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MSC.1/Circ.1361/Rev.1
28 April 2022

REVISED RECOMMENDATIONS ON THE SAFE USE OF PESTICIDES IN SHIPS APPLICABLE TO THE FUMIGATION OF CARGO TRANSPORT UNITS

1 The Maritime Safety Committee, at its eighty-fourth session (7 to 16 May 2008), approved the *Recommendations on the safe use of pesticides in ships applicable to the fumigation of cargo transport units* (MSC.1/Circ.1265), superseding MSC/Circ.612, as amended by MSC/Circ.689 and MSC/Circ.746, with regard to the fumigation of cargo transport units, proposed by the Sub-Committee on Dangerous Goods, Solid Cargoes and Containers at its twelfth session.

2 The Committee, at its eighty-seventh session (12 to 21 May 2010), having considered the proposal by the Sub-Committee on Dangerous Goods, Solid Cargoes and Containers, at its fourteenth session, with regard to the amendments to the IMDG Code which had been adopted at that session, approved *Revised recommendations on the safe use of pesticides in ships applicable to the fumigation of cargo transport units* (MSC.1/Circ.1361), which apply to the carriage of packaged dangerous goods in pursuance of the requirements of SOLAS regulation VI/4 and the relevant provisions of the IMDG Code.

3 The Committee, at its 105th session (20 to 29 April 2022), approved amendments to MSC.1/Circ.1361, as prepared by the Sub-Committee on Carriage of Cargoes and Containers at its seventh session, resulting from the amendments (41-22) to the IMDG Code, as adopted by resolution MSC.501(105). The amended Revised recommendations are set out in the annex.

4 The Committee agreed that the Revised recommendations should not apply to the carriage of fresh food produced under controlled atmosphere.

5 Member Governments are invited to bring the Revised recommendations to the attention of competent authorities, mariners, fumigators, fumigant and pesticide manufacturers and others concerned, taking into account the voluntary application date of 1 January 2023 of amendments (41-22) to the IMDG Code, pending their envisaged entry into force on 1 January 2024.

6 The present circular supersedes MSC.1/Circ.1361.

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ANNEX

REVISED RECOMMENDATIONS ON THE SAFE USE OF PESTICIDES IN SHIPS APPLICABLE TO THE FUMIGATION OF CARGO TRANSPORT UNITS

1 INTRODUCTION

1.1 These recommendations address the hazards to personnel arising from the operations involved in the carriage of fumigated cargo transport units. This guidance is aimed at everyone involved in the supply chain. Although the contents of the cargo transport unit may not be subject to the provisions of the International Maritime Dangerous Goods (IMDG) Code, fumigating a cargo transport unit brings it into the scope of the IMDG Code. According to this Code the mandatory hazard communication provisions include:

.1 warning mark on cargo transport unit;

.2 documents (transport document and special list, manifest or detailed stowage plan) associated with the transport of cargo transport units that have been fumigated and have not been completely ventilated before transport; and

.3 instructions for disposal for any residual fumigant.

1.2 It is generally acknowledged, however, that there may be non-compliance with these provisions. Before entering the cargo transport units, 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.

2 REASONS FOR FUMIGATION

2.1 General

2.1.1 The CTU Code defines pest contamination as "Visible forms of animals, insects or other invertebrates (alive or dead, in any lifecycle stage, including egg casings or rafts), or any organic material of animal origin (including blood, bones, hair, flesh, secretions, excretions); viable or non-viable plants or plant products (including fruit, seeds, leaves, twigs, roots, bark); or other organic material, including fungi; or soil, or water; where such products are not the manifested cargo within the CTU". The presence of pest contamination, including rodents, on ships is clearly undesirable for various reasons, and in addition to aesthetic and nuisance aspects, they may damage equipment and spread disease and infection, contaminate food in galleys and food stores, and cause damage to cargoes that will result in commercial or other losses.

2.1.2 The same highly toxic chemicals are used in cargo transport units as on board bulk ships. However, when a cargo transport unit that contains fumigant chemicals leaves the place at which it was fumigated, no one can practically supervise the hazard unless they are aware of the presence of the fumigant. Any person who later enters the cargo transport unit can, therefore, be unknowingly exposed to dangerous levels of highly toxic chemicals.

