THE REPUBLIC OF LIBERIA
LIBERIA MARITIME AUTHORITY

Office of
Deputy Commissioner
of Maritime Affairs

Marine Notice

SAF-003
Rev. 01/26

TO: **ALL OWNERS, OPERATORS, MASTERS AND OFFICERS OF MERCHANT SHIPS and MOBILE OFFSHORE UNITS, AGENTS AND RECOGNIZED ORGANIZATIONS**

SUBJECT: **Procedures for Entering Enclosed Spaces and Enclosed Space Entry and Rescue Drills**

References:
(a) Liberian Maritime Regulation 10.296(9)
(b) SOLAS 74, as amended
(c) MODU Codes 1979, 1989, and 2009 as amended and as applicable
(d) ISM Code
(e) IMSBC Code
(f) IMDG, IBC and IGC Codes
(g) MLC 2006, as amended, Standard A4.3
(h) MSC.581(110)

Supersedes: **Marine Notice SAF-003, dated 12/25**

The following changes have been included:

a. Amended paragraph 6.2 to clarify the number of atmosphere testing instruments to carry on board.

PURPOSE

This Notice establishes safety requirements and recommendations for entering enclosed spaces on board ships, including but not limited to spaces such as cargo holds, bilge spaces, ballast and other tanks, pump-rooms, chain lockers and engine crankcases, . The objective is to encourage the adoption of safety procedures and the development of sound practices aimed at preventing casualties to, and enhancing the safety of, personnel entering or working in enclosed spaces where there may be an oxygen-deficient, oxygen-enriched, flammable and/or toxic atmosphere.

Investigations into the circumstances of enclosed space accidents have shown that a failure to systematically identify the hazards, assess the risks and implement an appropriate entry procedure remains a significant factor in many accidents. Likewise, the complex structure of some spaces on board ships creates problems with appropriate ventilation, illumination and movement within the space. Organizational leadership on ship and shore plays a crucial role in successful implementation of the safety requirements and recommendations by empowering shipboard staff to make the right decisions.

APPLICABILITY

The following requirements and recommendations apply to all types of vessels and provide guidance to vessel operators, seafarers and shore personnel who work on board ships. It should be noted that on vessels where entry into enclosed spaces may be infrequent, for example, on certain passenger ships or small general cargo ships, the dangers may be less apparent, and accordingly there is a need for increased vigilance.

It may not be practicable to apply all of these requirements and recommendations to all situations; however, when applying these recommendations becomes impracticable, every endeavor should be made to observe the intent of the recommendations, and attention should be paid to the hazards that may be involved in the specific entry and mitigations required to reduce the risks to an acceptable level.

INTRODUCTION

The atmosphere in any enclosed space may be oxygen-deficient or oxygen-enriched and/or contain flammable and/or toxic gases or vapours. Such unsafe atmospheres could also subsequently occur in a space previously found to be safe. Unsafe atmospheres are likely to be present in spaces that are connected to a space containing a hazardous atmosphere and may also be present in spaces adjacent to those spaces where a hazard is known or suspected to be present.

An unsafe atmosphere can also quickly occur in a space previously found to be safe, including cargo holds and tanks where the hatch covers and tank covers have been open for some time. Unsafe atmospheres can occur in frequently visited working areas and stores, such as forecastle head spaces, pump-rooms, compressor rooms, inert gas rooms and other spaces that are adjacent to, or connected to, spaces containing a hazardous atmosphere. These spaces include cargo holds containing cargo that depletes oxygen and/or emits toxic, flammable or explosive gases, or is under fumigation.

An unsafe atmosphere can also occur in void spaces, cofferdams, pipe tunnels and also in accommodation areas and engine-rooms adjacent to or connected to cargo holds containing hazardous cargo or under fumigation due to a failure in the means of sealing the connection between the cargo space and the adjacent spaces.

The emission of toxic, flammable or explosive gases from cargo tanks, fuel tanks, slop tanks and sewage tanks can also give rise to a potentially dangerous situation around open access hatches, manholes and ventilators on deck.

1.0 DEFINITIONS

1.1 **Enclosed space**: A space which may contain a hazardous atmosphere or lack of oxygen and has any of the following characteristics:

.1 limited openings for entry and exit;
.2 inadequate ventilation; or
.3 is not designed for continuous human occupancy, and includes but is not limited to that are diverse in their characteristics such as cargo holds, bilge spaces, ballast and other tanks, pump-rooms, chain lockers, and engine crankcases.

