IAPH
International Association of Ports and Harbors

WPSP
WORLD PORTS SUSTAINABILITY PROGRAM
Clean Marine Fuels

LNG Ready Terminal

Port and Terminal guidance

Explanatory document

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List of abbreviations and definitions

CMF	Clean Marine Fuels
IAPH	International Association of Ports and Harbors
JPO	Joint Plan of Operation
LNG	Liquefied Natural Gas
LNG BFO	An LNG bunker facility operator. A company that operates an asset that supplies LNG as a marine fuel to a LNG fueled vessel by means of a LNG bunker operation and is in full control of this process and all related processes, including, but not limited to, vessel crewing, but excluding full control over the molecule supplier/owner processes.
LNG bunker company	See LNG BFO
LRT	LNG Ready Terminal
STS	Ship-To-Ship
SIMOPS	Simultaneous Operations – Terminal and vessel operations that occur at the same time as a bunkering operation

1. Introduction

1.1 Background

The IAPH CMF working group provides practical tools for use by ports and port stakeholders to increase the safety of bunkering clean marine fuels. These tools include bunker checklists and an audit tool for bunker facility operators. Stakeholders such as LNG-fuelled-vessel operators and LNG-bunker vessel operators can use these tools for their safety management. Port authorities can use the tools to establish a safety framework for (new) clean marine fuels in their ports. In addition to these tools, the IAPH CMF working group provides guidance on the preparedness of terminals for LNG-fuelled vessels and for ship-to-ship bunkering of LNG alongside the terminal. However, terminal safety management systems and the results of safety studies carried out by the terminals can always take precedence.

The number of LNG-fuelled vessels is increasing. Terminals may be confronted with requests to facilitate LNG-fuelled vessels alongside the terminal and the request to allow bunkering of these vessels with LNG. An LNG-fuelled vessel should meet the IGF code and is allowed entry by the flag state, which is the basis for saying that the alternatively fuelled vessel operating as intended, has a risk equal to a standard vessel. However, some operational aspects of an LNG-fuelled vessel introduce additional risks. Terminals must therefore be prepared to deal with the risks of LNG-fuelled vessels moored at the terminal, particularly if these LNG-fuelled vessels are going to be bunkered with LNG. Since terminals will perform operations on board LNG-fuelled vessels, cooperation between the terminal, the LNG-fuelled vessel and the LNG bunker vessels is essential.

Proper preparation of individual terminals in a port may differ. In the end a terminal must be able to demonstrate to stakeholders and the port authority its readiness for the safe handling of LNG-fuelled vessels alongside the terminal.

Ports could use an LNG Ready Terminal Designation in order to demonstrate that a company is capable to receive LNG-fuelled vessels and LNG bunker vessels alongside its terminals, including all the operations and interactions that come with this facilitation.

1.2 Objective of this document

This document has been prepared by the IAPH CMF working group to explain to ports the use of the Port Authority Checklist - LNG Ready Terminal. It also provides guidance to terminals and ports on issues they must consider to achieve a proper terminal preparedness level for LNG fuelled vessels. Terminal safety management systems and the results of safety studies carried out by the terminals will always take precedence.

1.3 Structure of this document

This document consists of the LNG Ready Terminal description as found in paragraphs 2 – 3, and the four annexes:

- Annex 1 - Risks associated with LNG-fuelled Vessels
- Annex 2 - Terminal LNG Preparedness
- Annex 3 - Third party LNG Preparedness and examples of third-party LNG flyers
- Annex 4 - Port Authority Checklist

2. Terminal preparedness

2.1 Terminal safety arrangement

Terminal preparation for LNG fuelled vessels is established by setting up a safety arrangement. The required arrangement depends on the nature of the operations planned during the stay of the LNG-fuelled vessel alongside the terminal. Four levels of operations are addressed:

1. Lay-by berth
2. Operations, like cargo operations, without LNG bunkering
3. LNG bunkering without other operations, like cargo operations
4. LNG bunkering with simultaneously other operations, like cargo operations

2.2 Safety arrangement approach

For a terminal to setup a safety arrangement on all four operational levels, two approaches are defined:

Project-based safety approach

If an LNG-fuelled vessel moors at a dedicated location and the vessel is bunkered only by a specific LNG bunker vessel, a project-based approach to ensure the safety of handling could be sufficient. The terminal will be fully involved in the arrangements made between the terminal, the LNG-fuelled vessel, the LNG bunker vessel and the competent authority. A bespoke Joint Plan of Operations (JPO) will be established and adopted by all parties.

System-based safety approach

Ports with different terminal operators or several LNG bunker vessel operators will receive visits from LNG-fuelled vessels on short notice. For these terminals a more flexible approach will be necessary and they will not be able to participate in the early stage of safety preparations made by the vessels. The flexibility and proper level of safety can be achieved by adjusting operational processes. These terminals should establish system-based preparedness.

Often in practice, a project-based approach precedes a system-based approach. In other words, by attending a number of risk assessments and subsequently applying a number of safety measures, knowledge is built up and the terminal gradually evolves from a project-based into a system-based LNG Ready Terminal.

Annex 2 of this document describes the way the terminal safety arrangement can be established by taking measures for the four operations; both for a project-based and a system-based approach.

3. Definition and designation

3.1 Definition

The definition of an LNG Ready Terminal is:

LNG Ready Terminal

A terminal which has aligned the procedures of its safety management system, the skills of its personnel and the preparedness of visitors such that it may handle LNG-fuelled vessels in a safe way. Doing so, the measures as described in this document have been considered.

