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**GUIDELINES ON TANK ENTRY FOR TANKERS USING NITROGEN
AS AN INERTING MEDIUM**

1 The Maritime Safety Committee at its eighty-ninth session (11 to 20 May 2011), having considered the proposal by the Sub-Committee on Bulk Liquids and Gases, at its fifteenth session, approved the Guidelines on tank entry for tankers using nitrogen as an inerting medium, set out in the annex.

2 Member Governments are invited to bring the annexed Guidelines to the attention of shipowners, ship operators and seafarers, urging them to apply these Guidelines, as appropriate, to all tankers using nitrogen as an inerting medium.

ANNEX

GUIDELINES ON TANK ENTRY FOR TANKERS USING NITROGEN AS AN INERTING MEDIUM

1 PURPOSE

The purpose of these Guidelines is to describe the procedures and minimum precautions, which are to be followed when personnel intend to enter a tank, in order to reduce the risk of asphyxiation after inerting the tanks by nitrogen. These Guidelines should be used in conjunction with the Revised Recommendations for entering enclosed spaces aboard ships.*

2 USE OF NITROGEN

2.1 Nitrogen is a colourless and odourless gas that can cause oxygen deficiency in confined spaces, and at exhaust openings on deck, during purging of tanks and void spaces.

2.2 Nitrogen (N₂) is classified as a simple asphyxiate, meaning that it will displace oxygen in high concentrations and create an oxygen deficient (< 21%) atmosphere without any significant physiological effects. Breathing is stimulated and controlled by carbon dioxide (CO₂) present in the lungs. As the CO₂ level increases, the brain sends a message to increase respiration. When the CO₂ level drops, the rate of respiration will also decrease in order to maintain the proper balance.

2.3 Everyone should understand that one deep breath of 100% N₂ will be fatal.

100% N₂ will displace CO₂ and O₂ completely and, in the absence of a CO₂ signal to the brain, the stimulus to breathe no longer exists.

3 PRE-PLANNING

3.1 Prior to entering a tank, all persons who are to be involved in the task should meet to:

- .1 define the purpose of entering the tank;
- .2 identify the steps to be taken to achieve the purpose;
- .3 develop a plan of action; and
- .4 assign responsibilities.

3.2 The meeting should address:

- .1 scheduling of manpower – may include the following:
 - .1 authorization: the master will be ultimately responsible for authorizing tank entry. An officer should be designated as the responsible person with sufficient knowledge of the procedures to be established and complied with on board, in order for ensuring that the correct procedures are observed;

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The Revised Recommendations for entering enclosed spaces aboard ships (DSC 15/18, annex 6) are expected to be adopted at the twenty-seventh session of the Assembly.

- .2 the person undertaking the testing of the atmosphere should be trained in the use of the equipment. Only properly calibrated equipment should be used and the manufacturers' instructions should be strictly followed;
 - .3 *attendant* means a person who is suitably trained within the safety management system, maintains a watch over those entering the tank, maintains communications with those inside the tank and initiates the emergency procedures in the event of an incident occurring; and
 - .4 *tank rescue team* are any members of the crew trained in the use of rescue and resuscitation equipment;
- .2 tank washing;
 - .3 gas freeing;
 - .4 testing of the tank atmosphere;
 - .5 identifying and minimizing physical hazards;
 - .6 listing equipment needed, i.e. safety, fire fighting, communication, tools, escape and rescue;
 - .7 advising personnel who will enter the space of the hazards associated with the operation;
 - .8 maintaining safe conditions in the tank; and
 - .9 reviewing emergency procedures for rescue and fire fighting – may include the following:
 - .1 the person in charge of the rescue party should not enter the tank, but should coordinate the rescue operation from the tank access;
 - .2 in the event that a casualty must be removed from the tank, sufficient persons must be on deck and available to effect proper use of the rescue equipment;
 - .3 sufficient persons should be assigned to the tank rescue team. They should be familiar with the tank arrangement and trained in the use of the equipment and able to deliver first aid; and
 - .4 the decision to remove an injured person from the space must be based on the relative danger of his location and extent of his injuries, versus the danger of increasing his injuries by movement prior to effecting first aid.

4 INITIAL PREPARATION

4.1 Marking of cargo tanks

4.1.1 Tanks should be clearly marked to make it clear to all which are safe for entry and which must not be entered. Any tank where crew are working should be clearly marked as such.

