

The Control and Safe Use of Fumigants

- Parts One & Two A Code of Practice approved under the Hazardous Substances and New Organisms Act 1996
- Part Three An industry best practice document

Prepared by the Pest Management Association of New Zealand (Inc)

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SUMMARY

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Part One provides an outline of the main features of the HSNO legislation as it applies to fumigation practice. Part Two contains information and guidance about recommended practices and links these into the HSNO system of controls for Fumigants. Part Three contains best practice information linked to the other main legislation involved such as the Health and Safety in Employment Act and the Ozone Layer Protection Act.

The HSNO Act allows for Codes of Practice to be approved by The Environmental Risk Management Authority (ERMA). This code (Parts One and Two) about fumigation practices provides guidance on acceptable practice in the safe use of fumigants used in New Zealand. If the advice provided in this code is followed, employers and others will be taking practical steps to comply with the laws that are applicable. Once a code has been approved by ERMA, it is one means of compliance to ensure safety of workers and the environment.

Parts One and Two will be submitted to ERMA for consideration as an approved Code of Practice under the HSNO Act. Part three will be submitted to the DOL for endorsement as an industry best practice document.

Fumigants, comprising products containing methyl bromide, chloropicrin, dichloropropene, hydrogen cyanide and phosphine (including aluminium phosphide and magnesium phosphide) are regulated under the Hazardous Substances and New Organisms Act (HSNO) and its associated regulations. HSNO sets controls on the full lifecycle of a substance, covering manufacture/importation, storage, transportation, use and disposal. These controls are performance based and therefore specify the outcome that is desired rather than how to achieve them. For users who desire some form of prescription codes of practice provide this. In addition, the requirements of the Health and Safety in Employment Act (HSE) apply to the use of fumigants in the workplace.

This document applies to all fumigation procedures carried on, in, or about buildings, ports, ships, vehicles, and similar locations. It also covers fumigation of shipping containers for quarantine purposes but does not cover the specialized area of soil fumigation in horticultural undertakings. This document provides guidance on steps to be taken to prepare for and during fumigation, including notification requirements, on training and supervision, monitoring methods, exposure limits and standards, personal protective equipment requirements and emergency management.

This document does not include all comment or discussion on every aspect of the safe use of fumigants because to do so would be repeating what is already available in other recognised official documents. Rather the document makes general comment in such cases and includes a reference for readers to consult for the detail.

Users of this code are encouraged to use it in conjunction with the other documents many of which are available on the websites of ERMA New Zealand www.ermanz.govt.nz , and The Department of Labour www.dol.govt.nz .

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Preface

Endorsement: The Control and Safe Use of Fumigants

Part One

1.1 Introduction

1.1.1 Legislative environment and responsibility

Fumigants are highly toxic chemicals that can cause serious harm and death to humans, animals, insects and other living organisms. Because of their toxicity, the use of these chemicals for fumigation is a very effective means of treating produce, buildings and vessels to eradicate unwanted pests. However, the dangerous nature of the substances, and the nature of the fumigation operation itself places a responsibility on those concerned to adopt safe work practices to protect themselves and others who may lawfully be in the vicinity.

The management of fumigant chemicals and their use in fumigation activities in New Zealand is controlled under the Hazardous Substances and New Organisms (HSNO) Act 1996. In addition, workplace health and safety provisions are contained in the Health and Safety in Employment Act 1992 (HSE) and apply to workplaces and work activities¹. The Department of Labour (DOL) (Previously OSH) undertakes the compliance activities for both the HSNO and HSE Acts in places of work.

In addition to this, Civil Aviation Authority and Maritime Safety Authority (MSA) are involved in workplace health and safety, particularly where fumigation occurs in ship's holds (MSA).

Fumigants are also registered under the Agricultural Compounds and Veterinary Medicines Act 1997 and will have a number of registration conditions placed on their use. Users should find these conditions on the label of the containers. A summary of these and other relevant legislation is provided in Part Three.

Persons involved in the fumigation industry, whether they be importers, distributors or users of fumigant chemicals must be aware of their responsibilities to ensure safe health and environmental practices are followed. The work procedures and guidance set out in this code will provide a basis for safe management of fumigants, and lead to a well-informed and responsible fumigation pest control industry.

1.1.2 Who Should Use this Code?

The Hazardous Substances and New Organisms Act (HSNO) is the primary legislation governing hazardous substances. Accompanying the Act is a suite of regulations covering a range of important aspects of hazardous substances management. The over 18 different HSNO Regulations on separate issues, are for the most part, designed to be performance based. They specify the outcomes that are desired, but do not prescribe how to achieve those outcomes. This gives flexibility to use a range of existing and new methods without being constrained by regulation. For users who require some degree

of prescription and assistance in meeting the control requirements, the HSNO Act allows for approved Codes of Practice that indicates how compliance may be achieved. Compliance with a HSNO code of practice is not mandatory, but may be used as a defence in Court.

The HSE Act requirements are extra and are covered in Part Three. This code describes the safe working practices and other controls to be followed in order to maintain health and safety and environmental protection when using fumigants and fumigant generating substances.

1.1.3 Scope

This code applies to the use of all fumigants containing dichloropropene, chloropicrin, hydrogen cyanide, methyl bromide and phosphine (The use of the term phosphine in this code includes all phosphine producing products that have been transferred to the HSNO regime such as aluminium phosphide and magnesium phosphide) that are HSNO approved substances. A list of current trade name fumigants that are approved under HSNO is provided in **ANNEX 1**. This Annex also contains the hazard classification for each substance bringing them into different categories depending on their intrinsic properties. **ANNEX 8** is a guide to compliance for fumigants.

The use of fumigants to sterilise soil is not covered in this code. Readers requiring information about his activity should consult other documents such as NZS 8409:2004 Code of Practice for the Management of Agrichemicals. Readers should also note that the use of methyl bromide as a fumigant is not permitted for soil fumigation.

Other hazardous chemicals can also be used for fumigation, such as formaldehyde, ethylene oxide and sulfuryl fluoride. The practices and procedures provided for in this Code can also apply to the use of these and other substances that have a fumigant type action, and can represent best practice where applicable.

This Code is limited to **the application of fumigants** and provides methods of meeting the requirements of the HSNO Act. It is not applicable to other situations.

This Code is approved by ERMA New Zealand as a code of practice under the HSNO Act for the application of fumigants, as a means for meeting the performance requirements of:

- The Hazardous Substances (Fumigants) Transfer Notice 2004 (as amended), and
- Decision for application HRC08002, and

for the application of fumigants.

Fumigation is a hazardous process, which involves the use of highly toxic gases to kill pests. It is therefore subject to the HSNO Act 1996, and certain HSNO regulations. As the fumigation process is a hazardous operation in terms of worker safety the provisions of the HSE Act also apply. The HSE Act requires any person carrying out fumigations to apply the hierarchy of controls, i.e. elimination, isolation and minimisation. The HSE legislation therefore places duties upon employers to:

- a) Identify hazards involved and if found to be significant control them according to the hierarchy of elimination, isolation, or minimization.

- b) Assess the risks from the use of hazardous substances and take steps to manage those risks;
- c) Prevent or control the exposure of employees and others affected by the work;
- d) Establish and maintain control measures as necessary in compliance with the HSNO legislation;
- e) Ensure that adequate procedures are in place to manage any emergency arising from the use of a fumigant and
- f) Inform, supervise and train employees, in the safe and effective use of fumigants.

As fumigation activities tend to be carried out in different types of locations it is difficult to lay down hard and fast rules to cover all situations. Therefore the person in charge of the place of work where the fumigation is being carried out will need to be well trained and appropriately qualified in correct procedures. A person holding an approved handlers qualification under HSNO will be required.

This revision of April 2011 provides a description of the application of the HSNO Act to fumigation activities as of that date. However, where new hazardous substances, fumigation techniques or other hazards are introduced – or the Code is silent on any matters – reference should be made to the legislation itself and the accompanying regulations.

1.1.4 Interpretation

In this Code, **shall** and **must** indicate that a provision is mandatory in all cases for compliance with this Code and hence HSNO.