3.2 Designation

Ports could introduce an LNG Ready Terminal designation. A terminal could be, depending on the level of preparedness due to the planned activity, designated as an LNG Ready Terminal if it:

- has incorporated procedures into its safety management system to ensure the proper level of preparedness for the handling of LNG-fuelled vessels;
- can deliver terminal-specific and location-specific safety measures to be incorporated into the JPO, such as (but not limited to) weather conditions and limitations, potential restrictions with regard to simultaneous operations, and means of communication;
- can review and agree upon a JPO;
- can review, contribute to and agree upon SIMOPS and risk mitigation;
- can adjust the operational process to deal with safety measures necessary for the safe handling of the LNG-fuelled vessel, with and/or without simultaneous operations;
- can adjust the operational process to deal with the safety measures necessary for safe, JPO-compliant LNG bunkering;
- has prepared the terminal incident response organisation to deal with an LNG-related incident;
- has instructed terminal personnel on the procedures and safety measures;
- has trained relevant personnel;
- has established proper interaction and communication with all the relevant terminal personnel;
- has established proper interaction and communication with all the relevant vessels.

The LNG Ready Terminal designation can be used by a terminal to demonstrate its level of preparedness for handling LNG-fuelled vessels. A port may decide to use the LNG Ready Terminal designation in its spatial planning and safety framework for LNG bunker activities.

An efficient way of doing so would be to include a condition in the port's LNG bunker licences that requires LNG bunker vessels to bunker LNG only at LNG Ready Terminals.

Designated LNG Ready Terminals can be incorporated into a port's official safety framework if the port operates a system of periodic assessment of terminal preparedness and on this basis designates terminals as LNG Ready Terminal and withdraws this designation where necessary.

LNG-fuelled vessels operators and LNG bunker vessel operators have to ensure terminals, where their vessels will moor, are properly prepared.
To be a designated LNG Ready Terminal could be considered to be an incentive for the terminal, since shipping is likely to choose a terminal that can prove that it is sufficiently prepared.

LNG Ready Terminal - Annex 1 - Risks Associated with LNG-fuelled Vessels

Liquefied Natural Gas

LNG (liquefied natural gas) is natural gas that has been cooled sufficiently to condense into a liquid. This happens at a temperature of -162°C. As the natural gas condenses to liquid its volume is reduced by a factor of 600 (one volume of liquid is equivalent to 600 volumes of gas). LNG is a mixture of hydrocarbons, predominantly methane (80-99%).

LNG is a very cold, colourless and odourless liquid and burns only when evaporated into its vapour state.
The vapour is heavier than air until it warms up to about -110°C. It is colourless, but can be seen as it mixes with air because water vapour in the air is condensed by the coldness of the natural gas, which appears in the form of a white cloud.[1]

Once it has evaporated, the natural gas has a flammability range of 5% to 15% by volume when mixed with air.

LNG on board of vessels in bunker tanks

Due to the physical properties of LNG, conditions in the LNG bunker tank will change over time. LNG is stored at very cold (cryogenic) temperatures in the bunker tanks to keep the gas in liquid form. Although LNG bunker tanks are well insulated, some ambient heat will always get through. As the LNG slowly becomes less cold, it partly evaporates into natural gas (boil off-gas) and the pressure in the tanks increases.

Safety valves prevent this increase in pressure reaching critical levels. To keep the pressure in the bunker tanks within set limits and prevent emissions, it is therefore essential that the vessel's LNG pressure and temperature management and control system continue to function properly. If this system does not function properly, a safety relief valve may automatically open and the terminal would then be confronted with an emission of natural gas from the vessel's vent riser. The vessel could also release gas out the vent stack if the LNG system trips to diesel mode, and the purge of LNG lines may be vented. While this is a small amount, it can happen at any time the vessel is operating.

LNG-powered vessels must be safely supplied with fuel with as little impact as possible on the logistics and operational process of the terminal and the vessel. This presents a safety challenge to all parties and requires proper coordination and communication.

[1] See the SGMF publication 'Gas as a Marine Fuel – An introductory guide'

LNG on board of vessels alongside a terminal

Handling an LNG-fuelled vessel, whether during LNG bunkering or not, requires awareness, skills, competence and insight into the safety framework and risk assessments of the terminal personnel.

During LNG bunkering, personnel may observe unusual activities or occurrences:

- On and around LNG-fuelled vessels there are control zones established;
- There will be icing on pipes and connections and there may be a white cloud caused by moisture in the air condensing due to the cold equipment. However, the visible creation of a very large cloud could indicate an unwanted release of LNG;
- The connections are also very different from the bunkering of oil. There is an emergency release coupling installed, and there are emergency stop connections between both vessels.
- To protect the deck from the coldness of LNG in the event of a spill, a water curtain may be spread over the deck or a drip tray may be installed beneath the manifold, with a gutter to discharge any escaped liquid overboard.
- After bunkering, the bunker hoses or bunker lines may be heated with water jets to allow the LNG in the equipment to evaporate more quickly.

Operations by the terminal can affect the safety of LNG bunkering and vice versa. LNG bunkering is a highly controlled process with many safety measures, and many additional safeguards apply to operations during LNG bunkering. These safety measures may affect other operations in the terminal. An example of a safety measure is the establishment of control zones, such as the Hazardous Zone and the Safety Zone, while the vessel is being bunkered with LNG.[2] Further safeguards during bunkering are specific restrictions and procedures for the planning and control of operations within the specific control zones.[3]

The strict safety requirements that apply to IMO certified gas tankers and gas terminals should also be adhered to on board LNG-fuelled vessels and during LNG bunkering. However, if all the built-in safeguards and safety measures fail, there may be a spill of LNG or emission of natural gas. Released LNG can cause problems because the liquid is very cold and will evaporate very quickly to form a potentially flammable natural gas cloud. Many safety measures are in place to prevent the released gas being ignited.

For ship-to-ship all the bunkering activity is on the side away from the terminal and it is not clear that there would be an expectation that the terminal response would be to board the vessel to deal with the bunkering incident.

In the event of such an incident, an emergency stop should be triggered automatically and the main shut-off valve will close. Any released LNG will evaporate quickly, but escalation can never be ruled out. For this reason, the terminal's in-house emergency response organisation must be prepared to respond adequately to such an incident.

[2] See the SGMF publication 'Recommendation of Controlled Zones during LNG bunkering' and/or Annex B of ISO 20519 or ISO / TS 18683

[3] See the SMGF publication 'Simultaneous Operations (SIMOPS) during LNG bunkering'.

