance Indicators as applicable in the reporting period.

Attachment 1: Legal and Other Requirements

LEGAL AND OTHER REQUIREMENTS

Contractor shall comply with applicable Papua New Guinea Laws and Regulations, applicable International Finance Institution (IFI) requirements and International Treaties and Conventions (where applicable).

Papua New Guinea Laws and Regulations

PNG has no air emissions or ambient air quality standards. The Environment Act 2000 does however contain numerous provisions that promote environmental protection, regulate environmental impacts associated with development activities, and safeguard the life supporting capacity of air, water land and ecosystems.

International Financial Institution Requirements

The following International Finance Corporation (IFC) Performance Standards are applicable to air emissions and ambient air quality during construction:

- IFC Performance Standard 1: *Social and Environmental Assessment and Management System*, which establishes requirements for assessment, management, organizational capability, training, community engagement, monitoring, and reporting.
- IFC Performance Standard 3: *Pollution Prevention and Abatement*, and specifically the following provisions:

  "The objectives of pollution prevention are a) to avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities; and b) to promote the reduction of emissions that contribute to climate change."

  "To achieve these objectives, clients should take into account the potential impact of their emissions on the ambient conditions (such as ambient air quality) and seek to avoid or minimize these impacts within the context of the nature and significance of pollutants emitted. Large projects with potentially significant emissions and /or high impacts may require impacts on the surrounding environment (i.e., changes in ambient levels) to be monitored, in addition to the implementation of control measures."

  "General requirements. During the design, construction, operation and decommissioning of the project (the project life-cycle) the client will consider ambient conditions and apply pollution prevention and control technologies and practices (techniques) that are best suited to avoid or, where avoidance is not feasible, minimize or reduce adverse impacts on human health and the environment while remaining technically and financially feasible and cost-effective[1]. The project-specific pollution prevention and control techniques applied during the project life-cycle will be tailored to the hazards and risks associated with project emissions and consistent with good international industry practice[2], as reflected in various internationally recognized sources, including IFC's Environmental, Health and Safety Guidelines (the EHS General Guidelines)."

[1] "Technical feasibility" and "financial feasibility" are defined in Performance Standard 1. "Cost-effectiveness" is based on the effectiveness of reducing emissions relative to the additional cost required to do so.

[2] Defined as the exercise of professional skill, diligence, prudence and foresight that would reasonably be expected from skilled and experienced professionals engaged in the same type of undertaking under the same or similar circumstances globally. The circumstances that skilled and experienced professionals may find when evaluating the range of pollution prevention and control techniques available to a project may include, but are not limited to, varying levels of environmental degradation and environmental assimilative capacity as well as varying levels of financial and technical feasibility.

"Pollution Prevention, Resource Conservation and Energy Efficiency. The client will avoid the release of pollutants or, when avoidance is not feasible, minimize or control the intensity or load of their release. This applies to the release of pollutants due to routine, non-routine or accidental circumstances with the potential for local, regional, and transboundary impacts[3]. In addition, the client should examine and incorporate in its operations resource conservation and energy efficiency measures, consistent with the principles of cleaner production."

"The client should also minimize the unintentional generation and release such as by incineration, of chemicals listed in Annex C of the Stockholm Convention, as outlined in that Annex."

"Technical Guidance. The client should refer to the current versions of the EHS Guidelines when evaluating and selecting pollution prevention and control techniques for the project. These documents contain the performance levels and measures that are normally acceptable to IFC and are generally considered to be achievable at reasonable costs by existing technology."

"Ambient Considerations. To address adverse project impacts on existing ambient conditions[4], the client will: (i) consider a number of factors, including the finite assimilative capacity[5] of the environment, existing and future land use, existing ambient conditions, the project's proximity to ecologically sensitive or protected areas, and the potential for cumulative impacts with uncertain and irreversible consequences; and (ii) promote strategies that avoid or, where avoidance is not feasible, minimize or reduce the release of pollutants, including strategies that contribute to the improvement of ambient conditions when the project has the potential to constitute a significant source of emissions in an already degraded area. These strategies include, but are not limited to, evaluation of project location alternatives and emissions offsets."

"If ambient levels are in compliance with relevant ambient quality guidelines and/or standards, projects with potentially significant emissions of pollutants should be designed so as to reduce the potential for significant deterioration and to ensure continuing compliance."

The following IFC Guidelines are applicable to air emissions and ambient air quality during construction. Contractor shall meet the intent of these guidelines:

- IFC EHS General Guidelines (April 2007), incorporating WHO Ambient Air Quality Guidelines (1987, 1999 and 2006); Section 1.1 and 4. Relevant provisions include:
    - Minimizing dust from material handling sources by using covers and/or control equipment (water suppression, bag house, or cyclone)
    - Minimizing dust from open area sources, including storage piles, by using control measures such as installing enclosures and covers, and increasing the moisture content
    - Dust suppression techniques should be implemented, such as applying water or non-toxic chemicals to minimize dust from vehicle movements
    - Managing emissions from mobile sources (refer Section 1.5)

[3] In reference to transboundary pollutants, including those covered under the Convention on Long-range Transboundary Air Pollution.

[4] Such as air, surface and groundwater, and soils.

[5] The capacity of the environment for absorbing an incremental load of pollutants while remaining below a threshold of unacceptable risk to human health and the environment.