4.1.2 Warning signs should also be posted at the gangway, and at other locations as deemed necessary by the master, when nitrogen is being produced on board or received from shore.

4.2 After a tank has been cleaned and ventilated, the following steps should be taken:

4.2.1 Ensure that the tank to be entered has been segregated from all other spaces which contain or may contain a non-gas free atmosphere. All common line valves should be lashed in the closed position and labelled.

4.2.2 Check that all cargo pipes in the tank being entered have been flushed and drained.

4.2.3 In addition to the safety equipment used for tank entry, rescue and resuscitation and fire-fighting equipment should be available, inspected and in proper working order. This may include the following:

- .1 equipment to be immediately available on deck:
 - .1 rescue hoist equipment to enable an injured person to be removed from the tank;
 - .2 self-contained breathing apparatus;
 - .3 oxygen meter;
 - .4 gas meter; and
 - .5 toxic gas detector;
- .2 equipment to be carried on board and readily available:
 - .1 stretchers;
 - .2 resuscitator;
 - .3 first-aid kit;
 - .4 fire hose with spray nozzle; and
 - .5 dry chemical and foam fire extinguishers;
- .3 equipment for each member of the tank entry party: flashlight and protective clothing; and
- .4 equipment to be carried by at least one member of the tank entry team: intrinsically safe two-way portable radiotelephone apparatus.

4.2.4 The attendant should stand by the tank entrance while people are in the tank. In addition, sufficient people to form a rescue team should be identified, readily available and should not be involved in the tank entry.

4.2.5 Establish a means of communication and emergency signals between the persons on deck and the persons in the tank. Ensure everybody understands these signals before tank entry and ensure that intrinsically safe two-way portable radiotelephone apparatus is available for the use of the attendant at the tank entrance.

5 TESTING THE ATMOSPHERE IN THE TANK

5.1 After a tank has been cleaned, ventilated and prepared for entry, it should be tested for oxygen content, and finally, as appropriate, for toxic gases at various levels from top to bottom.

5.2 The atmosphere can only be accepted as suitable for entry when all the relevant hazards have been identified and removed.

5.3 Appropriate testing of the atmosphere of a tank 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 of the tank should be carried out before any person enters the tank, and at regular intervals thereafter until all work is completed. Where appropriate, the testing of the tank should be carried out at as many different levels as is necessary to obtain a representative sample of the atmosphere in the tank. In some cases, it may be difficult to test the atmosphere throughout the tank without entering the tank and this should be taken into account when assessing the risk to personnel entering the tank. The use of flexible hoses or fixed sampling lines which reach remote areas within the tank, may allow for safe testing without having to enter the tank.

5.4 All ventilation must be stopped prior to and during the atmosphere tests and resumed prior to any person entering the tank.

5.5 Criteria for Tank Entry

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

- .1 21% oxygen by volume by oxygen content meter*;
- .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; and
- .3 not more than 50% of the occupational exposure limit (OEL) of any toxic vapours and gases.**

5.5.2 A responsible person should ensure that all measuring instruments in use have been properly calibrated and are maintained in accordance with the respective manufacturer's instructions.

* National requirements may determine the safe atmosphere range.

** 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.

5.5.3 If these conditions cannot be met, additional ventilation should be applied to the tank and re-testing should be conducted after a suitable interval.

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

6.1 Tanks that have not been tested should be considered unsafe for persons to enter.

6.2 If the atmosphere in a tank is suspected or known to be unsafe, the tank should only be entered in the event of an emergency. The number of persons entering the tank should be the minimum compatible with the task to be performed.

6.3 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.

6.4 Persons entering tanks should be provided with calibrated and tested personal multi-gas detectors that monitor the levels of oxygen, carbon monoxide and other gases, as appropriate. Rescue harnesses should be worn and, unless impractical, lifelines should be used. 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 tank.

7 FINAL PREPARATION

The responsible person should ensure that:

- .1 all personnel involved understand the emergency procedures;
- .2 each person entering the tank is wearing the appropriate protective clothing and has the correct personal safety equipment;
- .3 all personnel involved understand the task to be undertaken; and
- .4 the equipment stated in paragraph 4.2.3 is readily available.

8 TANK ENTRY PERMIT

8.1 The relevant sections of the Tank Entry Permit (see appendix) should be filled in upon completion of preparations for tank entry. Entry permits may be made for multiple tank entries, however tanks which are not immediately entered should be re-tested and a new permit issued. At no time should a permit be granted for entry into more than six tanks.