LNG Ready Terminal - Annex 2 - Terminal LNG Preparedness

Introduction

For a terminal to be LNG ready, its procedures need to be adjusted to ensure LNG-fuelled vessels berthed at the terminal can be handled safely. A terminal can achieve this by establishing safety management procedures: identifying and assessing the risks, managing these risks by adjusting the processes where necessary, and implementing proper risk mitigating measures, considering local conditions and terminal-specific items.

Preparedness classification

This annex describes the terminal preparedness for four operational levels based on a classification of pre-defined measures. Table 1 below gives an overview of this classification.

A full description of the measures can be found in the table that is referred to below.

Table 1 – Terminal preparedness measures classification

Measure Level	Measures	Table
Terminal Organization	1 – 9	4
General Awareness	10 – 15	5
Incident Response	20 – 24	6
LNG Bunker Operations	30 – 35	7
Simultaneous Operations	40 – 49	8

Please note that unused numbers are left open for future additional preparedness measures.

Measures per operation

Sufficient preparedness for the terminal in receiving LNG-fuelled vessels alongside is created when a minimum set of measures is taken for the following operational levels:

1. Lay-by berth
2. Operations, like cargo operations, without LNG bunkering
3. LNG bunkering without other operations, like cargo operations
4. LNG bunkering simultaneously with other operations, like cargo operations

Since the preparedness of a terminal can either have a project-based or system-based approach, the measures that are to be taken differ.

Table 2 below shows the measures that are to be taken as per operation when a project-based approach is taken. Table 3 shows the measures that are to be taken as per operation when a system-based approach is taken.

Table 2 – Project-based terminal preparedness for LNG-fuelled vessels

Operation	Terminal Organization	General Awareness	Incident Response	LNG Bunker Operations	Simultaneous Operations
Lay-by berth	1	10	23	-	-
Operations without LNG bunkering	1	11, 14, 15	20, 21, 23	-	48
LNG bunkering without other operations	1, 2, 3, 7, 8, 9	10, 11, 12, 13	20, 21, 22, 23, 24,25	30, 32, 34, 35	-
LNG bunkering simultaneously with other operations	1, 2, 3,4, 7, 8, 9	10,11,12,13, 14,15	20, 21, 22, 23, 24,25	34, 35	40, 42, 44, 45, 46, 47, 48, 49,

Table 3 – System-based terminal preparedness for LNG-fuelled vessels

Operation	Terminal Organization	General Awareness	Incident Response	LNG Bunker Operations	Simultaneous Operations
Lay-by berth	1	10	23	-	-
Operations without LNG bunkering	1	11, 14, 15	20, 21, 23	-	48
LNG bunkering without other operations	1, 2, 5, 7, 8, 9	10, 11, 12, 13	20, 21, 22, 23, 24, 25	31, 33, 34, 35	-
LNG bunkering simultaneously with other operations	1, 2, 5, 6, 7, 8, 9	10, 11, 12, 13, 14, 15	20, 21, 22, 23, 24, 25	34, 35	41, 43, 44, 45, 46, 47, 48, 49

Description of the measures per operation

Tables 4 to 8 give a full the description of the measures that should be taken. Within the tables a 'B', 'P' or 'S' indicates that the preparedness measures apply in one or more of the following situations:

Column 2 — Lay-by Berth
The vessel uses the berth as a lay by berth without activities.

Column 3 — Operations without LNG Bunkering
The vessel and terminal will carry out cargo or other activities without LNG bunkering.

Column 4 — LNG bunkering without other operations
The vessel will carry out LNG bunkering without cargo or other activities.

Column 5 — LNG bunkering simultaneously with other operations
The vessel and terminal will carry out cargo or other activities simultaneously with LNG bunkering.

Description of the letter codes in the columns

B	Preparedness measure applicable for both project-based approach and system-based approach;
P	Preparedness measure only applicable for project-based approach;
S	Preparedness measure only applicable for system-based approach;
-	Preparedness measure not applicable.

Table 4 - Preparation of the terminal organization

#	Lay by Berth	Operations without LNG Bunkering	LNG bunkering without other operations	LNG bunkering simultaneously with other operations	Terminal Organization *Preparatory Actions by the terminal safety organization* [4] Preparedness measure
01	B	B	B	B	A terminal must be prepared for a possible unintended increase in pressure in the bunker tank that can lead to an emission of natural gas. During the exchange of information before a vessel's arrival it is important that the terminal requires the vessel to report the fuels on board, the position of the vent mast and the applicable control zones of the vessel. LNG on board: Make sure the vessel reports to the terminal that the LNG monitoring system will remain constantly operational and that the LNG bunker tank atmosphere management system will be able to control the pressure in the bunker tanks during the stay at the terminal. Make sure the vessel reports any failure in the above system to the terminal. (See the risk of an increase in pressure in a bunker tank described in Annex 1 of this document)
02	-	-	B	B	During the planning of an LNG bunkering the vessel operators will ask for location- and terminal-specific information, including possible restrictions on LNG bunkering and/or the carrying out of simultaneous operations. Based on a terminal-specific risk assessment, the terminal will prepare a package of LNG-bunker-relevant information including a relevant description of the terminal activities and equipment. .
03	-	-	P	P	In a project-based safety arrangement, the terminal participates at an early stage in risk assessments, HAZIDs and HAZOPs arranged by the LNG bunker facility operator. The terminal will contribute input on location- and terminal-specific information and on restrictions to the drafting of the Joint Plan of Operations (JPO).
04	-	-	-	P	In a project-based safety arrangement, the terminal will participate in the SIMOPS safety assessment and will review, agree to and accept the JPO specifying the safety mitigation strategies specific for terminal operations on the LNG-fuelled vessel concerned. Terminal safety procedures must be developed to handle the LNG-fuelled vessel simultaneously with LNG bunkering.

