

Hong Kong Offshore LNG Terminal Project

Mitigation Proposal for Avoidance and Minimisation of the Potential Impacts on Avifauna associated with Emergency Gas Discharge

19 December 2022

Project No.: 0505354

| Document details | |
|-------------------|---|
| Document title | Hong Kong Offshore LNG Terminal Project |
| Document subtitle | Mitigation Proposal for Avoidance and Minimisation of the Potential Impacts on Avifauna associated with Emergency Gas Discharge |
| Project No. | 0505354 |
| Date | 19 December 2022 |
| Version | 3 |
| Author | Var |
| Client Name | Hong Kong LNG Terminal Limited |

Document history

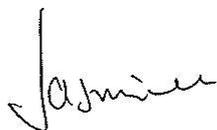
| | Revision | Author | Reviewed by | ERM approval to issue | | Comments |
|--|----------|--------|-------------|-----------------------|------------|----------|
| | | | | Name | Date | |
| | 0 | Var | RC | JN | 25/2/2022 | N/A |
| | 1 | Var | RC | JN | 1/8/2022 | N/A |
| | 2 | Var | RC | JN | 30/8/2022 | N/A |
| | 3 | Var | RC | JN | 19/12/2022 | N/A |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

Signature Page

19 December 2022

Hong Kong Offshore LNG Terminal Project

Mitigation Proposal for Avoidance and Minimisation of the Potential Impacts on Avifauna associated with Emergency Gas Discharge



Dr Jasmine Ng
Managing Partner

ERM-Hong Kong, Limited
2509, 25/F One Harbourfront
18 Tak Fung Street
Hung Hom
Kowloon
Hong Kong

© Copyright 2022 by ERM Worldwide Group Ltd and/or its affiliates ("ERM").
All rights reserved. No part of this work may be reproduced or transmitted in any form,
or by any means, without the prior written permission of ERM.



**Hong Kong Offshore LNG Terminal - Works associated with the double berth
jetty at LNG Terminal
Environmental Certification Sheet
FEP-01/558/2018/A**

Reference Document/Plan

| | |
|--|---|
| Document/ Plan to be Certified/ Verified: | Mitigation Proposal for Avoidance and Minimisation of the Potential Impacts on Avifauna associated with Emergency Gas Discharge |
| Date of Report: | 19 December 2022 |
| Date received by ET: | 19 December 2022 |
| Date received by IEC: | 20 December 2022 |

Reference EP Requirement

| | |
|--|--|
| EP Condition: | Condition No. 4.8 of FEP-01/558/2018/A |
| Content: | <i>Mitigation Proposal for Avoidance and Minimisation of the Potential Impacts on Avifauna associated with Emergency Gas Discharge</i> |
| <p>The Permit Holder shall implement appropriate measures to avoid and minimize the potential impacts on avifauna associated with emergency gas discharge via the vent stack for natural gas during operation of the Project. The Permit Holder shall, no later than 3 months before the commencement of operation of the Project, submit 3 hard copies and 1 electronic copy of the mitigation proposal for avoiding and minimizing the potential impacts on avifauna associated with emergency gas discharge via the vent stack for natural gas to the Director for approval. The mitigation proposal shall include but not limited to information relating to the measures to avoid and minimize the emergency gas flaring, alternative measures in lieu of emergency gas flaring for depressurization and prior alert measures to the avifauna before emergency gas discharge.</p> | |

ET Certification

| | |
|---|--|
| I hereby certify that the above referenced document/ plan complies with the above referenced condition of FEP-01/558/2018/A. | |
| Mr Raymond Chow, Environmental Team Leader: |  Date: 19 December 2022 |

IEC Verification

| | |
|--|--|
| I hereby verify that the above referenced document/ plan complies with the above referenced condition of FEP-01/558/2018/A. | |
| Ms Lydia Chak, Independent Environmental Checker: |  Date: 21 December 2022 |