1.2 **Connected space**: A space that is connected, by either permanent or temporary means (such as a door), to a source space that may contain a hazardous atmosphere. For clarity, a space separated by a manual door, even if watertight, should be considered as "connected" as it is impossible to tell from outside the space whether it is open or closed or indeed properly sealed. A connected space should be treated as containing a hazardous atmosphere until testing proves o y.

1.3 **Adjacent space**: A space that shares a common boundary with a compartment that may contain a hazardous atmosphere. Such a space has no openings, temporary or permanent, into the hazardous compartment whatsoever and is designed to be a contiguous barrier. Such a space may only contain a hazardous atmosphere in the event of failure of that barrier. Precautions should relate to the possibility of such a failure.

1.4 **Trapped Hazardous Atmosphere:** A hazardous atmosphere that may be trapped in a connected space in a manner that causes that space's atmosphere to fill and/or to empty at a different rate to the source space. Such a space, while recognized as containing the same atmosphere, should be treated independently to the source space, and should be assumed to contain a hazardous atmosphere until proved otherwise by testing. For example, a trapped atmosphere may remain even after the cargo in the source space is discharged

1.5 **Competent person**: A person with an operational level of competency to make an informed assessment of the likelihood of a dangerous atmosphere being present or subsequently arising in the space.

1.6 **Responsible person**: A Person in a management level on board a ship (i.e. master, chief mate, chief engineer officer or second engineer officer) of competency and authorized by the shipping company to permit entry into an enclosed space.

1.7 **Attendant**: A person who maintains a watch over those entering the enclosed space, to maintain communications with those inside the space and to initiate the emergency procedures in the event of an incident occurring.

1.8 **Enclosed Space Register:** A ship-specific register which lists all enclosed spaces on board the ship, along with their connected spaces and adjacent spaces, their hazards, associated risk mitigations if applicable, and how the atmosphere in these spaces may change depending upon the nature of cargo carried or the content of the space, and which forms a part of the safety management for enclosed spaces.

REQUIREMENTS

2.0 Safety Management System for Entry into Enclosed Spaces

2.1 A safety strategy should be adopted in order to prevent accidents on entry into enclosed spaces in a comprehensive manner by the company, in consultation with the ship. This should include an Enclosed Space Register, which should be produced on a ship-by-ship basis to identify enclosed spaces, the hazards of those spaces, assessment of risks under the differing conditions likely to arise in the space and the risk mitigation measures required to be put into place prior to entry. This should also include an assessment of how the atmosphere in these enclosed spaces may be impacted by the contents of the spaces themselves, or the contents of connected spaces or adjacent spaces, including cargo, fumigants, fuel oils, slops, oxygen-depleting conditions and the physical or structural

arrangement of the space. The Enclosed Space Register is to contain at least the items noted in paragraph 3.3.

2.2 The Company should ensure that all relevant information relating to the hazards of the cargo, as submitted by the shipper in accordance with the applicable requirements of SOLAS regulation VI/2, the International Maritime Solid Bulk Cargoes Code (IMSBC Code), the International Maritime Dangerous Goods Code (IMDG Code), the IBC Code and the International Gas Carrier Code (IGC Code), references (e) and (f), is provided in a format that is understandable to the ship's crew and distributed to those on board who may be exposed to these hazards.

2.3 The Company shall ensure that clear instructions and procedures for entering enclosed spaces are included and implemented among the key shipboard operations concerning the safety of personnel and the vessel, in accordance with paragraphs 6.4, 7 and 12.3 of the International Safety Management (ISM) Code, reference (d). The instructions and procedures should ensure that entries into enclosed spaces are carried out in a safe manner, taking into account the guidance provided in this Marine Notice.

2.3 The company shall ensure that adequate time has been allowed for any planned enclosed space activity, and that undue time pressure, either explicit or implied, is avoided as this has been found to be a causal factor of many enclosed space accidents. The company shall also ensure that single person entry into an enclosed space is not permitted

2.4 The competent and responsible persons designated by the Company shall be trained in enclosed space hazard recognition, evaluation, measurement, control and elimination, using internationally recognized standards. The competent person should have received adequate training along with sufficient theoretical knowledge and practical experience to make an informed assessment of the likelihood of a dangerous atmosphere being present or subsequently arising in the space. The responsible person should have sufficient knowledge of the procedures to be established and complied with on board and have received adequate training, in order to ensure that an enclosed space is safe for entry and occupancy. The attendant shall be adequately trained within the safety management system.