[4] See the SGMF Publication 'Safety Guidelines – Bunkering'

Table 4 – Continued: Preparation of the terminal organization

#	Lay by Berth	Operations without LNG Bunkering	LNG bunkering without other operations	LNG bunkering simultaneously with other operations	Terminal Organization *Preparatory Actions by the terminal safety organization* [5] Preparedness measure
05	-	-	S	S	In a system-based safety arrangement, the terminal will arrange generic preparedness for LNG bunkering. As the terminal is not able to participate at an early stage in the safety preparations of the vessel operators, the participation of the terminal starts when it receives a proposal for the JPO, and preferably also the SIMOPS HAZID report, to give the terminal insight into the mitigated risks that should be reflected in the safety measures in the JPO. The terminal will review the JPO and has to agree to and accept the document. If the document cannot be accepted, the terminal must discuss the relevant elements with the LNG-fuelled vessel operator and the bunker vessel operator. If the terminal cannot or will not comply with the JPO or does not agree with the required safety mitigation, the LNG bunkering must be cancelled.
06	-	-	-	S	In a system-based safety arrangement, the terminal should prepare operational safety procedures to ensure the operational part of the terminal organization is capable of operating in compliance with the required risk mitigation during an LNG bunkering as prescribed in the JPO.
07	-	-	B	B	Communication procedures should be prepared for sharing with all relevant personnel the proper operational information on the LNG bunkering received from the vessels, including restrictions on other activities during the LNG bunkering.
08	-	-	B	B	It is recommended that the terminal inform terminal contractors or third-party visitors that have to be present in the vicinity of or on board the LNG-fuelled vessel about the possible STS LNG bunker operations when they sign in at the entrance of the terminal. An additional notice during the common safety instruction could be: “LNG-fuelled vessels might call at this terminal. Please be informed that in case an LNG bunkering operation is taking place, specific safety zones will clearly be indicated, and strict safety requirements will be applied”
09	-	-	B	B	If the JPO and gas dispersion study indicate that the Safety Zone will overlap with the terminal on the shore side, does the terminal have procedures in place for the proper action to restrict and control all activities within the Safety Zone at the shore?[6]

[5] See the SGMF Publication ‘Safety Guidelines – Bunkering’

[6] See Chapter 4.2 of the SGMF publication ‘Recommendation of Controlled Zones during LNG bunkering’

Table 5 – General awareness

#	Lay by Berth	Operations without LNG Bunkering	LNG bunkering without other operations	LNG bunkering simultaneously with other operations	General Awareness *Awareness of terminal personal and visitors*[7] Preparedness measure
10	B	B	B	B	Terminal personnel should be acquainted with vessels that use LNG as a fuel. If they have to visit the vessel they should be acquainted with the vessel's primary safety rules.
11	-	B	B	B	The relevant terminal personnel should be aware that vessels can use LNG as a fuel and they should understand the behaviour of LNG and the different hazards of LNG compared with conventional fuels. (See Annex 1.)
12	-	-	B	B	Terminal personnel should be acquainted with unusual activities or occurrences, such as ice formation on transfer lines, floating water near the bunker manifold, white clouds and water spraying on the bunker hose.
13	-	-	B	B	Terminal personnel should be trained or instructed to be aware of their environment and all activities that may have an impact on the risks of LNG bunkering, such as the work planning of vessel service providers and repair teams or other activities on board or in the vicinity of the vessels involved. In the LNG bunker world this is called the implementation of good practice in the Monitoring and Security Area.[8]
14	-	-	B	B	The terminal should provide procedures and means of communication to obtain reports from its personnel on issues that might affect the LNG bunkering. The terminal should have procedures and means of communication in place to inform the vessels of possible safety breaches during LNG bunkering. The means of communication should be incorporated into the JPO and the action to be taken in the event of a possible safety breach should be included in the emergency response or contingency chapter of the JPO.
15	-	B	B	B	The terminal should instruct crane operators and planners on the existence and location of the control zones on board the vessel. Crane operators and planners should know that activities in the Hazardous Zones are not allowed and other control zones, such as the safety zone, can have restrictions on operations specified in the JPO. Crane operators should ensure that the crane does not remain above the vent riser for a long period. When moving the crane past the vent riser, there should be as much space as possible between the vent riser outlet and the crane.

[7] See SGMF publication 'Bunkering of Ships with LNG - Competency and assessment guidelines'

[8] See section 4.4 of the SGMF publication 'Recommendation of Controlled Zones during LNG bunkering' section 4.4

Table 6 – Incident response preparedness

#	Lay by Berth	Operations without LNG Bunkering	LNG bunkering without other operations	LNG bunkering simultaneously with other operations	Incident Response *Preparedness of the terminal incident and emergency response organisation*[9] Preparedness measure
20	-	B	B	B	The terminal should establish alarm procedures and lines of communication between the vessels and the terminal as introduced and specified in the JPO. Equally important is a properly-arranged alarm procedure and communication between the terminal and all relevant terminal personnel.
21	B	B	B	B	Terminal personnel, especially personnel who will handle the vessel or board the vessels, must be instructed on how to recognize an alarm and how to act in the event of an alarm.
22	-	-	B	B	The terminal should have a terminal emergency response plan containing LNG scenarios. In-house emergency response and the terminal's incident response organization must be prepared to respond adequately in the event of an LNG leakage or emission of natural gas. However, in many cases the in-house terminal incident organization is mainly organized to facilitate and support external professional emergency services. Incident communication procedures with external emergency services should be adapted and established, and the relevant personnel trained. Emergency response plans of involved parties should be known to each other and coordinated and aligned as much as possible. The terminal response plan should also consider the emergency response and firefighting capabilities of the vessels concerned. First aid responders should be prepared for frostbite injuries. The incident response organization can prepare itself by developing incident response plans for credible LNG incident scenarios. The LNG-specific incident response plans must be included in the regular training and exercises. (See Annex 1).
23	B	B	B	B	In the event of an incident on the terminal, the terminal should inform the vessels of any immediate or anticipated effects on the safety of the LNG bunkering or safety on board the vessels.
24	B	B	B	B	The terminal should require LNG-fuelled vessels to provide a sign or handout at the gangway entrance to the vessel giving proper safety information on LNG and information on the Safety Zone, muster points and alarm procedures.
25	-	-	B	B	If the JPO and gas dispersion study indicate that the Safety Zone will overlap with the terminal on the shore side, the terminal emergency response plans should take into account a possible escalation of a ship incident into a shore incident.