CONTENTS

| | |
|--|----------|
| 1. INTRODUCTION | 1 |
| 1.1 Background..... | 1 |
| 1.2 Purpose of the Mitigation Proposal..... | 2 |
| 1.3 Structure of the Mitigation Proposal..... | 2 |
| 2. MEASURES TO AVOID AND MINIMISE EMERGENCY GAS VENTING | 5 |
| 2.1 Utilisation of Boil Off Gas | 5 |
| 2.2 Design Considerations for Vent Systems..... | 5 |
| 3. ALTERNATIVE MEASURES IN LIEU OF EMERGENCY GAS FLARING FOR DEPRESSURISATION | 6 |
| 4. ALERT MEASURES TO THE AVIFAUNA IN THE EVENT OF EMERGENCY GAS VENTING | 7 |

List of Figures

| | |
|------------|--|
| Figure 1.1 | Indicative Location of Key Project Components |
| Figure 1.2 | The Cold Vent Stack at Mooring Dolphin 5 of the Double Berth Jetty |
| Figure 1.3 | Vent Masts of the FSRU Vessel |

Annexes

| | |
|---------|--|
| Annex A | The Operation Process of the BOG Recovery and Vent Systems |
|---------|--|

1. INTRODUCTION

1.1 Background

To support the increased use of natural gas in Hong Kong from 2020 onwards, Castle Peak Power Company Limited (CAPCO) and The Hongkong Electric Co., Ltd. (HK Electric) have identified that the development of an offshore liquefied natural gas (LNG) receiving terminal in Hong Kong using Floating Storage and Regasification Unit (FSRU) technology ('the Hong Kong Offshore LNG Terminal Project') presents a viable additional gas supply option that will provide energy security through access to competitive gas supplies from world markets. The Project will involve the construction and operation of an offshore LNG import facility to be located in the southern waters of Hong Kong, a double berth jetty, and subsea pipelines that connect to the gas receiving stations (GRS) at the Black Point Power Station (BPPS) and the Lamma Power Station (LPS). The location plan is shown in **Figure 1.1**.

The Environmental Impact Assessment (EIA) Report for the Project was submitted to the Environmental Protection Department (EPD) of the Hong Kong Special Administrative Region Government in May 2018. The EIA Report (EIAO Register No. AEIAR-218/2018) was approved by EPD and the associated Environmental Permit (EP) (EP-558/2018) was issued in October 2018. An application for Further Environmental Permits (FEP) was made on 24 December 2019 to demarcate the works between the different parties. The following FEPs were issued on 17 January 2020 and the EP under EP-558/2018 was surrendered on 5 March 2020:

- the double berth jetty at LNG Terminal under the Hong Kong LNG Terminal Limited, joint venture between CAPCO and HK Electric (FEP-01/558/2018/A) ⁽¹⁾;
- the subsea gas pipeline for the BPPS and the associated GRS in the BPPS under CAPCO (FEP-03/558/2018/B) ⁽²⁾; and
- the subsea gas pipeline for the LPS and the associated GRS in the LPS under HK Electric (FEP-02/558/2018/A) ⁽³⁾.

In accordance with Condition 4.8 of the FEP of the LNG Terminal (FEP-01/558/2018/A) ('the Project'):

FEP No. FEP-01/558/2018/A, Condition 4.8:

"The Permit Holder shall implement appropriate measures to avoid and minimize the potential impacts on avifauna associated with emergency gas discharge via the vent stack for natural gas during operation of the Project. The Permit Holder shall, no later than 3 months before the commencement of operation of the Project, submit 3 hard copies and 1 electronic copy of the mitigation proposal for avoiding and minimizing the potential impacts on avifauna associated with emergency gas discharge via the vent stack for natural gas to the Director for approval. The mitigation proposal shall include but not limited to information relating to the measures to avoid and minimize the emergency gas flaring, alternative measures in lieu of emergency gas flaring for depressurization and prior alert measures to the avifauna before emergency gas discharge."

- (1) Application for variation of an environmental permit for FEP-01/558/2018 was undertaken and the latest FEP (FEP-01/558/2018/A) was issued on 6 November 2020.
- (2) Application for variation of an environmental permit for FEP-03/558/2018/A was undertaken and the latest FEP (FEP-03/558/2018/B) was issued on 25 August 2021.
- (3) Application for variation of an environmental permit for FEP-02/558/2018 was undertaken and the latest FEP (FEP-02/558/2018/A) was issued on 22 December 2020.