2.2 Pest contamination of cargo in cargo transport units

2.2.1 Cargo, as well as packaging, dunnage, etc., associated with the cargo, may at any stage during harvesting, manufacture, processing, storage, packing or transport be

contaminated by pests. These can spoil foodstuffs, textiles, leather goods, furniture, art and antiques, affect electronic equipment, contaminate sterile goods or deface consumer packaging or labelling, making the goods unfit for sale and therefore valueless.

2.2.2 Pests may be carried into the cargo transport unit with goods (introduced infestation); they may move from one kind of product to another (cross-infestation) and may remain to attack subsequent cargoes (residual infestation). Their control may be required to comply with phyto-sanitary requirements to prevent their spread and for commercial reasons to prevent infestation and contamination of, or damage to, cargoes of human and animal food.

2.3 Rodents

2.3.1 Rodents should be controlled not only because of the damage they may do to cargo or the ship's equipment, but also, as required by the International Health Regulations, to prevent the spread of disease. Importers, particularly those that operate food processing plants, make great efforts to eliminate infestation in order to prevent the invasion of the importer's local storage or processing plant from infestation carried in incoming cargo. Consequently, they regularly fumigate their premises and may insist that goods delivered to their premises are certified free of infestation by means of fumigation.

3 PROVISIONS FOR FUMIGATED CARGO TRANSPORT UNITS

3.1 General provisions

3.1.1 When transporting a fumigated cargo transport unit, the provisions of the IMDG Code should apply. The relevant text is reproduced below:

> **"5.5.2 Special provisions applicable to fumigated cargo transport units (UN 3359)**
>
> **5.5.2.1 General**
>
> 5.5.2.1.1 Fumigated cargo transport units (UN 3359) containing no other dangerous goods are not subject to any provisions of this Code other than those of this section.
>
> 5.5.2.1.2 When the fumigated cargo transport unit is loaded with dangerous goods in addition to the fumigant, any provision of this Code relevant to these goods (including placarding, marking and documentation) applies in addition to the provisions of this section.
>
> 5.5.2.1.3 Only cargo transport units that can be closed in such a way that the escape of gas is reduced to a minimum shall be used for the transport of cargo under fumigation.
>
> 5.5.2.1.4 The provisions of 3.2 and 5.4.3 apply to all fumigated cargo transport units (UN 3359).
>
> **5.5.2.2 Training**
>
> Persons engaged in the handling of fumigated cargo transport units shall be trained commensurate with their responsibilities.

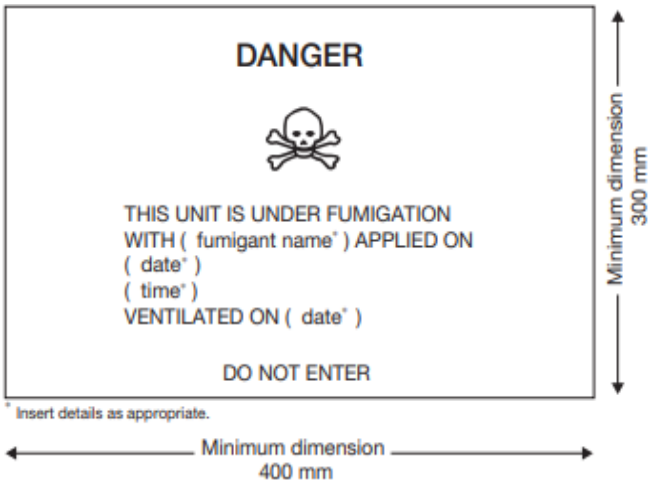
5.5.2.3 Marking and placarding

5.5.2.3.1 A fumigated cargo transport unit shall be marked with a warning mark, as specified in 5.5.2.3.2, affixed at each access point in a location where it will be easily seen by persons opening or entering the cargo transport unit. This mark shall remain on the cargo transport unit until the following provisions are met:

.1 the fumigated cargo transport unit has been ventilated to remove harmful concentrations of fumigant gas; and

.2 the fumigated goods or materials have been unloaded.