[9] See section 41.3.2. of the SGMF Publication 'Safety Guidelines – Bunkering'

Table 7 – Preparations for LNG bunkering

#	Lay by Berth	Operations without LNG Bunkering	LNG bunkering without other operations	LNG bunkering simultaneously with other operations	LNG Bunker Operations *LNG Bunker Awareness and Training[10] for terminal personnel boarding the vessel during LNG bunkering* Preparedness measure
30	-	-	P	-	IAPH CMF Working Group provides the LNG STS bunker checklists for use for ship-to-ship LNG bunkering in a port. The 'A' version of the STS bunker checklist with three columns – for the receiving vessel, the bunker vessel and the terminal – should be completed together with the terminal. The terminal will have already contributed to the preparation of the JPO. It should be clearly stated that no simultaneous operations will be carried out by the terminal during the LNG bunkering.
31	-	-	S	-	IAPH CMF Working Group provides the LNG STS bunker checklist for use with ship-to-ship LNG bunkering in a port. The 'B' version of the STS bunker checklist with two columns – for the receiving vessel and the bunker vessel – should be completed. The terminal will receive a Terminal Information Sheet with up-to-date operational information. The terminal will have already received and agreed to the JPO during the planning stage. This clearly states that no simultaneous operations will be carried out by the terminal during the LNG bunkering.
32	-	-	P	-	Terminal participation in the pre-operation meeting with the vessel operators should be attended.
33	-	-	S	-	Terminal participation in the pre-operation meeting with the vessel operators is recommended.
34	-	-	B	-	Terminal personnel who have to board the vessel should know how to act in the event of an alarm or another signal indicating a process failure in the bunker process (see 24).
35	-	-	B	-	Terminal personnel who board vessels during LNG bunker operations must be properly trained in the risks of LNG and the safety measures to be taken during an LNG bunkering. They must know about the control zones and the restrictions within the control zones that apply during an LNG bunkering. Control zones are the Hazardous Zone, the Safety Zone, the Monitoring and Security Zone, the Marine Exclusion Zone and the External Zone.

[10] See IAPH-CMF LNG bunker checklists: https://sustainableworldports.org/clean-marine-fuels/

Table 8 – Preparations for SIMOPS and LNG bunkering

#	Lay by Berth	Operations without LNG Bunkering	LNG bunkering without other operations	LNG bunkering simultaneously with other operations	Simultaneous Operations *Awareness and training for terminal personal involved in cargo handling during LNG bunkering*[11,12] Preparedness measure
40	-	-	-	P	IAPH CMF Working Group provides the LNG STS bunker checklists for use for ship-to-ship LNG bunkering in a port. The 'A' version of the STS bunker checklist with three columns – for the receiving vessel, the bunker vessel and the terminal – should be used in cooperation with the terminal. The terminal will have already participated in the drafting of the JPO and agreed to the JPO. It should be clearly stated which simultaneous activities may be carried out by the terminal during the LNG bunkering and which conditions apply during the SIMOPS.
41	-	-	-	S	IAPH CMF Working Group provides the LNG STS bunker checklist for use with ship-to-ship LNG bunkering in a port. The 'B' version of the STS bunker checklist with two columns – for the receiving vessel and for the bunker vessel – should be used. The terminal will receive a Terminal Information Sheet with up-to-date operational information. The terminal will have already received and agreed to the JPO during the planning stage. In the JPO it should be clearly stated which simultaneous activities may be carried out by the terminal during the LNG bunkering and which conditions apply during the SIMOPS.
42	-	-	-	P	The terminal will participate in the pre-operation meeting with the vessel operators.
43	-	-	-	S	The terminal will participate in the initial pre-operation meeting with the vessel operators. In the event of frequent LNG bunkering of the same vessels, joining the pre-operation meeting will depend on the content and outcome of the previous meetings and may become optional.
44	-	-	-	B	Terminal personnel boarding vessels during LNG bunker operations or involved in terminal operations on board a vessel during an LNG bunkering must be trained in the risks of LNG and the safety measures necessary to ensure safe cargo handling simultaneously with an LNG bunkering, and vice versa. They must know about the applicable control zones and the restrictions applying within them, in particular the Hazardous Zone and Safety Zone, and must know which activities may and may not be carried out in these zones.

[11] See IAPH-CMF LNG bunker checklists: https://sustainableworldports.org/clean-marine-fuels/

[12] See the SGMF publications 'Recommendation of Controlled Zones during LNG bunkering' and 'Simultaneous Operations (SIMOPS) during LNG bunkering'

Table 8 – Continued: Preparations for SIMOPS and LNG bunkering

#	Lay by Berth	Operations without LNG Bunkering	LNG bunkering without other operations	LNG bunkering simultaneously with other operations	Simultaneous Operations *Awareness and training for terminal personal involved in cargo handling during LNG bunkering*[13,14] Preparedness measure
45	-	-	-	B	With good planning of cargo and activities, cargo activities in the Safety Zone can be avoided during LNG bunkering (this can even be arranged by the planning departments outside the terminal). Performed risk assessments normally assume that only first party personnel (bunkering personnel) are present in the safety zone during bunkering and that 2nd party personnel (terminal operator, other ship crew) are present outside the safety zone. In safety management, avoiding a risk is always the best action. In case simultaneous operations in the safety zone cannot be avoided, proper risk assessment should be performed by all parties and mitigation measures should be in place to decrease the risk[15]
46	-	-	-	B	Terminal personnel should be properly informed about the applicable safety measures and restrictions described in the JPO and checklist/Terminal Information Sheet, and should be able to comply with the vessel-specific risk mitigation measures during LNG bunkering.
47	-	-	-	B	Terminal personnel boarding or handling the vessel, such as crane operators, must know how to act in the event of an alarm or other signal indicating a process failure in the bunkering process (see 24).
48	-	B	-	B	Crane operators should know the location of the vent riser. Cranes should not remain above the vent riser for a long period, but moving across it at a sufficient height is permissible. The vessel should give the terminal a copy of the Hazardous Zoning Plan (drawing) to inform the crane operator of the appropriate passage height above the vent stack. The crane and attached equipment should remain outside the Hazardous Zone around the vent stack.
49	-	-	B	B	Terminal personnel and third parties, such as cargo securing companies, boarding- or handling vessels should be instructed and aware of the safety measures in place to reduce the risk of objects falling on the LNG bunker vessel and its equipment.