Should and **may** suggest that a recommendation be adopted where practical.

1.1.5 Definitions used in this document.

The following definitions may assist in understanding the various terms used in this COP. Other useful definitions may be found in the HSNO Act and suite of HSNO Regulations, and the Transfer Notice for fumigants.

Acute Toxicity	Means a toxic effect, which occurs immediately or shortly after a single exposure
Buffer Zone	Means an area extending outwards in all directions from the perimeter of each enclosed space where fumigation is being carried out, to a distance at which the TEL will not be exceeded. The minimum buffer zone distances for methyl bromide are specified in the table in clause 2.2.3.
Buffer zone period	the period of time starting when the fumigant is first applied to an enclosed space and lasts until the fumigation has ceased. In the case of methyl bromide, the period lasts until air quality monitoring shows that the concentration of methyl bromide in the air are below the limit of detection.
Chronic Toxicity	Means a toxic effect, which occurs after repeated or prolonged exposure. Chronic effects may occur some time after exposure has ceased.

Code	Means this code The Control and Safe Use of Fumigants
DOL	Means the Department of Labour.
EEL	Means an Environmental Exposure Limit. An EEL is the maximum concentration of an ecotoxic substance (or ecotoxic component of a substance) in an environmental medium that will present a low risk of adverse environmental effects to organisms in non target areas.
ERMA or ERMA NZ	Means the Environmental Risk Management Authority of New Zealand.
ERP	Means an emergency response plan prepared in accordance with the requirements set out in the Hazardous Substances (Emergency Management) Regulations 2001
Exposure Level	Means the concentration of fumigant in the air recorded at the monitoring location.
Fumigant	Means a chemical, which at a specific temperature and pressure can exist in a gaseous state in sufficient quantities to be lethal to a pest organism and which is an approved substance under the HSNO Act. The approved substances are specified in Annex 1 of this Code.
Fumigation	Means the use of a Fumigant for the purpose of destruction of rodents, pests, or other plant or animal organisms.
Fumigation Area	Means a ship, shipping container, aircraft, building, fumigation cell, glasshouse, enclosed structure, any covered space, or part therein which fumigation is being or is intended to be carried out.
Fumigation cell	Means a sealed chamber, which may include a shipping container, used exclusively for fumigation.
Fumigation under sheets	Means fumigation carried out under sheets of plastic, tarpaulins, or other materials, but does not include space fumigation in which such sheets are used to isolate the fumigation area.
HSE	Health and Safety in Employment Act 1992
HSNO	Hazardous Substances and New Organisms Act 1996
IMDG	Code International Maritime Dangerous Goods Code.
MAF	Ministry of Agriculture and Forestry
MED	Ministry of Economic Development.
MOH	Medical Officer of Health

Monitoring location	Means the point on land at the edge of the buffer zone that is in the most downwind direction from the enclosed space being ventilated
NZFS	New Zealand Fire Service
PHU	Public Health Unit of the District Health Board
PMANZ	Pest Management Association of New Zealand
PPE	Means Personal Protective Equipment and can include equipment of a variety of sorts used for protection to minimise the health effects of Hazardous Substances when selected for the job after careful assessment of all the factors related to the substance.
ppm	Means parts per million, a standard measure used in testing.
QPS	Quarantine and pre-shipment
Recapture Technology	means a system that mitigates fumigant emissions from fumigation enclosures such that the residual level of fumigant in the enclosed space is less than the Workplace Exposure Standard.
Records of Use	Means the requirement under the regulation 5 of the Hazardous Substances (Classes 6, 8 and 9 Controls) Regulations for a person in charge to keep a written record of each application of a hazardous substance, when the application is in a place where members of the public may lawfully be present or the substance is likely to enter air or water and leave the place.
Risk	Means the likelihood that a substance will cause harm in the circumstances of its use.
Risk Area	Means all adjacent spaces where it is considered that concentrations of the fumigant in excess of the relevant WES may occur.
RPE	Means Respiratory Protective Equipment suitable for protection against fumigant gas.
SCBA	Self-Contained (positive pressure) Breathing Apparatus.
SDS	Means a Safety Data Sheet made available by the manufacturer/importer of all hazardous substances. A document that describes the properties and safe use of the substances prepared in accordance with the HSNO Approved Code of Practice on the Preparation of Safety Data Sheets, NZCIC 2004

Space fumigation	Means fumigation carried out in a building or other enclosed structure, and— (a) Includes fumigation under gas proof sheets of plastic, tarpaulins, or other materials to isolate the fumigation area in a building or other enclosed structure: (b) Does not include fumigation of a ship, shipping container, aircraft, or fumigation in a fumigation cell, or fumigation under sheets.
UNRTDG	United Nations Recommendations on the Transport of Dangerous Goods – Model Regulations
STEL	Means the WES STEL (Short Term Exposure Level) the exposure standard applying to any 15-minute period in the working day that should not be exceeded.
TEL	Means the Tolerable Exposure Limit. A TEL is the (maximum) concentration of a toxic substance (or toxic component of a substance) in an environmental medium that will present a low risk of a toxic effect occurring in people exposed to that substance. TELs protect members of the general public and are not to be used as an exposure limit for a place of work.
Transfer Notice	A notice, published in the New Zealand Gazette, by which hazardous substances covered by the transitional provisions of the HSNO Act are transferred to the main framework of the Act. For fumigants, the transfer notice is the Hazardous Substances (Fumigants) Transfer Notice, <i>New Zealand Gazette</i> , October 2004. Issue No.140. (Three amendments have also been made in October 2004, April 2005 and June 2006.)
TWA	Time Weighted Average over 8 hours. See DOL WES booklet
WES –C	Means the WES Ceiling limit that should not be exceeded during any part of the working day.
WES	Means an airborne concentration of a particular substance in a person's breathing zone. Set in accordance with Regulations 29 and 30 of the Hazardous Substances (Classes 6, 8 and 9 Controls) Regulations 2001. Usually expressed as a TWA meaning the "time weighted average" exposure designed to protect a worker from the effects of long term exposure. These are printed in the DOL publication Workplace Exposure Standards.

1.2 The Management of Fumigants under HSNO

1.2.1 Hazardous Substances and New Organisms Act 1996

The Hazardous Substances and New Organisms (HSNO) Act 1996 reformed and developed new legislation relating to the management of hazardous substances and new organisms in New Zealand. With particular reference to hazardous substances (this summary does not include discussion on new organisms), the HSNO Act replaced the Dangerous Goods Act 1974, the Explosives Act 1957, the Pesticides Act 1979 and the Toxic Substances Act 1979. The HSNO Act now provides for a co-ordinated and integrated approach to the management of hazardous substances and, in particular, provides a management framework that takes account of all the hazardous properties a substance may have.

1.2.2 The Purpose of HSNO

The purpose of the HSNO Act is:

“To protect the environment, and health and safety of people and communities, by preventing or managing the adverse effects of hazardous substances and new organisms”.

HSNO brings New Zealand into line with best international practice in managing hazardous substances. The HSNO Act is administered by the Environmental Risk Management Authority (ERMA), which is an independent body that assesses the environmental and health risks posed by hazardous substances. When a substance is approved by ERMA, controls are placed on the substance to ensure that all environmental and health risks are properly managed.

1.2.3 HSNO Regulations

A series of about 18 Regulations made under the HSNO Act manage the different risks associated with hazardous substances. One set of regulations deals with defining a hazardous substance (Minimum Degrees of Hazard Regulations) while another provides for the levels of the various types of hazards to be classified (Classification Regulations). A third set of Regulations provides for a range of controls to manage hazardous substances in order to minimise adverse effects. The suite of Regulations covers both controls on the hazardous properties of substances and controls on the lifecycle and infrastructure surrounding the substances.

