



The Gafta Standard for **Fumigation**

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Contents

A	Introduction	3
B	Scope – The Gafta Standard for Fumigation	4
C	General Terms and Definitions	5
D	Specific Terms and Definitions	5
1	General Obligations and Requirements	7
2	Complaints Procedure	8
3	Insurance	8
4	Risk Assessment	8
5	Internal Audit	9
6	Records and Record Keeping	9
7	Health and Safety Regulations for Employees	9
8	Equipment	10
9	Training	10
10	In-transit Fumigation of Bulk and Bagged Cargo in Ships’ Holds with Phosphine	11
11	In-Port Fumigation using Methyl Bromide or Sulfuryl Fluoride	14
12	Fumigation of Freight Containers	15
13	Store and Silo Fumigation	16
14	Degassing/Venting	16

Appendices

Appendix I – Accepted Methods of Phosphine Application 18

Appendix II – Example of Schematic Fumigation Plan 20

Appendix III – Properties of Ordinarily Used Fumigants 21

A Introduction

Gafta (The Grain and Feed Trade Association) is the international Association representing the trade and supply of agricultural commodities, animal feed materials, pulses, rice, spices and general produce worldwide.

The Gafta Standard is an independently audited scheme designed to maintain and improve the level of competence of activities related to the trade of agricultural commodities, animal feed materials, pulses, rice, spices and general produce worldwide.

It comprises three Codes of Practice:

- The Gafta Standard for Analysis and Testing
- The Gafta Standard for Fumigation
- The Gafta Standard for Supervision, Sampling and Check Weighing.

Certification to the Gafta Standard for Fumigation is conditional on a successful audit assessment by the Certification Body/Bodies approved and appointed by Gafta. Continued certification is conditional on successful annual audits of the Gafta Standard for Fumigation no later than 14 months of the anniversary of the initial audit.

The initial audit will be completed by a site visit by the auditor. The following two annual audits may be carried out remotely via electronic sharing of documents and telephone or video conferencing. The fourth audit, and every third audit thereafter will be completed by a site visit by the auditor. Gafta and the Certification Body reserve the right to complete a site visit at any annual audit or any other time (e.g. unannounced 'spot checks') where it considers it to be necessary.

If any audit is cancelled or postponed by the Fumigator within 2 weeks of the audit date, 100% cancellation fee applies.

Audits will be conducted in English and it is the responsibility of the Fumigator to arrange suitable independent translation of documents and/or a suitable independent interpreter as required at their cost. Failure to comply with this requirement may

result in the rearrangement of the audit when suitable interpreters are available. The costs associated with the rearranged audit shall be borne by the Fumigator.

The Fumigator must permit access to the auditor to the premises, information, documentation and facilities required to undertake the audit. The auditor reserves the right to refuse to carry out an audit where they deem conditions are inappropriate, dangerous or unsafe, the cost of a cancellation due to any of these factors will be borne by the Fumigator. Any certification currently in place may be suspended if an audit is cancelled and full reinstatement of a certificate may require a full on-site audit.

Non-conformances raised at the audit of the Gafta Standard must be closed by providing documentary evidence or a revisit. Non-conformances must be closed within 90 days of an initial audit and within 28 days of any subsequent audit. Failure to provide satisfactory evidence will result in suspension from the Gafta Approved Register of Fumigators and may lead to inquiry under the terms of the Gafta Membership Complaints and Disciplinary Regulations.

Failure to reinstate from 'suspended' status within 28 days of notification of the suspension will result in the Fumigator being withdrawn from the scheme. After withdrawal, reinstatement will only be possible after a full initial audit at the cost of the Fumigator.

Gafta and the appointed Certification Body reserves the right to suspend or withdraw certification and/or membership of the Gafta Approved Register of Fumigators when it considers it necessary to do so to prevent the Standard, Register or the Association being brought into disrepute.

Successful third-party audit to the Gafta Standard is one of the requirements of entry onto the Gafta Approved Registers which provide authorisation for companies to provide its services under Gafta Contract Terms and Conditions. This Standard should be read in conjunction with the requirements for the Approved Registers and the relevant Gafta Codes of Practice which can be found on the Gafta website www.gafta.com

B Scope – The Gafta Standard for Fumigation

This Standard covers the management and operational procedures of the Fumigator (and his trained representatives) when carrying out the fumigation and degassing of agricultural commodities on a ship, in a store/silo or in freight containers in relation to food/feed safety. It details best practice procedures of the Fumigator within the scope of his responsibility, including the handing over of responsibility to the owner or custodian of the commodity when required.

It is a requirement of this Standard that only fumigants approved for use on agricultural commodities by the relevant authorities in the countries and ports where the commodities are treated are used.

This Standard only covers the fumigation or treatment of agricultural commodities.

This Standard does not guarantee the success of the fumigation or treatment and relates only to the process of the application.

This Standard does not replace any legislative or Health and Safety requirements applicable in the country where the activity is carried out.

Marine fumigation is the fumigation of commodities in ships' holds.

Phosphine gas (Hydrogen Phosphide), is the only fumigant allowed for this purpose by IMO Recommendations on the Safe Use of Pesticides in Ships (latest version of), and in the IMDG Code Supplement (latest version of).

The process of in-transit marine fumigation begins at the load port, continues for a defined time during the voyage to destination and ends at the discharge port. To provide for safety and efficacy the participation and cooperation of at least three parties is required throughout this period of time: Fumigators at the load port, mariners, and Fumigators at the discharge port. As the vessel will normally sail shortly after completion of fumigant application it is impossible to assess the full efficacy of the fumigation before sailing.

It is a requirement of this Standard that a Fumigator is responsible for degassing at the discharge port, or other agreed safe anchorage point, and a recommendation that the Fumigator-at-Discharge is listed on the Gafta Approved Register of Fumigators.

Fumigation can also be carried out on cargoes while the ship is in-port, either before sailing or on arrival at destination port.

Where phosphine gas is used, the same procedure as for in-transit fumigation should be followed. A separate procedure is followed for the use of methyl bromide and sulfuryl fluoride for in port fumigation.

Store and Silo fumigation is the fumigation of goods on land, in a recognised storage facility, usually with phosphine gas although other fumigants may be used in some situations.

Goods in silo bins are treated in similar fashion to those in a ship's hold. Goods in flat stores need to be enclosed by gas-tight sheeting, and the fumigated area or building sealed off to prevent access.

Fumigation of Freight Containers is the fumigation of goods that are being carried in freight containers. The fumigation and ventilation are usually completed before transit.

Containers that are transported while under in-transit fumigation are classified by the IMDG Code – Dangerous Goods as a 'FUMIGATED UNIT CLASS 9 UN3359'.

This standard therefore requires the Fumigator to perform his operations all in accordance with the relevant sections of the IMDG Code, and to ensure all other safety requirements are complied with.

Degassing/Venting is the process at the end of the exposure period, after the fumigation enclosure is unsealed, when fumigant gas desorbs and diffuses out of the product that was fumigated and the fumigation enclosure. It is a requirement of this Standard that a Fumigator is responsible for degassing at the discharge port, or other agreed safe anchorage point, and a recommendation that the Fumigator-at-Discharge is listed on the Gafta Approved Register of Fumigators.

C General Terms and Definitions

In this document the following words are used and defined as:

Must – This is a requirement of the Standard which has to be met

Should – This is a strong recommendation of the Standard, but not mandatory

Key Standards – Standards marked with a **K** in the left-hand margin indicate a ‘key’ requirement. If during an audit an assessor finds a major non-conformance against a key requirement this shall result in suspension until rectified.

Major Non-Conformance – a substantial failure to meet a requirement of the standard.

Minor Non-Conformance – a requirement of the Standard has not been fully met.

The level of non-conformance against a requirement of the Standard is based upon evidence and observations made during the audit.

Evidence – Objective evidence must be available to demonstrate compliance with each requirement. Evidence can include, but is not limited to: records, documented processes, reports, manuals, correspondence, certificates and photographs. Evidence can be hard copy or electronic.

Confidentiality – the auditor requires access to all documentation relevant to the Gafta Standard assessment. All information will remain in confidence with the certification body and will not be disclosed to any third party.

D Specific Terms and Definitions

Specific terms and definitions relating to this manual are as follows:

Clearance (previously known as Gas Free) – is the assessment after the degassing period when the Fumigator tests the air in the workspace to make sure that the concentration of fumigant gas has fallen to or below safe levels as defined in the relevant safety regulation.

Clearance Certificate (previously known as Gas Free Certificate) – is the certificate confirming presence of harmful concentrations of fumigant is below Threshold Limit Value and is only valid at the time and place of issuance. This is provided by the Fumigator at discharge port after cargo degassing operations are concluded.

Degassing/Venting – is the process at the end of the exposure period, after the fumigation enclosure is unsealed, when fumigant gas desorbs and diffuses out of the product that was fumigated and the fumigation enclosure. It is a requirement of this Standard that a Fumigator is responsible for degassing at the discharge port or other agreed safe anchorage point, and a recommendation that the Fumigator-at-Discharge is listed on the Gafta Approved Register of Fumigators.

Disposal – is the process of collection of the waste residues from on-board vessels and other means of transport for neutralisation and destruction by an approved and qualified operator.

Exposure Time – is the period of time the product applied (toxic gas or biocide) is in direct contact with the target organism at a specific spot (location) to achieve the desired effect on the pest. The time required for in-situ release in case of the active ingredient and/or the time required for dissipation (migration) throughout the product to the relative spot (location) is not part of the exposure time. As long as the product applied is not in direct contact with the target organism, the exposure time has not commenced. The exposure time is dependent on physical, chemical and biological parameters e.g. temperature, relative humidity, target species, product applied etc.

Fumigants – are toxic gases which are used to target infestations.

Fumigant Application – is the process of introduction of a specific toxic gas or a chemical releasing toxic gas into the product to be treated and its enclosure for control of target organism(s).

Fumigation – is the process of application, exposure and dissipation of a toxic chemical in its gaseous state with the purpose of control of target insect pests in the product and its enclosure.

Fumigation Certificate (or Fumigant Application Certificate) – is the document reflecting the service rendered issued after fumigant application stating the characteristics and procedure applied.

Fumigator – means the appointed fumigation company including the Fumigator-in-Charge and his trained technician(s).

Gas Tightness – is the determination of how effective the holds are at retaining the fumigant gas generated. Wherever possible measures should be taken to check the gas tightness of the ships hold prior to commencement of loading for both the safety of the crew and also to ensure the efficacy of the treatment. These measures could include, but are not limited to, ultrasonic testing, smoke test or visual checks and inspections.

In-transit Fumigation – is the process of fumigation during a voyage.

***NOTE:** as the vessel will normally sail shortly after completion of fumigant application it is impossible to assess the full efficacy of the fumigation before sailing.*

Master – the Ships Master and/or his trained representative(s).

Re-circulation System – a recirculation system requires the installation and deployment of pipework and spark proof fans into each hold to recirculate the gas during transit and facilitate the venting process on arrival in disport. The pipework should be installed into the ship's holds prior to commencement of loading. The pipework and fans are not considered to be of a hazardous nature after use and no specific handling is required at removal.

Removal of Spent Fumigant – the process of removal of retrievable parcels (sleeves, sachets, plates, blankets) of residues from the reacted metal phosphides at the end of the exposure/fumigation process. Residues must be handled in accordance with the applicable regulations and manufacturer's safety guidelines.

Treatment Period – is the period of time required for release (generation) of the toxic gas from the product applied, dissipation throughout the product and the exposure time required to achieve effective action on the target pests in the fumigated product and its enclosure. In addition to the parameters relevant for the exposure time, treatment time depends on the permeability of the commodity, the volume of the fumigated cargo, the commodity or product type etc.

TLV – the Threshold Limit Value of a chemical substance is a level to which a worker can be exposed day after day for a working lifetime without adverse effects.

1 General Obligations and Requirements

1.1 Management Structure

1.1.1 **K** The fumigator must be a legal entity, or a defined part of a legal entity, which is legally responsible for its fumigation activities.

1.1.2 Where fumigators operate on multiple sites, in the same country, each site must be part of the same legal entity, follow the same procedures, issue the same certificates and/or reports, with a management system having overall responsibility for the fumigation activities.

1.1.3 **K** For a multinational Fumigation company with offices in different countries, each country must hold its own certification to the Gafta Standard and be audited separately.

1.1.4 **K** The Fumigator must have documented operating and management procedures.

1.1.5 **K** Fumigators must regularly (at least annually) review their management system to ensure continued conformance with procedures and policies, fulfilment of objectives, and identify opportunities for improvement. In particular a management review must consider (but is not limited to):

- Internal or external changes relevant to the scope of this Standard
- Suitability of operating and management procedures
- Outcomes of internal audits, audits against this Standard and any other external/third party audits
- Complaints, customer and personnel feedback
- Risk Assessments
- Corrective actions, and effectiveness of preventative actions/improvements.

1.2 **K** Outlined in this manual are the main areas of importance with respect to fumigation matters relating to combinable crops and animal feed materials and must be read in conjunction with the following manuals/guide notes which address the individual requirements for particular logistical operation/procedures. Fumigators must demonstrate access to the latest version of each publication.

- Gafta Fumigation Rules No.132
- Recommendations on the Safe Use of Pesticides in Ships applicable to the Fumigation of Cargo Holds
- International Maritime Dangerous Goods (IMDG) – relevant sections
- Fumigation product instructions, manufacturer guidance, product datasheets etc
- All relevant local legislation and/or regulations.

1.3 **K** Fumigators and ship owners and their representatives must comply with all the relevant requirements of the country and ports that vessels or cargo spaces are fumigated or ventilated in. For example, in USA ports to the requirements of the US Coastguard, in UK ports to the requirements of the UK Merchant Shipping Regulations and the UK Marine Coastguard Agency requirements, such as MGN284. In addition, any requirements of the country that the ship is flagged to must be adhered to.

1.4 **K** The fumigation products used must be applied strictly in accordance with the manufacturer's instructions, calibrations and safety precautions on the label, and records retained.

1.5 The fumigation products used must be used in accordance with the approval in the country where the fumigation is being conducted.

1.6 In order for Fumigators to perform their activities, precise instructions are needed from their principals at the time of receiving the order.

1.7 The Fumigator should advise their principal of the requirement to employ a Fumigator at discharge or other agreed safe anchorage point. The principals (i.e. the seller and/or the buyer or receiver) are responsible for appointing a fumigator at discharge or other agreed safe anchorage point as agreed in the contract for the goods.

- 1.8 **K** Fumigators must nominate a suitably experienced person as a Technical/File Manager who shall be the responsible person for receiving instructions from a principal and who shall be responsible for forwarding the appropriate instructions to the Fumigator-in-Charge. The Technical/File Manager must be a permanent employee responsible for ensuring that sufficient information has been received to enable the Fumigator-in-Charge to satisfactorily carry out their duties.
- 1.9 For in-transit fumigation the fumigator should ensure the nomination specifies who is responsible for the provision of RPE on board the vessel. (Refer also to point 10.1.8)
- 1.10 **K** A Fumigator must only contract out operations which it has been appointed to carry out to another Fumigation company certified under the Gafta Standard for Fumigation and/or from the Gafta Approved Register of Fumigators (excepting the recommendation in Section 14).

2 Complaints Procedure

- 2.1 The Fumigator must have a documented procedure for handling complaints.

This procedure must include systems for:

- The prompt documentation and investigation of complaints
- The prompt feedback to the complainant with findings
- Deciding on internal actions required to prevent re-occurrence
- Identifying trends and feeding into management review.

3 Insurance

- 3.1 **K** Fumigators must demonstrate that they have adequate and appropriate insurance in place to cover any claims which may arise as a result of liability in respect of their operations.

4 Risk Assessment

- 4.1 **K** Fumigators must have a risk assessment in place that identifies and controls any hazards or risks that negatively impact their ability to carry out their services. Hazards and risks to the following must be considered: equipment, resources, personnel, confidentiality/information security, external influences, explosion, fire, food/feed safety, intoxication, personnel exposure and poisoning.

NOTE *this list is not exhaustive. Food and feed safety, i.e. hazards affecting the commodity being fumigated, must also be considered.*

5 Internal Audit

- 5.1 **K** A documented internal auditing procedure must be in place, which reviews processes and verifies they are followed correctly and consistently and identifies opportunities for improvement.
- 5.2 Internal audits must be carried out for all activities against the documented operating and management procedures and this Standard as a minimum. They must be completed at least annually at each site and in addition to the 3rd party audits carried out for this Standard.
- 5.3 The audit programme must include the frequency, methods, responsibilities, planning requirements and reporting, and must take into consideration the importance of the activities concerned, changes affecting activities or services, and the results of previous audits.
- 5.4 Where possible, internal audits must be undertaken in such a way that the person undertaking the internal audit is not auditing their own work. Internal audits can be carried out by suitably competent external 3rd party.
- 5.5 Internal audits must include work carried out by sub-contractors.
- 5.6 Internal audit reports should include objective evidence to show compliance with the audit criteria.
- 5.7 **K** The person responsible for overall control of the fumigation operations must ensure non-conformances raised through internal audit and any 3rd party audits (such as audits to this Standard) are rectified within specified timescales and implement suitable preventative action to avoid recurrence.

6 Records and Record Keeping

- 6.1 **K** Internally produced records must be signed by the person carrying out the task or activity.
- 6.2 **K** Records must be legible and kept in suitable conditions that allow ready retrieval and prevent deterioration.
- 6.3 Records must be kept for a minimum of seven years unless there are additional requirements.
- 6.4 **K** The Fumigator must only report actual and true findings.

7 Health and Safety Regulations for Employees

- 7.1 **K** The Fumigator must comply with all relevant local and national Health and Safety Regulations of the country in which it is operating with regard to its employees and any other operatives under its control.
- 7.2 **K** Fumigators must wear the appropriate Personal Protective Equipment. The items provided must be appropriate to the activities being performed, must be in good order and within any applicable validity period or expiry date. Records must be retained for the issuance and receipt of such equipment to/by Fumigators.
- 7.3 Where Fumigators are asked to perform their duties in an environment or in conditions deemed by them to be dangerous or unsafe, they should refuse to undertake said duties or operations until such time as the conditions are made safe to their satisfaction. Where a Fumigator refuses to perform an activity or operation due to concerns regarding safety they must immediately notify the principal accordingly.

8 Equipment

- 8.1 K** Equipment must be fit for the purpose for which it is used and maintained and serviced to manufacturers' specifications or tolerances. Maintenance and servicing schedules must be recorded.
- 8.2** Manufacturers' operating instructions or in-house procedures must be available.
- 8.3 K** Equipment must be checked before use on a regular basis.
- 8.4 K** Equipment must be calibrated where appropriate according to the manufacturers' instructions or in-house procedures, and records kept. Calibration adjustments must only be undertaken by authorised and trained personnel.

9 Training

- 9.1** Competence:
The Fumigation company must define and document (for example in a job description) the responsibilities and competency requirements for each employee, including (but not limited to) education, training, experience, technical knowledge and skills.
- 9.2** Where available, Fumigators should be a member of the national or regional professional trade association/body applicable to fumigation operations.
- 9.3 K** Fumigation technicians must be trained (or operating under a qualified technician) and licensed (or equivalent permit/document) to the requirements of the country where the fumigation or ventilation activities are conducted.
- 9.4 K** Training programmes must be regular and updated as appropriate.
- 9.5 K** Written training programmes must be implemented and include the following stages:
- Induction period
 - Supervised/mentored working period with experienced operators
 - Continued training to remain up to date with changing technology, methods, legislation etc.
- 9.6 K** Individual training records must be kept for each employee.
- 9.7 K** The requirement to attend or receive training must take into account the ability, experience and other qualifications held by each employee and shall be appropriate to their activities.
- 9.8 K** Regular performance reviews must be completed for all employees. This must be completed at least annually, but more frequently as required. Performance reviews must include a combination of on-site observations, interviews, self-assessment and other techniques to assess performance. Performance reviews must be used to identify training needs.
- 9.9 K** Training must cover at least, but not limited to, the following areas of activity:
- All relevant codes and regulations including, but not limited to, those listed in Section 1 – General Obligations and Requirements
 - The requirements of the Gafta Standard for Fumigation
 - The applicable Gafta Contract terms and Gafta Rules
 - Health and Safety requirements
 - Fumigants and products used by the Fumigator.
- 9.10** Personnel who carry out internal audits must be trained to do so.

10 In-transit Fumigation of Bulk and Bagged Cargo in Ships' Holds with Phosphine

NOTE: *The use of methyl bromide or sulfuryl fluoride for in-transit fumigation is not permitted by the IMO*

It is the responsibility of the principal to ensure that the suitability of the carrying vessel and the appropriate permissions regarding the operation of fumigation on-board a vessel are agreed and acceptable to the master/owners by incorporating suitable terms in the freight contract (Charter Party).

Obligations on the Parties:

When the owners/charterers/Master agree to fumigation being carried out in-transit with phosphine, the Master should ensure he is familiar with the relevant requirements of IMO Recommendations.

Safe and effective in-transit fumigation is dependent on the participation and cooperation of fumigation team under the responsibility of the Fumigator-in-Charge and the ship's crew. The specific responsibilities are listed below. For the purposes of this Standard, only the Fumigator's responsibilities are audited, although evidence is required of the Fumigator's obligation to make the Master and ship's crew aware of their responsibilities.

Where phosphine fumigation and ventilation are carried out in port or at anchor (not in-transit – i.e. after loading but prior to sailing, or at discharge port, prior to discharge) the same procedure should be followed.

It is recommended that all parties involved are familiar with the recommendations given in the IMO Recommendations on the Safe Use of Pesticides in Ships applicable to the Fumigation of Cargo Holds.

10.1 Before fumigant application:

- 10.1.1** **K** The Master must appoint a suitably trained representative/crew member to accompany the Fumigator during the inspections/testing of empty holds prior to loading to determine whether they are gas tight, or can be made gas tight and if necessary what work is to be carried out to ensure they are gas tight. The Fumigator must record the name of the representative.
- 10.1.2** **K** The Fumigator must receive written confirmation that the Master and/or the crew have searched the vessel thoroughly to ensure there are no stowaways or other unauthorised personnel on board before fumigation takes place.
- 10.1.3** **K** The Fumigator must carry out a safety assessment at load port taking into account the IMO Recommendations and also any limitations applied by the law of the country of loading and destination or flag of the ship, and any contract information provided to the Fumigator (see requirement 1.6), or to the ship owner's instructions. A report of findings and any recommendations should be made in writing to all relevant parties. The recommendations made should have been performed prior to fumigation. All necessary measures must be taken to ensure the safety of the vessel and crew with regards to fumigation operations.
- 10.1.4** **K** The Fumigator must ensure that all the cargo spaces to be fumigated are suitable for fumigation.
- 10.1.5** **K** The Fumigator must ensure the Master or his trained representative has briefed the crew on the fumigation process before fumigation takes place. The Master must appoint at least two members of crew to be trained by the Fumigator. The crew members must maintain safe conditions on board the ship during the voyage. The Fumigator must record the name of the representative(s).

- 10.1.6** **K** The Fumigator must ensure that the Master or his trained representative has been made familiar with the fumigant product label, detection methods, safety product and emergency procedures. This may include, but is not limited to, the provision of Safety Datasheets.
- 10.1.7** **K** The Fumigator must verify that gas detection and Respiratory Protection Equipment (RPE) (as required by IMDG and IMO recommendations) carried on the ship are all in good working order and are suitable and appropriate for the task, and that adequate fresh supplies of consumable items for this equipment are available to allow proper measurement.
- 10.1.8** In case of regulatory requirements RPE may consist of Self Contained Breathing Apparatus. Canister respirators must be properly selected for the fumigant used and not expired. The Fumigator must make sure that four sets of RPE are on board as well as gas monitoring equipment suitable for the length of the voyage. (Refer also to point 1.9)
- 10.1.9** In the event that sufficient quantities of effective safety equipment are not on-board, the Fumigator must remind the Master in writing of his responsibility to carry this and must assist the Master wherever possible by either supplying the equipment at the owner's cost or making arrangements for it to be supplied so that the ship fulfils its responsibility to carry sufficient items. (Refer also to point 1.9)
- 10.1.10** The IMDG and IMO state that 'the ship should carry 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.' The Fumigator must record whether this has been verified and record that the Master is made aware of this requirement.
- 10.1.11** **K** The Fumigator must ensure that the Master has been notified in writing of the spaces containing fumigated cargo. The Fumigator must post warning signs at all entrances to these spaces including the type of fumigant used with the time and date.
- 10.1.12** **K** The Fumigator must ensure that the Master has been notified in writing of any other spaces that are considered unsafe or could become unsafe to enter during the fumigation. The Fumigator must post warning signs at all entrances to these spaces including the type of fumigant used with the time and date.
- 10.1.13** **K** The Fumigator must ensure the agreed formulation of fumigant is used at the correct dosage to comply with the contractual requirements, and records retained. The Fumigator must advise the appropriate efficacy criteria in relation to the required minimum effective dosage, method of application (see Appendix I) and exposure time. Guidance criteria are available in a number of guide notes and handbooks. Other National Plant Protection Organisation requirements may apply.
- 10.2** Following fumigant application:
- 10.2.1** **K** The Fumigator must ensure that the Master or his trained representatives have been made aware of the specific areas to be checked for gas concentrations throughout the fumigation period.
- 10.2.2** **K** The Fumigator must ensure that responsible crew members have been shown how to take gas readings correctly when gas is present, and they are fully conversant with the use of gas detection equipment available.
- 10.2.3** **K** The Fumigator must ensure that the Master or trained representatives have been made 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 concentrations may reach their highest levels after several days.
- 10.2.4** **K** The Fumigator must ensure that the Master or trained representatives have been made aware of the possibility of gas diffusing throughout the duct keel and/or ballast tanks and/or fire warning system.

10.2.5 **K** The Fumigator must ensure that the Master or trained representatives have been made aware that the Master is responsible for all aspects of the safety of the fumigation once the Fumigator has formally handed over responsibility to him and left the vessel.

10.2.6 **K** The Fumigator must ensure that the Master clearly understands that even if no leakage of fumigant is detectable at the time of sailing this does not mean that leakage will not occur at some time during the voyage due to the movement of the ship or other factors. This is why it is essential the Master ensures regular checks are carried out during the voyage.

The Master should ensure that during the voyage, regular checks for gas leakage should be made throughout all occupied areas and the findings recorded in the ship's log (IMO Recommendations). If any leakage is detected, appropriate precautions to avoid any crew being exposed to harmful concentrations must be taken.

10.2.7 **K** The Fumigator must ensure that he has supplied a signed statement to the Master confirming all points as listed above and all other requirements of the IMO Recommendations and any other relevant requirements must be adhered to.

10.2.8 **K** Written documentation in respect of the following must be supplied by the Fumigator to the Master. The names of crew members who have been trained must be recorded.

Copies signed by both parties should be retained by both parties:

- Pre-Fumigation Inspection Report
- Safety recommendations for vessels with fumigated cargoes
- Manufacturer's information or safety data sheet
- Information on Residue Hazards
- First aid and medical treatment instructions
- Fumigation certificate
- Fumigation plan – for examples of a schematic fumigation plan see Appendix II
- Instructions for the use of the Phosphine Gas Detecting Equipment

- Precautions and procedures during voyage
- Instructions for aeration and ventilation
- Precautions and procedures during discharge
- Emergency procedures.

10.2.9 **K** When the Fumigator has discharged his responsibilities, the Fumigator must formally hand over in writing responsibility to the Master for maintaining safe conditions in all occupied areas, which the Master should accept (IMO Recommendations).

The Master may start the ventilation of the cargo spaces prior to arrival at the first discharge port, only if requested to do so by the Fumigator, taking into account instructions issued by the Fumigator.

Prior to arrival at the first discharge port the Master should inform the authorities at the port that the cargo has been fumigated in-transit (IMO Recommendations).

10.2.10 **K** The Master, Fumigator or relevant authorities must not allow discharge of the cargo to commence until they are satisfied that the cargo has been correctly ventilated (see Section 14) and metal phosphide residues that can be removed, have been removed, and that any other requirements of the discharge port have been met (IMO Recommendations). Retrievable residues must only be handled or removed by a Fumigator.

It is a requirement of this Standard that a Fumigator is responsible for degassing at the discharge port, and a recommendation that the Fumigator-at-Discharge is listed on the Gafta Approved Register of Fumigators. It is acceptable that this may not be the same Fumigator or fumigation company employed for application of the fumigant at loading (see section 1.7).

11 In-Port Fumigation using Methyl Bromide or Sulfuryl Fluoride

Methyl Bromide or Sulfuryl Fluoride are sometimes used for cargo fumigation as it is normally possible to achieve an effective fumigation of the cargo in 24-48 hours.

NOTE: Each type of fumigation product requires specific procedures, equipment and expertise from the applicator/fumigator. See Section 9.0 Training.

Note: Methyl Bromide is banned for use in many countries but allowed or required in others. However even when it is allowed for use this Standard does not recommend its use for environmental and safety reasons. Methyl Bromide is not permitted for in-transit fumigation.

NOTE: Sulfuryl fluoride is allowed for use on grain fumigation in some countries (USA, Canada, Australia, South Africa) but this use is still under development in other countries. Sulfuryl fluoride is not permitted for in-transit fumigation.

NOTE: Where phosphine is used for in-port fumigation, the requirements in Section 10.0 are applicable.

NOTE: Whilst recognising that Hydrogen Cyanide is legally able to be used in some countries this Standard does not recommend or endorse its use.

11.1 K The Fumigator must receive written confirmation that the Master and/or the crew have searched the vessel thoroughly to ensure there are no stowaways or other unauthorised personnel on board before fumigation takes place.

11.2 K The crew must be landed and remain ashore until the ship is certified gas free in writing by the Fumigator. The Master may appoint a competent crew member to remain in attendance to ensure the safety of the ship provided they adhere to safety instructions issued by the Fumigator. A record of the crew member's name must be kept.

11.3 The vessel must not be moved during the fumigation and ventilation periods.

11.4 K The Fumigator must carry out a safety assessment taking into account the IMO Recommendations and also any limitations applied by the law of the country or flag of the ship, and contracts related to the cargo, or to the ship owner's instructions. A report of findings and any recommendations should be made in writing to all relevant parties. The recommendations made should have been performed prior to fumigation. All necessary measures must be taken to ensure the safety of the vessel and crew with regard to fumigation operations.

11.5 K The Fumigator must ensure that all the cargo spaces to be fumigated are suitable for fumigation.

11.6 K The Fumigator must ensure the agreed formulation of fumigant is used at the correct dosage to comply with the contractual requirements, and records retained. The Fumigator must advise the appropriate efficacy criteria in relation to the required minimum effective dosage, method of treatment and exposure time. Guidance criteria are available in a number of guide notes and handbooks. Other National Plant Protection Organisation requirements may apply.

11.7 K The Master, Fumigator or relevant authorities must not allow discharge of the cargo to commence until he is satisfied that the cargo has been correctly ventilated (see Section 14) and that any other requirements of the discharge port have been met (IMO Recommendations).

It is a requirement of this Standard that a Fumigator is responsible for degassing, and a recommendation that the Fumigator-at-Discharge is listed on the Gafta Approved Register of Fumigators.

12 Fumigation of Freight Containers

12.1 **K** Containers which are fumigated are subject to the provisions of the IMDG Code: “Special Provisions applicable to fumigated cargo transport units (UN3359)”. The Fumigator must demonstrate access to the latest version of the IMDG Code, and/or the latest version of Recommendations on the Safe Use of Pesticides in Ships Applicable to the Fumigation of Cargo Transport Units and ensure their procedures meet the necessary requirements.

12.2 **K** The Fumigator must ensure that as far as is practicable the container is made gas tight before the fumigant is applied either by sealing as necessary, pressure testing or some other accepted method.

12.3 **K** The Fumigator must ensure that the containers are within a cordoned off safety area with appropriate signage and controls as required by the relevant local authorities. Containers must not be fumigated once they have been loaded aboard the ship.

12.4 **K** The Fumigator must ensure that the containers are clearly marked with appropriate warning signs as required by the IMDG Code (UN3359) and all other details as required by the relevant local authorities. This label must remain on the container until it has been ventilated AND goods have been unloaded.

12.5 **K** The Fumigator must ensure the agreed formulation of fumigant is used at the correct dosage to comply with the contractual requirements, and records retained. The Fumigator must advise the appropriate efficacy criteria in relation to the required minimum effective dosage, method of treatment and exposure time. Guidance criteria are available in a number of guide notes and handbooks. Other National Plant Protection Organisation requirements may apply.

12.6 **K** After the required exposure time, the Fumigator must safely ventilate and test the containers. The Fumigator can then issue a ‘certificate confirming presence of harmful concentrations of fumigant is below Threshold Limit Value (TLV)’. The container label must be updated with the date of ventilation. The label must remain on the container until it has been ventilated AND goods have been unloaded.

***NOTE:** A ‘certificate confirming presence of harmful concentrations of fumigant is below Threshold Limit Value’ is only valid at the time and place of issuance since commodities can desorb noxious fumes following ventilation resulting in the return of a toxic atmosphere.*

12.7 **K** Where the container is fumigated but NOT ventilated prior to transport, the following must be documented in the accompanying paperwork:

- “UN3359 Fumigated Transport Unit Class 9”
- Date and time of fumigation
- Type and amount of fumigant used
- Instructions for opening and venting the container by a Fumigator or competent authority
- Instructions for disposal of residues by a Fumigator or competent authority.

***NOTE:** Where the container is fumigated but NOT ventilated prior to transport, according to IMO Recommendations it must not be loaded on board the vessel for a period of time determined by the local competent authority (normally not less than 24 hours).*

Obligations on the Exporter/Agent:

- The Exporter/Agent must ensure the correct permissions have been obtained to allow fumigated containers on-board the ship
- The Exporter/Agent must ensure that the Master is informed that the containers are under fumigation prior to the loading of the containers
- The Exporter/Agent must ensure that the containers are clearly marked by the Fumigator with appropriate warning signs stating the type of fumigant used and the date applied, and all other details as required by the IMDG Code and IMO Recommendations
- The Exporter/Agent must ensure that shipping documents show the date of fumigation and the type of fumigant and the amount used all as required in the IMDG Code
- The Exporter/Agent must follow all specific port regulations.

The Fumigator is recommended to ensure the Exporter/Agent is aware of his obligations.

13 Store and Silo Fumigation

- 13.1** **K** The Fumigator must carry out a safety assessment of the store/silo to be treated. This must consider potential areas of gas leakage, such as ducting on the floor or via the walls. A report of findings and any recommendations must be made in writing to all relevant parties. The recommendations made must have been performed prior to fumigation.
- 13.2** **K** The Fumigator must ensure, using appropriate signage and security (locks etc), that the premises are declared out of bounds to personnel and public for the duration of the fumigation.
- 13.3** The Fumigator should recommend any equipment (such as temperature probes and other monitoring equipment) within the commodity has been removed prior to fumigation to prevent any damage to the equipment. (This does not apply to sulfuryl fluoride).
- 13.4** **K** The Fumigator must ensure that the store/silo is clearly marked with appropriate warning signs stating the type of fumigant used and the date applied, and all other details as required by the relevant local authorities.
- 13.5** **K** The Fumigator must ensure the agreed formulation of fumigant is used at the correct dosage to comply with the contractual requirements, and records retained. The Fumigator must advise the appropriate efficacy criteria in relation to the required minimum effective dosage, method of treatment and exposure time. Guidance criteria are available in a number of guide notes and handbooks. Other National Plant Protection Organisation requirements may apply.

To ensure an even distribution of the fumigant in the commodity a powered circulation system is recommended.

- 13.6** **K** After the required exposure time, the Fumigator must safely ventilate and test the store/silo. The Fumigator can then issue a 'certificate confirming presence of harmful concentrations of fumigant is below Threshold Limit Value' (TLV).

NOTE: A 'certificate confirming presence of harmful concentrations of fumigant is below Threshold Limit Value' is only valid at the time and place of issuance since commodities can desorb noxious fumes following ventilation resulting in the return of a toxic atmosphere.

14 Degassing/Venting

This section is applicable to in-transit fumigation with phosphine.

It is a requirement of this Standard that a Fumigator is responsible for degassing at the discharge port, and a recommendation that the Fumigator-at-Discharge is listed on the Gafta Approved Register of Fumigator. It is acceptable that this may not be the same fumigator or fumigation company employed for application of the fumigant at loading (see section 1.7).

- 14.1** The Fumigator-at-Discharge should receive, in advance of arrival of the ship, information from the Fumigator at loading or the receivers or the agents. This should include the method and type of fumigation employed and rate of application per hold (e.g. numbers of sleeves used, kg of product per sleeve).
- 14.2** **K** The Fumigator must consider the information received as well as any local health regulations and other port requirements.

- 14.3** **K** The Fumigator must have a procedure in place for ventilation operations and carry out a risk assessment before commencing ventilation operations. The risk assessment must consider, but not limited to, type, method and rate of fumigant application per hold, voyage duration, conditions (e.g. temperature) during the voyage, likely risk of desorption, gas readings, onward transportation/handling of the goods (e.g. into store, barge etc).
- 14.4** At all times during the ventilation procedure, all crew members and other interested parties must comply with the instructions issued by the Fumigator. The Fumigator-at-Loading must issue safety instructions to the crew and other interested parties, who must comply, for the duration of the ventilation procedure.
- 14.5** **K** The Fumigator must remove any retrievable fumigant residues (bags, sleeves, blankets etc) and convey them away from the shipment and port without delay to be disposed of safely in accordance with local requirements. A record must be kept of how residues have been disposed.

NOTE: residues cannot be removed if loose pellets have been used and the Fumigator must consider the risk of gas desorption with this method.

NOTE: The pipework and fans of recirculation equipment are not considered to be of a hazardous nature after use and no specific handling is required at removal.

- 14.6** The Fumigator must carry out periodic gas readings during ventilation.

The decision to issue the Clearance or Gas Free Certificate should take into account a range of factors including the method and period of fumigation, discharge and storage procedure.

- 14.7** Where ventilation is carried out offshore, instructions must be provided to the ships master for the onward journey. A Certificate for Residue Removal detailing what has been removed must be issued and supplied to the receivers and/or the fumigator at final destination port.
- 14.8** If necessary further gas checking should be carried out in-store to check possible gas desorption from the commodity.

NOTE: Only when the cargo space or container is fully ventilated AND the goods removed can the warning signs be removed.

Appendix I – Accepted Methods of Phosphine Application

A summary of the various methods of phosphine application methodology that can be considered for 'in-transit' fumigation of bulk or bagged cargoes in ships' holds and the key elements of each are listed below.

NOTE: These methods can also be used for store and silo fumigation when the appropriate gas-tight sheeting or other sealing materials are used.

NOTE: It is recommended that the method and type of fumigation to be employed is included in the discussions and negotiations between buyers and sellers prior to loading taking place.

The criteria that are relevant in respect of the fumigation are (inter alia):

- Type of fumigant product and formulation used
- Application method
- Exposure time
- Conditions: temperature/moisture
- Type and volume of cargo/product.

i) Surface tablet/pellet application – is the application of tablets or pellets of a metal phosphide on the cargo surface worked into the cargo/below the surface/not scattered on the surface/buried.

High concentrations of gas build up in the head space, potentially resulting in significant leakage through the hatch covers unless they are very well sealed. Penetration down into the cargo is limited. Powdery residues cannot be removed.

It should be borne in mind that the use of loose tablets or pellets can lead to additional precautions and delays at discharge port because they cannot be removed (i.e. in sleeves, blankets etc) and may still be generating gas due to a partial reaction of the used product under unfavourable conditions such as but not limited to low cargo temperature, low atmospheric temperature/moisture and short passage time. The opening of the hatches and/or movement of the goods can cause further reaction resulting in increasing gas levels which may cause considerable delay and precautions due to safety concerns, at discharge port.

ii) Surface blanket application – is the application of metal phosphide in blankets, sachets or sleeves, placed on the surface of the cargo (or into the top half metre).

All points the same as (i) except that with this method powdery residues can be removed prior to discharge.

iii) Fumigation by probing – is the application of tablets or pellets by probing into the cargo of at least 0.3 m depth up to a few metres. There is less loss of gas through hatch covers than in (i).

Better penetration of gas is experienced compared to applications on the cargo (sub)surface. The procedure is only fully effective if the holds are relatively shallow and voyage time relatively long. Powdery residues cannot be removed.

iv) Probing sleeve application – is the application of tablets or pellets by probing into the cargo a few metres in retrievable sleeves. All points as for (iii) except that with this method powdery residues can be removed prior to discharge.

v) Surface application with re-circulation – is the fitting of an enclosed powered re-circulation system to the hold and application of metal phosphide tablets or pellets to the surface. This to ensure the gas is homogeneously and rapidly distributed throughout the cargo. Powdery residues cannot be removed.

The re-circulation system consists of a permeable tubular loop placed in the lower part of a hold prior to commencement of loading operations. The tubular loop is connected via an impermeable tube/hose to the headspace of the hold. The mixture of gas and air is circulated by a spark proof ventilator. The pipework and fans are not considered to be of a hazardous nature after use and no specific handling is required at removal.

Recirculation is recommended in holds of more than 10 metres' depth.

vi) Probing sleeve/blanket application with re-circulation – is the fitting of an enclosed powered re-circulation system to the hold and application of metal phosphide in blankets, strips, sachets or sleeves on the surface or probed into the top one or two metres. As for

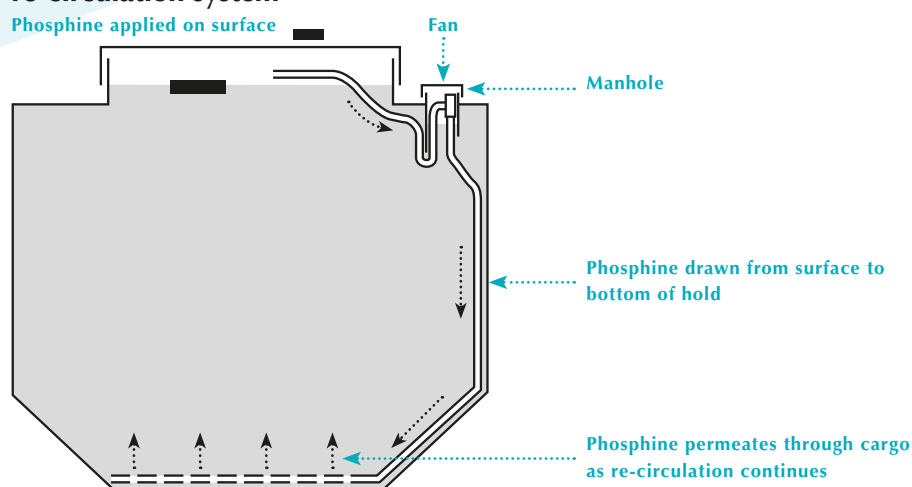
(v) except that with this method, powdery residues can be removed. Also, gaseous residues can be removed more easily than with other methods, as once the powdery residues have been removed the re-circulation system can be used to assist in the evacuation of the gas.

Recirculation is recommended in holds of more than 10 metres' depth.

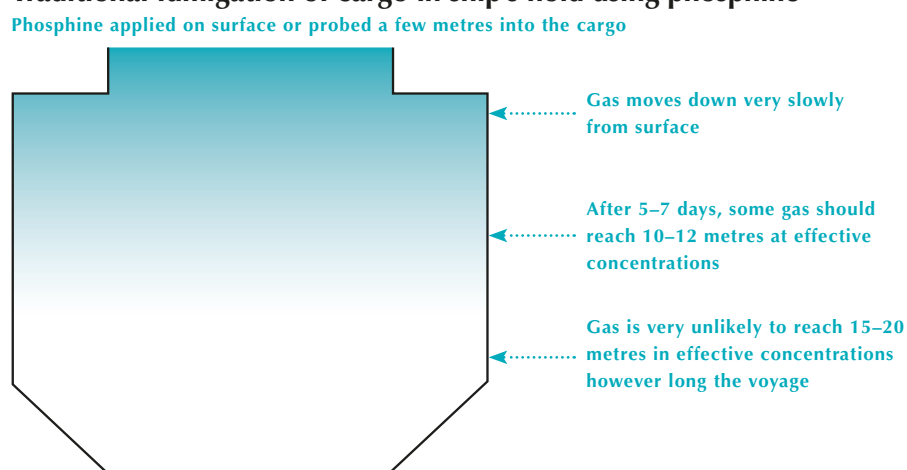
- vii) **Liquid phosphine/pure phosphine gas** – “Pure” or “liquid” phosphine – is the application of phosphine gas from cylinders. As yet not widely used, the phosphine in cylinders must be applied with specialist equipment that mixes the phosphine with air or carbon dioxide in a safe and effective manner to a level below the lower flammability limit of 1.8% (18,000 ppm).

The re-circulation system consists of a permeable tubular loop placed in the lower part of a hold prior to commencement of loading operations. The tubular loop is connected via an impermeable tube/hose to the headspace of the hold, this is to ensure that the gas is homogeneously and rapidly distributed throughout the cargo. The mixture of gas and air is circulated by a spark proof ventilator. The pipework and fans are not considered to be of a hazardous nature after use and no specific handling is required at removal.

Fumigation of cargo in ship's hold using phosphine and a powered re-circulation system



Traditional fumigation of cargo in ship's hold using phosphine



Appendix II – Example of Schematic Fumigation Plan

Vessel Name:

Date of Fumigation:

Place of Fumigation:

Port of Destination:

Fumigant Used:	Aluminium Phosphide (AIP)	Magnesium Phosphide (MgP)	Other:		
Method of Application	Short Probe	Long Probe	Residue retaining x sleeves	Surface application re-circulation	Other re-circulation method

Annotate amounts of fumigant blankets, sleeves, plates, sachets, ducts, pipes or fans placed in each hold:

Hold 1	Hold 2	Hold 3	Hold 4	Hold 5	Hold 6	Hold 7
Volume 0000 m ³	Volume 0000 m ³	Volume 0000 m ³	Volume 0000 m ³	Volume 0000 m ³	Volume 0000 m ³	Volume 0000 m ³
AIP/MgP 00.0 kgs	AIP/MgP 00.0 kgs	AIP/MgP 00.0 kgs	AIP/MgP 00.0 kgs	AIP/MgP 00.0 kgs	AIP/MgP 00.0 kgs	AIP/MgP 00.0 kgs
No. Retaining sleeves:	No. Retaining sleeves:	No. Retaining sleeves:	No. Retaining sleeves:	No. Retaining sleeves:	No. Retaining sleeves:	No. Retaining sleeves:
Total volume = 0000 m³ Total fumigant AP/MP = 00 kgs						

It is hereby certified that the above-mentioned fumigant formulation was applied to the above vessel on (date). After the application of the fumigant all holds were closed and sealed and warning placards posted on all entrances to all fumigated holds. The cargo was treated at the rate of (00) grams of active ingredient per cubic metre of hold space using the (x) method.

Total amount of residue retaining sleeves (if applicable):

Required minimum exposure time:

Estimated voyage time:

Date: Port:

Fumigator-in-Charge: Master:

Appendix III – Properties of Ordinarily Used Fumigants

Molecular weight	Specific Gravity Air = 1	Boiling Point (°C)	Flammability By Volume in Air (%)	Water Solubility ppm	Odour as Gas	Incompatibility – Liquid or Solid	Incompatibility – Gas
Phosphine – (PH ₃)							
34.04 g	1.21 at 0°C 18% heavier than air	-87.4°C	1.79% by volume of air	416 ppm at 17°C (very slightly soluble)	Carbide or garlic-like odour due to impurities, contaminant, ammonia in certain formulation.	Exothermic reaction with moisture or acid. Solid metal phosphide formulations can spontaneously ignite if contacted by water, acids, or chemicals.	Can corrode copper, brass, copper alloys and precious metals such as gold and silver. Can react with metallic salts on photographic film.
Methyl Bromide – (CH ₃ Br)							
94.94 g	3.27 at 0°C three times heavier than air	Non-flammable	Non-flammable	15,444 ppm at 25°C	None (sickly sweet odour in high concentrations).	Contact of liquid with aluminium, magnesium, zinc and alkali metals may result in liberation of toxic gases and possible fire and explosion. Liquid incompatible with plastics, like polyvinyl. Liquid may react with sulphur compounds to create stench.	In high concentrations, gas may react with sulphur compounds to create stench. Decomposes in flame, glowing filament to produce HBr. When pure, non-corrosive to metals.
Sulfuryl Fluoride – (SO ₂ F ₂)							
94.94g	4.18 mg/ml at 25°C and 760 mm Hg- 3.5 times heavier than air	-55°C	Non-flammable	750ppm	None	Contact with liquid should be avoided, can only be introduced through the flow of an introduction fan.	Essentially non-reactive as a gas. Can react on strong bases. Decomposes in flames, glowing filament and temperature >400°C in hydrofluoridric acid

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