[13] See IAPH-CMF LNG bunker checklists: https://sustainableworldports.org/clean-marine-fuels/
[14] See the SGMF publications 'Recommendation of Controlled Zones during LNG bunkering' and 'Simultaneous Operations (SIMOPS) during LNG bunkering'
[15] See ISO 20519

LNG Ready Terminal - Annex 3 - Third Party LNG preparedness

Third party preparedness

Besides terminal personnel (all persons covered by the safety management plan of the terminal), other people (third party persons) will also visit or work on board or in the vicinity of LNG-fuelled vessels. Often, ISPS will be applicable on LNG-fuelled vessels. Access by third parties and informing third party visitors of any conditions, regulations, codes or protocols is the responsibility of the LNG-fuelled vessel concerned. These third parties must be made aware of the risks of LNG by the LNG-fuelled vessel when boarding and they must be familiar with what to do in event of an alarm and if applicable, the do's and don'ts during a LNG-bunkering. This may be done in the form of a warning sign or a flyer at the entrance to the vessel listing do and don'ts during LNG bunkering. An example of a flyer, which can be issued by the vessel, is given in enclosure 2.

It is recommended that the terminal checks that the LNG-fuelled vessel gives third parties sufficient information when boarding.

Companies that routinely allow their employees to go on board for work during LNG bunkering (e.g. lashing companies and repair or maintenance companies) must make similar preparations to those of terminals and instruct and inform their employees about LNG. Ports should encourage these companies to offer LNG awareness training to their employers. Terminals can support this by offering to supply training materials (e.g. the awareness toolbox) for awareness training of third parties who visit LNG-fuelled vessels.

Third party personnel will also be present on the terminal. If they have to be present in the vicinity of the LNG-fuelled vessel, they will operate in the Monitoring and Security Area. Since the terminal contracts these third-party personnel, they should be informed by the terminal of ongoing activities.

It is recommended that the terminal informs terminal contractors or third-party visitors that have to be present in the vicinity of or on board the LNG-fuelled vessel about the planned STS LNG bunker operations when they sign in at the entrance to the terminal. When this isn't practical, or its impossible to provide up-to-date information at the gate, an additional notice during the common safety instruction should be considered. We recommend adding: "LNG-fuelled vessels might call at this terminal. Please be informed that in case an LNG bunkering operation is taking place, specific safety zones will clearly be indicated, and strict safety requirements will be applied". See item 08 in the checklist.

When issuing work orders to third party personnel, terminal personnel should be aware of the possible impact of the third-party activities, such as repairs to the terminal or maintenance of cranes in the vicinity of an LNG-fuelled vessel. This is also a control measure in the Monitoring and Security Area.

Enclosures

Enclosure 1	Example of a Terminal Flyer for third parties.
Enclosure 2	Example of a Vessel Flyer for visitors to LNG-fuelled vessels.

Enclosure 1 - Example of a Terminal Flyer for third parties

Golden Safety Rules for LNG bunkering at the terminal

During LNG bunkering additional safety requirements are applicable near the LNG bunker manifold. Please be aware of the hazardous and safety zone!

You have to:

- Sign up
- Know the escape routes to the assembly points
- Know when an LNG bunkering starts and ends

When a alarm occurs:

- Recognize the alarm signal
- Know what the alarm means
- Follow the directions
- Go to the assembly point

Control zones:

- There are two zones on board, the hazardous zone and the safety zone
- The hazardous zone is forbidden area for entry
- The safety zone is a safe area unless the alarm goes off
- In the safety zone all persons and activities are controlled by a ship's officer.

Additional safety requirements:

- Smoking is prohibited
- Work in the safety zone is carried out according to stated procedures
- Outside the hazardous and safety zones you should be safe from LNG bunker risks

LNG is liquefied natural gas with an extremely low temperature of -162 degrees. LNG is neither flammable or toxic, but due to its extreme low temperature it is dangerous to come into physical contact with LNG (e.g. severe burns).
In the event of leakage, LNG evaporates into a cold natural gas cloud that condenses into mist due to the moisture in the air. The fog cloud is flammable. When the cloud burns, the flame returns to the source. There will be no explosion in the open air. However an explosion can occur in a confined space. Always stay out of the fog cloud and avoid ignition sources.

Enclosure 2 - Example of a Vessel Flyer for visitors to LNG-fuelled vessels

SSE RULES for stevedores

External visitors ***shall do this form.***

Following rules should be reminded by the watchman to any visitors.
All stevedores, visitors, authorities should agree and sign it as evidence:

Follow below instruction to ensure your and our safety.

In case of an **emergency**, following signal is raised:

(7 short blasts followed by 1 prolonged blast).

You are to proceed to the ship evacuation.

SAFETY RULES

Personal Protective Equipment are compulsory.
You shall use at every moment.


Safety helmet


Safety gloves


High visibility clothes


Safety shoes

Vessel is a non smoking area.
Consumption of **drugs and alcohol is strictly prohibited.**

Warning
Every accident / incident should be reported to the vessel.

SECURITY RULES

The vessel is in compliance with the **ISPS Code** security regulations.
Access to accommodation and forecastle is prohibited except with a crew member.
All persons coming should have an ID.


AUTHORISED PERSONS ONLY

ENVIRONMENT RULES

Keep the vessel clean.
Do not throw any garbage in inappropriate locations.