Legend

- Boundary of HKSAR
- Proposed GRS Location at BPPS
- Proposed GRS Location at LPS
- Proposed Route of BPPS Pipeline
- Proposed Route of LPS Pipeline
- Proposed Site for LNG Terminal
- Proposed LNG Terminal Safety Zone

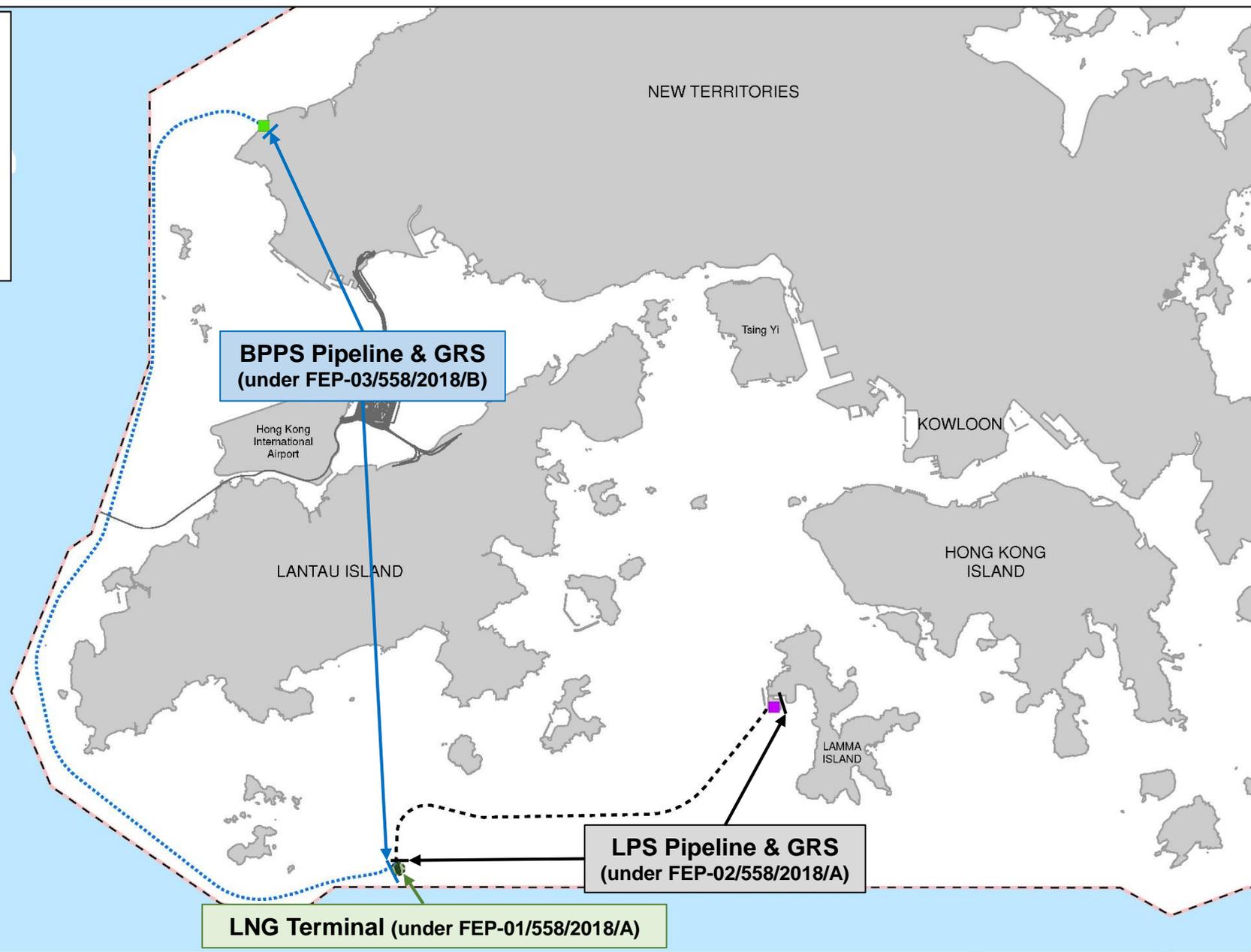


Figure 1.1

Indicative Location of Key Project Components

1.2 Purpose of the Mitigation Proposal

This *Mitigation Proposal* presents the information relating to the measures to avoid and minimise the emergency gas venting, the alternative measures in lieu of emergency gas venting for depressurization and the alert measures to the avifauna in the event of emergency gas discharge.

