

Title	IMDG Code / SUPPLEMENT / Appendix / DSC/Circ. 11
Note	Incorporating Amendment 42-24

DSC/Circ. 11

30 April 2003

SHIPS CARRYING FUMIGATED BULK CARGOES

- 1 The Sub-Committee on Dangerous Goods, Solid Cargoes and Containers (DSC), at its seventh session (23 to 27 September 2002), considered a number of reports on casualties and incidents involving dangerous cargoes submitted by Governments and international organizations concerned.
- 2 The Sub-Committee's attention was drawn to the risks associated with ships carrying solid bulk cargoes (DSC 7/6/2), which have been treated with toxic gases (fumigated) and might negatively affect the safety and health of personnel. These include:
- .1 the assumption that the concentration of the toxic fumigant is sufficiently low when the ship arrives in the port of discharge, as to avoid safety and health risks to ship and shore personnel or enforcement officers. Unfortunately, this is not always the case and there are reported incidents where employees have been exposed to the fumigant, usually phosphine, causing health problems;
 - .2 unlike cargo transport units (CTU's), ships containing bulk cargo under fumigation are not required to be labelled as such. So they are not visibly recognized as a potential safety and health risk; and
 - .3 though some ports require a notification to the Harbour Master, and/or appropriate authorities, from the Master of a ship containing fumigated bulk cargo, wishing to enter the port, that action has been taken to make the ship's holds and the cargo gas-free, such notification does not always take place, resulting in potential health risks for the ship's crew, terminal personnel and others when the ship is being unloaded.
- The attention of Member Governments is drawn to the following observations:
- .4 the International Convention for the Safety of Life at Sea (SOLAS) regulation VI/4, obliges that appropriate precautions shall be taken in the use of pesticides in ships, in particular for the purposes of fumigation. The *Recommendations on the Safe Use of Pesticides in Ships*, recommended to governments in pursuance of their obligations under chapter VI of the SOLAS Convention, as amended, are intended as a guide to competent authorities, mariners, fumigators, fumigant and pesticide manufacturers, and others concerned; and
 - .5 for bulk carriers SOLAS requires a Safety Management System that should contain safety procedures for fumigated cargoes. For ships other than bulk carriers that transport fumigated bulk cargoes, the Safety Management System became mandatory on 1 July 2002.
- 3 It is therefore recommended that Member Governments issue regulations to oblige ships that carry solid bulk cargoes under fumigation to notify accordingly the Harbour Master, as well as any other appropriate authorities, prior to arrival in port and to ensure that the ship's hold and its cargo are gas-free upon berthing the ship.
- 4 Member Governments are invited to bring the above information to the attention of shipowners, ship operators, companies, shipmasters, shippers and all other parties concerned requesting that appropriate action be taken in accordance with the provisions of the relevant IMO instruments.

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MSC.1/Circ.1264/Rev.1
17 September 2025

**RECOMMENDATIONS ON THE SAFE USE OF PESTICIDES IN SHIPS
APPLICABLE TO THE FUMIGATION OF CARGO HOLDS**

- 1 The Maritime Safety Committee, at its sixty-second session (24 to 28 May 1993), approved MSC/Circ.612 on *Recommendations on the safe use of pesticides in ships*, proposed by the Sub-Committee on Containers and Cargoes, at its thirty-second session.
- 2 The Maritime Safety Committee, at its eighty-fourth session (7 to 16 May 2008), approved MSC.1/Circ.1264 on *Recommendations on the safe use of pesticides in ships applicable to the fumigation of cargo holds*, which apply to carriage of solid bulk cargoes including grain in pursuance of the requirement of SOLAS regulation VI/4, proposed by the Sub-Committee on Dangerous Goods, Solid Cargoes and Containers, at its twelfth session.
- 3 The Maritime Safety Committee, at its eighty-ninth session (11 to 20 May 2011), approved MSC.1/Circ.1396 on *Amendment to the recommendations on the safe use of pesticides in ships applicable to the fumigation of cargo holds (MSC.1/CIRC.1264)*, as prepared by the Sub-Committee on Dangerous Goods, Solid Cargoes and Containers at its fifteenth session.
- 4 The Maritime Safety Committee, at its 110th session (18 to 27 June 2025), approved the revised *Recommendations on the safe use of pesticides in ships applicable to the fumigation of cargo holds* (the Recommendations), proposed by the Sub-Committee on Carriage of Cargoes and Containers, at its tenth session, as set out in the annex to the present circular.
- 5 The Committee agreed that the revised Recommendations should not apply to the carriage of fresh food produce under controlled atmosphere.
- 6 Member States are invited to bring the revised Recommendations to the attention of competent authorities, mariners, fumigators, fumigant and pesticide manufacturers and others concerned.
- 7 The present circular supersedes MSC.1/Circ.1264 and MSC.1/Circ.1396.

ANNEX

RECOMMENDATIONS ON THE SAFE USE OF PESTICIDES IN SHIPS APPLICABLE TO THE FUMIGATION OF CARGO HOLDS

1 INTRODUCTION

1.1 Insect and mite pests of plant and animal products may be carried into the cargo holds 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 phytosanitary requirements to prevent spread of pests and for commercial reasons to prevent infestation and contamination of, or damage to, cargoes of human and animal food both raw and processed materials. Although fumigants may be used to kill rodent pests, the control of rodents on board ships is dealt with separately. In severe cases of infestation of bulk cargoes such as cereals, excessive heating may occur.

1.2 The following sections provide guidance to shipmasters in the use of pesticides¹ with a view to safety of personnel. They cover pesticides used for the control of insect² and rodent pests in empty and loaded cargo holds.

2 PREVENTION OF INFESTATION

2.1 Maintenance and sanitation

2.1.1 Ship cargo holds, tank top ceilings and other parts of the ship should be kept in a good state of repair to avoid infestation. Many ports of the world have rules and by-laws dealing specifically with the maintenance of ships intended to carry grain cargoes; for example, boards and ceilings should be completely grain-tight.

2.1.2 Cleanliness, or good housekeeping, is as important a means of controlling pests on a ship as it is in a home, warehouse, mill or factory. Since insect pests on ships become established and multiply in debris, much can be done to prevent their increase by simple, thorough cleaning. Box beams and stiffeners, for example, become filled with debris during discharge of cargo and unless kept clean can become a source of heavy infestation. It is important to remove thoroughly all cargo residue from deckhead frames and longitudinal deck girders at the time of discharge, preferably when the cargo level is suitable for convenient cleaning. Where available, industrial vacuum cleaners are of value for the cleaning of cargo holds and fittings.

2.1.3 The material collected during cleaning should be disposed of, or treated, immediately so that the insects cannot escape and spread to other parts of the ship or elsewhere. In port it may be burned or treated with a pesticide, but in many countries such material may only be landed under phytosanitary supervision. If any part of the ship is being fumigated the material may be left exposed to the gas.

¹ The word *pesticide* as used throughout the text means fumigants. Examples of some commonly used pesticides are listed in appendix 1.

² The word *insect* as used throughout the text includes mites.

2.2 Main sites of infestation

2.2.1 *Tank top ceiling:* If, as often happens, cracks appear between the ceiling boards, food material may be forced down into the underlying space and serve as a focus of infestation for an indefinite period. Insects bred in this space can readily move out to attack food cargoes and establish their progeny in them.

2.2.2 *Tween-deck centre lines, wooden feeders and bins* are often left in place for several voyages and because of their construction are a frequent source of infestation. After unloading a grain cargo, burlap and battens covering the narrow spaces between the planks should be removed and discarded before the holds are cleaned or washed down. These coverings should be replaced by new material in preparation for the next cargo.

2.2.3 *Transverse beams and longitudinal deck girders* which support the decks and hatch openings may have an L-shaped angle-bar construction. Such girders provide ledges where grain may lodge when bulk cargoes are unloaded. The ledges are often in inaccessible places overlooked during cleaning operations.

2.2.4 *Insulated bulkheads near engine-rooms:* When the hold side of an engine-room bulkhead is insulated with a wooden sheathing, the airspace and the cracks between the boards often become filled with grain and other material. Sometimes the airspace is filled with insulating material which may become heavily infested and serves as a place for insect breeding. Temporary wooden bulkheads also provide an ideal place for insect breeding, especially under moist conditions, such as when green lumber is used.

2.2.5 *Cargo battens:* The crevices at the sparring cleats are ideal places for material to lodge and for insects to hide.

2.2.6 *Bilges:* Insects in accumulations of food material are often found in these spaces.

2.2.7 *Electrical conduit casings:* Sometimes the sheet-metal covering is damaged by general cargo and when bulk grain is loaded later, the casings may become completely filled. This residual grain has often been found to be heavily infested. Casings that are damaged should be repaired immediately or, where possible, they should be replaced with steel strapping, which can be cleaned more easily.

2.2.8 Other places where material accumulates and where insects breed and hide include:

The area underneath burlap, which is used to cover limber boards and sometimes to cover tank top ceilings.

Boxing around pipes, especially if it is broken.

Corners, where old cereal material is often found.

Crevices at plate landings, frames and chocks.

Wooden coverings of manholes or wells leading to double-bottom tanks or other places.

Cracks in the wooden ceiling protecting the propeller shaft tunnel.

Beneath rusty scale and old paint on the inside of hull plates.

Shifting boards.

Dunnage material, empty bags and used separation cloths.

Inside lockers.

3 CHEMICAL CONTROL OF INSECT INFESTATION

3.1 Methods of chemical disinfection

3.1.1 *Types of pesticides and methods of insect control*

3.1.1.1 To avoid insect populations becoming firmly established in cargo holds and other parts of a ship, it is necessary to use some form of chemical toxicant for control. The materials available may be divided conveniently into two classes: contact insecticides and fumigants. The choice of agent and method of application depend on the type of commodity, the extent and location of the infestation, the importance and habits of the insects found, and the climatic and other conditions. Recommended treatments are altered or modified from time to time in accordance with new developments.

3.1.1.2 The success of chemical treatments does not lie wholly in the pesticidal activity of the agents used. In addition, an appreciation of the requirements and limitations of the different available methods is required. Crew members can carry out small-scale or "spot" treatments if they adhere to the manufacturer's instructions and take care to cover the whole area of infestation. However, extensive or hazardous treatments including fumigation and spraying near human and animal food should be placed in the hands of professional operators, who should inform the master of the identity of the active ingredients used, the hazards involved and the precautions to be taken.

3.1.2 *Fumigants*

3.1.2.1 Fumigants act in a gaseous phase even though they may be applied as solid or liquid formulations from which the gas arises. Effective and safe use requires that the space being treated be rendered gastight for the period of exposure, which may vary from a few hours to several days, depending on the fumigant type and concentration used, the pests, the commodities treated and the temperature. Additional information is provided on two of the most widely used fumigants, Methyl bromide and Phosphine, in appendix 1.

3.1.2.2 Since fumigant gases are poisonous to humans and require special equipment and skills in application, they should be used by specialists and not by the ship's crew.

3.1.2.3 Evacuation of the space under gas treatment is mandatory and in some cases it will be necessary for the whole ship to be evacuated (see 3.3.1 and 3.3.2 below).

3.1.2.4 A "fumigator-in-charge" should be designated by the fumigation company, government agency or appropriate authority. They should be able to provide documentation to the master proving their competence and authorization. The master should be provided with written instructions by the fumigator-in-charge on the type of fumigant used, the hazards to human health involved and the precautions to be taken, and in view of the highly toxic nature of all commonly used fumigants these should be followed carefully. Such instructions should be written in a language readily understood by the master or their representative.

3.2 Disinfection of empty cargo holds

3.2.1 An empty cargo hold may be fumigated. Examples of some commonly used pesticides are listed in appendix 1. (For precautions before, during and after fumigation of cargo holds see 3.3 below.)

3.3 Disinfestation of cargoes and surrounds

3.3.1 *Fumigation with aeration (ventilation) in port*

3.3.1.1 Fumigation and aeration (ventilation) of empty cargo holds should always be carried out in port (alongside or at anchorage). Ships should not be permitted to leave port until gas-free certification has been received from the fumigator-in-charge.

3.3.1.2 Prior to the application of fumigants to cargo holds, the crew should be landed and remain ashore until the ship is certified "gas-free", in writing, by the fumigator-in-charge or other authorized person. During this period a watchman should be posted to prevent unauthorized boarding or entry, and warning signs should be prominently displayed at gangways and at entrances to accommodation. A specimen of such a warning sign is given in appendix 2.

3.3.1.3 The fumigator-in-charge should be retained throughout the fumigation period and until such time as the ship is declared gas-free.

3.3.1.4 At the end of the fumigation period the fumigator will take the necessary action to ensure that the fumigant is dispersed. If crew members are required to assist in such actions, for example in opening hatches, they should be provided with adequate respiratory protection and adhere strictly to instructions given by the fumigator-in-charge.

3.3.1.5 The fumigator-in-charge should notify the master, in writing, of any spaces determined to be safe for re-occupancy by essential crew members prior to the aeration of the ship.

3.3.1.6 In such circumstances the fumigator-in-charge should monitor, throughout the fumigation and aeration periods, spaces to which personnel have been permitted to return. Should the concentration in any such area exceed the occupational exposure limit values set by the flag State regulations, crew members should be evacuated from the area until measurements show re-occupancy to be safe.

3.3.1.7 No unauthorized persons should be allowed on board until all parts of the ship have been determined gas-free, warning signs removed and clearance certificates issued by the fumigator-in-charge.

3.3.1.8 Clearance certificates should only be issued when tests show that all residual fumigant has been dispersed from empty cargo holds and adjacent working spaces and any residual fumigant material has been removed.

3.3.1.9 Entry into a space under fumigation should never take place except in the event of an extreme emergency. If entry is imperative the fumigator-in-charge and at least one other person should enter, each wearing adequate protective equipment appropriate for the fumigant used and a safety harness and lifeline. Each lifeline should be tended by a person outside the space, who should be similarly equipped.

3.3.1.10 If a clearance certificate cannot be issued after the fumigation of cargo in port, the provisions of 3.3.2 should apply.

3.3.2 *Fumigation continued in transit*

3.3.2.1 Fumigation in transit should only be carried out at the discretion of the master. This should be clearly understood by owners, charterers, and all other parties involved when considering the transport of cargoes that may be infested. Due consideration should be taken

of this when assessing the options of fumigation. The master should be aware of the regulations of the flag State Administration with regard to in-transit fumigation. The application of the process should be with the agreement of the port State Administration. The process may be considered under two headings:

- .1 fumigation in which treatment is intentionally continued in a sealed space during a voyage and in which no aeration has taken place before sailing; and
- .2 in-port cargo fumigation where some aeration is carried out before sailing, but where a clearance certificate for the cargo hold(s) cannot be issued because of residual gas and the cargo hold(s) has been re-sealed before sailing.

3.3.2.2 Before a decision on sailing with a fumigated cargo hold(s) is made it should be taken into account that, due to operational conditions, the circumstances outlined in 3.3.2.1.2 may arise unintentionally, e.g. a ship may be required to sail at a time earlier than anticipated when the fumigation was started. In such circumstances the potential hazards may be as great as with a planned in-transit fumigation and all the precautions in the following paragraphs should be observed.

3.3.2.3 Before a decision is made as to whether a fumigation treatment planned to be commenced in port and continued at sea should be carried out, special precautions are necessary. These include the following:

- .1 at least two members of the crew (including one officer) who have received appropriate training (see 3.3.2.6) should be designated as the trained representatives of the master responsible for ensuring that safe conditions in accommodation, engine-room and other working spaces are maintained after the fumigator-in-charge has handed over that responsibility to the master (see 3.3.2.12); and
- .2 the trained representatives of the master should brief the crew before a fumigation takes place and satisfy the fumigator-in-charge that this has been done.

3.3.2.4 Empty cargo holds, are to be inspected and/or tested for leakage with instruments so that proper sealing can be done before or after loading. The fumigator-in-charge, accompanied by a trained representative of the master or a competent person, should determine whether the cargo holds to be treated are or can be made sufficiently gastight to prevent leakage of the fumigant to the accommodation, engine-rooms and other working spaces in the ship. Special attention should be paid to potential problem areas such as bilge and cargo line systems. On completion of such inspection and/or test, the fumigator-in-charge should supply to the master for their retention, a signed statement that the inspection and/or test has been performed, what provisions have been made and that the cargo holds are or can be made satisfactory for fumigation. Whenever a cargo hold is found not to be sufficiently gastight, the fumigator-in-charge should issue a signed statement to the master and the other parties involved.

3.3.2.5 Accommodation, engine-rooms, areas designated for use in navigation of the ship, frequently visited working areas and stores, such as the forecastle head spaces, adjacent to cargo holds being subject to fumigation in transit should be treated in accordance with the provisions of 3.3.2.13. Special attention should be paid to gas concentration safety checks in problem areas referred to in 3.3.2.4.

3.3.2.6 The trained representatives of the master designated in 3.3.2.3 should be provided and be familiar with:

- .1 the information in the relevant Safety Data Sheet; and
- .2 the instructions for use, e.g. on the fumigant label or package itself, such as the recommendations of the fumigant manufacturer concerning methods of detection of the fumigant in air, its behaviour and hazardous properties, symptoms of poisoning, relevant first aid and special medical treatment and emergency procedures.

3.3.2.7 The ship should carry:

- .1 gas-detection equipment and adequate fresh supplies of service items for the fumigant(s) concerned as required by 3.3.2.12, together with instructions for its use and the occupational exposure limit values set by the flag State regulations for safe working conditions;
- .2 instructions on disposal of residual fumigant material;
- .3 at least four sets of adequate respiratory protective equipment; and
- .4 a copy of the latest version of the Medical First Aid Guide for Use in Accidents Involving Dangerous Goods (MFAG), including appropriate medicines and medical equipment.

3.3.2.8 The fumigator-in-charge should notify the master, in writing, of the spaces containing the cargo to be fumigated and also of any other spaces that are considered unsafe to enter during the fumigation. During the application of the fumigant the fumigator-in-charge should ensure that the surrounding areas are checked for safety.

3.3.2.9 If cargo holds are to be fumigated in transit:

- .1 After application of the fumigant, an initial check should be made by the fumigator-in-charge together with trained representatives of the master for any leak which, if detected, should be effectively sealed. When the master is satisfied that all precautions detailed in 3.3.2.1 to 3.3.2.12 have been fulfilled (refer to model checklist in appendix 3) then the vessel may sail. Otherwise, provisions outlined in 3.3.2.9.2 or 3.3.2.9.3 are to be followed.

If the provisions of 3.3.2.9.1 are not satisfied,

either:

- .2 After application of fumigants, the ship should be delayed in port alongside at a suitable berth or at anchorage for such a period as to allow the gas in the fumigated cargo holds to reach sufficiently high concentrations to detect any possible leakage. Special attention should be paid to those cases where fumigants in a solid or liquid form have been applied which may require a long period (normally from 4 to 7 days unless a recirculation or similar distribution system is used) to reach such a high concentration that leakages can be detected. If leakages are detected, the ship should not sail until the source(s) of such leakages are determined and eliminated. After ascertaining that the ship is in a safe condition to sail, i.e. no gas leakages are present, the fumigator-in-charge should furnish the master with a written statement that:

- .2.1 the gas in the cargo hold(s) has reached sufficiently high concentrations to detect any possible leakages;
- .2.2 spaces adjacent to the treated cargo hold(s) have been checked and found gas free; and
- .2.3 the ship's representative is fully conversant with the use of the gas-detection equipment provided.

or:

- .3 After application of the fumigants, and immediately after the sailing of the ship, the fumigator-in-charge should remain on board for such a period as to allow the gas in the fumigated cargo hold or spaces to reach sufficiently high concentrations to detect any possible leakage, or until the fumigated cargo is discharged (see 3.3.2.20), whichever is the shorter, to check and rectify any gas leakages. Prior to their leaving the ship, they should ascertain that the ship is in a safe condition, i.e. no gas leakages are present, and they should furnish the master with a written statement to the effect that the provisions of 3.3.2.9.2.1, 3.3.2.9.2.2 and 3.3.2.9.2.3 have been carried out.

3.3.2.10 On application of the fumigant, the fumigator-in-charge should post warning signs at all entrances to places notified to the master as in 3.3.2.8. These warning signs should indicate the identity of the fumigant and the date and time of fumigation. A specimen of such a warning sign is given in appendix 2.

3.3.2.11 At an appropriate time after application of the fumigant, the fumigator-in-charge, accompanied by a representative of the master, should check that accommodation, engine-rooms and other working spaces remain free of harmful concentrations of gas.

3.3.2.12 Upon discharging their agreed responsibilities, the fumigator-in-charge should formally hand over to the master, in writing, responsibility for maintaining safe conditions in all occupied spaces. The fumigator-in-charge should ensure that gas-detection and respiratory protection equipment carried on the ship is in good order, and that adequate fresh supplies of consumable items are available to allow sampling as required in 3.3.2.13.

3.3.2.13 Gas concentration safety checks at all appropriate locations, which should at least include the spaces indicated in 3.3.2.5, should be continued throughout the voyage at least at eight-hour intervals or more frequently if so advised by the fumigator-in-charge. These readings should be recorded in the ship's log-book.

3.3.2.14 Except in extreme emergency, cargo holds sealed for fumigation in transit should never be opened at sea or entered. If entry is imperative, at least two persons should enter, wearing adequate protection equipment and a safety harness and lifeline tended by a person outside the space, similarly equipped with protective, self-contained breathing apparatus.

3.3.2.15 If it is essential to ventilate a cargo hold or holds, every effort should be made to prevent a fumigant from accumulating in accommodation or working areas. Those spaces should be carefully checked to that effect. If the gas concentration in those areas at any time exceeds the occupational exposure limit values set by the flag State regulations, they should be evacuated and the cargo hold or cargo holds should be re-sealed. If a cargo hold is re-sealed after ventilation, it should not be assumed that it is completely clear of gas and tests should be made and appropriate precautions taken before entering.

3.3.2.16 Prior to the arrival of the ship, generally not less than 24 hours 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, the cargo holds which have been fumigated, and whether ventilation has commenced. Upon arrival at the port of discharge, the master should also provide information as required in 3.3.2.6.2 and 3.3.2.7.2.

3.3.2.17 On arrival at the port of discharge the requirements of receiving countries regarding handling of fumigated cargoes should be established. Before entry of fumigated cargo holds, trained personnel from a fumigation company or other authorized persons, wearing respiratory protection, should carry out careful monitoring of the spaces to ensure the safety of personnel. The monitored values should be recorded in the ship's logbook. In case of need or emergency, the master may commence ventilation of the fumigated cargo holds under the conditions of 3.3.2.15, having due regard for the safety of personnel on board. If this operation is to be done at sea, the master should evaluate weather and sea conditions before proceeding.

3.3.2.18 Only mechanical unloading that does not necessitate entry of personnel into the cargo holds of such fumigated cargoes should be undertaken. However, when the presence of personnel in cargo holds is necessary for the handling and operation of unloading equipment, continuous monitoring of the fumigated spaces should be carried out to ensure the safety of the personnel involved. When necessary, these personnel should be equipped with adequate respiratory protection.

3.3.2.19 During the final stages of discharge, when it becomes necessary for personnel to enter the cargo holds, such entry should only be permitted subsequent to verification that such cargo holds are gas free.

3.3.2.20 Upon completion of discharge and when the ship is found free of fumigants and certified as such, all warning signs should be removed. Any action in this respect should be recorded in the ship's logbook.

4 REGULATIONS FOR THE USE OF PESTICIDES

4.1 National and international controls on pesticide usage

4.1.1 In many countries the sale and use of pesticides are regulated by governments to ensure safety in application and prevention of contamination of foodstuffs. Among the factors taken into account in such regulations are the recommendations made by international organizations such as FAO and WHO, especially in regard to maximum limits of pesticide residues in food and foodstuffs.

4.1.2 Examples of some commonly used pesticides are listed in appendix 1. Pesticides should be used strictly in accordance with the manufacturer's instructions as given on the label or package itself. National regulations and requirements vary from one country to another; therefore, particular pesticides which may be used for treatment of cargo holds and accommodation in ships may be limited by the regulations and requirements of:

- .1 the country where the cargo is loaded or treated;
- .2 the country of destination of the cargo, especially in regard to pesticide residues in foodstuffs; and
- .3 flag State of the ship.

4.1.3 Ships' masters should ensure that they have the necessary knowledge of the above regulations and requirements.

5 SAFETY PRECAUTIONS – GENERAL

5.1 Fumigation

5.1.1 Ship's personnel should not handle fumigants and such operations should be carried out only by qualified operators. Personnel allowed to remain in the vicinity of a fumigation operation for a particular purpose should follow the instructions of the fumigator-in-charge implicitly.

5.1.2 Aeration of treated cargo holds should be completed and a clearance certificate issued as in 3.3.1.8 or 3.3.1.10 before personnel are permitted to enter.

5.2 Exposure to pesticides resulting in illness

5.2.1 In the case of exposure to pesticides and subsequent illness, medical advice should be sought immediately. Information on poisoning may be found in the Medical First Aid Guide for Use in Accidents Involving Dangerous Goods (MFAG) or on the package (manufacturer's instructions and safety precautions on the label or the package itself).

5.3 Fire risk

5.3.1 When Phosphine generating formulations are used to fumigate, any collected residue may ignite.

APPENDIX 1

FUMIGANTS SUITABLE FOR SHIPBOARD USE

The materials listed should be used strictly in accordance with the manufacturer's instructions and safety precautions given on the label or package itself, especially in respect of flammability, and with regard to any further limitations applied by the law of the country of loading, destination or flag of the ship, contracts relating to the cargo, or the shipowner's instructions.

1 Fumigants against insects in empty cargo holds

TO BE APPLIED ONLY BY QUALIFIED OPERATORS

- Carbon dioxide
- Nitrogen
- Methyl Bromide and carbon dioxide mixture
- Methyl Bromide
- Hydrogen cyanide
- Phosphine

2 Fumigants against insects in loaded or partially loaded cargo holds

CARE IS NEEDED IN SELECTING TYPES AND AMOUNTS OF FUMIGANTS FOR TREATMENT OF PARTICULAR COMMODITIES

- Carbon dioxide
- Nitrogen
- Methyl Bromide and carbon dioxide mixture
- Methyl Bromide
- Phosphine

3 Fumigant information

3.1 *Methyl Bromide*

Methyl Bromide is used in situations where a rapid treatment of commodities or space is required. It should not be used in spaces where ventilation systems are not adequate for the removal of all gases from the free space. In-ship in-transit fumigations with Methyl Bromide should not be carried out. Fumigation with Methyl Bromide should be permitted only when the ship is in the confines of a port (either at anchor or alongside) and to disinfest before discharge, once crew members have disembarked (see 3.1.2.3). Prior to discharge, ventilation must be done, forced if necessary, to reduce the gaseous residues below the occupational exposure limit values set by the flag State regulations in the free spaces. (See procedures for ventilation in 3.3.2.17 to 3.3.2.19).

3.2 *Phosphine*

3.2.1 A variety of Phosphine-generating formulations are used for in-ship in-transit or at-berth fumigations. Application methods vary widely and include surface-only treatment, probing, perforated tubing laid at the bottom of spaces, recirculation systems and gas-injection systems or their combinations. Treatment times will vary considerably depending on the temperature, depth of cargo and on the application method used.

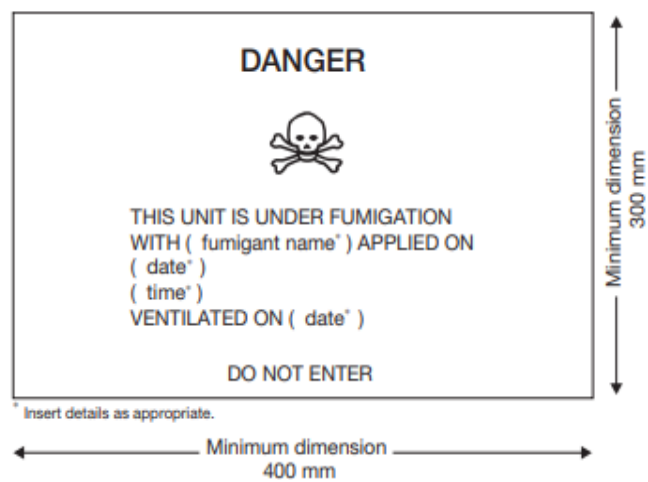
3.2.2 Any discharge of active packages producing Phosphine gas represent a significant risk to the public who may encounter them at sea. It should therefore be ensured that all waste and residues are disposed of in an appropriate manner, either by incineration or by disposal on shore, as recommended by the manufacturer. **Clear written instructions must be given to the master of the ship, to the receiver of the cargo and to the authorities at the discharging port as to how any powdery residues are to be disposed of.**

3.2.3 These will vary with each formulation and the method of application. Prior to discharge, ventilation must be done, forced if necessary, to reduce the gaseous residues below the occupational exposure limit values set by the flag State regulations in the free spaces (see procedures for ventilation in 3.3.2.17 to 3.3.2.19). For safety aspects during the voyage see 3.3.2.3.

3.3 *Gas-generating agents*

3.3.1 When a solid bulk cargo is fumigated using a gas-generating agent (such as a Phosphine generating agent) as treatment for the cargo, it is recommended not to use it in the form of loose tablets. The fumigator-in-charge, for safety reasons, should consider using sleeves instead of loose tablets. The use of loose tablets incurs a serious risk that unreacted gas-generating agent remains in the cargo which creates a serious hazard for the ship's crew and personnel involved in the discharge or transshipment of the cargo.

APPENDIX 2



APPENDIX 3

MODEL CHECKLIST FOR IN-TRANSIT FUMIGATION

Date:
Port: Terminal/Quay:
Name of ship:
IMO number*
Type of fumigant: Method of application:
Date and time fumigation commenced:
Name of fumigator/company:

The master and fumigator-in-charge, or their representatives, should complete the checklist jointly. The purpose of this checklist is to ensure that the responsibilities and requirements of 3.3.2.11, and 3.3.2.12 are carried out fully for in-transit fumigation under section 3.3.2.9.

Safety of operations requires that all questions should be answered affirmatively by ticking the appropriate boxes. If this is not possible, the reason should be given and agreement reached upon precautions to be taken between ship and fumigator-in-charge. If a question is considered to be not applicable write "n/a", explaining why, if appropriate.

* IMO Ship Identification Number Scheme, adopted by the Organization through resolution A.1117(30).

PART A: BEFORE FUMIGATION

	SHIP	FUMIGATOR- IN-CHARGE
1 The inspection required before loading has been performed (3.3.2.4)	<input type="checkbox"/>	<input type="checkbox"/>
2 All the cargo holds to be fumigated are satisfactory for fumigation	<input type="checkbox"/>	<input type="checkbox"/>
3 Spaces, where found not to be satisfactory, have been sealed	<input type="checkbox"/>	<input type="checkbox"/>
4 The master or their trained representatives have been made aware of the specific areas to be checked for gas concentrations throughout the fumigation period	<input type="checkbox"/>	<input type="checkbox"/>
5 The master or their trained representatives have been made familiar with the fumigant label, detection methods, safety procedures and emergency procedures (refer to 3.3.2.6)	<input type="checkbox"/>	<input type="checkbox"/>
6 The fumigator-in-charge has ensured that gas-detection and respiratory protection equipment carried on the ship is in good order, and that adequate fresh supplies of consumable items for this equipment are available to allow sampling as required by 3.3.2.13.	<input type="checkbox"/>	<input type="checkbox"/>
7 The master has been notified in writing of:		
(a) the spaces containing cargo to be fumigated	<input type="checkbox"/>	<input type="checkbox"/>
(b) any other spaces that are considered unsafe to enter during the fumigation	<input type="checkbox"/>	<input type="checkbox"/>

PART B: AFTER FUMIGATION

The following procedure should be carried out after application of fumigant and closing and sealing of cargo holds.

	SHIP	FUMIGATOR- IN-CHARGE
8 Presence of gas has been confirmed inside each hold under fumigation	<input type="checkbox"/>	<input type="checkbox"/>
9 Each hold has been checked for leakage and sealed properly	<input type="checkbox"/>	<input type="checkbox"/>
10 Spaces adjacent to the treated cargo holds have been checked and found gas free	<input type="checkbox"/>	<input type="checkbox"/>
11 The responsible crew members have been shown how to take gas readings properly when gas is present and they are fully conversant with the use of gas-detection equipment provided	<input type="checkbox"/>	<input type="checkbox"/>

12 Methods of application:

- | | | |
|---|--------------------------|--------------------------|
| (a) Surface application method
Initial rapid build-up of the gas in the upper regions of hold
airspace with subsequent penetration downward of the gas
over a longer period | <input type="checkbox"/> | <input type="checkbox"/> |
| or | | |
| (b) Deep probing
More rapid dispersion of gas than in (a) with lower
concentrations in upper regions of airspace in the hold | <input type="checkbox"/> | <input type="checkbox"/> |
| or | | |
| (c) Recirculation
Rapid dispersion of gas throughout hold but at lower initial
gas levels with subsequent build-up of gas levels which,
however, may be lower due to even distribution | <input type="checkbox"/> | <input type="checkbox"/> |
| or | | |
| (d) Other | <input type="checkbox"/> | <input type="checkbox"/> |

- | | | |
|---|--------------------------|--------------------------|
| 13 The master or their trained representatives have been briefed
fully on the method of application and the spread of the gas
throughout the hold | <input type="checkbox"/> | <input type="checkbox"/> |
|---|--------------------------|--------------------------|

14 The master or their trained representatives have been made:

- | | | |
|--|--------------------------|--------------------------|
| (a) aware that even though the initial check may not
indicate any leaks, it is essential that monitoring is to be
continued in the accommodation, engine-room, etc.
because gas concentrations may reach their highest
levels after several days | <input type="checkbox"/> | <input type="checkbox"/> |
| (b) aware of the possibility of the spreading of gas
throughout the duct keel and/or ballast tanks | <input type="checkbox"/> | <input type="checkbox"/> |

- | | | |
|---|--------------------------|--------------------------|
| 15 The fumigator-in-charge has supplied a signed statement to
the master conforming to the requirements of 3.3.2.12 for their
retention | <input type="checkbox"/> | <input type="checkbox"/> |
|---|--------------------------|--------------------------|

The above has been agreed:

Time: Date:

For ship:

IMO number: Fumigator-in-charge:

Rank:

4 ALBERT EMBANKMENT
LONDON SE1 7SR
Telephone: +44 (0)20 7735 7611 Fax: +44 (0)20 7587 3210

MSC.1/Circ.1358/Rev.1
17 September 2025

RECOMMENDATIONS ON THE SAFE USE OF PESTICIDES IN SHIPS

- 1 The Maritime Safety Committee, at its sixty-second session (24 to 28 May 1993), approved the *Recommendations on the safe use of pesticides in ships* (MSC/Circ.612), proposed by the Sub-Committee on Containers and Cargoes at its thirty-second session.
- 2 The Maritime Safety Committee, at its eighty-seventh session (12 to 21 May 2010), approved the revised *Recommendations on the safe use of pesticides in ships* (MSC.1/Circ.1358) in pursuance of the requirement of SOLAS regulation VI/4, proposed by the Sub-Committee on Dangerous Goods, Solid Cargoes and Containers at its fourteenth session.
- 3 The Maritime Safety Committee, at its 110th session (18 to 27 June 2025), approved the revised *Recommendations on the safe use of pesticides in ships* to update the references to the relevant circulars, proposed by the Sub-Committee on Carriage of Cargoes and Containers at its tenth session, as set out in the annex.
- 4 Member Governments are invited to bring the revised Recommendations to the attention of competent authorities, mariners, fumigators, fumigant and pesticide manufacturers, and others concerned.
- 5 The present circular supersedes MSC.1/Circ.1358.

ANNEX**RECOMMENDATIONS ON THE SAFE USE OF PESTICIDES IN SHIPS****TABLE OF CONTENTS**

1	INTRODUCTION
2	PREVENTION OF INFESTATION
2.1	Maintenance and sanitation
2.2	Main sites of infestation
3	CHEMICAL CONTROL OF INSECT INFESTATION
3.1	Methods of chemical disinfestations
3.1.1	Types of pesticides and methods of insect control
3.1.2	Contact insecticides
3.1.3	Fumigants
3.1.4	Fumigation with aeration (ventilation) in port
3.2	Disinfestation of empty cargo spaces
3.3	Disinfestation of food stores, galleys and crew and passenger accommodation
3.4	Disinfestation of cargoes and surrounds
3.5	Carriage of fumigated freight containers, barges and other cargo transport units on a ship
4	CONTROL OF RODENT PESTS
4.1	General
4.2	Fumigation and baiting
4.3	Rodent baits – chronic poisons permitted for use by ship's personnel
5	REGULATIONS FOR THE USE OF PESTICIDES
5.1	National and international controls on pesticides usage
6	SAFETY PRECAUTIONS – GENERAL
6.1	Pesticide materials
6.2	Space and surface spraying
6.3	Fumigation
6.4	Exposure to pesticides resulting in illness

ANNEX: Pesticides suitable for shipboard use

1 INTRODUCTION

1.1 These Recommendations have been compiled by the Sub-Committee on Dangerous Goods, Solid Cargoes and Containers under the direction of the Maritime Safety Committee of the International Maritime Organization (IMO).

1.2 Insects and rodents on ships are objectionable for various reasons. In addition to aesthetic and nuisance aspects, pests 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. Very few pesticides are suitable for use against all kinds of pests that may occur aboard or in different parts of ships. It is therefore necessary to consider the main categories of pesticides individually.

1.2.1 Insects in cargo spaces and cargoes

1.2.1.1 Insect and mite pests of plant and animal products may be carried into the cargo spaces 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 phytosanitary requirements to prevent the spread of pests and, for commercial reasons, to prevent infestation and contamination of, or damage to cargoes of human and animal food.* In severe cases of infestation of bulk cargoes such as cereals, excessive heating may occur.

1.2.2 Rodents

1.2.2.1 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.

1.3 The following sections provide guidance to shipmasters in the use of pesticides** with a view to the safety of personnel and the avoidance of excessive residues of toxic agents in human and animal food. They cover pesticides used for the control of insects*** and rodent pests in empty and loaded cargo spaces, in crew and passenger accommodation and in food stores. Account has been taken of existing recommendations of the World Health Organization (WHO), the International Labour Organization (ILO), and the Food and Agriculture Organization (FAO) of the United Nations, in regard to pesticide residues and occupational safety.

2 PREVENTION OF INFESTATION

2.1 Maintenance and sanitation

2.1.1 Ship cargo spaces, tank top ceilings and other parts of the ship should be kept in a good state of repair to avoid infestation. Many ports of the world have rules and by-laws dealing specifically with the maintenance of ships intended to carry grain cargoes; for example, boards and ceilings should be completely grain tight.

* References to human and animal food include both raw and processed material.

** The word "pesticide" as used throughout the text means insecticides, fumigants and rodenticides. Examples of some commonly used pesticides are listed in the annex.

*** The word "insect" as used throughout the text includes mites.

2.1.2 Cleanliness, or good housekeeping, is as important a means of controlling pests on a ship as it is in a home, warehouse, mill or factory. Since insect pests on ships become established and multiply in debris, much can be done to prevent their increase by simple, thorough cleaning. Box beams and stiffeners, for example, become filled with debris during the discharge of cargo, and unless kept clean, can become a source of heavy infestation. It is important to thoroughly remove all cargo residues from deckhead frames and longitudinal deck girders at the time of discharge, preferably when the cargo level is suitable for convenient cleaning. Where available, industrial vacuum cleaners are of value for the cleaning of cargo spaces and fittings.

2.1.3 The material collected during cleaning should be disposed of, or treated, immediately so that the insects cannot escape and spread to other parts of the ship or elsewhere. In port, it may be burnt or treated with a pesticide, but in many countries such material may only be landed under phytosanitary supervision. Where destruction ashore is not practicable, the sweepings should be jettisoned well out to sea. If any part of the ship is being fumigated the material may be left exposed to the gas.

2.2 Main sites of infestation

2.2.1 Tank top ceiling: if, as often happens, cracks appear between the ceiling boards, food material may be forced down into the underlying space and serve as a focus of infestation for an indefinite period. Insects bred in this space can readily move out to attack food cargoes and establish their progeny in them.

2.2.2 'Tween-deck centre lines, wooden feeders and bins are often left in place for several voyages and because of their construction are frequent sources of infestation. After unloading a grain cargo, burlap and battens covering the narrow spaces between the planks should be removed and discarded before the holds are cleaned or washed down. These coverings should be replaced by new material in preparation for the next cargo.

2.2.3 Transverse beams and longitudinal deck girders which support the decks and hatch openings may have an L-shaped angle-bar construction. Such girders provide ledges where grain may lodge when bulk cargoes are unloaded. The ledges are often in inaccessible places overlooked during cleaning operations.

2.2.4 Insulated bulkheads near engine-rooms: when the hold side of an engine-room bulkhead is insulated with a wooden sheathing, the air space and the cracks between the boards often become filled with grain and other material. Sometimes the air space is filled with insulating material which may become heavily infested and serve as a place for insect breeding. Temporary wooden bulkheads also provide an ideal place for insect breeding, especially under moist conditions, such as when green lumber is used.

2.2.5 Cargo battens: the crevices at the sparring cleats are ideal places for material to lodge and for insects to hide.

2.2.6 Bilges: insects in accumulations of food material are often found in these spaces.

2.2.7 Electrical conduit casings: sometimes the sheet-metal covering is damaged by general cargo and when bulk grain is loaded later, the casings may become completely filled. This residual grain has often been found to be heavily infested. Casings that are damaged should be repaired immediately or, where possible, they should be replaced with steel strapping, which can be cleaned more easily.

2.2.8 Other places where material accumulates and where insects breed and hide include:

- .1 the area underneath burlap, which is used to cover limber boards and sometimes to cover tank top ceilings;
- .2 boxing around pipes, especially if it is broken;
- .3 corners, where old cereal material is often found;
- .4 crevices at plate landings, frames and chocks;
- .5 wooden coverings of manholes or wells leading to double-bottom tanks or other places;
- .6 cracks in the wooden ceiling protecting the propeller shaft tunnel;
- .7 beneath rusty scale and old paint on the inside of hull plates;
- .8 shifting boards;
- .9 dunnage material, empty bags and used separation cloths; and
- .10 inside lockers.

3 CHEMICAL CONTROL OF INSECT INFESTATION

3.1 Methods of chemical disinfestations

3.1.1 Types of pesticides and methods of insect control

3.1.1.1 To avoid insect population becoming firmly established in cargo spaces and other parts of a ship, it is necessary to use some form of chemical toxicant for control. The materials available may be divided conveniently into two classes: contact insecticides and fumigants. The choice of agent and method of application depend on the type of commodity, the extent and location of the infestation, the importance and habits of the insects found and the climatic and other conditions. Recommended treatments are altered or modified from time to time in accordance with new developments.

3.1.1.2 The success of chemical treatments does not lie wholly in the pesticidal activity of the agents used. In addition, an appreciation of the requirements and limitations of the different available methods is required. Crew members can carry out small-scale or "spot treatments" if they adhere to the manufacturer's instructions and take care to cover the whole area of infestation. However, extensive or hazardous treatments including fumigation and spraying near human and animal food should be placed in the hands of professional operators who should inform the master of the identity of the active ingredients used, the hazards involved and the precautions to be taken.

3.1.2 Contact insecticides

3.1.2.1 Space treatments – insecticides may be discharged into the air as fine particles of liquid or solid. There are a number of types of equipment for producing and distributing such particles. This method of treatment kills flying insects and deals with superficial infestation where exposed insects come into contact with the particles, whilst there may be limited residual pesticidal effect on surfaces on which the particles settle.

3.1.2.2 For use in cargo spaces, space sprays and fogs can be produced in several different ways. These include fog generators in which an insecticide in the form of a liquid or coarse spray is vaporized. Such vaporized insecticides may condense into fine particles on reaching cool air. Alternatively, fine particles may be produced mechanically from suitable formulations by dispersing nozzles, venturi systems or centrifugal force. Insecticidal smokes are evolved from generators simply by igniting the material and such generators are a convenient form of application for use by ships' personnel.

3.1.2.3 Tests have shown that these insecticidal smokes and sprays can be very effective against insects moving freely in the open, in spaces such as holds. However, no appreciable penetration or control of insects can be obtained in deep crevices, or between or under deck boards, tank top ceilings and limber boards, places where infestation commonly occurs. Where insects are deep seated, it is usually necessary to use a fumigant.

3.1.2.4 Surface sprays – spraying with a suitable insecticide can also be used to control residual infestation. Within the limitations of the technique this is a convenient way to control insects as it does not require evacuation of spaces not being treated. Various formulations are available:

- .1 emulsifiable concentrates and water-dispersible powder concentrates for dilution with water; and
- .2 oil concentrates for dilution with a suitable carrier oil and, for small-scale use, ready-to-use formulations, usually in a light oil.

3.1.2.5 Hand-operated or mechanically-operated sprayers may be used according to the size of the job to be done. To reach the heights of some ships' holds, power equipment is required which will develop enough pressure to get the spray material where it is needed. Hand sprayers are rarely adequate; "Knapsack" sprayers which develop enough pressure to reach infested areas may be used. Such surface sprays produce a deposit toxic to insects present at the time and also to those that subsequently crawl over or settle on treated surfaces.

3.1.2.6 As with fogging, a disadvantage of spraying is that the insecticide does not kill insects hidden in inaccessible parts of cargo spaces. Insecticidal sprays applied in oil solutions or water emulsions take some time to dry and may be hazardous to persons moving about the ship. No cargo should be loaded until spray deposits have dried.

3.1.2.7 In addition to methods described above, insecticidal lacquers may be painted on to boundary junctures in accommodation and galley areas in accordance with the manufacturers' instructions, to provide control of pests. Hand sprayers and hand-held aerosols may also be effective in these areas.

3.1.2.8 During the application of contact insecticides by any method, all personnel not directly involved should be evacuated from the areas being treated for a period of time not less than that recommended by the manufacturer of the specific pesticide used on the label or package itself.

3.1.3 Fumigants

3.1.3.1 Fumigants are used where contact insecticides will not give control. Fumigants act in a gaseous phase even though they may be applied as solid or liquid formulations from which the gas arises. Effective and safe use requires that the space being treated be rendered gas-tight for the period of exposure, which may vary from a few hours to several days, depending on the fumigant type and concentration used, the pests, the commodities treated and the temperature. Additional information is provided on two of the most widely used fumigants, methyl bromide and phosphine (hydrogen phosphide), in the annex, paragraph 5.

3.1.3.2 Since fumigant gases are poisonous to humans and require special equipment and skills in application, they should only be used by specialists and not by the ship's crew.

3.1.3.3 Evacuation of the space under gas treatment is mandatory and in some cases it will be necessary for the whole ship to be evacuated (see 3.1.4 and the annex, paragraph 5).

3.1.3.4 A fumigator-in-charge should be designated by the fumigation company, government agency or appropriate authority. They should be able to provide documentation to the master proving their competence and authorization. The master should be provided with written instructions by the fumigator-in-charge on the type of fumigant used, the hazards involved, and the precautions to be taken, and in view of the highly toxic nature of all commonly used fumigants these should be followed carefully. Such instructions should be written in a language readily understood by the master or their representative.

3.1.4 Fumigation with aeration (ventilation) in port

3.1.4.1 Fumigation and aeration (ventilation) of spaces on board a ship should always be carried out in port (alongside or at anchorage). Ships should not be permitted to leave port until gas-free certification has been received from the fumigator-in-charge.

3.1.4.2 Prior to the application of fumigants to spaces, the crew should be landed and remain ashore until the ship is certified "gas-free", in writing, by the fumigator-in-charge or other authorized person. During this period, a watchman should be posted to prevent unauthorized boarding or entry and warning signs should be prominently displayed at gangways and at entrances to accommodation.

3.1.4.3 The fumigator-in-charge should be retained throughout the fumigation period and until such time as the ship is declared gas-free.

3.1.4.4 At the end of the fumigation period, the fumigator-in-charge will take the necessary action to ensure that the fumigant is dispersed from the space. If crew members are required to assist in such actions, for example in opening hatches, they should be provided with adequate respiratory protection and adhere strictly to instructions given by the fumigator-in-charge.

3.1.4.5 The fumigator-in-charge should notify the master in writing of any spaces determined to be safe for re-occupancy by essential crew members prior to the aeration of the ship.

3.1.4.6 In such circumstances, the fumigator-in-charge should monitor throughout the fumigation and aeration periods, spaces to which personnel have been permitted to return. Should the concentration in any such area exceed the occupational exposure limit values set by the flag State regulations or by the regulations of the port State where the fumigation is carried out, crew members should be evacuated from the area until measurements show re-occupancy to be safe.

3.1.4.7 No unauthorized persons should be allowed on board until all parts of the ship have been determined gas-free, warning signs removed and gas-free certificates issued by the fumigator-in-charge.

3.1.4.8 Gas-free certificates should only be issued when tests show that all residual fumigant has been dispersed from empty cargo spaces and adjacent working spaces and any residual fumigant material has been removed.

3.1.4.9 Entry into a space under fumigation should never take place except in the event of an extreme emergency. If entry is imperative, the fumigator-in-charge and at least one other person should enter, each wearing adequate protective equipment including respiratory protection appropriate for the fumigant used and a safety harness and lifeline. Each lifeline should be tended by a person outside the space who should be similarly equipped.

3.2 Disinfestation of empty cargo spaces

3.2.1 An empty cargo space may be treated by any of the methods described, excepting the use of insecticidal lacquers. Care should be taken to avoid contamination and taint to subsequent cargoes. Examples of some commonly used pesticides are listed in the annex. (For precautions see 3.1.4.)

3.3 Disinfestation of food stores, galleys and crew and passenger accommodation

3.3.1 In general, only those insecticides suitable for use in cargo spaces should be used in dry food stores in ships. A wider range of insecticides may be needed for treatments in galleys and in passenger and crew accommodation, especially against pests such as cockroaches, ants, flies and bed-bugs. Examples of some commonly used pesticides are listed in the annex.

3.4 Disinfestation of cargoes and surrounds

3.4.1 The recommendations applicable to the fumigation of loaded or partially loaded cargo holds are contained in MSC.1/Circ.1264, as revised.

3.5 Carriage of fumigated freight containers, barges and other cargo transport units on a ship

3.5.1 The recommendations applicable to the fumigation of cargo transport units are contained in MSC.1/Circ.1361, as revised.

4 CONTROL OF RODENT PESTS

4.1 General

4.1.1 With regard to rodent control, ships are subject to the provisions of WHO's International Health Regulations.

4.1.2 Rodents may be controlled by fumigation, by the use of a bait incorporating a poison which acts within a few minutes (acute poison), or one which acts over a period (chronic poison), or by trapping.

4.2 Fumigation and baiting

4.2.1 Fumigation against rodents is normally done at dosages and periods of exposure much less than those required for insect control. It follows that an insect fumigation also controls rodents in areas that are treated. However, rodent control often requires fumigation of accommodation and working spaces that may not normally be treated for insect control.

4.2.2 Fumigation against rodents alone should be undertaken in port, and ventilation should be completed in port. The precautions in 3.1.4 should be observed.

4.2.3 Methods involving fumigation or the use of acute poisons should be employed only by qualified personnel of pest control servicing firms or appropriate authorities (e.g. port health authorities). Baits containing acute poisons should be collected and disposed of by such personnel when the treatment is completed. Chronic poisons should be used strictly in accordance with the manufacturer's instructions contained on the label or on the package itself.

4.3 Rodents baits – chronic poisons permitted for use by ship's personnel

4.3.1 Careless use may cause injury to ship's personnel.

4.3.2 For rodenticides to be efficient, they should be placed where the rodents are moving. Runways are usually detected by evidence of marking, debris and dirt. The use of rodenticides, however, is no substitute for high standards of hygiene and the rodent-proofing of equipment whenever possible.

4.3.2.1 Baits should be protected from accidental consumption by humans or domestic animals and from contact with human and animal food.

4.3.2.2 Where practicable, cereal baits should be replaced within 30 days to avoid providing a source of insect infestation.

4.3.3 A record should be kept of the locations in which baits are set, particular care being taken to search for and remove all baits from cargo spaces prior to the loading of bulk foodstuffs and livestock cargoes.

5 REGULATIONS FOR THE USE OF PESTICIDES

5.1 National and international controls on pesticides usage

5.1.1 In many countries the sale and use of pesticides are regulated by governments to ensure safety in application and prevention of contamination of foodstuffs. Among the factors taken into account in such regulations are the recommendations made by international organizations such as FAO and WHO, especially in regard to maximum limits of pesticide residues in food and foodstuffs.

5.1.2 Examples of some commonly used pesticides are listed in the annex. Pesticides should be used strictly in accordance with the manufacturer's instructions as given on the label or package itself. National regulations and requirements vary from one country to another, therefore particular pesticides which may be used for treatment of cargo spaces and accommodation in ships may be limited by the regulations and requirements of:

- .1 the country where the cargo is loaded or treated:
- .2 the country of destination of the cargo, especially in regard to pesticide residues in foodstuffs; and
- .3 the country of registration of the ship.

5.1.3 Ships' masters should ensure that they have the necessary knowledge of the above regulations and requirements.

6 SAFETY PRECAUTIONS – GENERAL

6.1 Pesticide materials

6.1.1 Pesticides are often at least as poisonous to humans as to the pests against which they are used. The instructions given on the label or package itself, particularly those relating to safety and disposal of residual material, should be strictly followed.

6.1.2 Pesticides should be stored in strict compliance with national regulations and requirements or the manufacturers' instructions.

6.1.3 Smoking, eating or drinking while using pesticides should always be avoided.

6.1.4 Empty pesticide receptacles and packaging should never be re-used.

6.1.5 Hands should always be washed after applying pesticides.

6.2 Space and surface spraying (see also 3.1.2 above)

6.2.1 When spraying is being carried out by professional operators, they are responsible for taking the necessary safety precautions. If operations are carried out by the crew, the master should ensure that the following safeguards are observed, both in the preparation and the application of the pesticides:

- .1 wear protective clothing, gloves, respirators and eye protection appropriate to the pesticides being used;
- .2 do not remove clothes, gloves, respirators or eye protection whilst applying pesticides, even under hot conditions; and
- .3 avoid excessive application and run-off on surfaces and avoid contamination of foodstuff.

6.2.2 If clothing becomes contaminated:

- .1 stop work immediately and leave the area;
- .2 remove clothing and footwear;
- .3 take a shower and wash skin thoroughly;
- .4 wash clothing and footwear, and rewash skin; and
- .5 seek medical advice.

6.2.3 After work:

- .1 remove and wash clothing, footwear and other equipment; and
- .2 take a shower using plenty of soap.

6.3 Fumigation

6.3.1 Ships' personnel should not handle fumigants and such operations should be carried out only by qualified operators. Personnel allowed to remain in the vicinity of a fumigation operation for a particular purpose should follow the instructions of the fumigator-in-charge implicitly.

6.3.2 Aeration of treated spaces on board a ship should be completed and a gas-free certificate should be issued as described in 3.1.4 before personnel are permitted to enter.

6.4 Exposure to pesticides resulting in illness

6.4.1 In the case of exposure to pesticides and subsequent illness, medical advice should be sought immediately. Information on poisoning by specific compounds may be found in the IMO Medical First Aid Guide for Use in Accidents Involving Dangerous Goods (MFAG), or on the package (manufacturer's instructions and safety precautions on the label or the package itself).

ANNEX

PESTICIDES SUITABLE FOR SHIPBOARD USE

1 INTRODUCTION

1.1 The materials listed should be used strictly in accordance with the manufacturers' instructions and safety precautions, given on the label or package itself, especially in respect of flammability and with regard to any further limitations applied by the law of the country of loading, destination or flag of the ship, contracts relating to the cargo, or the shipowner's instructions.

1.2 Materials may be used by ship's personnel unless the contrary is indicated. A space-application insecticide may be used in conjunction with a residual insecticide.

1.3 It should be especially noted that some materials listed may taint sensitive commodities, e.g. coffee and cocoa, and special care should be taken when stowing these commodities in order to prevent this. The reason for naming purified grades in the list below is to minimize tainting.

2 CONTACT INSECTICIDES IN A CARGO SPACE

2.1 Fast-acting insecticides for space application, e.g. against flying insects:

- .1 Pyrethrins (with or without synergist);
- .2 Bioresmethrin; and
- .3 Dichlorvos.

2.2 Slower-acting residual insecticides for surface application:

- .1 Malathion (premium grade);
- .2 Bromophos;
- .3 Carbaryl;
- .4 Fenitrothion;
- .5 Chlorpyrifos-methyl; and
- .6 Pirimiphos-methyl.

3 CONTACT INSECTICIDES AND BAITS IN ACCOMMODATION

3.1 Fast-acting insecticides for space application, e.g. against flying insects:

- .1 Pyrethrins (with or without synergist);
- .2 Bioresmethrin; and
- .3 Dichlorvos.

3.2 Slower-acting residual insecticides:

- .1 Malathion (premium grade);
- .2 Diazinon;
- .3 Fenitrothion;
- .4 Propoxur;
- .5 Bendiocarb; and
- .6 Permethrin.

3.3 Insecticides for use against particular pests and as an additional treatment:

- .1 Diazinon, as an aerosol spray or lacquer against ants, cockroaches and flies;
- .2 Dieldrin and Aldrin, in lacquers for control of ants and cockroaches;
- .3 Methoprene bait, for control of Pharaoh's ants; and
- .4 Chlorpyrifos-ethyl, as a bait and as a lacquer.

4 RODENTICIDES

4.1 Chronic poisons in baits:

- .1 Calciferol; and
- .2 Any anticoagulant in the following two classes:
 - .2.1 Hydroxycoumarins (e.g. Warfarin, Fumarin, Coumatetralyl, Difenacoum, Brodifacoum); and
 - .2.2 Indandiones (e.g. Pival, Diphacinone, Chlorophacinone).

4.2 Acute poisons in baits or liquids:

TO BE USED ONLY IN PORT AND BY QUALIFIED OPERATORS

- .1 Barium fluoroacetate;
- .2 Fluoroacetamide;
- .3 Sodium fluoroacetate; and
- .4 Zinc phosphide.

5 FUMIGANTS

TO BE APPLIED ONLY BY QUALIFIED OPERATORS

Additional information on methyl bromide and phosphine (hydrogen phosphide) to be read in conjunction with 3.1.3.

Methyl bromide

Methyl bromide is used in situations where a rapid treatment of spaces or commodities is required. Fumigation with methyl bromide should be **permitted only when the ship is in the confines of a port** (either at anchor or alongside) and to disinfest the spaces after the crew members have disembarked (see 3.1.3.3). Prior to re-embarkation of the crew, ventilation of the treated spaces should be completed and a gas-free certificate should be issued as described in 3.1.4 before personnel are permitted to enter.

Phosphine (Hydrogen phosphide)

A variety of phosphine-generating formulations are used for at-berth fumigations and also for in-ship in-transit fumigations. Application methods vary widely and include surface-only treatment, probing, perforated tubing laid at the bottom of spaces, recirculation systems and gas-injection systems or their combinations. Ventilation of the treated spaces should be completed, and a gas-free certificate should be issued as described in 3.1.4 before personnel are permitted to enter. **All safety recommendations related to the fumigation of cargo in cargo holds under in-ship in-transit fumigation are laid down in MSC.1/Circ.1264/Rev.1.**

5.1 Fumigants against insects in empty cargo spaces and against rodents anywhere aboard ship:

Carbon dioxide

Nitrogen

Methyl bromide and carbon dioxide mixture

Methyl bromide

Hydrogen cyanide

Phosphine (Hydrogen phosphide)

5.2 Fumigants against insects in loaded or partially loaded cargo spaces and cargo transport units:

Refer to MSC.1/Circ.1264/Rev.1, and MSC.1/Circ.1361/Rev.1.

CARE IS NEEDED IN SELECTING TYPES AND AMOUNTS OF FUMIGANTS FOR TREATMENT OF PARTICULAR COMMODITIES

.1 Carbon dioxide;

.2 Nitrogen;

- .3 Methyl bromide and carbon dioxide mixture;
 - .4 Methyl bromide; and
 - .5 Phosphine (Hydrogen phosphide).
-

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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.

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

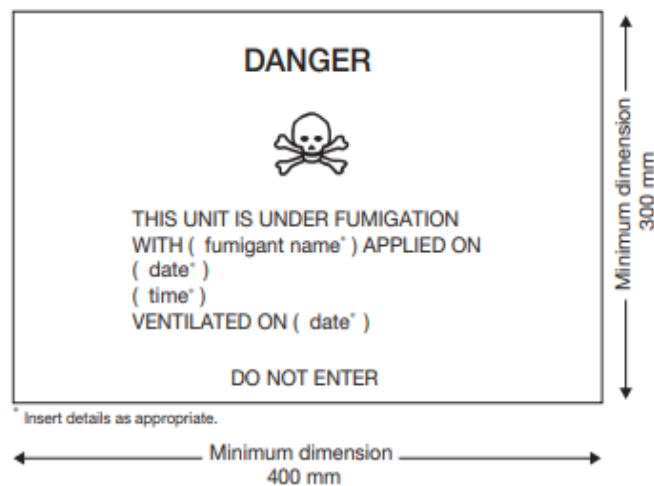
Persons engaged in the handling of fumigated cargo transport units shall be trained commensurate with their responsibilities.

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)

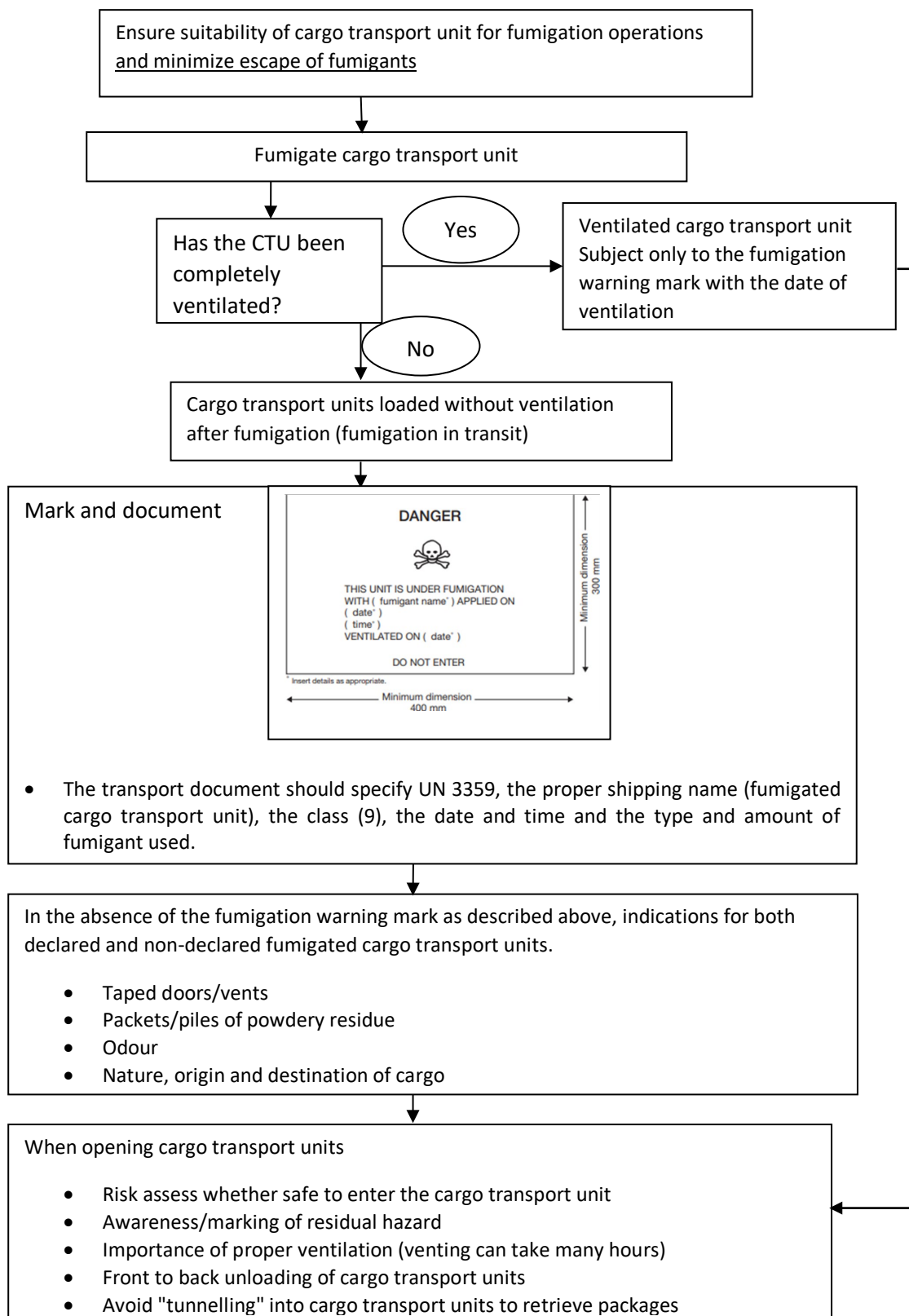
6.3.1 Gas tests can be carried out that detect the presence of gases and their concentration levels. Similarly, equipment can confirm that there is a safe level of oxygen within the cargo transport unit. At the present time, the technology is such that both the quantification and discrimination are poor. 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





IMO

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Ref. T3/1.02

MSC-MEPC.2/Circ.1
18 July 2006

DISPOSAL OF FUMIGANT MATERIAL

1 The Marine Environment Protection Committee, at its fifty-third session (18 to 22 July 2005), and the Maritime Safety Committee, at its eighty-first session (10 to 19 May 2006), considered a report, concerning the discharge of active packages of the cargo fumigant Magnesium Phosphide into New Zealand's marine waters.

2 The Committees' attention was drawn to the fact that, while there appeared to be no prohibition on the discharge of such material pursuant to the existing marine pollution prevention conventions, the discharge of active packages producing phosphine gas, represented a significant risk to the public who may encounter them at sea.

3 The attention of Member Governments is, therefore, drawn to the following observations.

4 The most recent version of the IMO Recommendations on the Safe Use of Pesticides in Ships, incorporated into the Supplement to the IMDG Code (hereafter referred to as IMO Recommendations) recommends, *inter alia*, that:

- .1 fumigation of this nature should only be undertaken by a suitably qualified and trained person;
- .2 a "fumigator-in-charge" should be designated by the fumigation company, government agency or appropriate authority. He should be able to provide documentation to the master confirming his competence and authorization;
- .3 the master should be provided with written instructions by the fumigator-in-charge on the type of fumigant used, the hazards involved, the threshold limit values (TLV) and the precautions to be taken, and in view of the highly toxic nature of all commonly used fumigants these should be followed carefully;
- .4 clear written instructions should be given to the master of the ship, to the receiver of the cargo and to the authorities at the discharging port as to how any powdery residues are to be disposed of. Furthermore, with regard to fumigation to be continued in transit, the ship should carry instructions on the disposal of residual material; and
- .5 annex 4 of the IMO Recommendations also provides a Model Checklist for in-transit fumigation with phosphine, which should be completed and signed by both the fumigator-in-charge and the master.

5 It is, therefore, recommended that Member Governments issue regulations to oblige ships that carry solid cargoes requiring fumigation, to ensure that all waste and residues are disposed of in appropriate manner, either by incineration or by disposal on shore, as recommended by the manufacturer.

6 Member Governments are invited to bring the above information to the attention of shipowners, ship operators, companies, shipmasters, fumigation companies and all other parties concerned, requesting that appropriate action be taken in accordance with the provisions of the relevant IMO instruments.
