

Fumigation

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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

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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 m³.

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

Fumigation

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

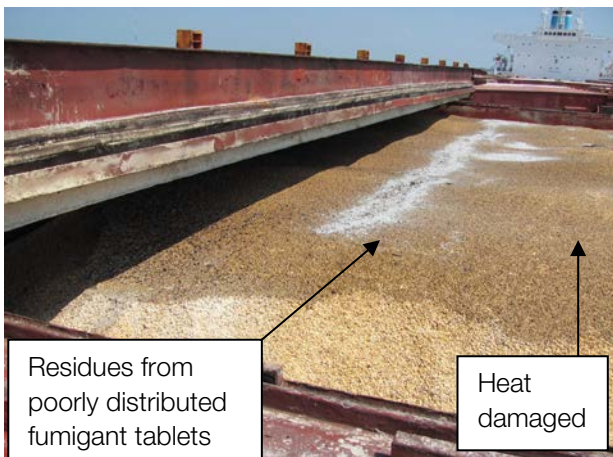
While the fumigant is toxic to insects, it is also toxic to humans and other animals. It is therefore critical that effective procedures, which are strictly adhered to, are in place to ensure the safety of the crew, the fumigators and any personnel on board.

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.

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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:

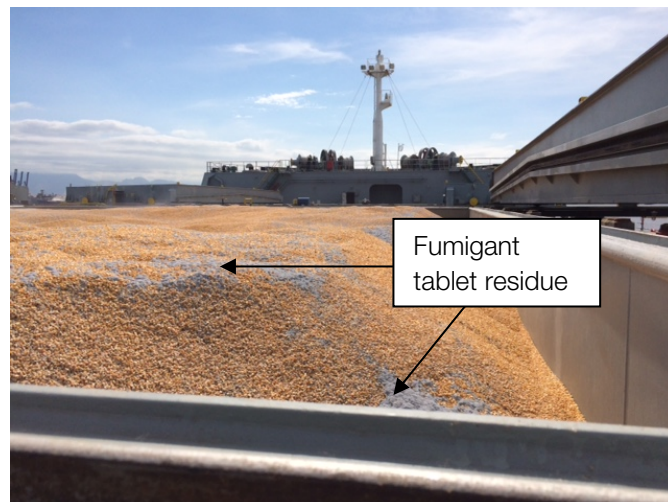
- how to ensure that safe on board conditions can be maintained throughout
- fumigant MSDS information
- fumigant instructions including
 - methods of detecting the fumigant in air
 - its behavior and hazardous properties
 - symptoms of poisoning
 - relevant first aid including special medical treatment
 - 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

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- 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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