While it is mentioned in Section 9.5.2 of the EIA Report that flaring of gas would occur during emergency/ upset conditions only as part of safety measures to maintain integrity of the facility, the latest Project design has confirmed that the double berth jetty at LNG Terminal and the FSRU Vessel are equipped with a cold vent stack and vent masts, respectively, instead of flare stack for emergency gas discharge. Therefore, no gas flaring will be involved during the course of operation of the Project. Such design avoids hot flare flame to be emitted which may attract avifauna (especially at night-time) due to the presence of light from the flare ⁽⁴⁾. Impacts to avifauna, such as mortality of avifauna that passes by the vent stack when flaring happens, are thus avoided. Consequently this *Mitigation Proposal* focuses on the measures in relation to gas venting from the cold vent stack instead of gas flaring in the event of emergency. Such gas venting will discharge non-toxic and odourless cold vapour in the event of emergency ⁽⁵⁾. Thus, unacceptable impacts to avifauna due to gas exposure is not expected. The indicative layout of the cold vent stack situated at Mooring Dolphin 5 of the double berth jetty and the vent masts of the FSRU Vessel for emergency gas discharge are presented in **Figure 1.2** and **Figure 1.3**, respectively.

1.3 Structure of the Mitigation Proposal

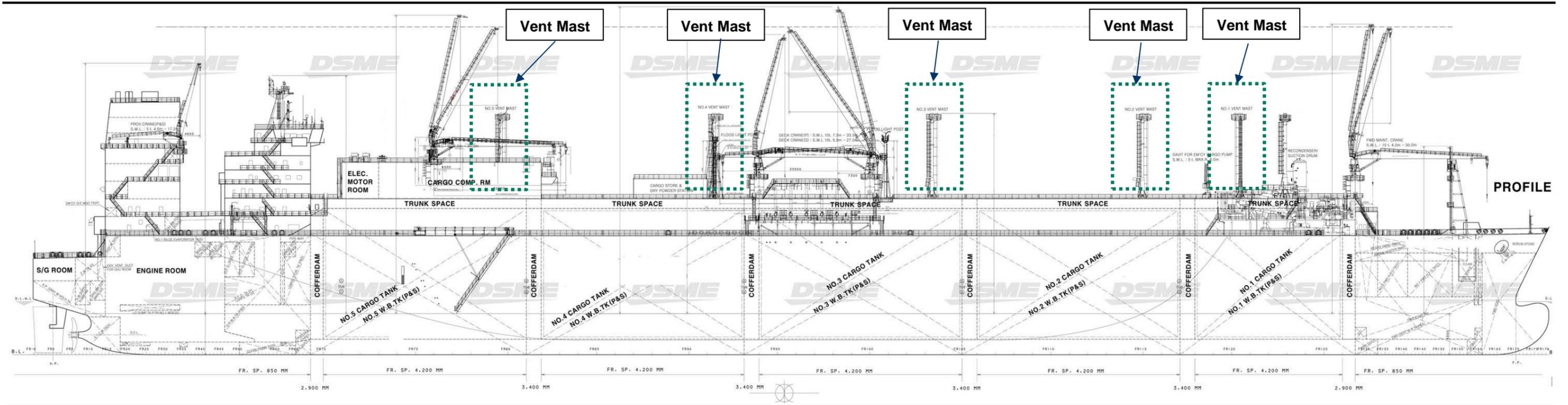
The remainder of this *Mitigation Proposal* is set out as follows:

- **Section 2** describes the measures to avoid and minimise the emergency gas venting;
- **Section 3** describes the alternative measures in lieu of emergency gas flaring for depressurisation; and
- **Section 4** outlines the alert measures to the avifauna in the event of emergency gas venting.

(4) Day RH, Rose JR, Prichard AK, Streever B (2015). Effects of Gas Flaring on the Behavior of Night-Migrating Birds at an Artificial Oil-Production Island, Arctic Alaska. *Arctic* 68(3): 367-379.