The Regulations most relevant to the management of fumigants under HSNO are:

- Hazardous Substances (Minimum Degrees of Hazard) Regulations 2001
- Hazardous Substances (Classification) Regulations 2001
- Hazardous Substances (Classes 1 to 5 Controls) Regulations 2001
- Hazardous Substances (Classes 6, 8 and 9 Controls) Regulations 2001
- Hazardous Substances (Identification) Regulations 2001
- Hazardous Substances (Packaging) Regulations 2001
- Hazardous Substances (Disposal) Regulations 2001
- Hazardous Substances (Emergency Management) Regulations 2001
- Hazardous Substances (Tracking) Regulations 2001
- Hazardous Substances and New Organisms (Personnel Qualifications) Regulations 2001
- Hazardous Substances (Compressed Gases) Regulations 2004

- Hazardous Substances (Tank Wagons and Transportable Containers) Regulations 2004

In addition to these regulations, a flammable substance may also need to comply with controls in the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 (as amended). Fumigants which have a flammable classification, including methyl bromide, must comply with Schedule 10 of this transfer notice.

Detailed explanation and interpretation of these regulations can be found in the ERMA NZ User Guides to the HSNO thresholds, classifications and control regulations.

Readers should note that regulations and legislation is continually being updated or amended and therefore the ERMA website at www.ermanz.govt.nz should be checked for updated information.

1.2.4 Hazard Classification

All hazardous substances approved under HSNO are assigned a hazard classification. The classification scheme uses an alphanumeric system to describe the process and a matrix chart is available on the ERMA website or in the User Guide to Control Regulations. From this classification, controls are derived from a classification/controls matrix.

The key component of the controls toolbox contained in the regulations is the hazard based classification system. The controls are allocated according to the hazard classification based on the:

- Nature of the hazard or hazards for example, flammability, explosiveness, or toxicity; and
- The degree of hazard, so that strict controls are provided for higher hazard categories.

The hazard classification system is based on the existence of six hazardous properties set out in the Act, which follows international systems. The six are:

- Explosiveness
- Flammability
- Oxidising ability
- Corrosiveness
- Toxicity
- Ecotoxicity

1.2.5 HSNO Controls

Under the HSNO Act the ERMA Authority sets controls on a hazardous substance at the time of its approval. Knowledge about these controls is the key to proper use of hazardous substances and non-compliance with these controls is an offence under the Act.

In setting the controls ERMA will use the regulations, or if appropriate may vary them. As a general rule the higher the degree of hazard classification the stricter the controls will be. Controls on substances with more than one hazardous property will attract controls covering each property. The controls that are imposed are designed to allow for some flexibility in how they can be complied with. This is called the performance based approach where an objective is prescribed but the "how to" comply is left for the user to decide.

Controls on hazardous substances are broadly divided into two types:

- Hazardous property controls focus on the management of specific hazardous properties (explosiveness, flammability, oxidising capacity, toxicity, corrosiveness and ecotoxicity) rather than directly on the management of the substances themselves. The controls for substances with *physical* hazards (explosiveness, flammability, oxidising capacity) are primarily aimed at stopping the hazard from actually occurring e.g. keeping ignition sources away from flammable substances. The controls for substances with *biological* hazards (toxicity, biological corrosiveness and ecotoxicity) are aimed at limiting the exposure of people or the environment to below levels where adverse effects may occur.
- Lifecycle controls are system controls which extend across all types of hazardous property and which focus on the lifecycle management of actual substances.

ERMA NZ maintains a database of controls for approved hazardous substances on their website. This is at:

<http://www.ermanz.govt.nz/search-databases/Pages/controls-search.aspx>

1.2.6 Transfer of Substances

Every hazardous substance imported or manufactured in New Zealand for the first time requires an approval from ERMA. Fumigants were transferred to HSNO on 1 November 2004, by way of the Hazardous Substances (Fumigants) Transfer Notice 2004, *New Zealand Gazette*, Issue No. 140 (October 2004). An amendment on 28 April 2005 made two amendments to include Tracking controls and transitional provisions for importers, manufacturers, and suppliers. A further amendment was made in June 2006 to amend the Tolerable Exposure Level (TEL) for phosphine. This means that all aspects of the management of fumigants, including their importation or manufacture, use, storage and disposal are now managed under the HSNO Act and its accompanying regulations and controls.

Reassessment

Substances are able to be reassessed under the HSNO Act and their controls may be amended as a consequence. A list of substances that have been reassessed is available on the ERMA New Zealand web site at:

<http://www.ermanz.govt.nz/hazardous-substances/reassessments-reviews/Pages/Completed-reassessments.aspx>

Methyl bromide and solutions of methyl bromide have been reassessed. The information concerning methyl bromide in the Gazette Notice is not now applicable as it has been superseded. The controls on methyl bromide and the other fumigants is available from the controls register on the ERMA New Zealand website at:

<http://www.ermanz.govt.nz/search-databases/Pages/controls-search.aspx>

1.2.7 Test Certification

HSNO implements a test certification system. Test certificates are documents that show that a particular situation complies with the controls set down for the hazardous substance. Approved test certifiers issue test certificates. These certificates can be thought of as similar in effect to a warrant of fitness for a car.

1.2.8 Location test Certificate

Unless it is a transit depot, the place where a substance with a classification of 1- 5 i.e. flammable or oxidising, is stored requires a location test certificate if it is stored in excess of 2 hours duration and in quantities that are above the threshold quantity. (See **ANNEX 8** for threshold quantities). In addition to this, operators must notify the relevant enforcement agency at least 30 days before establishment of the location.

1.2.9 Person in Charge

HSNO Act requires that many of the controls for hazardous substances be under the responsibility of a “person in charge”. A person in charge is the person who is in control of a site managing hazardous substances. This may be the owner, lessee, sub lessee, occupier or just the person in possession. It is similar to the person in control of a place of work under the health and safety legislation. Since these responsibilities are a legal requirement it is an offence not to comply and penalties may occur for non-compliance.

The person in charge is responsible for ensuring that the hazardous substances are managed correctly on that site. This may include the requirement for obtaining a test certificate for a site or for ensuring that there is an approved handler.

1.2.10 Controlled Substances Licence

The HSNO Act allows for the requirement that a person holds a licence in order to possess a hazardous substance. This requirement is only added to substances where the risks are very high and it is considered only a fit and proper person should have them in their possession. This licence is very similar to a firearms licence administered by the New Zealand Police.

To obtain a licence, the person must be 17 years of age and over, require the substance for their work, be a fit and proper person and be an approved handler for the substances concerned.

The requirement for a licence applies to all phases of the lifecycle of a substance, including the manufacture, importation, sale, use and storage, but does not apply to the transportation of a substance provided other requirements are met. As fumigants are highly toxic the requirement to hold a controlled substances licence under HSNO applies. Further details on the application of licence requirements to fumigants are provided in Part two 2.1.7.1

1.2.11 Tracking

As fumigants are highly toxic there is a requirement to track them under HSNO. Tracking is the recording of what happens to hazardous substances throughout their lifecycle (i.e. from the point of import or manufacture in New Zealand, through distribution and transport to the point of use and/or disposal). For most substances the lifecycle end point is the use of the substances for its intended purpose.

Tracking also makes sure that there are appropriately trained people responsible for the hazardous substance

Tracking ensures that qualified persons are handling the substances and reduces the risk that a hazardous substance will go astray. Tracking also helps demonstrate that substances that are highly hazardous are being effectively managed as well as compliance with HSNO controls. Further, tracking provides information for managing

emergencies involving the substances. See Part one, 2.2.7 of this COP for more information about tracking.

1.2.12 Exposure Limits

The HSNO legislation provides for three different types of exposure limits:

1. Tolerable Exposure Limits (TELs)
2. Environmental Exposure Limits (EELs)
3. Workplace Exposure Standards (WES)

These exposure limits are enforceable controls under the HSNO Act and the person in charge must ensure that the fumigant is used in a manner that does not result in a concentration which exceeds the TEL value at a location where the general public may be present.

