

# Carefully to Carry

SEPTEMBER 2006

## Agricultural produce – insect infestation and fumigation

*Fumigant gases are poisonous to humans and should only be used by specialists, not by the ship's crew*

Insects and mites of plant products may be found within cargo spaces as:

- Introduced infestation (carried onboard with the produce).
- Cross infestation (moved across from one product parcel to another).
- Residual infestation (remaining onboard from a prior infested cargo to attack subsequent cargo(es)).

Leaving aside localised spraying with contact insecticides in liquid or powder form the principal method of treating cargo spaces or their contents for the control of insects is by fumigation, which is the application of an insecticidal chemical in its gas phase.

The fumigants in common use are:

- Methyl bromide ( $\text{CH}_3\text{Br}$ ).
- Phosphine ( $\text{PH}_3$ ) generated from solid phosphide preparations.

Both chemicals are extremely toxic and hazardous to humans.

The effective and safe use of fumigants requires the space being treated to be rendered gas-tight for the period of exposure, which may vary from a few hours to several days, depending on the type of fumigant and concentration used, the pests, the commodities treated and the ambient temperature.

Fumigant gases are poisonous to humans and require special equipment and skill in application. They should only be used by specialists, not by the ship's crew.

Evacuation of the space under gas treatment is essential and in some cases it will be necessary for the whole ship to be evacuated.



**“The carrier shall properly and carefully load, handle, stow, carry, keep, care for and discharge the goods carried.”**

Hague Rules,  
Articles iii, Rule 2

### Carefully to Carry Advisory Committee

This report was produced by the Carefully to Carry Committee – the UK P&I Club's advisory committee on cargo matters. The aim of the Carefully to Carry Committee is to reduce claims through contemporaneous advice to the Club's Members through the most efficient means available.

The committee was established in 1961 and has produced many articles on cargoes that cause claims and other cargo related issues such as hold washing, cargo securing, and ventilation.

The quality of advice given has established Carefully to Carry as a key source of guidance for shipowners and ships' officers. In addition, the articles have frequently been the source of expertise in negotiations over the settlement of claims and have also been relied on in court hearings.

In 2002 all articles were revised and published in book form as well as on disk. All articles are also available to Members on the Club website. Visit the Carefully to Carry section in the Loss Prevention area of the Club website [www.ukpandi.com](http://www.ukpandi.com) for more information, or contact the Loss Prevention Department.

The master should require written instructions to be provided 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.

Methyl bromide is supplied as a liquefied gas in metal containers. The holds into which it is to be applied should be reasonably gas tight. Delivery is made into the holds via a flexible pipe attached to the cylinder. As the valve of the cylinder is opened the liquefied gas begins to evaporate and enter and disperse within the hold and the cargo therein.

It should be noted that methyl bromide deposits a small residue of inorganic bromide in the cargo each time a fumigation is carried out. Many countries have legal restrictions on the maximum tolerable level of inorganic bromide in imported produce and there is therefore a limit to the number of fumigations that can safely be carried out on particular goods before the levels of inorganic bromide exceed the maximum tolerable values. It is an advantage of fumigation with phosphine that no measurable residues are deposited on the goods even after repeated fumigation.

The fumigation of cargoes with phosphine gas is effected using tablets, pellets or solid preparations in other physical forms which are supplied by the manufacturers in hermetically sealed containers. The active ingredient of these preparations is either aluminium phosphide or magnesium phosphide. These substances are highly reactive with water, and as the preparations are removed from their sealed containers the active ingredient comes into contact with atmospheric water vapour and yields phosphine gas into the cargo space under fumigation. The same 'crew evacuation' procedure that applies to methyl bromide fumigation ought equally to apply to phosphine fumigation because phosphine has a similar level of potentially severe human toxicity as methyl bromide. However, shippers or charterers frequently supply phosphine releasing preparations onboard and request the master to arrange for the fumigant to be applied to the cargo by the ship's crew during the course (often towards the end) of the voyage. Such requests flagrantly contradict IMO recommendations.

As well as noting this serious contradiction (applying apparently different procedural standards to the fumigation of goods according to which fumigant is employed) two further important points ought to be made in relation to requests to apply fumigant to goods whilst on passage:

- In order to fulfill such a request it would be necessary to open the weather-deck hatchcovers whilst at sea in order to apply the phosphine releasing preparation and then to release and secure

them. This may involve considerable risk and is contrary to good practice.

- A basic requirement of the fumigation process (reasonably gas-tight holds) is, during the exposure time of the fumigant gas, incompatible with the need to be able to ventilate the cargo as may be required by prevailing climatic conditions. The inability to ventilate the cargo during this time (usually between five to seven days) will exacerbate ship's sweat if the prevailing conditions are conducive to its formation during this period. This can lead to an adverse effect upon the cargo.

Experience indicates that many masters and officers are unaware of the IMO publication *Recommendations on the Safe Use of Pesticides in Ships*. This forms a part of the supplement to the IMDG Code; the section last amended in 1996 is now contained in the more recent 2010 edition of the Code. The relevant section of this booklet should be studied very carefully by masters but a few points derived from the booklet are mentioned below:

- In transit fumigation should only be carried out at the discretion of the master.
- In transit fumigation with methyl bromide should not be carried out. Fumigation with this gas is only permitted when the ship is in the confines of a port (either at anchorage or alongside) once crew members have disembarked.

The IMO recommendations only specifically forbid in-transit fumigation with methyl bromide; they admit a discretionary usage of phosphine in transit. It is possible that this has led to a common misconception that phosphine gas is less toxic to humans than methyl bromide and that consequently non-specialists such as ships' crew may distribute phosphine-releasing preparations prior to or during a sea voyage. It should be clear from the points noted above that such a misunderstanding is incorrect and potentially dangerous. Therefore masters should never agree to requests for the ship's crew to apply phosphine-releasing preparations in cargo spaces at any time, whether or not at sea.

## Fumigation continued in transit

If it is contemplated that a fumigation begun in port should be continued in transit, it is strongly recommended that the master should possess and familiarise himself with all the relevant passages in the IMDG supplement *Recommendations on the Safe Use of Pesticides in Ships*. This will enable him to make suitably informed decisions whether or not to allow fumigation to be continued in transit and, if such

fumigation is allowed, to be aware of and to implement the appropriate safety precautions that ought to be taken before the ship leaves port and during the course of the voyage.

When specialists apply phosphine in port, with a view to the fumigation being continued in transit, they usually install flexible pipework in stows in order to circulate the phosphine gas better throughout the stow.

This provides more effective fumigation of deep stows than would be achieved by the fumigant being applied only to the surface of the stow with reliance being placed upon diffusion alone to deliver the gas reaching to lower regions of the stow.

## Compatibility between fumigant and cargo

It should be borne in mind that compatibility between the fumigant and the particular cargo being carried needs to be determined. Decisions on this point should be left to specialists; however, it should be noted that whilst both fumigants are suitable for many different cargoes, they each separately bear notable exceptions to this general suitability.

## Charterparties

Charterparties, on occasions, provide the charterer with an option to fumigate cargoes (usually cereal grains and oil seeds or similar agricultural produce) onboard ship after loading has been completed. Whilst it is convenient for the charterer or the shipper to fumigate cargoes onboard instead of ashore, problems may well be experienced as a result of this practice. Before considering the most significant problems encountered it is worth remembering that although the goods may have been fumigated prior to loading, this will not mean they are therefore free of all live insects. Insects in one or other of their metamorphic stages of development may still be present in the products because there is no permanence in any treatment against insects.

A standard sale contract (e.g. GAFTA 120) usually requires cargoes such as cereal grains to be free from 'live infestation' at the time of shipment. However, rarely, if ever, will such a cargo be absolutely free from insects.

Although the terms of the contract of sale may only affect the relationship between the buyer and the seller, it makes little sense to expect a master to adopt a standard which is at odds with the standards anticipated in standard forms of contract. If the expectation of the standard contract of sale is that the goods should be 'free' of live infestation at the time of

shipment but infestation is clearly apparent to the master at that time he is bound to conclude that the goods are not in apparent good order and condition. If clearly infested goods are loaded onboard, even though there is an intention to fumigate the goods upon completion of loading, it is advisable to clause the relevant mate's receipts and bills of lading in terms similar to the following:

*"Some live insects detected at the time of shipment onboard; cargo to be fumigated by shippers/charterers at their risk and expense upon completion of loading"*

If the charterer intends to have the goods fumigated onboard it is also advisable to make a suitable provision in the charterparty in terms similar to the following:

*"Charterers shall indemnify the owners in respect of any and all claims of whatsoever nature howsoever arising as a consequence of any infestation of the cargo at the time of shipment onboard the vessel and/or the presence of dead insects in the cargo following the fumigation thereof."*

Regulations applying in some countries will only allow the presence of limited numbers of dead insects in imported goods. In such circumstances sale contracts will be drafted to reflect these limitations. However, the fumigation of goods onboard clearly anticipates a residue of dead insects remaining within the cargo following the fumigation and it is therefore doubtful whether the issuance of clean bills of lading in such circumstances can be justified.

## Clean bills of lading

A shipper usually requires clean bills of lading and charterers usually arrange for their charterparties to reflect this requirement. But when insects (whether alive or dead and whatever their stage of development) are seen to be present in bulk cargoes or on the packing of bagged cargoes at the time of loading, it is questionable whether clean bills of lading can justifiably be issued. This reservation applies regardless of whether or not the cargo will be fumigated subsequently onboard.

The master may be told by a representative of the shipper or charterer that the presence of live insects in agricultural produce is quite normal, and that any insects present will be killed during the fumigation process onboard after the completion of loading. This is usually the basis of the request for clean bills of lading notwithstanding the visible presence of insects at the time of shipment. It is therefore important to consider this point further.

## Recommendations on the safe use of pesticides in ships

The IMO has issued a booklet entitled *Recommendations on the Safe Use of Pesticides in Ships* and also include this information in the *IMDG Code Supplement 2000* Edition. This is a very helpful and comprehensive publication which it is recommended is carried on all dry cargo ships. The publication covers the use of insecticide sprays, smokes and gaseous fumigants. The former two can be used effectively on clean empty holds. However, the eradication of either insect infestation or rodents in loaded holds can only be effected with fumigant gas treatment.

Owners' and masters' attention is drawn specifically to the following entries:

### 3.1.1.2

*"The success of chemical treatments does not tie 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."*

When a cargo or empty vessel is to be treated with gaseous fumigation the following requirement must be observed :

### 3.1.3.4

*"A 'fumigator-in-charge' should be designated by the fumigation company, government agency or appropriate authority. The master should be provided with written instructions by the fumigator-in-charge on the type of fumigant used, the hazards involved, the threshold unit 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. Such instructions should be written in a language readily understood by the master or his representative."*

Fumigation in port is covered in Section 3.4.2. Especially important sections are:

### 3.4.2.1

*"Fumigation and aeration (ventilation) of empty cargo spaces should always be carried out in port. Ships*

*should not be permitted to leave port until gas-free certification has been received from the fumigator-in-charge."*

### 3.4.2.2

*"Prior to the application of fumigants to cargo 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 authorised person. During this period a watchman should be posted to prevent unauthorised boarding or entry, and warning notices should be prominently displayed at gangways and at entrances to accommodation."*

### 3.4.2.3

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

### 3.4.2.5

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

The Committee would draw the attention of owners and masters to 3.4.2.2 on the previous page. It is common practice these days to fumigate ships, both empty and loaded, with crew still onboard. In some instances this requirement is incorporated in charter parties. Conversely in some ports the authorities will not allow fumigation with the crew onboard. Whilst it is the Committee's view that evacuation of the crew provides the safest option, if a master is prepared or required to allow fumigation with the crew onboard it is imperative that he is satisfied that the fumigator-in-charge is equipped with proper gas detection and measuring equipment for the fumigant gas being employed. When Draeger tubes are used the master should ensure that adequate tubes are available bearing in mind that each measurement requires the use of a separate tube. The master should also insist that the fumigator-in-charge remains onboard throughout the whole operation, i.e. from initial closing to completion of ventilation and the issue of a gas-free certificate. The master should also be satisfied that the fumigator-in-charge regularly checks for gas leakages in areas where the crew may be working or resting.

Section 3.4.3. covers in-transit fumigation which is now a fairly common practice, especially for bulk cargoes of agricultural products. With this type of operation the master is responsible for the safety of all onboard his ship.

The Committee wishes to draw attention to the following paragraphs:

### **3.4.3**

*Fumigation continued in transit*

#### **3.4.3.1**

*“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 space(s) cannot be issued because of residual gas and the cargo space(s) has been re-sealed before sailing.”*

#### **3.4.3.2**

*“Before a decision on sailing with a fumigated cargo is made it should be taken into account that, due to operational conditions, the circumstances outlined in 3.4.3.1.2 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.”*

#### **3.4.3.3**

*“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 3.4.3.6) 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 3.4.3.12); 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.”*

#### **3.4.3.4**

*“Empty cargo spaces 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 spaces 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 spaces are or can be made satisfactory for fumigation. Whenever a cargo space is found not to be sufficiently gastight, the fumigator-in-charge should issue a signed statement to the master and the other parties involved.”*

#### **3.4.3.5**

*“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 spaces being subject to fumigation in transit should be treated in accordance with the provisions 3.4.3.13. Special attention should be paid to gas concentration safety checks in problem areas referred to in 3.4.3.4.”*

#### **3.4.3.6**

*“The trained representatives of the master designated in 3.4.3.3 should be provided and be familiar with:*

- 1 the information in the relevant Material Safety Data Sheet, if available; and*
- 2 the instructions 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.”*

#### **3.4.3.7**

*“The ship should carry:*

- 1 gas detection equipment and adequate fresh supplies of service items for the fumigant(s)*

concerned as required by 3.4.3.13 together with instructions for its use and the threshold limit values for safe working conditions;

- 2 instructions on disposal of residual fumigant material;
- 3 at least four sets of adequate protective equipment appropriate for the fumigant used;
- 4 the necessary medicines and medical equipment; and
- 5 a copy of the latest version of the Medical First Aid Guide for Use in Accidents Involving Dangerous Goods (MFAG). Particular attention is drawn to table 550."

### 3.4.3.12

*"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 3.4.3.13."*

### 3.4.3.13

*"Gas concentration safety checks at all appropriate locations, which should at least include the spaces as indicated in 3.4.3.5, 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."*

## Conclusion

It has been noted in recent years that some fumigations have been unsatisfactory due basically to three causes:

- Excessively heavy infestation or infestation with fumigant resistant strains of various insect species
- Inadequate initial dosing
- Insufficient time allowed for total penetration of the fumigant gas

It is of course possible for masters to have sufficient expertise to be able to decide whether a proposed fumigation operation should prove satisfactory. Although it is possible for the Association to obtain expert advice on this matter, it is difficult for any experts to advise other than in general terms when they have not seen either the ship or the cargo. It is the fumigators' duty to perform a proper fumigation and if they are employed by shippers or charterers it is the latter's duty to ensure that fumigators are competent. However, to safeguard the shipowners' position the master must insist on receiving a certificate of fumigation from the fumigators which states:

- The fumigant used
- The dose level in terms of weight of fumigant per volume of hold e.g. lb/1000ft<sup>3</sup>.
- The dates and times when fumigation commenced and ceased (i.e. when either ventilation fans were turned on or hatches were opened, whichever was the earlier)

If insects are observed in or on any cargo it could be helpful if specimens are taken and placed in a small bottle with a secure closure, such as an aspirin bottle and placed in a refrigerator. These can be supplied to experts at a later date if there are complaints at the time of discharge.

If heavy infestation is observed surveyors should be instructed to draw substantial samples of affected cargo (1kg lots) which should be sealed and kept refrigerated pending expert examination to determine the level and nature of the infestation.

Shipowners are particularly warned that receivers in certain countries, especially in the Middle East, may reject cargo, with the backing of their government authorities, if minimal live infestation is detected or even if the cargo is contaminated with a very small quantity of dead insect residues. It follows that if a master detects any insect infestation when cargoes are being loaded for Syria, Egypt and some other eastern Mediterranean countries, shipowners should be informed immediately and they should seek advice from the Club.