8.2 The validity of an entry permit should not exceed 8 hours.

9 TANK ENTRY

After the tank entry requirements have been met, the tank may be entered by the work party. While persons are working in the space, safe working conditions must be maintained. Particular attention should be given to the following:

- .1 the responsible person should ensure that the atmosphere is continuously monitored and order the evacuation of the space if the safe limits are exceeded, or if there is any doubt about it, at any stage of the operation;

- .2 ventilation must be provided during the entire period of the operation. Where necessary, portable ducting should be provided to ensure a good supply of air to the actual working area inside the space;
- .3 the responsible person should ensure that all identified risk mitigation measures are being enforced;
- .4 the attendant should be in continuous attendance at the entrance to the tank;
- .5 the responsible person should be aware of the location of every person in the tank at all times. The work party should stay together whenever possible;
- .6 safety harnesses should be worn at all times when working in tanks;
- .7 rescue equipment should be rigged and ready for use throughout the operation and persons assigned to the rescue party should be readily available; and
- .8 access openings should be kept open and clear for emergency exit at all times.

10 LEAVING THE TANK

10.1 If the tank is vacated for any reason, such as for a meal break, ventilation should continue during the break and the atmosphere of the tank should be re-tested and the provisions of paragraph 7 should be observed.

10.2 When finally leaving the tank, the responsible person should ensure that all persons in the work party are accounted for and that all tools and equipment have been removed from the tank.

* * *

APPENDIX

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 person.

| | | |
|---|-----------------|------------|
| 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 by mechanical means? | " | " |
| • Has the space been segregated by blanking off or isolating all connecting pipelines or valves and electrical power/equipment? | " | " |
| • Has the space been cleaned where necessary? | " | " |
| • Has the space been tested and found safe for entry? (See note 2) | " | " |
| • Pre-entry atmosphere test readings: | By: | |
| - oxygen % vol (21%)** | Time: | |
| - hydrocarbon % LFL (less than 1%) | (See note 3) | |
| - toxic gases ppm (less than 50% OEL of the specific gas) | | |
| • Have arrangements been made for frequent atmosphere checks to be made while the space is occupied and after work breaks? | " | " |
| • Have arrangements been made for the space to be continuously ventilated throughout the period of occupation and during work breaks? | " | " |
| • Are access and illumination adequate? | " | " |
| • Is rescue and resuscitation equipment available for immediate use by the entrance to the space? | " | " |
| • Has an attendant been designated to be in constant attendance at the entrance to the space? | " | " |
| • Has the officer of the watch (bridge, engine-room, cargo control room) been advised of the planned entry? | " | " |
| • Has a system of communication between all parties been tested and emergency signals agreed? | " | " |
| • Are emergency and evacuation procedures established and understood by all personnel involved with the enclosed space entry? | " | " |
| • Is all equipment used in good working condition and inspected prior to entry? | " | " |
| • Are personnel properly clothed and equipped? | " | " |

* It should be noted that this is a generic entry permit that may be used for all enclosed spaces on board all ships.
** Note that National requirements may determine the safe atmosphere range.

| SECTION 2 – PRE-ENTRY CHECKS | | |
|--|-----|----|
| (To be checked by each person entering the space) | | |
| | Yes | No |
| • I have received instructions or permission from the master or nominated responsible person to enter the enclosed space | " | " |
| • Section 1 of this permit has been satisfactorily completed by the master or nominated responsible person | " | " |
| • I have agreed and understand the communication procedures | " | " |
| • I have agreed upon a reporting interval of minutes | " | " |
| • Emergency and evacuation procedures have been agreed and are understood | " | " |
| • 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 | " | " |

| 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 any breathing apparatus to be used | " | " |
| • The breathing apparatus has been tested as follows: - gauge and capacity of air supply - low pressure audible alarm if fitted - face mask – under positive pressure and not leaking | | |
| • The means of communication has been tested and emergency signals agreed | " | " |
| • All personnel entering the space have been provided with rescue harnesses and, where practicable, lifelines | " | " |

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

Master or nominated responsible person Date Time

Attendant Date Time.....

Person entering the space Date Time.....

| | |
|---|----------------------|
| SECTION 4 – PERSONNEL ENTRY (To be completed by the responsible person supervising entry) | |
| Names | |
| Time in | Time out |
| 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.