The ERMA New Zealand web site maintains a list of TELs and EELs at

<http://www.ermanz.govt.nz/search-databases/Pages/substance-exposure-limit-register.aspx>

In an area where the WES is exceeded, no person must enter the area unless they are appropriately protected. DoL maintains a list of WESs at

<http://www.osh.dol.govt.nz/order/catalogue/329.shtml>

Exposure limits that have been set for fumigants are discussed further in Part two, 2.2.8

1.2.13 Enforcement

There are a number of enforcement agencies that are involved in the enforcement of the HSNO Act and they have extensive powers to inspect and take action to affect compliance. For instance the Dept of Labour enforces the use of hazardous substances in the workplace. As hazardous substances are usually used in the workplace this is the largest enforcement agency in terms of involvement. Other enforcement agencies include Local Authorities, Ministry of Health, (through the PHU and local MOH) Police, Maritime New Zealand, Civil Aviation Authority, and NZ Customs Service. Specific details about enforcement agencies can be found in Section 97 of the HSNO Act. The development and publishing of this code confirms that the industry is taking responsibility for the safe and effective management of Fumigants.

1.2.14 Managing emergencies

The HSNO Act gives powers to specific agencies to take action at times of an emergency caused by a hazardous substance. The Act defines emergency and sets out the parameters for declaring an emergency. After an emergency has been declared an enforcement officer has wide powers to deal with the situation. There are also provisions for cleanup, compensation, and enquiries into the cause. A more detailed discussion on managing emergencies is contained in Part Two, 2.2.9

1.2.15 Notification of incidents involving Hazardous Substances

The HSNO Act also requires notification of an incident involving hazardous substances, such as fumigants, to be made to ERMA. ERMA maintains a register of incidents involving hazardous substances. An enforcement agency may investigate any incident to determine if an offence has been committed.

Part Two

2.1 Information specific to the use of fumigants

2.1.1 Safe storage

The NZ Standard, NZS 8409:2004 Management of Agrichemicals published by Standards NZ and the Agri-chemical Education Trust provides general guidance on the safe storage of hazardous substances such as pesticides and fumigants. Various Australian/NZ Standards also provide useful advice such as AS/NZS 4452.1997 Storage and Handling of Toxic Substances.

Fumigants must be segregated from other incompatible substances. Refer to Annex 11 of this Code. For instance Methyl Bromide is not compatible with oxidising agents or materials such as perchlorates, chlorines and peroxides. Methyl Bromide attacks aluminium to form aluminium trimethyl, which is spontaneously flammable. Readers are encouraged to also refer to the Hazardous Substances (Classes 1-5 Controls) Regulations 2001 schedules for information about segregation from other classes of substances. For additional information about the controls placed on the storage of flammable substances the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 (as amended) provides essential information.

Five out of the ten fumigants have an associated flammability issue under certain circumstances so they must be kept away from ignition sources during storage. Those fumigants, including Methyl Bromide and 1-3 dichloropropene have a flammability classification that require location test certificates if quantities over the threshold are held. See **ANNEX 8**

Table 1 below sets out ideal storage arrangements for all fumigants and fumigant-generating substances. Where fumigants are stored in a building above the threshold quantity, the building store must have warning signage similar to the example in **ANNEX 4**. This signage must be on entrances to the building and on entrances to a room, if the fumigants are stored in a room. Refer also to the NZCIC HSNO approved COP on "Signage for Premises Storing Hazardous Substances and Dangerous Goods"

Table 1 Storage Conditions for Fumigants

DESIGN OF STORE	Keep away from foodstuffs and human or animal habitation. The storage facility must be designed to be used for the storage of fumigants and other chemicals and designed in such a way that segregation complies with HSNO requirements. This can be achieved by following the HSNO approved Hazardous Substances Storage Code COP 16-1. Available from NZCIC PO Box 5069 Wellington.
SECURITY	Keep store secure and restrict access to nominated personnel for whom RPE is readily available. RPE must be kept off the premises in an outside store in case a leak occurs and action is needed. The HSNO controls for fumigants require them to be under the control of a person who has a Controlled Substance Licence (this requires them to be an approved handler also) or they must be secured under lock and key. (Note Aluminium phosphide or Magnesium phosphide up to 3kg aggregate total does not need a licence)
WARNING SIGN	ANNEX 4 provides the details of warning signage that must be attached to the storage facility
VENTILATION	Provide good general ventilation at all times. Storage facilities must be kept dry and free from moisture.
OTHER CONDITIONS	Keep fumigation materials away from direct sunlight and sources of heat. Keep the store dry and keep fumigant-generating materials in marked waterproof container away from sunlight and direct sources of heat and above the level of any bunding.

2.1.2 Transport requirements

Fumigants and fumigant-generating materials must be transported in accordance with the requirements of the legislation governing transport of dangerous goods, enforced by the Police for Land Transport New Zealand (LTNZ) See NZS 5433:2007 Transport of Dangerous Goods on Land and the Land Transport Rule, Dangerous Goods 2005. (LTDG rule)

Fumigation operators will be required to comply with specific requirements for the transport of Fumigants. These requirements differ depending on the quantities carried and the nature of the fumigant.

For more detailed information readers are encouraged to refer to the NZS 5433 directly, or download a free copy of a guide to the LT DG Rule from the website;

<http://www.transport.govt.nz/assets/NewPDFs/dg-multimodal0805.pdf>

As a general rule operators should always carry gas cylinders, packages of fumigant and associated equipment in a secure way, outside the passenger compartment of transport vehicles. Keep these cargo areas well ventilated at all times and ensure that respiratory protective equipment (RPE) is available in the driver's cab in case of emergency and train the driver in its use. RPE must be kept in a suitable container with the canister/filter

in a sealed plastic bag to ensure it is not exposed to chemicals until needed. Emergency response information is also essential in accordance with section 2.2.9 of this Code.

2.1.3 Fumigants with Flammable Properties

Hazardous atmosphere zones must be established for flammable substances when they are stored in excess of the threshold quantities, refer to Regulation 58 of the Hazardous Substances (Class 1-5 Controls) Regulations 2001. These threshold quantities are specified in Annex 8 of this Code. The hazardous atmosphere zone must be delineated in accordance with NZS/AS 60079.10: 2009: *Explosive atmospheres - Classification of areas - Explosive gas atmospheres*. The hazardous atmosphere zone must be managed such that sources of ignition are excluded and all electrical equipment must be compliance with the Electricity Act and the regulations made under this act.

Flammable substances may still develop hazardous atmosphere zones below the threshold quantities and the implementation of hazardous atmosphere zones for these smaller quantities should be considered.

Schedule 10 of the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 (as amended) specifies the building and location requirements for the storage of flammable substances. These are applicable and therefore must be complied with. Refer to Annex 8 for the threshold quantities.

The Hazardous Substances (Emergency Management) Regulations 2001 require fire extinguishers to be placed within 30 metres of flammable hazardous substances when the quantity exceeds the threshold values. This must be complied with when the threshold values specified in Annex 8 are exceeded. The fire extinguishers must have a rating of at least 30B. Many 2 kg dry powder extinguishers and 9 L foam extinguishers meet this rating. Check the labels on the extinguishers to ensure they comply.

2.1.4 Toxic hazards of Fumigants

The Hazardous Substances (Class 6, 8, and 9 Controls) Regulations 2001 specify the controls to be applied to substances that have biological properties such as toxicity, corrosiveness, or ecotoxicity and is aimed at controlling exposure of people or the environment to levels that may cause harm. All fumigants are highly toxic (Class 6.1).

2.1.5 Disposal considerations

During the hazard assessment process a decision must be made about any requirement to dispose of fumigant residues and old packaging. The provisions of the Hazardous Substances (Disposal) Regulations 2001 must be complied with. These regulations require manufacturers, importers and suppliers to supply details of disposal. This is normally provided on the container label. Fumigation operators must comply with these requirements. In addition to this, the safety data sheets contain disposal information and must be available within 10 minutes for each fumigant.

Most packaging used in fumigation operations will require appropriate disposal either in a landfill, or where allowed by local bylaws, burning after all residues have been cleaned out. Metal containers such as aluminium/ magnesium phosphide flasks must be rendered unusable before disposal by punching holes in them or crushing. Cardboard and paper packaging can be disposed of in the landfill. Where cylinders are used these are normally returned to the supplier for refilling.