(5) Mokhatab S, Mak JY, Valappil JV, Wood DA (2014). Handbook of Liquefied Natural Gas. Chapter 9 – LNG Safety and Security Aspects.

Figure 1.3 Vent Masts of the FSRU Vessel



2. MEASURES TO AVOID AND MINIMISE EMERGENCY GAS VENTING

2.1 Utilisation of Boil Off Gas

To avoid and minimise emergency gas venting of the Project, boil off gas (BOG) generated from the FSRU Vessel LNG storage tanks will be (i) utilised as fuel gas for FSRU Vessel for supporting the power generation for FSRU Vessel, (ii) stored in LNG storage tanks and fed into the LNG regasification process via Recondenser, and (iii) burned off via the Gas Combustion Unit (GCU), which plays a part in maintaining the LNG storage tank pressure at a safe level. The FSRU Vessel is equipped with a BOG recovery system to handle the BOG generated by heat ingress during normal operations as well as BOG generated during unloading and reloading operations. The BOG recovery system consists of the following major equipment items:

- BOG Compressors;
- Recondenser; and
- Gas Combustion Unit (GCU).

During LNG Carrier (LNGC) unloading, the displacement vapour from the FSRU Vessel LNG storage tanks flows back to the LNGC via the vapour return loading arm to replace the displaced LNG volume in the LNGC storage tanks. Excess displacement vapour, if any, will also flow to the BOG Compressors where it is compressed and sent to the Recondenser to be fed into the LNG regasification process or the GCU to be burned off.

When the FSRU Vessel is not connected to the double berth jetty (e.g. during adverse weather conditions), BOG which cannot be held in the FSRU Vessel LNG storage tanks and is not required for power generation for LNG regasification process will be utilised as fuel for mobilisation of FSRU Vessel.

The operation process of the BOG recovery is presented in **Annex A**.

2.2 Design Considerations for Vent Systems

In the case that BOG could not be utilised in the FSRU Vessel, the excess hydrocarbon vapour would be discharged via the cold vent systems at the Jetty and at the FSRU Vessel to gather and safely dispose of hydrocarbon vapour from vent headers, control valves and safety relief devices. The vent systems are designed to accommodate the following:

- Discharge from process operational venting sources, during process upsets. This includes gas flow from the Jetty LNG Drain Drum during any period when the pressure in the drum exceeds the control set-point.
- Discharge from safety relief devices.
- Blowdown of high pressure (HP) gas piping during an emergency shutdown scenario as required, or a depressurization operation scenario.
- During the cold standby between the unloading operations of the Jetty, the vapour return arm will stay connected with the FSRU. Hence, the BOG generated in the Jetty LNG piping can be returned to the FSRU via the vapour arm and managed by the FSRU BOG system.
- Alternatively, the LNG in the Jetty piping can be drained empty and returned to the FSRU by nitrogen purging after the unloading operation. As such, no BOG will be generated from the Jetty after all LNG has returned to the FSRU.

The operation process of the vent systems is presented in **Annex A**.

3. ALTERNATIVE MEASURES IN LIEU OF EMERGENCY GAS FLARING FOR DEPRESSURISATION

Since there will be no emergency gas flaring involved with the adoption of design considerations and operation of the Project as described in **Section 1.2** and **Section 2**, alternative measures in lieu of emergency gas flaring for depressurisation are considered not applicable. In addition, in the event of emergency, gas will be treated with the measures as described in **Section 2.1** and **Section 2.2**.

4. ALERT MEASURES TO THE AVIFAUNA IN THE EVENT OF EMERGENCY GAS VENTING

Gas venting would occur during emergency/ upset conditions only as part of safety measures to maintain integrity of the facility. In the event of emergency gas venting which is unavoidably to be implemented as the last resort for the operation of the Project, the following alert measure to the avifauna in the event of emergency gas venting will be implemented.

- Alerting mechanisms of the audible and visual alarm devices, in the event of fire and/or gas hazards, will be triggered with use of horns and beacons. Horns will be installed outdoor at the Jetty that will be audible to avifauna with loud noise to repel them.

ANNEX A

THE OPERATION PROCESS OF THE BOG RECOVERY AND VENT SYSTEMS