5.5.2.3.2 The fumigation warning mark shall be as shown in the figure below.



The mark shall be a rectangle. The minimum dimensions shall be 400 mm wide × 300 mm high and the minimum width of the outer line shall be 2 mm. The mark shall be in black print on a white background with lettering not less than 25 mm high. Where dimensions are not specified, all features shall be in approximate proportion to those shown.

The method of marking shall be such that this information will still be identifiable on cargo transport units surviving at least three months' immersion in the sea. In considering suitable marking methods, account shall be taken of the ease with which the surface of the cargo transport unit can be marked.

5.5.2.3.3 If the fumigated cargo transport unit has been completely ventilated either by opening the doors of the unit or by mechanical ventilation after fumigation, the date of ventilation shall be marked on the fumigation warning mark.

5.5.2.3.4 When the fumigated cargo transport unit has been ventilated and unloaded, the fumigation warning mark shall be removed.

5.5.2.3.5 Class 9 placards (Model No.9, see 5.2.2.2.2) shall not be affixed to a fumigated cargo transport unit except as required for other class 9 substances or articles packed therein.

5.5.2.4 Documentation

5.5.2.4.1 Documents associated with the transport of cargo transport units that have been fumigated and have not been completely ventilated before transport shall include the following information:

.1 UN 3359, fumigated cargo transport unit, 9, or UN 3359, fumigated cargo transport unit, class 9;

.2 The date and time of fumigation; and

.3 The type and amount of the fumigant used.

5.5.2.4.2 The transport document may be in any form, provided it contains the information required in 5.5.2.4.1. This information shall be easy to identify, legible and durable.

5.5.2.4.3 Instructions for disposal of any residual fumigant including fumigation devices (if used) shall be provided.

5.5.2.4.4 A document is not required when the fumigated cargo transport unit has been completely ventilated and the date of ventilation has been marked on the warning mark (see 5.5.2.3.3 and 5.5.2.3.4).

5.5.2.5 Additional provisions

5.5.2.5.1 Fumigants shall not be applied to the contents of a cargo transport unit once it has been loaded aboard the ship.

5.5.2.5.2 Cargo transport units shall be fumigated in accordance with the requirements determined by the competent authority, to ensure a sufficient period has elapsed to attain a reasonable uniform gas concentration throughout the cargo in it. Twenty-four hours is normally sufficient for this purpose.

5.5.2.5.3 The master shall be informed prior to the loading of a fumigated cargo transport unit."

3.2 Shoreside fumigation operations: fumigated cargo transport units

3.2.1 Fumigated cargo transport units which have been ventilated

3.2.1.1 It is important to ensure that cargo transport units are properly ventilated by opening the doors and allowing the gas to escape. This can be a natural process, or can be accelerated by mechanical means such as blowers or extractors. The ventilation process can take many hours or even days.

3.2.1.2 When the cargo transport unit has been completely ventilated without unloading the cargo, the date of ventilation should be added to the fumigation warning mark in accordance with 5.5.2.3.3 of the IMDG Code. For such cargo transport units, a transport document and the instructions for disposal of any residual fumigant are not required.

3.2.1.3 Care should be taken even after a cargo transport unit has been declared as ventilated. Gas can be held in packages of cargo, then desorbed over a long period of time,

even over many days, raising the level of gas inside the cargo transport unit to above the safe exposure level. Bagged cereals and cartons with large air spaces are likely to produce this effect. Alternatively, gas and the fumigant sachets or tablets can become "trapped" at the far end of a cargo transport unit by tightly-packed cargo.

3.2.2 Cargo transport units loaded without ventilation after fumigation (fumigation in transit)

3.2.2.1 A cargo transport unit containing cargo under fumigation should not be allowed on board until sufficient time has elapsed to allow the attainment of a reasonably uniform gas concentration throughout the cargo. Because of variations due to types and amounts of fumigants and commodities and temperature levels, the period between fumigant application and loading of the fumigated cargo transport unit on board the ship should be determined by the competent authority. Twenty-four hours is normally adequate for this purpose.

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

3.2.2.3 In column (17) (Properties and observations) of the Dangerous Goods List for UN 3359, the following information is given:

> "FUMIGATED CARGO TRANSPORT UNIT" is a closed cargo transport unit containing goods or materials that either are or have been fumigated within the unit. The fumigant gases used are either poisonous or asphyxiant. The gases are usually evolved from solid or liquid preparations distributed within the unit. See also 5.5.2."

3.2.3 Marking of the cargo transport unit

3.2.3.1 A fumigated cargo transport unit should be marked with the warning mark, as specified in 5.5.2.3.2 of the IMDG Code. Class 9 placards should not be affixed to the fumigated cargo transport units except as required by other class 9 substances or articles packed therein. This mark should remain until the cargo has been unloaded. When the fumigated cargo transport unit is loaded with dangerous goods in addition to the fumigant, the cargo transport unit should display the placards and marks relevant to these goods.

3.2.4 Documentation

3.2.4.1 When transporting a fumigated cargo transport unit that has not been completely ventilated, the transport document, which may be in any form and which should contain the information regarding UN 3359, should be provided. When the fumigated cargo transport unit is loaded with dangerous goods in addition to the fumigant, the transport document relevant to these goods should also be provided.

3.2.5 Training

3.2.5.1 Persons engaged in the handling of fumigated cargo transport units should be trained commensurate with their responsibilities.

3.3 Ship-side operations

3.3.1 Fumigation after loading on board a ship

3.3.1.1 No person should be allowed by the master to fumigate the contents of a cargo transport unit once it has been loaded on board a ship.

3.4 Cargo transport units loaded without ventilation after fumigation (fumigation in transit)

3.4.1 When a cargo transport unit under fumigation is taken on board ship without preliminary ventilation, it should be transported as FUMIGATED CARGO TRANSPORT UNIT, UN 3359, class 9 in accordance with the provisions of the IMDG Code. The following special precautions apply to ship-side operations:

.1 A fumigated cargo transport unit should not be allowed on board until a sufficient period has elapsed to attain a reasonable uniform gas concentration throughout the cargo in it. Because of variations due to types and amounts of fumigants and commodities and temperature levels, the period between fumigant application and loading of the fumigated unit on board the ship should be determined by the competent authority. Twenty-four hours is normally sufficient for this purpose. Before loading the cargo transport unit should be checked for leaks and any leakage sealed.

.2 The master should be informed prior to loading of fumigated cargo transport units under fumigation. They should be identified with the warning mark, incorporating the fumigant name and the date and time of fumigation.

.3 The special list/manifest/stowage plan should identify the fumigated cargo transport units and indicate their stowage location on board. The transport document for fumigated cargo transport units should indicate the date of fumigation and the type and amount of fumigant used.

.4 Stowage category B has been assigned to UN 3359; however, on deck stowage is preferred. In addition, it shall be stowed clear of living quarters and should be 6 m away from vent intakes.

.5 If stowed under deck, the cargo space should be equipped with mechanical ventilation sufficient to prevent the build-up of fumigant concentrations above the toxicity levels (threshold limits) set out by competent authorities. The threshold limit for occupational exposure to the fumigant can be found on the Safety Data Sheet if available. The ventilation rate of the mechanical ventilation system should be at least two air changes per hour, based on the empty cargo space.

.6 If stowed under deck, equipment suitable for detecting the fumigant gas or gases used should be carried on the ship, with instructions for its use.

3.4.2 Before a fumigated cargo transport unit is loaded to a ship under deck, special precautions are necessary. These should include the following:

.1 at least an officer and one other are to receive appropriate training and will be designated as the trained representatives of the master. The master, through his representative, is responsible for ensuring safe conditions in the occupied spaces of the ship; and

.2 the trained representatives should brief the crew before the fumigated cargo transport unit is loaded.

3.4.3 Most fumigant gases are heavier than air so care should be taken in the holds particularly when working on the tank tops.

3.4.4 The trained representatives of the master should be provided, and be familiar, with:

.1 the information in the relevant Safety Data Sheet (SDS), if available; and

.2 the recommendations of the fumigant manufacturer concerning methods of detection of the fumigant in air, its behaviour and hazards properties, symptoms of poisoning, relevant first aid and special medical treatment and emergency procedures.

3.4.5 The ship should carry:

.1 appropriate gas-detection equipment for the fumigant concerned, together with instructions for its use when the fumigated cargo transport unit is stowed under deck;

.2 instructions on disposal of residual fumigant material; and

.3 emergency response information regarding UN 3359 such as a copy of the latest version of the Medical First Aid Guide for Use in Accidents Involving Dangerous Goods (MFAG).

In addition, the ship should carry at least four sets of appropriate respiratory protective equipment; and when the fumigated cargo transport unit is stowed on deck, appropriate gas-detection equipment for the fumigant concerned, together with instructions for its use.

3.4.6 Prior to the arrival of the ship, generally not less than 24 h in advance, the master should inform the appropriate authorities of the country of destination and ports of call that fumigation in transit is being carried out. The information should include the type of fumigant used, the date of fumigation and cargo spaces carrying fumigated cargo transport units.

4 FUMIGANTS USED

There are a number of chemicals that are used as fumigants such as phosphine and methyl bromide.

4.1 Phosphine

4.1.1 This process requires a long period of time to work completely. This can be applied with little technical training as it is supplied in sachets, tablets or pressed plates containing magnesium phosphide or aluminium phosphide. These generate phosphine gas when exposed to the moisture in the air. The gas has a slight "fishy garlic" smell and breaks down into a powdery grey residue.

4.1.2 The rate of generation of phosphine depends on the temperature, the airborne moisture and the extent to which the generating material is exposed to the air.

4.1.3 Symptoms of poisoning by inhalation of phosphine include nausea, vomiting, headaches, feeling weak, fainting, pain in chest, cough, chest tightness and difficulty breathing. Pulmonary oedema (the presence of excess fluid in the lungs usually due to heart failure) can follow, usually within 24 h, but sometimes this is delayed for some days.

4.2 Methyl bromide

4.2.1 Fumigation with methyl bromide is a relatively rapid process that can normally be completed in less than 48 h.

4.2.2 Symptoms of poisoning by inhalation of methyl bromide include headaches, dizziness, eye irritation, coughing, nausea, abdominal discomfort and numbness of feet. Higher exposure will bring about unconsciousness to the central nervous system, convulsions and loss of vision, balance and hearing.

4.2.3 Methyl bromide is supplied as a gas. So, during application, expertise is required to carry out the operation.

5 HAZARDS TO PERSONNEL

5.1 If, for any reason, the ship's crew or other personnel have to open a fumigated cargo transport unit or a fumigated cargo transport unit which has been ventilated they should take proper precautions.

5.2 There are no obvious signs when methyl bromide has been used as a fumigant (e.g. by sight or smell). The cargo transport unit should be left open as long as possible and then checked with the equipment available and should be declared gas-free before entry is allowed. In the case of an emergency, entry may be allowed, with full confined space precautions, if there is any gas found to be present.

5.3 If the cargo transport unit is fumigated with phosphine there are normally visual signs inside the cargo transport unit of the fumigant in the form of sachets, tablets, pressed plates or powder. The state of the packaging depends on the time these have been exposed and the atmosphere that they have been exposed in. It is also possible that the fumigants have moved between cargo items and may not be immediately visible.

5.4 As moisture is required for the reaction to take place, when a cargo transport unit is opened at sea the level of moisture in the air may restart the reaction.

5.5 After the magnesium or aluminium phosphide reacts with moisture to generate phosphine, a residue of magnesium or aluminium hydroxide remains. This is a light powdery grey substance like ash. Hopefully, this has been retained in some kind of packaging so that it can be removed safely. If, however, there is a residue over the cargo, the crew must avoid breathing in this residue or getting it into their eyes or mouth. If not, they are still at risk of being poisoned by the residue, which may still be able to generate some phosphine.

5.6 It should be noted that there are certain commodities (e.g. edible nuts) where a small amount of fumigant is put in cotton wool and placed inside each bag. These items are then dangerous because their handling brings the fumigant close to the face.

5.7 Personnel should be made aware that not every fumigated cargo transport unit is declared and, hence, not marked as such. There are indicators for fumigated cargo transport units like tapes on vents or the door joints, a possible "fishy garlic" smell of phosphine and packets or piles of powdery residue inside the cargo transport unit.

6 FUMIGATION DETECTION

6.1 General

6.1.1 The most effective method of protection is to carry out gas tests before the cargo transport unit is opened. As a minimum, it is recommended to test for phosphine and methyl bromide as the two most common fumigants used. If gas is found, the cargo transport unit should be put aside for ventilation.

6.2 Stain tube gas test equipment

6.2.1 Glass stain tube equipment is simple in design and use, robust and reliable. A test for phosphine and methyl bromide can be carried out by a person standing outside the cargo transport unit using a lance inserted into the cargo transport unit doorway. In practice, air is drawn by small handheld bellows through a glass tube containing impregnated crystals which react with the gas for which the test is being done. If the air is contaminated by the gas in question, the crystals change colour. The function is not affected by moisture, but care has to be taken to warm the tubes to above 0°C in sub-zero temperatures. Also, a reasonable degree of light is required to detect the colour change of the crystals. The tubes should be used in accordance with the manufacturer's instructions. In particular, they should not be used after their expiry date.

6.3 Electronic (photo-ionization gas testing equipment)

6.3.1 Gas tests can be carried out that detect the presence of gases and their concentration levels. Similarly, equipment can confirm that there is a safe level of oxygen within the cargo transport unit. At the present time, the technology is such that both the quantification and discrimination are poor. There are frequent false positives due to cross-sensitivities and readings are not accurate enough for determining safe exposure levels. Therefore, these instruments are used for preliminary screening.

6.4 Personal monitors

6.4.1 Small electronic personal monitors are available for phosphine, but not for methyl bromide. Phosphine monitors can be placed inside the cargo transport unit while unloaders are working, or worn by individuals on outer garments. The location of an independent monitor is important both to ensure that any fumigant is detected and ensure that the reading is not compromised by ventilation at the door or external contaminants. Monitors issue an audible signal if phosphine levels reach the pre-set level and are useful as warning devices. However, they should not be used for the initial fumigation detection and measurement process. Also, electronic monitors have the disadvantage that they can respond to a range of harmless substances giving misleading alarm signals.

6.4.2 Personal monitors are also available to show the level of oxygen within the cargo transport unit. This would indicate a deoxygenated atmosphere but would not necessarily indicate that the atmosphere is free from fumigant.

APPENDIX

Ensure suitability of cargo transport unit for fumigation operations and minimize escape of fumigants

Fumigate cargo transport unit

Has the CTU been completely ventilated?

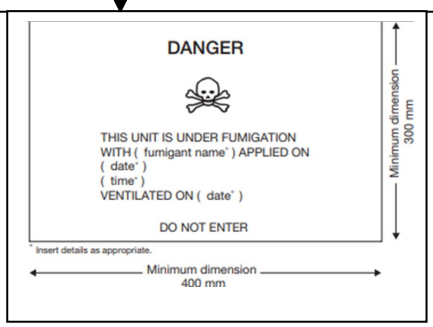
Yes

Ventilated cargo transport unit Subject only to the fumigation warning mark with the date of ventilation

No

Cargo transport units loaded without ventilation after fumigation (fumigation in transit)

Mark and document



- The transport document should specify UN 3359, the proper shipping name (fumigated cargo transport unit), the class (9), the date and time and the type and amount of fumigant used.

In the absence of the fumigation warning mark as described above, indications for both declared and non-declared fumigated cargo transport units.

- Taped doors/vents
- Packets/piles of powdery residue
- Odour
- Nature, origin and destination of cargo

When opening cargo transport units

- Risk assess whether safe to enter the cargo transport unit
- Awareness/marking of residual hazard
- Importance of proper ventilation (venting can take many hours)
- Front to back unloading of cargo transport units
- Avoid "tunnelling" into cargo transport units to retrieve packages