2.1.6 Identification Regulations

2.1.6.1 Labelling requirements

All manufacturers must comply with packaging and labelling requirements for hazardous substances under the provisions of the HSNO Act. The Hazardous Substances (Identification) Regulations 2001 set out minimum requirements in respect to information to be printed on or affixed to a package. This will identify the hazards of the substance and how to use or handle it safely. The requirements for labels are not described in this Code as they have particular relevance to parties selling or supplying the substances. Further detailed information can be found in the ERMA approved COP "Labelling of hazardous Substances" by NZCIC.

Labels must be readily available, that is before removing a substance from any container, the person must be able to locate the required information within 10 seconds.

2.1.6.2 Safety Data Sheets (SDS)

Under the Hazardous Substances (Identification) Regulations 2001 all suppliers and manufacturers of hazardous substances must prepare Safety Data Sheets (SDS) about their product, which must be made available to users. SDS includes information about the substance, its chemical and physical properties, health hazard information, precautions in use and safe handling information. The requirements for SDSs are not described in this Code as they have particular relevance to parties selling or supplying the substances. Further detailed information can be found in the ERMA approved COP "Preparation of Safety Data Sheets" by NZCIC.

SDS of all substances used on the job must be available in the work vehicle or on site for ready reference. They must be available within 10 minutes.

2.1.7 Controlled Substances Licence

A HSNO control requires that a person in possession of any quantity² of a fumigant must hold a controlled substances licence. The purpose of a licence, which applies to the most highly hazardous substances and for which the risks are considered to be very high, is to ensure that only a person who is considered to be fit and proper should have them in their possession.

2.1.7.1 Requirements for a Licence

To have a Controlled Substances Licence for fumigants, the holder must:

- be 17 years of age and over;
- require the fumigant for their work
- be a fit and proper person
- be adequately trained to use the fumigant (i.e. be an approved handler).

² Unless the fumigant is aluminium phosphide or magnesium phosphide, in which case, and provided that the person has no other fumigant, a person can be in possession of up to 3 kg without requiring a licence.

In order to hold a controlled substances licence, the holder must require possession of the fumigant for their work. In other words, the holder must have a legitimate work related purpose for possessing a licenced hazardous substance.

In general terms, a fit and proper person is a person of good character who abides by the laws of New Zealand and is likely to continue to do so while in possession of a fumigant. The New Zealand Police are the primary agency for assessing whether a person is fit and proper.

To obtain a licence, a person must have an approved handler test certificate. To be certified as an approved handler, the person must fulfil the competency requirements of the Hazardous Substances and New Organisms (Personnel Qualifications) Regulations, summarised below:

- Be able to explain the hazard classifications and the adverse effects that could be caused by the fumigant, and know and describe the HSNO controls imposed under the Act;
- Generally explain their obligations and liabilities under the HSNO Act, explain which regulations and Codes of Practice apply and know how to access the relevant information. Know and describe any conditions of their approved handler certification.
- Explain the precautions required to prevent injury to a person or damage to the environment and the procedures to respond to an emergency.
- have comprehensive practical experience and have demonstrated the practical skills to be able to handle fumigants or other hazardous substances. This includes being able to demonstrate a working knowledge of the operating procedures (including use of protective clothing and equipment) necessary to manage those hazardous substance(s) relevant to their approved handler certification.

A controlled substance licence will be required if you manufacture, import, sell, store or use a fumigant. If you possess a fumigant for the purpose of transporting it from one licence holder to another (such as a courier or transport firm), then provided you comply with the Land Transport Rule, Maritime Rules or Civil Aviation Rules you do not need a licence. However, the fumigant must be delivered to a licence holder or locked up securely until the licence holder can take possession.

2.1.7.2 Obtaining a Controlled Substances Licence

A controlled substance licence is obtained by application to a test certifier who is approved for their issue. The test certifier will advise you on what you are required to complete and provide as part of your application, including proof of identity and work assessment records. An application form for a licence is available from the ERMA website, or can be obtained from a test certifier. A Guide, Applying for a Controlled Substances Licence, is also available from the ERMA website. A list of test certifiers is available from

<http://www.ermanz.govt.nz/search/test-cert-reg.asp>.

A controlled substances licence would normally last for 5 years, after which time it will need renewal, again by application to a test certifier.

The holder of a licence can have their licence revoked for a number of reasons, including, for example, providing false or misleading information in an application, being

the subject of a Police investigation, or behaving in a way that indicates they are no longer fit and proper.

2.1.7.3 Fumigants Requiring a Controlled Substances Licence

The following fumigants trigger the requirement for a licence. For a list of trade name products associated with these fumigants, refer to **ANNEX 1**.

- 1,3-dichloropropene liquid
- 1,3-dichloropropene and chloropicrin liquid
- Chloropicrin liquid
- Hydrocyanic acid discoid
- Methyl bromide gas
- Phosphine gas
- Aluminium phosphide pellets*
- Magnesium phosphide pellets*

* A person does not need a licence if the aggregate quantity of any one or combination of these products (*) is 3 kg or less.

2.1.8 HSNO Register of Approved Fumigants

HSNO approved substances, including fumigants, are listed on the ERMA New Zealand register. The register can be accessed at:

<http://www.ermanz.govt.nz/search-databases/Pages/HSNO-CCID.aspx>

The register can be searched by the trade name of the substance, using the ERMA substance description or the ERMA approval code. For fumigants transferred on 1 November 2004, this information is provided in **ANNEX 1**.

A report that details the hazard classification can be obtained from the register.

A separate register can be searched to provide the controls for each approved substance. This register can be accessed at:

<http://www.ermanz.govt.nz/search-databases/Pages/controls-search.aspx>

The register can be searched by the name of the substance, the CAS number or the ERMA approval code.

2.1.9 Protective Equipment and Clothing

Protective equipment and clothing must ensure that the person:

- 1) Does not come into contact with the fumigant, and
- 2) Is not exposed to a concentration of the fumigant that is greater than the WES.

Documentation must be retained which:

- 1) Specifies the circumstances in which the equipment or clothing may be used, and
- 2) Includes the requirements for maintaining it.

2.1.10 Useful Reference material

All persons, including approved handlers, persons in charge, test certifiers and trainees either using fumigants or otherwise involved in the fumigation industry should be aware of and have access to copies of the Acts and Regulations referred to earlier.

For a complete understanding of this Code companies engaged in fumigation may find it necessary to consult a wide range of documents that may have relevance. Many can be viewed on the appropriate Internet websites or may be available through libraries or other sources.

The following is a list of relevant documents:

- Hazardous Substances (Fumigants) Transfer Notice 2004. *New Zealand Gazette*, October 2004. Issue No. 140.
- Controls for each approved fumigant. Available from <http://www.ermanz.govt.nz/search-databases/Pages/controls-search.aspx>
- Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 (as amended).
- AS/NZS 60079.10: 2009 Explosive Atmospheres - Classification of Areas – Explosive Gas Atmospheres
- Workplace Exposure Standards DoL 2010 www.dol.govt.nz.
- Globally Harmonised System (GHS) for the Classification and Labelling of Chemicals (published by the United Nations). (The purple book)
- 13th Edition of Recommendations on the Transport of Dangerous Goods Model Regulations UN 2003 (the orange book)
- NZS 5433:2007 Transport of Dangerous Goods on Land
- Land Transport Rule (Dangerous Goods) 2005
- NZS 8409:2004: Management of Agrichemicals
- *Recommendations on the safe use of pesticides in ships* International Maritime Organisation 1993 ISBN 92 801 1306 2
- International Maritime Dangerous Goods Code. Consolidated Edition, 1994. International Maritime Organisation ISBN 92 801 1314 3.
- AS/NZS 1716:2003 Selection, Use and Maintenance of Respiratory Protective Devices.
- AS/NZS 1715:2003 Respiratory Protection Devices
- SNZ HB 76: 2003 Dangerous goods – Initial Emergency Response Guide.
- New Zealand Chemical Industry Council (NZCIC Responsible Care Management System www.nzcic.org.nz)
- HSNO Approved Code of Practice. Signage for Premises Storing Hazardous Substances and Dangerous Goods.
- Code of Practice on the Preparation of Safety Data Sheets NZCIC 2004.
- NZ Chemical Industry Council, *Emergency Management*, Approved Code of Practice under the HSNO Act 1996. Draft, December 2003.
- Fire Service Act 1975 and the Fire safety Evacuation of Building Regulations 2006 (Evacuation schemes) consult www.fire.org.nz
- “Approved Biosecurity Treatments for Goods Directed for Treatment” BNZ – STD – Treat; (2007 version) Approval of Suppliers Providing Treatment of Imported Risk Goods and Forestry /Plant Related Material for Export
- Hazardous Substances Storage Code. HSNO Approved COP 16-1 (NZCIC)
- AS 2476:2008 General Fumigation Procedures
- Agricultural Compounds and Veterinary Medicines Act 1997
- ERMA Methyl bromide reassessment decision HRC08002 Available from the ERMA website <http://www.ermanz.govt.nz/documents/hrc08002-methyl-bromide-decision.pdf>