2.5 All crew members shall be trained, as appropriate, in enclosed space safety, including familiarization with onboard procedures for recognizing, evaluating and controlling hazards associated with entry into enclosed spaces

2.6 The training in 2.4, 2.5 and 6.3 should be recorded in the ships' on-board training record.

2.7 The company shall identify and provide the necessary equipment such as ventilation devices, atmosphere testing equipment, breathing apparatus and personnel recovery apparatus to facilitate safe entry and rescue from an enclosed space. The equipment provided should be suitable for the intended use.

2.8 The Company shall ensure crew members with enclosed space entry or rescue responsibilities are given adequate training in the safety management of enclosed spaces as per paragraphs 6.3 and 6.5 of the ISM Code and participate in rescue drills from enclosed space identified in their Enclosed Space Register at least once every two (2) months. Each enclosed space entry and rescue drill shall include:

- Checking and use of the personal protective equipment required for entry;

- Checking and use of communication equipment and procedures;
- Checking and use of instruments for measuring the atmosphere in enclosed spaces;
- Checking and use of rescue equipment, and
- Instructions in first aid and resuscitation techniques.

2.8.1 The drills shall be recorded in the official log book.

2.9 The Company shall ensure that single person entry into an enclosed space is not permitted.

2.10 An onboard means of recharging breathing apparatus cylinders used during drills shall be provided or a suitable number of spare cylinders shall be carried on board to replace those used during drills. These are in addition to those required under Regulation 10.10 of SOLAS Chapter II-2.

2.11 When deciding the number of spare cylinders to be provided for on board drills, the company should consider the requirements in the Safety Management System for the number/frequency of drills where breathing apparatus cylinders may be used, and the nature of the vessels trading pattern with respect to shore-based charging facilities.

2.12 Cylinders intended for drills should be prominently marked to indicate their intended use.

2.13 The Safety Management System shall take account that at least two fully charged spare cylinders for drills must be on board.

2.14 Internal audits by the company of the ship's safety management system should verify that the established procedures are complied with in practice and are consistent with the safety strategy adopted by the Company.

2.15 Masters and Officers are reminded that enclosed spaces shall be assumed to be incapable of supporting life and shall be well ventilated before testing and entry. 'Tanks and void spaces shall be adequately vented before testing and should take into account the contaminants in the tank, the lay-out and size of the tank and the rating and design of the ventilation system.'

3.0 Identification of Hazards and Assessment of Risk

3.1 The company should ensure that a risk assessment is conducted to identify all enclosed spaces on board the vessel and that the identified enclosed spaces are recorded in the Enclosed Space Register, which should be maintained on board the ship as well as ashore. This Enclosed Space Register and risk assessment should be dynamic and kept up to date as appropriate to ensure its continued validity, particularly after loading and during the carriage of cargoes which may adversely affect the safety of the atmosphere within a space; including after discharging the cargo, which may result in trapped hazardous atmosphere in connected spaces, such as bilges and stools

3.2 The Enclosed Space Register and risk assessment should form the basis for the development of the enclosed space emergency response plan (Refer to Appendix 1 of **reference (h)**).

3.3 The Enclosed Space Register should contain:

.1 physical layout of the space and access and egress points, including of connected spaces, if any;

.2 physical hazards in the space, e.g., vertical ladders, unguarded openings, poor lighting, wet or slippery conditions, excessive heat;

.3 connection to adjacent spaces;

.4 specific hazards within the space, for example, the effect of ballast water treatment method on the atmosphere within ballast tanks;

.5 if used, information related to additional technology, helping to determine enclosed space condition;

.6 information related to fixed and portable ventilation systems including equipment and where the equipment is stored;

.7 estimated time taken to achieve the air changes for safe entry, using forced or natural ventilation;

.8 lighting and means for temporary lighting including intrinsically safe lighting where appropriate;

.9 means for atmosphere testing;

.10 any pertinent information that would assist the risk assessment process;

.11 locking and "Safe to enter"/"Unsafe to enter" signage arrangements; and

.12 the equipment necessary to facilitate emergency rescue from the space.

3.4 In order to ensure safety from the outset, entry and occupancy, a competent person should always make an assessment of any potential hazards in the space to be entered. The assessment should consider current and previous cargo carried with Safety Data Sheets (SDS) and cargo information, safety restrictions related to treated ballast in the ballast water management plan, fumigation, inert gas, ventilation of the space, coating of the space and other relevant factors. The competent person's assessment should determine the potential for the presence of an oxygen-deficient, oxygen-enriched, flammable or toxic atmosphere, which includes carbon monoxide (CO) and carbon dioxide (CO_2) as well as other toxic or asphyxiant gases. The competent person should bear in mind that the ventilation procedures for an adjacent connected space may be different from the procedures for the ventilation of the enclosed space itself. The details of the assessment should be recorded in a standard format and maintained on board the vessel.

3.5 The procedures to be followed for testing the atmosphere in the space and for entry should be decided on the basis of the assessment. These will depend on whether the assessment shows that:

.1 there is minimal risk to the health or life of personnel entering the space; or

.2 there is no immediate risk to health or life but a risk could arise during the course of work in the space; or

.3 a risk to health or life is identified.

3.6 Where the assessment indicates minimal risk to health or life or potential for a risk to arise during the course of work in the space, the precautions described in sections 4, 5, 6 and 7 should be followed, as appropriate.

3.7 Where the assessment identifies a risk to life or health, if entry is to be made, the additional precautions specified in section 8 should also be followed.

3.8 Throughout the assessment process, there should be an assumption that the space to be entered is considered to be hazardous until positively proved to be safe for entry.

4.0 Authorization of Entry

4.1 No person should open or enter an enclosed space unless authorized by the master or the nominated responsible person and unless the appropriate safety procedures laid down for the particular vessel have been followed.

4.2 Entry into enclosed spaces should be planned and the use of an entry permit system, which may include the use of a checklist, shall always be used where the assessment identifies any risk to health or life. Prior to the entry of a space, an enclosed space entry permit shall be issued by the master or the nominated responsible person, and completed by the personnel who enter the space prior to entry. An example of the enclosed space entry permit is provided in **Appendix 2 of reference (h)**. The validity of the permit should be specified based on the risk assessment and should never be longer than eight hours.

5.0 General Precautions

5.1 Access to enclosed spaces should be carefully managed on ships where shore personnel regularly enter cargo spaces to load and discharge cargoes, especially on bulk carriers and general cargo ships. Before any personnel are authorized to enter any cargo space containing or that previously contained any cargo, the competent person should carry out a risk assessment of the cargo; identification of the physical characteristics of the cargo space(s) concerned; and the operations to be carried out.

5.2 Entry doors or access hatches leading to enclosed spaces should at all times be secured against entry unless the spaces have been risk assessed, atmospherically tested as required and declared safe for entry. A door or hatch cover which is opened to provide natural ventilation of an enclosed space may, wrongly, be taken to be an indication of a safe atmosphere and therefore, an attendant may be stationed at the entrance or the use of a mechanical barrier, such as a lock bar or chain positioned across the opening with an attached warning sign, could prevent such accidental entry.

5.3 The master or the responsible person should determine that it is safe to enter an enclosed space by ensuring that:

.1 potential hazards have been identified in the assessment and as far as possible isolated or made safe;

.2 the space has been thoroughly ventilated by natural or mechanical means to remove any toxic or flammable gases and to ensure an adequate level of oxygen throughout the space;

.3 the atmosphere of the space has been tested using certified and calibrated instruments to ascertain that the space contains 20.9% oxygen. If the testing indicates that the level of oxygen is less than 20.9%, or indicates the presence of even low levels of flammable or toxic gases, then the space should be treated as one where the atmosphere is known or suspected to be unsafe, as described in section 8;

.4 the space has been declared safe for entry and properly illuminated;

.5 a suitable system of communication between all parties for use during entry has been agreed and tested, including alternate means of attracting attention;

.6 personnel entering the space are wearing personal gas detection equipment that has been properly calibrated and is capable of monitoring the levels of oxygen, carbon monoxide and any other gases identified in the risk assessment;

.7 an appropriate means of rescue has been evaluated and agreed taking into account the nature and construction of the enclosed space and the rescue and resuscitation equipment available;

.8 an attendant has been instructed to remain at the entrance to the space whilst it is occupied;

.9 rescue and resuscitation equipment has been positioned, tested and ready for immediate use at the entrance to the space and a rescue plan detailing the rescue arrangements have been agreed;

.10 personnel are properly clothed and equipped for the entry and subsequent tasks;

.11 the required permits have has been issued, authorizing entry; and

.12 vessel's crew should be made aware of such operations in order to avoid accidents resulting from unauthorized use of equipment, valves, stopping the ventilation or closing of ventilators.

The precautions in subparagraphs .6,.8 and .9 may not apply to every situation described in this section. The responsible person authorizing entry should determine whether personal gas detectors, an attendant, and the positioning of rescue equipment at the entrance to the space are necessary.

5.4 Only trained and authorized personnel should be assigned the duties of entering, functioning as attendants or functioning as members of rescue teams. Ships' crews with rescue and first aid duties should be drilled periodically in rescue and first aid procedures. Training should include as a minimum:

.1 identification of the hazards likely to be faced during entry into enclosed spaces and whilst within the space, in particular the rapidity with which oxygen may be depleted in a space by corrosion or biological means especially in higher ambient temperatures;

.2 an explanation of how the pace at which oxygen is depleted will increase exponentially when ventilation is stopped, or when hatch covers are closed;

.3 identification and use of the various sources of information on the hazards associated with individual solid bulk and liquid bulk cargoes, and the precautions to be adopted when entering spaces containing such cargoes, or their residues;

.4 recognition of the signs of adverse health effects caused by exposure to hazards during entry;

.5 awareness of the fact that when a person or persons in an enclosed space shows signs of adverse health effects, that they should always assume that these effects are due to an oxygen-depleted or toxic atmosphere in the space, and that they should not enter it themselves;

.6 knowledge and experience in the use of personal protective equipment required for entry, communication equipment, atmosphere measuring instruments, rescue equipment, and procedures;

.7 rescue, first aid, cardio pulmonary resuscitation (CPR) techniques, emergency, and evacuation procedures;

.8 knowledge of the IMO/WHO/ILO Medical First Aid Guide for Use in Accidents involving Dangerous Goods (MFAG), where appropriate; and

.9 knowledge of use of emergency and the first aid equipment for chemical tankers (IBC Code section 14.3) and for gas carriers (IGC Code section 14.3), where appropriate.

5.5 All equipment used in connection with entry should be in good working condition and inspected and tested prior to use.

5.6 As far as practicable, enclosed space entry should be carried out during hours of daylight or normal working hours of the ship to ensure ready availability of reserve personnel in the event of an emergency.

6.0 Testing the Atmosphere

6.1 The gas detection equipment should be appropriate for the cargo that the ship has carried and is carrying considering information provided in the shipper's declaration, the Safety Data Sheets (SDS), the IMDG Code, the IMSBC Code, International Bulk Chemical Code (IBC Code) and the IGC Code. The gas detection equipment, including devices for

testing CO2, should be capable of operating correctly even in oxygen-depleted atmosphere.

6.2 Every vessel to which Chapter I of SOLAS and Chapter I of the MODU Codes apply (references (b) and (c)) shall as required by SOLAS regulation XI-1/7, carry an appropriate atmosphere testing instrument or instruments capable of measuring concentrations of oxygen, flammable gases or vapors, hydrogen sulphide and carbon monoxide, prior to entering enclosed spaces. The Safety Management System shall take account of the number of instruments to be carried on board based on a suitable risk assessment. The instrument should be capable of remote sampling and detection for all gases that it is designed for, without interference from the atmosphere or other characteristics of the intervening space. Any ship which may carry a cargo capable of generating hazardous vapour and which requires regular entry into the cargo space for cleaning or inspection should carry two sets of gas detection equipment in addition to those required by SOLAS regulation XI-1/7 for assessing the risk to personnel entering the space. Guidance in selecting the testing instrument is provided in **MSC.1/Circ.1477**. Instruments carried under other requirements may satisfy this regulation. The testing instrument should be calibrated in accordance with the manufacturer's instructions. Suitable means shall be provided for the calibration of all such instruments.

6.3 The company shall elaborate a procedural implementation scheme which provides for comprehensive training in the maintenance, calibration, and use of atmospheric testing equipment in enclosed spaces. This training should be recorded, and individual crew members who have been deemed competent in the maintenance, calibration and use of atmospheric testing equipment shall be listed.

6.4 Appropriate testing of the atmosphere of an enclosed space shall be carried out by persons trained in the use of the instrument. The manufacturers' instructions should be strictly followed. Testing of the space shall be carried out before any person enters the space and at regular intervals thereafter until all work is completed. Where appropriate, the testing of the space should be carried out at as many different levels as is necessary to account for gas stratification and obtain a representative sample of the atmosphere in the space. In some cases it may be difficult to test the atmosphere throughout the enclosed space without entering the space (e.g. the bottom landing of a stairway) and this should be taken into account when assessing the risk to personnel entering the space. The use of flexible hoses or fixed sampling lines, which reach remote areas within the enclosed space, may allow for safe testing without having to enter the space.

6.5 After completion of a suitable risk assessment targeted to the space to be entered, steady readings of all of the following should be obtained:

.1 20.9% oxygen by volume;

.2 the level of carbon dioxide has been checked and is less than 0.5% by volume (5,000 ppm);

.3 less than 1% of lower flammable limit (LFL), where the assessment has determined that there is potential for flammable gases or vapors; and

.4 less than 50% of the occupational exposure limit (OEL)* of any toxic vapors and gases.

If these conditions cannot be met, additional ventilation should be applied to the space and re-testing should be conducted after a suitable interval. Entry shall be allowed only after all the above conditions are met. When the atmosphere remains, or is suspected to be unsafe, then the guidance contained within section 8 should apply.

* It should be noted that the term Occupational Exposure Limit (OEL) includes the Permissible Exposure Limit (PEL), Maximum Admissible Concentration (MAC) and Threshold Limit Value (TLV) or any other internationally recognized terms.

6.6 Any gas testing should be carried out with ventilation to the enclosed space stopped, and after conditions have stabilized, in order to obtain accurate readings.

6.7 Where the assessment has determined that there is potential for the presence of toxic gases and vapors, appropriate testing should be carried out, using fixed or portable gas or vapor detection equipment. The readings obtained by this equipment should be below the occupational exposure limits for the toxic gases or vapors given in accepted international standards, in accordance with paragraph 6.5. It should be noted that testing for flammability or oxygen content does not provide a suitable means of measuring for toxicity, nor vice versa.

6.8 It should be emphasized that the internal structure of the space, cargo, cargo residues and tank coatings may also present situations where oxygen-deficient areas or areas with toxic vapours may exist, and should always be suspected, even when an enclosed space has been satisfactorily tested as being suitable for entry. This is particularly the case for spaces where the path of the supply and outlet ventilation is obstructed by structural members or cargo.

7.0 Precautions during Entry

7.1 The atmosphere should be tested frequently whilst the space is occupied and persons should be instructed to leave the space should there be deterioration in the conditions.

7.2 Persons entering enclosed spaces should be provided with calibrated and tested portable personal-gas detection instrument or instruments that monitor the levels of oxygen, carbon dioxide, flammable gases or vapours, toxic gases (including carbon monoxide), hydrogen sulphide and any other flammable/toxic gases or vapours (% of LFL) identified in the risk assessment.

7.3 Ventilation should continue during the period that the space is occupied and during temporary breaks. Before re-entry after a break, the atmosphere should be re-tested. In the event of failure of the ventilation system, any persons in the space should leave immediately.

7.4 Particular care should be exhibited when working on pipelines and valves within the space, which may contain hazardous gases, vapours, or liquids. If conditions change during the work, increased frequency of testing of the atmosphere should be performed. Changing conditions that may occur include increasing ambient temperatures, the use of oxygen-fuel torches, mobile plant, work activities in the enclosed space that could evolve vapors, work breaks, or if the vessel is ballasted or trimmed during the work.

7.5 In the event of an emergency, under no circumstances should the attending crew member enter the space before help has arrived and the situation has been evaluated to ensure the safety of those entering the space to undertake rescue operations. Only crew members with

enclosed space entry or rescue responsibilities should perform rescue operations in enclosed spaces.

8.0 Additional precautions for entry into a space where the atmosphere is known or suspected to be unsafe

8.1 In preparing to enter an enclosed space, every effort should be made to ensure that it is safe to do so in order to undertake the activity required within the space. Entry into enclosed spaces where the atmosphere is known or suspected to be unsafe requires very careful consideration, including an assessment of the hazards, residual risks and mitigations that need to be undertaken. Spaces that have not been tested should be considered unsafe for persons to enter..

8.2 When considering the planned work activity within an enclosed space where the atmosphere is known or suspected to be unsafe, type-approved breathing apparatus, e.g. of the air-line or self-contained type, should always be worn, and only personnel trained in its use should be allowed to enter the space. Air-purifying respirators, dust masks and canister face masks do not provide a supply of clean air from a source independent of the atmosphere within the space.

8.3 Emergency Escape Breathing Devices (EEBDs) should not be used for entering oxygen deficient spaces, as these are used only for escaping from a compartment that has a hazardous atmosphere, although spare EEBDs may be available at location in the enclosed space for emergency escape, when necessary.

8.4 Persons entering enclosed spaces that may contain a suspected atmospheric hazard should be provided with calibrated and personal gas detector suitable for the gas or gases assessed as likely to occur in the space..

8.5 Rescue harnesses should be worn and, unless impractical, lifelines should also be used. A means to facilitate evacuation from the enclosed space should be available and ready for use, as per emergency response plan.

8.6 Appropriate protective clothing should be worn, particularly where there is any risk of toxic substances or chemicals coming into contact with the skin or eyes of those entering the space.

8.7 The advice in paragraph 7.5 concerning emergency rescue operations is particularly relevant in this context.

9.0 Hazards related to specific types of ships, cargo or operations

Dangerous goods in packaged form

9.1 The atmosphere of any space containing dangerous goods may put at risk the health or life of any person entering it. Dangers may include flammable, toxic, corrosive gases or asphyxiant or vapors, residues on packages and spilled material. The same hazards may be present in spaces adjacent to the cargo spaces. Information on the hazards of specific substances is contained in the International Maritime Dangerous Goods (IMDG) Code, the IMDG Code supplement which contains the Emergency Procedures for Ships Carrying Dangerous Goods (EMS guide), Safety Data Sheets (SDS) and the shippers' declaration. If there is evidence or suspicion that leakage of dangerous substances has occurred, the

precautions specified in this Marine Notice should be followed.

9.2 Personnel required to deal with spillages or to remove defective or damaged packages should be appropriately trained and wear suitable breathing apparatus and appropriate protective clothing.

Liquid Bulk

9.3 The industry has produced extensive advice to managers, operators and crews of ships engaged in the bulk carriage of oil, chemicals, and liquefied gases, in the form of specialist international safety guides. Information in the guides on enclosed space entry amplifies these recommendations, In particular, for chemical tankers as defined in SOLAS regulation VII/8, the diversity of bulk liquid chemicals carried in some cargo tanks and the limitations in vapour detection technologies may pose complications that require specific and targeted mitigation.

9.4 Crew should be alerted to the danger which will arise if liquid cargo leaks from defective pumps or cargo piping systems into the pump-room bilges.

Use of Nitrogen as an inert gas

9.5 Nitrogen is a colorless and odorless gas that, when used as an inert gas, causes oxygen deficiency in enclosed spaces and at exhaust openings on deck during purging of tanks and void spaces and use in cargo holds. It should be noted that one deep breath of 100% nitrogen gas will be fatal. Refer to **MSC.1 Circ.1401**, for guidelines on tank entry on tankers using nitrogen as an inerting medium.

Solid Bulk

9.6 On ships carrying solid bulk cargoes, dangerous atmospheres may develop in cargo spaces and adjacent spaces. The dangers may include flammability, toxicity, oxygen depletion, carbon dioxide and/or carbon monoxide generation, or self-heating, as identified in the shipper's declaration and/or in the individual schedules in appendix 1 of the IMSBC Code. For additional information, reference should be made to the International Maritime Solid Bulk Cargoes (IMSBC) Code.

Entry of personnel into a cargo hold using a hold vertical ladder, “Australian Ladder” or any other type of enclosed access or trunk should only be permitted when:

1. the atmosphere in the access trunk and hold has been tested and found to be safe;
2. wearing a personal gas detector;
3. wearing a safety harness; and
4. an emergency response plan is in place.

Working spaces with connections to cargo holds

9.7 In certain designs of general cargo ships, bulk carriers and tankers, doors, and ventilation trunks of cargo spaces, as well as pipework connecting to cargo spaces, are connected directly into working spaces such as forecastle workspaces, stores rooms, windlass hydraulics, bow thruster, and other machinery rooms. When a certain cargo is stowed in the cargo space, there is a risk that gas or vapours from the cargo will penetrate into the connected working space. These working spaces should be identified as "connected spaces"

and consideration should be given to use of certified safe type of electrical equipment for an explosive atmosphere. When the cargo space contains a hazardous atmosphere and, given the propensity for hazardous atmospheres to be trapped in those spaces, these connected spaces should continue to be considered hazardous until the atmosphere is ensured to be gas free by the test.

Oxygen depleting cargoes and materials

9.8 A prominent risk associated with solid bulk cargoes is the potential for a hazardous atmosphere in an enclosed space due to the inherent nature of the cargo, including oxygen depletion and toxic or flammable gas emissions from materials that are flammable or toxic, or are liable to oxidation, self-heating, or to the emissions of toxic gases when wet. The individual schedules for solid bulk cargoes in the IMSBC Code list typical cargoes currently shipped in bulk, together with advice and guidance on their properties and methods of handling. Cargoes which possess a chemical hazard which could give rise to a dangerous situation on a ship are classified in the Code as group B. However, certain cargoes which are classified as group A or group C, including scrap metal, i.e. neither group A&B nor group B, can also possess properties which could give rise to a dangerous situation on a ship, depending on the condition and characteristics of the particular shipment. The cargoes named below are examples of cargoes that have caused many fatal accidents due asphyxiation, explosion and fire in cargo holds and adjacent and connected spaces on bulk carriers and general cargo ships:

.1 Coal;

.2 Wood products – general, including logs, timber, saw logs pulp wood, roundwood;

.3 Wood chips and wood pellets;

.4 Metal Sulphide Concentrates, including zinc concentrates, lead concentrates and copper concentrates;

.5 Ferrous;

.6 Seed cake cargoes containing residues of processed oily vegetables, including bran pellets, oil cake, palm kernel, copra, and other residues as listed in the individual schedules for the different seed cake cargoes in the Code; and

.7 scrap metal.

Grain cargoes and timber not in a bulk cargo form (stowed in cargo hold one by one) are also liable to cause oxygen depletion and the emission of CO_2 in cargo holds and adjacent spaces, while these cargoes are not covered by the IMSBC Code

Specific dangers associated with carbon dioxide

9.9 When organic cargoes are being transported the oxygen in the air is absorbed into the cargo and through microbiological degradation carbon dioxide is emitted.

9.10 The absorption of oxygen and the subsequent emission of carbon dioxide from the organic

cargo has the potential to make the hold or connected space unsafe for humans. The process of oxidation of the cargo will produce an atmosphere within the hold or connected space unsafe for humans, especially where carbon dioxide has accumulated to form a concentrated pocket within the enclosed space.

9.11 The impact of release of carbon dioxide into the space in relatively low concentrations of 4% is that exposure may lead to serious oxygen depletion. This may result in permanent brain damage, coma, even death. The atmosphere in the space will be harmful to life, not only due to oxygen deficiency but also because of the toxic concentration of carbon dioxide.

9.12 Ships carrying organic solid cargoes in bulk should continue to test for CO_2 prior to entry into enclosed spaces and frequently thereafter, as organic cargoes continue to emit CO_2.

Fumigation

9.13 When a ship is fumigated, the detailed recommendations contained in the Recommendations on the safe use of pesticides in ships in **MSC.1/Circ.1358/Rev.1**, and the Recommendations on the safe use of pesticides in ships applicable to the fumigation of cargo holds in **MSC.1/Circ.1264/Rev.1** should be followed. Spaces adjacent to fumigated spaces should be treated as if fumigated.

9.14 Care should be taken to ensure that piping leading from cargo spaces or adjacent connected spaces through the ship's accommodation are properly sealed in accordance with Class requirements.

9.15 Cargo Transport Units (CTUs):

Fumigated Cargo Transport Units (CTUs) may contain dangerous levels of highly toxic chemicals and pose hazards to crew. Such hazards to personnel arising from the operations involved in the carriage of fumigated CTUs are to be addressed.

When fumigated CTUs are carried onboard ships, the detailed recommendation contained in the Revised Recommendations on the Safe Use of Pesticides in Ships Applicable to the Fumigation of Cargo Transport Units in **MSC.1/Circ.1361/Rev.1** should be followed.

Transport of fumigated CTUs which have not been ventilated before loading onto the ship should be in accordance with the applicable provisions of the IMDG Code for UN 3359.

Persons engaged in the handling of fumigated CTUs should be trained commensurate with their responsibilities.

Before entering the CTUs, all personnel should assess the risk as to whether it is safe to enter and determine the presence of fumigant by the use of gas-detection equipment. Upon opening the doors, the fumigant and residues must be completely ventilated using natural ventilation or mechanical means prior to entry.

Additionally, the personnel should be aware of the marking on the CTUs, signs of residual hazards (even for ventilated CTUs), importance of ventilation, and relevant transport documents as applicable.

In the absence of the fumigation warning mark, personnel should look for indicators for both declared and non-declared fumigated CTUs such as taped doors/vents, packets/piles of powdery residues, odor etc.

10.0 Action to be taken in the event of an emergency

10.1 The guidance contained in resolution **A.1072(28)** should be understood and form the basis of any emergency response plan. In the event of an emergency in an enclosed space, the ship's crew should follow the ship-specific enclosed space emergency response plan. In an emergency the ship's crew, or any shore personnel, should **NEVER** perform rescue entering an enclosed space independently but should always follow the agreed rescue plan.

10.2 It is critical that the ship has an enclosed space emergency response plan, which is easily understood, regularly practiced, verified as effective and followed precisely. The emergency response plan should form a part of the company SMS.

10.3 Equipment should be provided for the ship's crew to utilize in the event of an enclosed space accident. Such equipment should fall into three main categories:

.1 Equipment to test and verify the enclosed space atmospheric conditions and determine the hazards to life and the mitigations necessary prior to entry;

.2 Equipment to ensure the safety of the rescue party such as self-contained breathing apparatus (SCBA), lifelines, harness, etc.; and

.3 Equipment to facilitate the safe recovery of a casualty, such as recovery hoist, stretchers and resuscitation equipment.

10.4 The rescue of a casualty should be undertaken in a steady, controlled, and methodical way. The aim is the safe rescue of the casualty without needlessly endangering the lives of those undertaking the rescue operation.

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