LOSS PREVENTION Briefing

NORTH SERVICE, STRENGTH, QUALITY

LOSS PREVENTION BRIEFING FOR NORTH MEMBERS CARGO / JANUARY 2016

Fumigation

Contents

Introduction

Many agricultural products shipped in bulk, such as grains, seed cakes and logs, may have insects living on or within the cargo and may also have larvae or eggs present. In order to prevent the spread of insects and pests within cargoes, fumigation may be carried out.

What is fumigation?

Fumigation is the introduction of poison into a space to suffocate any insects or pests within.

IMO Fumigation warning sign

Fumigation can be conducted in warehouses or silos ashore; however this briefing will focus only on fumigation carried out on board the vessel for empty holds or following loading.

Fumigation

Hazards

The hazards associated with fumigation on board ships are:

- Toxicity, risk of poisoning
- Flammability
- Heat

These are covered in more detail below.

Due to these hazards, fumigation and the handling of fumigants should only be carried out by authorised professional fumigators under the supervision of a fumigator in charge.

Fumigation should never be conducted by the crew.

However, it is important that ships' crews understand the process and hazards. They should also understand what is required of the fumigators in order to ensure that the operation is carried out safely.

This briefing is based on the guidance contained in the IMO Circular MSC.1/Circ.1264 – *Recommendations on the safe use of pesticides in ships applicable to the fumigation of cargo holds*. A copy is attached which should be read in conjunction with this briefing.

Fumigation Method

The method of fumigation normally employed on board is the introduction of a fumigant gas into the vessel by placing fumigant tablets into the hold. The tablets react slowly with atmospheric moisture to release the fumigant gas. The most common gas used is phosphine produced from aluminium or magnesium phosphide pellets / tablets.

Methyl bromide is the other main type of fumigant, but is banned from use in some areas as it is a greenhouse gas. This fumigant is only suitable for use in port when the crew have been disembarked from the vessel. In certain circumstances carbon dioxide or nitrogen, supplied in a gaseous form, may be used as the fumigant.

It is essential that the Master and crew are advised of the intended method of fumigation prior to the operation and are provided with a copy of the relevant fumigant Material Safety Data Sheet (MSDS).

Dosage

The intended dosage rate for the particular hold will be calculated by the fumigator in charge. This is based on the empty hold volume and the manufacturers recommended quantity of fumigant required per m^3.

Once the quantity of fumigant has been determined, the tablets / pellets should be evenly distributed. This is essential to ensure that the fumigant gas is produced evenly throughout the hold.

Depending on the method of application, the tablets / pellets may be either spread across or buried below the surface of the cargo. Based on the volume of the hold and the cargo being fumigated, the fumigator in charge will specify the amount of time the space must remain under fumigation. This will assume that the holds are gas-tight; therefore additional hold sealing is likely to be necessary.

If the fumigant cannot be contained within the hold for the required period of time then its effectiveness will be significantly reduced, potentially resulting in live insects still being present on discharge. Leaking fumigant will also present a hazard to the crew.

Fumigant circulation

In order to ensure that the fumigant permeates the stow effectively, the fumigation company may install recirculation fans.

Recirculation fan positioned in hold access trunking

These fans will draw fumigated air from the head space of the hold and pass this through flexible tubing (positioned prior to commencing loading) to the bottom of the stow. Failure to properly achieve recirculation can lead to an

ineffective fumigation or dangerous levels of fumigant building up in the head space.

Supplied fans should be in good condition and intrinsically safe.

Hazards

Toxicity

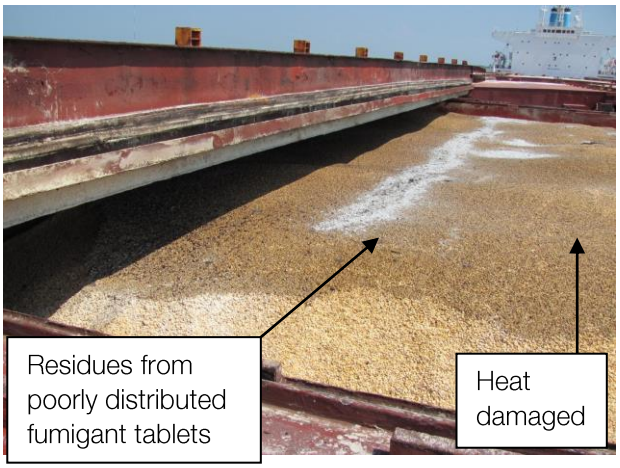
While the fumigant is toxic to insects, it is also toxic to humans and other animals. It is therefore critical that effective procedures, which are strictly adhered to, are in place to ensure the safety of the crew, the fumigators and any personnel on board.

Following application of the fumigant, the hatch covers must be closed. In order to ensure that holds are gas tight, the hatch covers, access hatches, ventilators and other openings may require additional sealing with marine tape.

As well as ensuring that gas concentrations within the hold are maintained at the required levels, additional sealing of all openings will prevent gas leaks onto deck which could be harmful to health.

Heat

Following application of the fumigant pellets / tablets, they will begin to react with atmospheric moisture to produce the fumigant gas. This chemical reaction will generate heat. If the pellets / tablets have not been correctly distributed then the heat produced may be excessive resulting in combustion and fire of the cargo.



Heat damaged cargo due to poorly distributed fumigant pellets

Flammability

Phosphine gas is flammable and becomes explosive at concentrations greater than 1.7% volume in air.

There have been a number of incidents where the heat produced during the generation of the phosphine gas has resulted in an explosion. Some of which have been significant enough to lift the vessels secured hatch covers resulting in structural damage.

The risk of an explosion significantly increases where:

- the pellets / tablets have not be correctly dispersed
- an excessive quantity of pellets / tablets have been used
- the pellets / tablets come into contact with water.

This will result in either too rapid a build-up or an excessive concentration of phosphine gas in the head space of the hold.

The risk of explosion is highest during the initial 24 hours after fumigation. The risk decreases after this time as the gas permeates through the cargo. This allows gas concentrations in the head space to decrease below the explosive limit.

Temperature also affects the decomposition rate of the tablets as phosphine gas is generated at a higher rate in high air temperatures.

Responsibilities of the Fumigator in Charge

The fumigator in charge is the individual responsible for the fumigation process. They will have been approved and certified by the relevant competent authority. The fumigator in charge should provide the Master with documentation confirming his competence and authorization.

On arrival on board the vessel the fumigator in charge should provide written details of the fumigant to be used including the safety data sheet and the precautions to be taken.

The fumigator in charge should discuss the intended method of fumigation with the Master and crew. This should specify whether fumigation is to be conducted alongside or whether it will be continued in transit.

Fumigation

Fumigation in Port

If fumigation is to be completed alongside the berth, then all crew members will be disembarked from the vessel for the required fumigation period (usually 24-48 hours) and will not return to the vessel until it has been confirmed gas free by the fumigation company.

The more usual method of fumigation is for it to be continued in transit. However the decision to continue fumigation in transit is at the Masters discretion.

Fumigation in Transit

At least two members of the vessels crew, designated by the Master, should be provided with appropriate training. This should be provided by the fumigator in charge and cover:

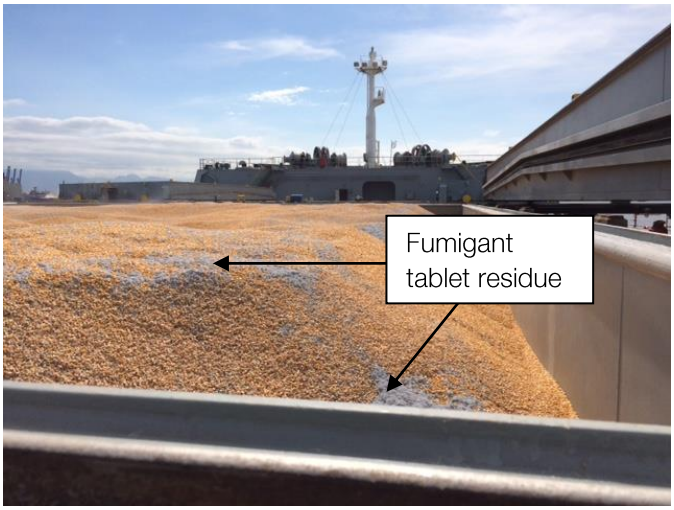
- how to ensure that safe on board conditions can be maintained throughout
- fumigant MSDS information
- fumigant instructions including
    - methods of detecting the fumigant in air
    - its behavior and hazardous properties
    - symptoms of poisoning
    - relevant first aid including special medical treatment
    - emergency procedures
    - disposal of unused fumigant
    - method of safe removal of fumigant residues from the holds.

Checks should be made by the fumigator in charge and the designated crew members of the cargo holds. This will confirm whether these spaces can be made sufficiently gas tight or whether additional sealing will be required.

All spaces under fumigation and those other spaces considered to be unsafe must be suitably marked with warning signs. Warning signs should state the type of fumigant used and the date and time of application. Details should also be provided to the Master in writing.

The fumigator in charge must remain on board long enough to allow the gas concentrations to build up to a level where testing for leaks can be carried out. Once it has been confirmed that the vessel is safe and no leaks are present, then the fumigator in charge should formally hand over and confirm this to the Master in writing.

Appendix 3 of the MSC Circular contains checklists covering the steps which must be taken by the fumigator in charge and the information which must be exchanged.



Fumigant pellet residues

Safety Measures

In order to ensure that fumigation can be conducted without posing any additional hazards to personnel, the following should be available on board:

- Gas detection equipment, suitable for the intended fumigant. Ensure an appropriate quantity of spares are available and that all relevant personnel are trained in its correct use
- Details of the intended fumigant, including its occupational exposure limits, instructions on the disposal of residual fumigant material and first aid requirements
- A suitable number of respiratory protective equipment, suitable for the intended fumigant, but no less than four sets.
- The latest version of the Medical First Aid Guide for Use in Accidents Involving Dangerous Goods (MFAG), including appropriate medicines and medical equipment
- Strict enforcement of enclosed space entry procedures for all spaces and any areas identified by the fumigator in charge as being hazardous
- Procedures on how to check gas concentration levels in all spaces identified by the fumigator in charge including recording of results and the frequency of checks. This should be no less than once every eight hours

- Emergency procedures covering entry into fumigated spaces and venting of fumigated spaces
- Procedures covering ventilation of previously fumigated spaces and atmosphere testing prior to commencing discharge

Fumigation Clause

In response to a number of accidents occurring as a result of fumigation being conducted by ships crews and a lack of provision in market clauses covering fumigation, BIMCO developed the *Cargo Fumigation Clause for Charter Parties.* A copy of the clause is included in Appendix I

The BIMCO clause incorporates the IMO guidance and recommendations thus ensuring that both parties secure a mutually agreed level of safety and detailed procedures for carrying out fumigation operations on board.

The clause sets out amongst other points the division of responsibilities and costs, the removal and disposal of fumigant residues and equipment and time losses due to fumigation and is suitable for both time and voyage charters.

It is recommended that this clause is incorporated into dry bulk charter parties in order to ensure that appropriate safety standards are followed when conducting fumigation.

Conclusion

By ensuring that the above information and the guidance and recommendations contained within the IMO Circular are strictly followed for every occasion where fumigation is required, the risks to personnel, the vessel and the cargo should be minimised.

Additional information on fumigation can be found in North's LP Guide – *Bulk Cargoes: A Guide to Good Practice*.

Appendix I

BIMCO Cargo Fumigation Clause for Charter Parties

a) The Charterers shall have the option to fumigate the cargo in the Vessel's holds in port and/or at anchorage and/or in transit. Such fumigation shall be performed always in accordance with IMO Recommendations on the Safe Use of Pesticides in Ships applicable to the Fumigation of Cargo Holds, MSC.1/Circ.1264 (IMO Recommendations) and any subsequent revisions.

b) Fumigation shall be at the Charterers' risk and responsibility. Any costs and expenses incurred in connection with or as a result of such fumigation, including but not limited to gas detection equipment, respiratory protective equipment and crew training, shall be for the Charterers' account. The Charterers shall indemnify the Owners for any liabilities, losses or costs arising out of or resulting from cargo fumigation.

c) If local authorities or IMO Recommendations require the crew to be accommodated ashore as a result of fumigation ordered by the Charterers, all costs and expenses reasonably incurred in connection thereto including, but not limited to, transportation, accommodation and victualling shall be for Charterers' account.

d) At the discharging port or place all fumigant remains, residues and fumigation equipment shall be removed from the vessel as soon as possible and disposed by the Charterers or their servants at Charterers' risk, responsibility, cost and expense in accordance with MARPOL Annex V or any other applicable rules relating to the disposal of such materials.

e)

*i) All time lost to the Owners in connection with or as a result of fumigation performed in accordance with sub-clause (a) shall be for Charterers' account and the vessel shall not be off-hire.

*ii) All time lost to the Owners in connection with or as a result of fumigation performed in accordance with sub-clause (a) prior to commencement of laytime and/or after cessation of laytime or time on demurrage shall be considered as detention and shall be compensated by Charterers at the demurrage rate stipulated in the Charter Party. Any unused laytime shall be deducted from such detention, in which case any despatch payable shall be reduced accordingly.

*Sub-clauses i) and ii) shall apply to time charter parties and voyage charter parties, respectively.

f) The exercise by the Charterers of the option to fumigate the cargo under this Clause shall not be construed as evidence as to the condition of the cargo at the time of shipment, and the Master or the Owners are not to clause bills of lading by reason of fumigation only.

g) In the event of a conflict between the provisions of this Clause and any implied or express provision of the Charter Party, this Clause shall prevail to the extent of such conflict, but no further.

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MSC.1/Circ.1264
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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 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-fourth session (7 to 16 May 2008), approved the 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, set out in the annex.

3 The Committee agreed that the Recommendations should not apply to the carriage of fresh food produce under controlled atmosphere.

4 Member Governments are invited to bring the Recommendations to the attention of competent authorities, mariners, fumigators, fumigant and pesticide manufacturers and others concerned.

5 The present circular supersedes MSC/Circ.612, as amended by MSC/Circ.689 and MSC/Circ.746 with regard to the fumigation of cargo holds.

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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 pesticides[*] with a view to safety of personnel. They cover pesticides used for the control of insect[**] 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 burnt 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.

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

[**] 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 disinfestation

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. He should be able to provide documentation to the master proving his 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 his representative.

3.2 Disinfestation 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 his 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 is(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 his leaving the ship, he should ascertain that the ship is in a safe condition, i.e. no gas leakages are present, and he 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 his 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 log-book. 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 log-book.

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).

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*

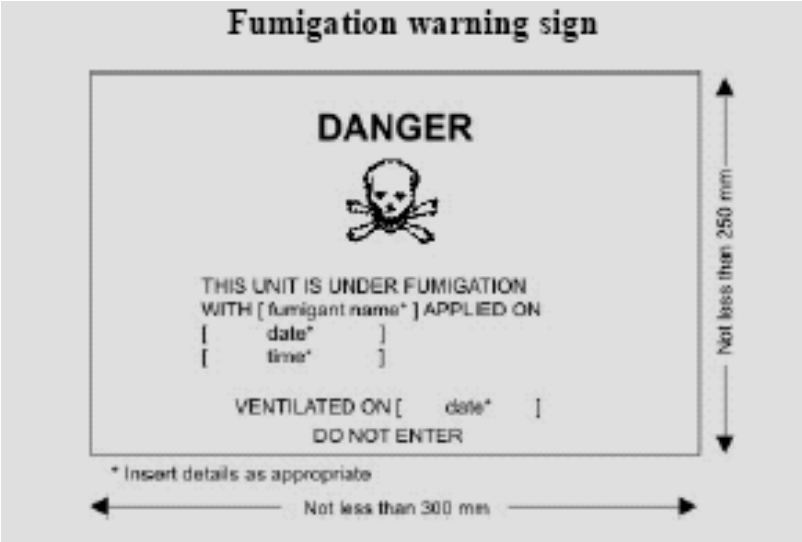
3.2.1 A variety of Phosphine-generating formulations are used for in-ship in-transit or at-berth fumigations. Application methods vary widely and include surface-only treatment, probing, perforated tubing laid at the bottom of spaces, recirculation systems and gas-injection systems or their combinations. 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 represents 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.

APPENDIX 2

Fumigation warning sign



APPENDIX 3

MODEL CHECKLIST FOR IN-TRANSIT FUMIGATION

Date: . . . . . .

Port: . . . . . Terminal/Quay: . . . . . .

Ship's name: . . . . . .

Type of fumigant: . . . . . Method of application: . . . . . .

Date & 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.

PART A: BEFORE FUMIGATION

		SHIP	FUMIGATOR-IN-CHARGE
1	The inspection required before loading has been performed (3.3.2.4)	[ ]	[ ]
2	All the cargo holds to be fumigated are satisfactory for fumigation	[ ]	[ ]
3	Spaces, where found not to be satisfactory, have been sealed	[ ]	[ ]
4	The master or his trained representatives have been made aware of the specific areas to be checked for gas concentrations throughout the fumigation period	[ ]	[ ]
5	The master or his trained representatives have been made familiar with the fumigant label, detection methods, safety procedures and emergency procedures (refer to 3.3.2.6)	[ ]	[ ]
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.	[ ]	[ ]
7	The master has been notified in writing of:		
	(a) the spaces containing cargo to be fumigated	[ ]	[ ]
	(b) any other spaces that are considered unsafe to enter during the fumigation	[ ]	[ ]

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	[ ]	[ ]
9	Each hold has been checked for leakage and sealed properly	[ ]	[ ]
10	Spaces adjacent to the treated cargo holds have been checked and found gas-free	[ ]	[ ]
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	[ ]	[ ]
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		
	or		
	(b) Deep probing	[ ]	[ ]
	More rapid dispersion of gas than in (a) with lower concentrations in upper regions of airspace in the hold		
	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		
	or		
	(d) Other	[ ]	[ ]
13	The master or trained representatives have been briefed fully on the method of application and the spread of the gas throughout the hold	[ ]	[ ]
14	The master or 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	[ ]	[ ]
	(b) aware of the possibility of the spreading of gas throughout the duct keel and/or ballast tanks	[ ]	[ ]
15	The fumigator-in-charge has supplied a signed statement to the master conforming to the requirements of 3.3.2.12 for his retention	[ ]	[ ]

The above has been agreed:

Time: . . . . . Date: . . . . . .

For Ship: . . . . . Fumigator-in-charge: . . . . . .

Rank: . . . . . .