ERMA New Zealand has published information on their website to assist persons to be compliant with the HSNO controls. This information is at:

<http://www.ermanz.govt.nz/hazardous-substances/using-storing/at-work/Pages/Fumigants.aspx>

2.2 Procedures Common to All Fumigations

2.2.1 Choice of Fumigant

All operators have a duty under the HSNO and HSE Acts to assess whether there are safer alternatives to fumigation, which would be reasonably practicable. Assuming that fumigation is necessary, the choice of fumigant will be determined by the individual circumstances, e.g. the commodities or premises to be fumigated, temperature, target pest and available time. To assist in making the decision useful information on the properties and potential effects of the most commonly used fumigant gases (methyl bromide, phosphine, cyanide and chloropicrin) may be found in **ANNEX 3**. Manufacturer and supplier technical information will also contain essential information.

Use of methyl bromide: Methyl bromide can only be used if authorised for QPS purposes only by MAF, Biosecurity NZ or other relevant government Department. More information is included in section 3.2.1 of this Code.

2.2.2 The Safe Management of Fumigation Operations

Responsible operators are encouraged to carry out a risk assessment process to identify hazards and establish controls to minimise or avoid those hazards before a fumigation operation is started. See **ANNEX 10**.

The purpose of the risk assessment is to determine the likelihood of operators and others suffering ill health through exposure to fumigants. The person in charge, employer and others must take all practicable steps to prevent exposure to the fumigant and ensure a safe place of work at all times. This involves ensuring that others lawfully in the vicinity such as the public must also be considered.

Carrying out a risk assessment for each fumigation exercise and taking into account the particular circumstances should ensure safe management. The risk assessment will result in a set of procedures to be followed during the fumigation exercise. Some of those procedures will be common to all fumigations (e.g. the marking out of fumigation and risk areas), others will depend on the type or form of gas being used (e.g. methods of application) and on the type of premises being fumigated. The following sections give guidance on the various aspects of a fumigation, which needs to be considered in the risk assessment.

Documents such as labels, Safety Data Sheets (SDS) (to be supplied by the supplier of the chemicals), standards, and manufacturer's technical documents and recommendations will be useful and should be consulted prior to the development of company policies and commencement of a fumigation operation.

2.2.3 Defining the Fumigation and Risk Areas

The fumigation area must always be sealed off from other areas and made gas-tight. No one may enter it during the fumigation period, except in a serious emergency such as fire, and then only by agreement with the approved handler in charge of the fumigation. In such circumstances, suitable personal protective equipment, including RPE, must be

worn. If there are any doubts about the need to wear RPE, operators should always err on the side of caution and go for self-contained breathing apparatus.

The approved handler in charge of the fumigation must set the risk area. Only operational staff associated with the fumigation activities are permitted to enter the risk area. The risk area shall only be entered with the permission of the approved handler. Suitable PPE, including RPE, must be readily available and worn whenever there is a risk of leakage or exposure.

The person in charge of the site must set the buffer zone and must:

1. exclude members of the public from this area, and
2. ensure that the fumigant is used in a manner that does not result in a concentration of the fumigant, in air at the boundary of the buffer zone, exceeding the TEL_{air} values.

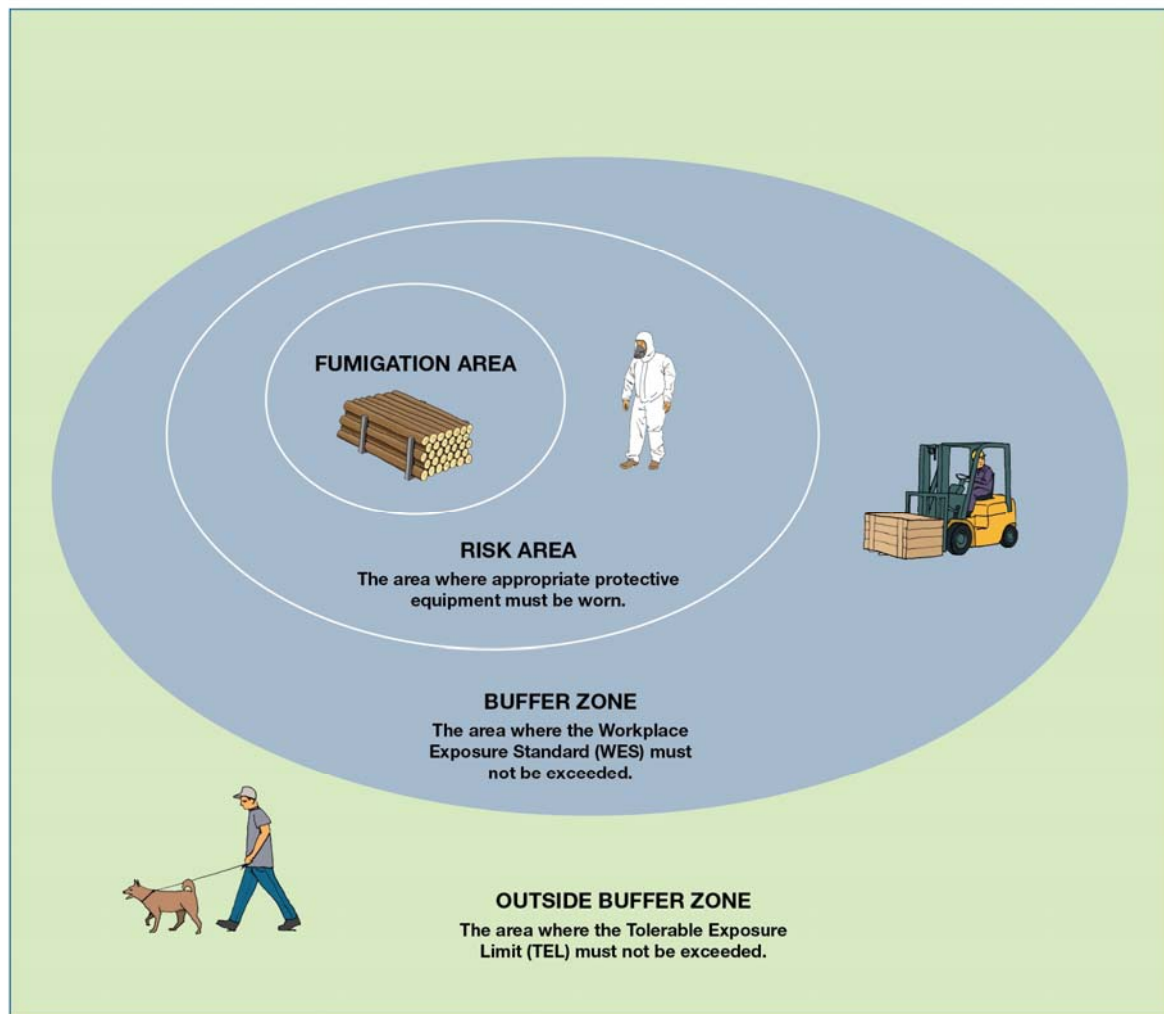
For methyl bromide, the buffer zone distances (the minimum distance between the enclosed space being fumigated and any area where a member of the general public may be present) must be equal or greater than the distances specified in the following table:

Use	Minimum buffer zone (metres)
Ship's hold (1000 kg or more of methyl bromide applied per site in any 24 hour period)	100
Ship's hold (less than 1000 kg methyl bromide applied per site in any 24 hour period)	50
Fumigation under sheets	50
Containers (total volume of 77 m ³ or more in any 60 minute period)	25
Containers (total volume of less than 77 m ³ in any 60 minute period)	10

The person in charge of the site must ensure that the buffer zone is fully secured at all times from unauthorised entry by members of the public and that members of the general public are not in the buffer zone during the buffer zone period. This can be achieved, for example, by having suitably informed security guards and or night watchmen on duty throughout the fumigation at the perimeter of the risk area. Signs must be erected at every entrance to the buffer zone and the signs must be illuminated if the fumigation is occurring during the hours of darkness.

Where a buffer zone extends over water, the person in charge of the site must take all practicable steps to ensure that the water is monitored and, if a member of the general public enters the buffer zone, that the member of the general public moves out of the buffer zone as soon as practicable. The requirement to comply with the buffer zone distances does not apply to a fumigation where recapture technology is used. There is also an additional requirement that no fumigation, including those which use recapture technology, using methyl bromide can occur within 25 m of any sensitive site. A sensitive site means a place where members of the public are likely to be present and are unable to readily evacuate themselves, such as a school, playground, early childhood centre, prison, hospital or long-term care facility.

The diagram below explains the risk area and buffer zone concept in graphic form.



2.2.3.1 Smaller Buffer Zones

Fumigators can use smaller buffer zones if they develop an approved code of practice that is approved by ERMA New Zealand which specifically allows for smaller buffer zones to be used. Such a code of practice would need to demonstrate that an alternative control, for example, by carrying out staged ventilating of ships' holds, would ensure that the TELs would not be exceeded with the smaller buffer zone.

2.2.4 Preparing for Fumigation

Each fumigation company should have a set of comprehensive fumigation procedural guidelines specifically designed for the various fumigants and types of fumigations. This procedure shall set out the minimum requirements to ensure that the fumigation is carried out safely. It will include information that is essential and some that is recommended practice, but overall it must contain all the information about the HSNO controls that apply to fumigants.

Fumigation may only be carried out in a place that is secured against ready access by unauthorised persons.

For all fumigants excluding 1,3 –dichloropropene, chloropicrin and mixtures of these two

- 1) where the fumigant is applied to a shipping container, the container must not be moved during fumigation except that a person may move a container during fumigation from a:
 - (a) wharf to a ship that is berthed at that wharf; or
 - (b) ship to a wharf where that ship is berthed.
- 2) A person may not apply a fumigant in a shipping container unless
 - (a) the container is in good repair and capable of being securely closed; and
 - (b) the container does not leak at any of the temperatures and/or pressures to which the container will be subject to and
 - (c) if the container does leak, it is able to be modified immediately so that it does not leak, for example by covering with one or more gas-proof sheets.
- 3) A person must not apply a fumigant under sheets unless the sheet is:
 - (a) in good repair without tears, rips or visible holes; and
 - (b) made secure against likely weather conditions at the site; and
 - (c) sealed with a border that is filled with heavy material

2.2.5 Special Precautions

Consider any particular precautions, which may need to be taken regarding entry into confined spaces. (A confined space is generally an enclosed space with only one means of entry or exit e.g. grain silo). These may be the whole or part of the intended fumigation area, risk area and/or other work area and there may be hazards other than those associated with release of fumigant. There are special requirements for safe working in confined spaces. These can be found on the DOL website in a publication "Safe Work in a Confined Space" which describes the correct procedures to be adopted when considering work in confined spaces. The standard AS 2865:2009 and AS/NZS HB 213:2003 Hand book – Guidelines for Safe Working in a Confined Space provide additional information. Generally speaking the dangers of incorrect procedures when working in confined spaces is the most hazardous of all activities and has led to many deaths over the years. Often it is not the poisonous nature of the gas involved but the lack of oxygen which does this.

2.2.6 Notification of fumigation operations.

The transfer of fumigants to the HSNO system stipulates the requirement for notification of any fumigation procedure to be made to specific organisations. In accordance with the HSNO controls (see table 2) advance written warning of the fumigation must be given to the following (where relevant):

- The nearest Communications Centre of the New Zealand Fire Service (www.fire.org.nz)
- Person in charge of the place where the fumigation is undertaken
- Port or Airport Authority

These parties must be given not less than 24 hours prior to the commencement of the fumigation. Shorter notification can be given in the case of a bio security or public health emergency, or where the fumigation is undertaken at an established location where such fumigations are routinely carried out. In the case of large fumigation operations (e.g. of

a building), it is good practice to give more advance notice where this is reasonably practicable.

In addition, it is good practice to advise other parties who may have an interest in the fumigation. This may include, for example, MAF Quarantine, Owner/Occupier, Customs Agent, Importer, etc, providing the appropriate information as needed for their co-operation and assistance. Co-operate with N.Z Customs and MAF who may on occasions have an interest in inspection and sealing of shipping containers for international border security compliance.

The notification requirements set out in **Table 2** and **Table 2A** provide ready identification of the notification rules.

Table 2 Notification Requirements for Fumigants except Methyl Bromide

Type of Fumigation	Authority and others who need to be notified
Space fumigation Fumigation of a building, or other enclosed structure	<ul style="list-style-type: none"> • The nearest Communications Centre of the New Zealand Fire Service; and (Auckland, Wellington or Christchurch) • Person in charge of the place
Fumigation of commodities on a ship Fumigation of a ship or aircraft	<ul style="list-style-type: none"> • The nearest Communications Centre of the New Zealand Fire Service; and • Port or Airport Authority (if on port/airport land); and • Person in charge of the place
Fumigation of silos Fumigation of grain or other loose material in small bins, or in bulk on the floor of a building or other structure	<ul style="list-style-type: none"> • Person in charge of the place
Fumigation in a fumigation cell Fumigation in a shipping container	<ul style="list-style-type: none"> • Port or Airport Authority (if on port/airport land); and • Person in charge of the place
Fumigation under sheets	<ul style="list-style-type: none"> • The nearest Communications Centre of the New Zealand Fire Service (if fumigation is in an area where the public may lawfully be present); and • Port or Airport Authority (if on port/airport land); and • Person in charge of the place
Fumigation of mammals underground	<ul style="list-style-type: none"> • The nearest Communications Centre of the New Zealand Fire Service if: <ul style="list-style-type: none"> (a) the fumigation is undertaken on, or adjacent to, land that is close to or adjoins a private dwelling, school, playing field or reserve, or any amenity area, or area where the public may lawfully be present; or (b) the risk area may encroach on any such land or area; and • Person in charge of the place

Note Where fumigations in a fumigation cell, a shipping container or under sheets are carried out at an established location on a routine basis as part of regular work activities, and the location is secured against ready access by unauthorised persons, there is no requirement to notify the fire service each time a fumigation is undertaken provided an initial notification of the first fumigation has been given. In addition, under these circumstances, notification to the person in charge of the place may be given only prior to the fumigation, not 24 hours before.

Table 2A Notification Requirements for Methyl Bromide

(1) A person who applies methyl bromide must notify in writing the relevant persons (specified in the table) of the intention to carry out fumigation at least 24 hours prior to applying the methyl bromide.

Type of application	Relevant persons to be notified
Ship's hold	<ul style="list-style-type: none"> • The nearest communications centre of the New Zealand Fire Service; and • Person in charge of the site.
Sheets	<ul style="list-style-type: none"> • The nearest communications centre of the New Zealand Fire Service; and • Person in charge of the site.
Container	<ul style="list-style-type: none"> • Person in charge of the site.

(2) A person who applies methyl bromide must also notify the occupants of each property within 25 metres of the site to be fumigated at least 24 hours prior to applying the methyl bromide.