Lashing rules

1. DAMAGED TWISTLOCKS CAMPAIGN

Please separate damaged twistlocks from the good one. All lashing material should be stored into dedicated racks. Hatch covers should not be open before securing the crossways.

2. Lashing bridges

Lashing bridges are protected with hand rails, wires and combined (hand rails and wires).

Little slack on protecting wires = Risk of fall from height (serious injury or fatality)

SSE RULES for stevedores

3. Bridge manholes

Bridge manhole without safety chains

Bridge manhole with safety chain

Always put a safety chain when a manhole is opened.
Close manholes when chains are not in place or not fitted.

4. Passage to hatch covers

Never leave the passage to hatch cover unsecured while the hold is open.
Secure the passage to the hatch cover by the chains or turn down the movable handrail

5. Lashing equipment

Twist lock storage containers

Lashing bars storage

Turnbuckles storage

Never throw twist locks, lashing bars and turnbuckles from height = Risks to injure persons and damage the vessel's structure

Lashing and unlashing operations should not be carried out under spreader movements = Risk of serious injuries or fatality

6. Turnbuckles

Turnbuckles in lashing bridge must never be removed from their positions
Safety pins must be kept closed
Locking devices must not be removed

7. Safety harness

Always work with safety harness if a risk of fall exists.

SSE RULES for stevedores

8. Midlocks housekeeping

Remove the midlocks from hatch covers and arrange it in the dedicated box.

9. Access to Aft Mooring Stations

Always pass by sea side ladder to join the aft mooring station to stay clear from mooring lines

LNG POWERED VESSELS RULES

During bunkering or under master's decision:

LNG is colorless and odorless.

Under pressure

Inflammable

Kindly confirm your understanding of this letter by returning the copy duly endorsed.

Thank you very much for your kind cooperation and assistance in this matter.

Master of ..... ***Date.....*** ***Stevedoring company Representative***

Completed

LNG Ready Terminal

Port and Terminal guidance

Port Authority Checklist

Checklist to determine a terminal's preparedness level

for LNG Fueled vessels

LNG Ready Terminal - Port Authority Checklist

Base information

Terminal name and location: ……

Time and date check: ……

Auditor: ……

What is the nature of the terminal's involvement?

Project-based	☐
System-based	☐

What activities are planned alongside the terminal?

Lay-by berth	☐
Operations without LNG Bunkering	☐
LNG bunkering without other operations	☐
LNG bunkering simultaneously with other operations	☐

Description of the checklist methodology

In order to find the preparedness measures that apply for the planned operations given the chosen terminal involvement, cross check the letters ‘B’, ‘P’ or ‘S’ against the operation columns. In this the letter codes significate the following:

B Preparedness measure applicable for both project-based approach and system-based approach;
P Preparedness measure only applicable for project-based approach;
S Preparedness measure only applicable for system-based approach;
- Preparedness measure not applicable.

In the checklist the letter indicates that the preparedness measures apply in one or more of the following situations:

Column 2 Lay-by Berth
The vessel uses the berth as a lay by berth without activities.

Column 3 Operations without LNG Bunkering
The vessel and terminal will carry out cargo or other activities without LNG bunkering.

Column 4 LNG bunkering without other operations
The vessel will carry out LNG bunkering without cargo or other activities.

Column 5 LNG bunkering with simultaneously with other operations
The vessel and terminal will carry out cargo or other activities simultaneously with LNG bunkering.

Port Authorities are to discuss the risk mitigation with the terminal on the issues indicated in the column with a ‘B’ and, dependent of the involvement/approach: ‘P’ or ‘S’.

#	Lay by Berth	Operations without LNG Bunkering	LNG bunkering without other operations	LNG bunkering simultaneously with other operations	Terminal Organisation *Preparatory Actions by the terminal safety organisation* Preparedness measure	Check
01	B	B	B	B	Has the terminal taken proper action to be aware of and deal with the risk of an emission of natural gas from the vent riser?	☐
02	-	-	B	B	Is a package of terminal information relevant to LNG bunkering available and ready for exchange with LNG-fuelled vessels and the LNG bunker vessel operator?	☐
03	-	-	P	P	In a project-based safety arrangement, has the terminal participated in HAZIDs and HAZOPs arranged by the LNG bunker facility operator at an early stage in risk assessments? Has the terminal contributed input on location- and terminal-specific information and on restrictions to the drafting of the Joint Plan of Operations (JPO)?	☐
04	-	-	-	P	In a project-based safety arrangement, has the terminal participated in a SIMOPS safety assessment? Does the terminal agree to and accept the safety mitigation strategies specific for terminal operations on the LNG-fuelled vessel concerned? Are appropriate terminal safety procedures in place for handling the LNG-fuelled vessel simultaneously with LNG bunkering?	☐
05	-	-	S	S	In a system-based safety arrangement, has the terminal arranged generic and flexible adaptive preparedness for LNG bunkering? Has the terminal the capacity in terms of know-how and procedures to review a proposal for JPO and to take the appropriate actions (acceptance, discussion or refusal)?	☐
06	-	-	-	S	In a system-based safety arrangement, has the terminal prepared operational safety procedures to make sure the operational part of the terminal organisation is capable of operating with the required risk mitigation during an LNG bunkering?	☐
07	-	-	B	B	Are communication procedures in place to share the proper operational information with all relevant personnel on the LNG bunkering, including restrictions on other activities during the LNG bunkering?	☐
08	-	-	B	B	Has the terminal procedures to inform terminal contractors or third-party visitors on planned STS LNG bunker operations when they sign in at the entrance of the terminal? (Not mandatory)	☐
09	-	-	B	B	If the Safety Zone overlaps with the terminal on the shore side, has the terminal procedures in place to take the proper action to restrict and control all activities within the Safety Zone?	☐

Remarks:

#	Lay by Berth	Operations without LNG Bunkering	LNG bunkering without other operations	LNG bunkering simultaneously with other operations	General Awareness *Awareness of terminal personal and visitors* Preparedness measure	Check
10	B	B	B	B	Is terminal personnel acquainted with vessels that use LNG as a fuel and with the primary safety rules?	☐
11	-	B	B	B	Do the relevant terminal personnel understand the behaviour of LNG and the different hazards of LNG compared with liquid fuels?	☐
12	-	-	B	B	Are the terminal personnel acquainted with unusual activities or occurrences?	☐
13	-	-	B	B	Does the terminal have procedures in place to effectuate the monitoring and security area during LNG bunkering, and are terminal personnel trained or instructed to be aware of their environment and all activities that may have an impact on the risks of LNG bunkering?	☐
14	-	-	B	B	Does the terminal provide procedures and means of communication to obtain reports from its personnel on issues that might affect the LNG bunkering? Does the terminal have procedures and means of communication in place to inform vessels of possible safety breaches during LNG bunkering?	☐
15	-	B	B	B	Does the terminal have procedures in place to give the appropriate instructions related to the agreed JPO to the terminal personnel boarding or handling the vessel, such as ed crane operators and planners? Are crane operators instructed to ensure the crane does not remain above the vent riser for a long period?	☐
Remarks:						

#	Lay by Berth	Operations without LNG Bunkering	LNG bunkering without other operations	LNG bunkering simultaneously with other operations	Incident Response *Preparedness of the terminal incident and emergency response organisation* Preparedness measure	Check
20	-	B	B	B	Does the terminal have established alarm procedures and proper lines of communication?	☐
21	B	B	B	B	Have terminal personnel been instructed on how to recognise an alarm and how to act in the event of an alarm?	☐
22	-	-	B	B	Are the in-house emergency response plans and the terminal's incident response organisation prepared and aligned with external incident response plans?	☐
23	B	B	B	B	Will the terminal inform vessels should an incident occur on the terminal that could affect these vessels?	☐
24	B	B	B	B	Does the terminal require LNG-fuelled vessels to provide proper safety information at the gangway?	☐
25	-	-	B	B	In case the safety zone has an overlap with the shore: Do the terminal emergency response plans consider a possible escalation of a ship incident into a shore incident?	☐
Remarks:						

#	Lay by Berth	Operations without LNG Bunkering	LNG bunkering without other operations	LNG bunkering simultaneously with other operations	LNG Bunker Operations *LNG Bunker Awareness and Training for terminal personnel boarding the vessel during LNG bunkering* Preparedness measure	Check
30	-	-	P	-	Does the terminal have a procedure in place to fill in the 'A' format of the IAPH CMF Working Group LNG STS bunker checklist? Will the terminal review and agree on a final JPO? Will the terminal clearly state that in this case no simultaneous operations will be performed by the terminal during the LNG bunkering?	☐
31	-	-	S	-	Does the terminal have a procedure in place to receive Terminal Information Sheet, and act accordingly upon its content? Will the terminal review and agree on a final JPO? Will the terminal clearly state that in this case no simultaneous operations will be performed by the terminal during the LNG bunkering?	☐
32	-	-	P	-	Will the terminal participate in the pre-operation meeting with the vessel operators?	☐
33	-	-	S	-	Will the terminal participate in the pre-operation meeting?	☐
34	-	-	B	-	Have terminal personnel boarding the vessel been instructed how to act in the event of an alarm or another signal indicating a process failure in the bunker process?	☐
35	-	-	B	-	Are terminal personnel boarding during LNG bunker operations acquainted with the risks of LNG and the safety measures to be taken during an LNG bunkering? Do they know about the control zones and the restrictions applying within the control zones during an LNG bunkering?	☐
Remarks:						

#	Lay by Berth	Operations without LNG Bunkering	LNG bunkering without other operations	LNG bunkering simultaneously with other operations	Simultaneous Operations *Awareness and training for terminal personal involved in cargo handling during LNG bunkering* Preparedness measure	Check
40	-	-	-	P	Does the terminal have a procedure in place to fill in the 'A' format of the IAPH CMF Working Group LNG STS bunker checklist? Will the terminal review and agree on a final JPO? Is the terminal able to identify which simultaneous activities may be carried out by the terminal during the LNG bunkering and which conditions apply during the SIMOPS in order to maintain the required level of safety?	☐
41	-	-	-	S	Has the terminal received a Terminal Information Sheet? Has the terminal received and agreed to the JPO? Is terminal able to identify which simultaneous activities may be carried out by the terminal during the LNG bunkering and which conditions apply during the SIMOPS in order to maintain the required level of safety?	☐
42	-	-	-	P	Will the terminal participate in the pre-operation meeting with the vessel operators?	☐
43	-	-	-	S	Will the terminal participate in the pre-operation meeting with the vessel operator?	☐
44	-	-	-	B	Are terminal personnel boarding the involved vessels acquainted with the risks of LNG and the safety measures that are necessary to ensure safe cargo handling simultaneously with an LNG bunkering, and vice versa? Do they know about the applicable control zones and the restrictions applying within them? Have terminal personnel been properly informed about the applicable safety measures?	☐
45	-	-	-	B	Will cargo activities be planned to ensure that they do not take place in the Safety Zone during the LNG bunkering?	☐
46	-	-	-	B	Are terminal personnel handling the ships that will bunker LNG (planners, crane operators) acquainted with the safety measures that are necessary to ensure safe cargo handling simultaneously with an LNG bunkering? Do they know about the applicable control zones and the restrictions applying within them? Have the terminal personnel been properly informed about the applicable safety measures?	☐
47	-	-	-	B	Do terminal personnel boarding the vessel or handling the vessel, such as crane operators, know how to act in the event of an alarm or other signal indicating a process failure in the bunkering process?	☐
48	-	B	-	B	Are the crane operators acquainted with the location of the vent riser? Do they know that they must not allow the crane to remain above the vent riser for a long period?	☐
49	-	-	-	B	Are the crane operators aware of the safety measures in place to reduce the risk of objects falling on the LNG bunker vessel and its equipment?	☐

Remarks: