

Commonwealth of Dominica**Office of the Maritime Administrator**

TO: ALL SHIPOWNERS, OPERATORS, MASTERS AND OFFICERS OF MERCHANT SHIPS, MOBILE OFFSHORE DRILLING UNITS AND RECOGNIZED ORGANIZATIONS

SUBJECT: Safety Precautions for Entering Enclosed Spaces Aboard Ships

**REFERENCE: (a) IMO MSC/CIRC.744, 14 June 1996 (enclosed)
(b) SOLAS Regulations II-2/17 and II-2/54.2.6.2**

PURPOSE: This Circular establishes safety guidelines that are to be followed by personnel entering enclosed spaces on board ships. These guidelines result from the increasing number of fatalities occurring due to this activity.

APPLICABILITY: The enclosed IMO MSC/Circ.744 Annex contains excellent general guidance for these instances and is reproduced here for the information and implementation of Masters, Officers and Crew Members.

REQUIREMENTS:**1.0 Preparation**

Masters and Officers are reminded that enclosed spaces shall be assumed to be incapable of supporting life. In every case, they shall be well ventilated before testing and entry. Tanks and void spaces shall be vented for at least 24 hours, or if mechanical venting is used, for 4 hours before testing.

2.0 Fatal Mistakes

The primary mistakes made, which have led to casualties, are:

- (1) entering an enclosed space without advising other persons of your intention;
- (2) entering an enclosed space without ensuring the space is adequately ventilated;

1 of 14

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- (3) attempting to enter an enclosed space to give aid to a person or persons inside the space without first taking the necessary safety precautions.

3.0 Cargo Pump Rooms

- 3.1 In tankers, the officers and pump men shall be alerted to the danger which will arise if liquid cargo leaks from defective pumps or cargo piping systems and floods the pump room bilges to a height which could obstruct the inlets of the air exhaust ducts. The result is that the pump room ventilating system could be rendered ineffective and permit heavy accumulation of cargo vapors within the compartment.
- 3.2 Constant vigilance shall be exercised by personnel on board tankers regarding asphyxiation and other toxic hazards associated with cargo pump rooms if there is any leakage of cargo into the pump room bilges. Only personnel properly trained and equipped with suitable breathing apparatus for the product involved shall enter such spaces. In every case, they shall be secured to a lifeline. Under no circumstances shall the breathing apparatus be removed while within a space containing or potentially containing an atmosphere fouled by noxious vapors or gases.

4.0 Breathing Apparatus

- 4.1 Reference (b) requires that breathing apparatus of an approved type be carried in all ships. The Chemical Code and Gas Code prescribe breathing apparatus for Chemical carriers and Liquefied Gas carriers respectively.
- 4.2 Masters and Officers are advised that smoke helmet types of apparatus are totally unsuitable for use where an oxygen deficiency exists or is suspected. In such cases self-contained breathing apparatus must be used.
- 4.3 The Administration does not, in general, approve of the use of oxygen breathing apparatus in merchant ships. Where oxygen-breathing apparatus is carried in special circumstances, Masters and Officers are cautioned that use of this equipment requires special training.

5.0 Instruction, Training and Drills

- 5.1.1 In order that personnel safety measures are maintained at a high level on Dominica registered vessels, it is important that ship owners impress upon the Masters and Officers of their ships the importance of proper utilization of personal safety equipment, and also the vital necessity for conducting periodic drills on board the boat.

- 5.1.2 Periodic exercises in the use of self-contained air breathing apparatus are especially important, and these shall include use of the lifelines and actual entry into a pump room or other space to familiarize the personnel with the limitations imposed on bodily movements when so equipped. The importance of regular training sessions cannot be over emphasized.
- 5.3 The Master and Safety Officer shall review periodically the safety instructions, which have been issued by the ship owner. These instructions shall be available on board in sufficient numbers for all personnel to have their own copies.

6.0 Safety Management System

The contents of this Circular shall be included within each ship Safety Management System Manual as appropriate.

- end -

MSC/Circ.744

ANNEX**RECOMMENDATIONS FOR ENTERING ENCLOSED
SPACES ABOARD SHIPS****PREAMBLE**

The object of these recommendations is to encourage the adoption of safety procedures aimed at preventing casualties to ships personnel entering enclosed spaces where there may be an oxygen deficient flammable and/or toxic atmosphere.

Investigations into the circumstances of casualties that have occurred have shown that accidents on board ships are in most cases caused by an insufficient knowledge of, or disregard for, the need to take precautions rather than a lack of guidance.

The following practical recommendations apply to all types of ships and provide guidance to seafarers. It should be noted that on ships 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 may be a need for increased vigilance.

The recommendations are intended to complement national laws or regulations, accepted standards or particular procedures which may exist for specific trades, ships or types of shipping operations.

It may be impracticable to apply some recommendations to particular situations. In such cases, every endeavour should be made to observe the intent of the recommendations, and attention should be paid to the risks that may be involved.

1 INTRODUCTION

The atmosphere in any enclosed space may be deficient in oxygen and/or contain flammable and/or toxic gases or vapours. Such an unsafe atmosphere could also subsequently occur in a space previously found to be safe. Unsafe atmosphere may also be present in spaces adjacent to those spaces where a hazard is known to be present.

2 DEFINITIONS

2.1 "Enclosed space" means a space which has any of the following characteristics:

- .1 limited openings for entry and exit;
- .2 unfavorable natural ventilation; and
- .3 is not designed for continuous worker occupancy,

and includes, but is not limited to, cargo spaces, double bottoms, fuel tanks, ballast tanks, pump-rooms, compressor rooms, cofferdams, void spaces, duct keels, inter-barrier spaces, engine crankcases and sewage tanks.

4 of 14

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2.2 "Competent person" means a person with sufficient theoretical knowledge and practical experience capable of making an informed assessment of the likelihood of a dangerous atmosphere being present or subsequently arising in the space.

2.3 "Responsible person" means a person authorized to permit entry into an enclosed space and having sufficient knowledge of the procedures to be followed.

3 ASSESSMENT OF RISK

3.1 In order to ensure safety, a competent person should always make a preliminary assessment of any potential hazards in the space to be entered taking into account the previous cargo carried, ventilation of the space, coating of the space and other relevant factors. The competent person's preliminary assessment should determine the potential for the presence of an oxygen-deficient, flammable or toxic atmosphere.

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

- .1 there is minimal risk to the health or life of personnel entering the space;
- .2 there is no immediate risk to health or life but a risk could arise during the course of work in the space;
- .3 there is a risk to health or life is identified.

3.3 Where the preliminary 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.

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

4 AUTHORIZATION OF ENTRY

4.1 No person should open or enter an enclosed space unless authorized by the master or nominated responsible person and the appropriate safety procedures laid down for the particular ship 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, is recommended. An Enclosed Space Entry Permit should be issued by the master or qualified responsible person and completed by a person who enters the space, prior to entry. An example of the Enclosed Space Entry Permit is provided in the annex.

5 GENERAL PRECAUTIONS

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

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

5 of 14

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- .3 that the atmosphere of the space has been tested as appropriate with properly calibrated instruments to ascertain acceptable levels of oxygen and acceptable levels of flammable or toxic vapours;
- .4 that the space has been secured for entry and properly illuminated;
- .5 that a suitable system of communication between all parties for use during entry has been agreed and tested;
- .6 that an attendant has been instructed to remain at the entrance to the space whilst it is occupied;
- .7 that rescue and resuscitation equipment has been positioned ready for use at the entrance to the space, and that rescue arrangements have been agreed;
- .8 that personnel are properly clothed and equipped for the entry and subsequent tasks; and
- .9 that a permit has been issued authorizing entry.

The precautions in .6 and .7 may not apply to every situation described in this section. The person authorizing entry should determine whether an attendant and the positioning of rescue equipment at the entrance to the space is necessary.

5.2 Only trained personnel should be assigned duties of entering or functioning as attendants or as members of rescue teams. Ships' crews should be drilled periodically in rescue and first aid.

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

6 TESTING THE ATMOSPHERE

6.1 Appropriate testing of the atmosphere of a space should be carried out with properly calibrated equipment by persons trained in the use of the equipment. The manufacturers' instructions should be strictly followed. Testing should 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 obtain a representative sample of the atmosphere in the space.

6.2 For entry purposes, steady readings of the following should be obtained:

- .1 21% oxygen by volume by oxygen content meter; and
- .2 not more than 1% of lower flammable limit (LFL) on a suitably sensitive combustible gas indicator, where the preliminary assessment has determined that there is potential for flammable gases or vapours.

If these conditions cannot be met, additional ventilation should be applied to the space and re-testing should be conducted after a suitable interval. Any gas testing should be carried out with ventilation to the enclosed space stopped, in order to obtain accurate readings.

6.3 Where the preliminary assessment has determined that there is potential for the presence of toxic gases and vapours, 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 vapours

6 of 14

given in accepted national or international standards. It should be noted that testing for flammability does not provide a suitable means of measuring for toxicity, nor vice versa.

6.4 It should be emphasized that pockets of gas or oxygen-deficient areas can exist and should always be suspected even when an enclosed space has been satisfactorily tested as being suitable for entry.

7 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 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.

7.3 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.

8 ADDITIONAL PRECAUTIONS FOR ENTRY INTO A SPACE WHERE THE ATMOSPHERE IS KNOWN OR SUSPECTED TO BE UNSAFE

8.1 If the atmosphere in an enclosed space is suspected or known to be unsafe, the space should only be entered when no practical alternative exists. Entry should only be made for further testing, essential operation, safety of life or safety of a ship. The number of persons entering the space should be the minimum compatible with the work to be performed.

8.2 Suitable 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 should not be used as they do not provide a supply of clean air from a source independent of the atmosphere within the space.

8.3 The precautions specified in section 5 should also be followed, as appropriate.

8.4 Rescue harnesses should be worn and, unless impractical, lifelines should be used.

8.5 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.

8.6 The advice in paragraph 7.3 concerning emergency rescue operations is particularly relevant in this context.

9 HAZARDS RELATED TO SPECIFIC TYPES OF CARGO

9.1 Dangerous goods in packaged form

9.1.1 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 or corrosive gases or vapours that displace oxygen, 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 IMDG Code, the Emergency Procedures for Ships Carrying Dangerous Goods (EMS) and Materials Safety Data Sheets (MSDS). If there is evidence or

suspicion that leakage of dangerous substances has occurred, the precautions specified in section 8 should be followed.

9.1.2 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.

9.2 Bulk liquid

The tanker industry has produced extensive advice to 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 and should be used as the basis for preparing entry plans.

9.3 Solid bulk

On ships carrying solid bulk cargoes, dangerous atmospheres may develop in cargo spaces and adjacent spaces. The dangers may include flammability, toxicity, oxygen depletion or self-heating, which should be identified in shipping documentation. For additional information, reference should be made to the Code of Safe Practice for Solid Bulk Cargoes.

9.4 Oxygen depleting cargoes and materials

A prominent risk with such cargoes is oxygen depletion due to the inherent form of the cargo, for example, self-heating, oxidation of metals and ores or decomposition of vegetable oils, animal fats, grain and other organic materials or their residues. The materials listed below are known to be capable of causing oxygen depletion. However, the list is not exhaustive. Oxygen depletion may also be caused by other materials of vegetable or animal origin, by flammable or spontaneously combustible materials, and by materials with a high metal content:

- .1 grain, grain products and residues from grain processing (such as bran, crushed grain, crushed malt or meal), hops, malt husks and spent malt;
- .2 oilseeds as well as products and residues from oilseeds (such as seed expellers, seed cake, oil cake and meal);
- .3 copra;
- .4 wood in such forms as packaged timber, roundwood, logs, pulpwood, props (pit props and other propwood), woodchips, woodshavings, woodpulp pellets and sawdust;
- .5 jute, hemp, flax, sisal, kapok, cotton and other vegetable fibers (such as esparto grass/Spanish grass, hay, straw, bhusa), empty bags, cotton waste, animal fibers, animal and vegetable fabric, wool waste and rags;
- .6 fishmeal and fishscrap;
- .7 guano;
- .8 sulphidic ores and ore concentrates;

- .9 charcoal, coal and coal products;
- .10 direct reduced iron (DRI)
- .11 dry ice;
- .12 metal wastes and chips, iron swarf, steel and other turnings, borings, drillings, shavings, filings and cuttings; and
- .13 scrap metal.

9.5 **Fumigation**

When a ship is fumigated, the detailed recommendations contained in the Recommendations on the Safe Use of Pesticides in Ships* should be followed. Spaces adjacent to fumigated spaces should be treated as if fumigated.

10 **CONCLUSION**

Failure to observe simple procedures can lead to people being unexpectedly overcome when entering enclosed spaces. Observance of the principles outlined above will form a reliable basis for assessing risks in such spaces and for taking necessary precautions.

* Refer to the Recommendations on Safe Use of Pesticides in Ships, approved by the Maritime Safety Committee of the Organization by circular MSC/Circ.612, as amended by MSC/Circ.689 and MSC/Circ.746.

ANNEX to MSC/Circ.744 –Pg. 1

**EXAMPLE OF
AN ENCLOSED SPACE ENTRY PERMIT**

This permit relates to entry into any enclosed space and should be completed by the master or responsible officer and by the person entering the space or authorized team leader.

General	
Location/Name of enclosed space	
Reason for entry	
This permit is valid	From _____ hrs. Date
	To _____ hrs. Date
(See Note 1)	

Section 1 - Pre-entry preparation		
(To be checked by the master or nominated responsible person)	Yes	No
· Has the space been thoroughly ventilated?	<input type="checkbox"/>	<input type="checkbox"/>
· Has the space been segregated by blanking off or isolating all connecting pipelines or valves and electrical power/equipment?	<input type="checkbox"/>	<input type="checkbox"/>
· Has the space been cleaned where necessary?	<input type="checkbox"/>	<input type="checkbox"/>
· Has the space been tested and found safe for entry?	<input type="checkbox"/>	<input type="checkbox"/>
(See Note 2)		
· Pre-entry atmosphere test readings:		
- oxygen % vol (21%)	By:	
- hydrocarbon % LFL (less than 1%)	Time:	
- toxic gases ppm (specific gas and PEL)		
(See Note 3)		
· Have arrangements been made for frequent atmosphere checks to be made while the space is occupied and after work breaks?	<input type="checkbox"/>	<input type="checkbox"/>
· Have arrangements been made for the space to be continuously ventilated throughout the period of occupation and during work breaks?	<input type="checkbox"/>	<input type="checkbox"/>
· Are access and illumination adequate?	<input type="checkbox"/>	<input type="checkbox"/>

ANNEX to MSC/Circ.744, Pg. 2

	Yes	No
· Is rescue and resuscitation equipment available for immediate use by the entrance to the space?	<input type="checkbox"/>	<input type="checkbox"/>
· Has a responsible person been designated to be in constant attendance at the entrance to the space?	<input type="checkbox"/>	<input type="checkbox"/>
· Has the officer of the watch (bridge, engine room, cargo control room) been advised of the planned entry?	<input type="checkbox"/>	<input type="checkbox"/>
· Has a system of communication between all parties been tested and emergency signals agreed?	<input type="checkbox"/>	<input type="checkbox"/>
· Are emergency and evacuation procedures established and understood by all personnel involved with the enclosed space entry?	<input type="checkbox"/>	<input type="checkbox"/>
· Is all equipment used in good working condition and inspected prior to entry?	<input type="checkbox"/>	<input type="checkbox"/>
· Are personnel properly clothed and equipped?	<input type="checkbox"/>	<input type="checkbox"/>

Section 2 - Pre-entry checks		
(To be checked by the person entering the space or authorized team leader)		
	Yes	No
· I have received instructions or permission from the master or nominated responsible person to enter the enclosed space.	<input type="checkbox"/>	<input type="checkbox"/>
· Section 1 of this permit has been satisfactorily completed by the master or nominated responsible person.	<input type="checkbox"/>	<input type="checkbox"/>
· I have agreed and understand the communication procedures.	<input type="checkbox"/>	<input type="checkbox"/>
· I have agreed upon a reporting interval of minutes.	<input type="checkbox"/>	<input type="checkbox"/>
· Emergency and evacuation procedures have been agreed and are understood.	<input type="checkbox"/>	<input type="checkbox"/>
· I am aware that the space must be vacated immediately in the event of ventilation failure or if atmosphere tests show a change from agreed safe criteria.	<input type="checkbox"/>	<input type="checkbox"/>

ANNEX to MSC/Circ.744, Page 3

Section 3 - Breathing apparatus and other equipment (To be checked jointly by the master or nominated responsible person and the person who is to enter the space)	Yes	No
· Those entering the space are familiar with the breathing apparatus to be used ?	<input type="checkbox"/>	<input type="checkbox"/>
· The breathing apparatus has been tested as follows:		
- gauge and capacity of air supply		
- low pressure audible alarm		
- face mask - under positive pressure and not leaking		
· The means of communication has been tested and emergency signals agreed?	<input type="checkbox"/>	<input type="checkbox"/>
· All personnel entering the space have been provided with rescue harnesses and, where practicable, lifelines.	<input type="checkbox"/>	<input type="checkbox"/>

Signed upon completion of sections 1, 2 and 3 by:

Master or nominated responsible person Date: Time:

Responsible person supervising entry Date: Time:

Person entering the space or authorized team leader Date: Time:

Section 4 - Personnel entry (To be completed by the responsible person supervising entry)		
Names	Time in	Time out
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.....
.....
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ANNEX to MSC/Circ.744, Page 4

Section 5 - Completion of job		
(To be completed by the responsible person supervising entry)		
· Job completed	Date:	Time:
· Space secured against entry	Date:	Time:
· The officer of the watch has been duly informed	Date:	Time:

Signed upon completion of sections 4 and 5 by:

Responsible person supervising entry Date: Time:

THIS PERMIT IS RENDERED INVALID SHOULD VENTILATION OF THE SPACE STOP OR IF ANY OF THE CONDITIONS NOTED IN THE CHECKLIST CHANGE.

Notes:

1. The permit should contain a clear indication as to its maximum period of validity.
2. In order to obtain a representative cross-section of the space's atmosphere, samples should be taken from several levels and through as many openings as possible. Ventilation should be stopped for about 10 minutes before the pre-entry atmosphere tests are taken.
3. Tests for specific toxic contaminants, such as benzene or hydrogen sulphide, should be undertaken depending on the nature of the previous contents of the space.

ANNEX to MSC/Circ.744, Page 5