(3) However, notification of the persons specified in clauses (1) and (2) may be less than 24 hours if the fumigation is urgent for a reason or reasons relating to public health or biosecurity.

(4) A person who intends to apply more than 100 kg of methyl bromide in a 24 hour period must notify the occupants of each property, including moored boats, within 100 m of the site at least 24 hours prior to applying the methyl bromide.

(5) At the end of the buffer zone period the person who applied the methyl bromide must notify every person required to be notified under clauses (1) to (4) that fumigation is complete.

(6) The requirement to notify persons under clauses (1) to (5) is met if the:

- (a) fumigation is carried out at the site on a weekly basis; and
- (b) the relevant persons are notified of the intention to carry out regular fumigations at the site initially and then again annually setting out:
 - (i) where the fumigation occurs;
 - (ii) the time at which ventilation normally occurs (if this can be specified);
 - (iii) the expected frequency of fumigation; and
 - (iv) any likely seasonal trends.

Clauses (2), (3), and (5) do not apply to a fumigation when recapture technology is used.

2.2.7 Tracking

All fumigants are required to be tracked under HSNO requirements. Tracking is the recording of what happens to a fumigant throughout its lifecycle, from the point of import or manufacture in New Zealand, through distribution and transport to the point of use and/or disposal. The person in charge of a site where a tracked substance is kept is responsible for keeping the necessary records.

2.2.7.1 Information to be recorded for tracking purposes

Tracking commences at the premises used by manufacturer if the substance is manufactured in New Zealand or at the port if the substance is imported. If the substance is imported, the normal UN or ICAO transport documentation relating to the shipment will be acceptable records up to the importer's premises, or person storing the substance on behalf of the importer.

Before a fumigant is transferred to another location the person in charge responsible for the transfer must ensure that:

- The site receiving the tracked fumigant has a person holding a controlled substances licence who will take responsibility for the fumigant;
- If the fumigant is flammable, the receiving premise has a location test certificate (if required, dependent on quantities of the fumigant involved);
- Any place the substance is to be held during transit complies with the emergency requirements and transit depot requirements of the hazardous substances regulations.

The tracking records that are required to be kept, and the form these records could take are summarised in Table 3. In many cases, normal commercial records are acceptable providing they are readily accessible if required.

2.2.7.2 Availability of Records

The information identified in Table 3 needs to be readily retrievable. It must be available to a person within 10 minutes of requiring the information. An enforcement officer entering the site must be able to identify the location and quantity of a substance within 2 minutes of viewing the record. If multiple record systems, such as a database and hard copy records are used, they will need to be cross-referenced to ensure all the information is retrievable. The documentation must be readily understandable to any fully trained person required to have access to it.

Tracking records must be kept at least 12 months after the fumigant has been transferred; or three years in the case of use, treatment or disposal of the fumigant.

Additional information on tracking is available in the ERMA Quick Guide on Tracking

A properly kept business record of amount used, date of use, location etc as required for tracking under the HSNO legislation and is described in section 2.2.12.6 Records of Fumigation.

Table 3: Tracking Records Required

Record requirements	Example record	Who keeps the record?
<p>Licence holder in possession of the fumigant</p> <ul style="list-style-type: none"> • The person's name and position within the organisation; • The physical address of the person's place of work; and • The fumigant and phases of the lifecycle for which the person is approved. 	<p>A copy of the persons Controlled Substance Licence held on file, the name and physical address of the organisation</p>	<p>Person in Charge of the place</p>
<p>Substance information</p> <ul style="list-style-type: none"> • Unequivocal identification of the fumigant such as the trade name, common name or the ERMA approval name and number. • The total quantity of the fumigant under the control of the licence holder at any one time. This record will change daily with substances being received and dispatched. • Location of Tracked Substance i.e. where exactly the fumigant is stored within the depot or building. • Batch or package number (where required). 	<p>Delivery dockets, stock records; electronic database systems; and/or other hard copy records</p>	<p>Person in Charge of the place</p>
<p>Transfer to another place</p> <ul style="list-style-type: none"> • Unequivocal identification of the fumigant and the amount transferred; • Address of the place and the identity of the licence holder (including the Controlled Substances Licence number if available) to whom the substance is being sent; • Position of the licence holder within their organisation; and • Date on which transfer occurred. 	<p>Consignment/stock records; electronic database systems; Persons Controlled Substances Licence; Location/stationary container certificate; and/or other hard copy records</p>	<p>Person in Charge of the place sending the fumigant</p>
<p>Transport</p> <ul style="list-style-type: none"> • As per the Land Transport Act and Land transport Rule (Dangerous Goods) requirements. 	<p>A consignment note and a Dangerous Goods Declaration</p>	<p>Person in Charge of the vehicle</p>
<p>Lifecycle endpoint (use, treatment or disposal, including accidental spills)</p> <ul style="list-style-type: none"> • The manner of disposal i.e. how the fumigant was used, consumed or released etc; • The amount of fumigant disposed of and the date of disposal; • The location where the fumigant was disposed of. 	<p>Electronic database systems; and/or other hard copy records</p>	<p>Person in Charge of the place where the use or disposal occurs</p>

2.2.8 Exposure Limits and Standards

2.2.8.1 Tolerable Exposure Limits

TELs are the maximum concentration of a substance (or toxic component of a substance) that is legally allowable in a particular environmental medium (such as air, soil, water). They are a concentration that will present a low risk of a toxic effect occurring in people exposed to that substance. In addition TELs should not be used as exposure limits for the workplace. TELs are provided for in the Hazardous Substances (Classes 6, 8 and 9 Controls) Regulations 2001 Regulation 24-27.

Details of the TELs for fumigants are given in **Table 4** below. TELs may be amended from time to time, so persons undertaking a fumigation operation should ensure that they keep up to date with changes by reference to the latest information from ERMA.

To assist monitoring of compliance with the TEL, the person in charge of the facility where regular fumigation occurs must either:

- a) know and be able to demonstrate that the TEL is not exceeded; or
- b) conduct dispersion modelling as a means of demonstrating compliance with the TEL.

Dispersion modelling can demonstrate whether the TEL is met by calculating an acute exposure level for each individual fumigation operation. The total annual average exposure can then be calculated by totalling the number of individual exposures in a year. In this way the number of individual fumigations can be limited to maintain the annual average exposure below the TEL.

This would be described as the number of fumigations, of specified types, that can be performed in one year (e.g. container fumigations vented with no vapour recovery, log fumigations, etc).

The exposure limits for methyl bromide include limits for 1 hour and 24 hour in addition to a limit for chronic exposure:

1 hour exposure level means the average exposure level for each 60 minute time period from the start of ventilation until the end of the buffer zone period .

24 hour exposure level means the average exposure level for each 24 hour time period from the start of ventilation until the end of the buffer zone period .
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Annual exposure level means the total hour exposure level recorded over a calendar year and averaged over 365 days.

2.2.8.2 Environmental Exposure Limits

EELs are the maximum concentration of an ecotoxic substance (or ecotoxic component of a substance) in an environmental medium that will present a low risk of adverse environmental effects. At the present time, no EELs have been set for fumigants.

2.2.8.3 Workplace Exposure Standards

The most applicable controls for workplace use of fumigants is the Workplace Exposure Standards (WES) [refer to regulation 29 and 30 of the Hazardous Substances (class 6, 8 and 9 Controls) Regulations 2001]. These are available on the DOL website

http://www.osh.dol.govt.nz/publications/booklets/wes-dec-2010/wes_01.asp

are amended from time to time so employers and others involved in fumigations should keep up to date with any changes.

Table 4 TELs and WES Values for Fumigants

Component of fumigant	TEL _{air}		WES
	ppm	Mg/m ³	
Methyl bromide	1 hour	1	8 hour TWA: 19mg/m ³ (skin ³) or 5 ppm
	24 hour	0.333	
	Chronic (annual average)	0.0013	
		.005	
Hydrogen Cyanide	0.009 mg/m ³ (chronic exposure)		Ceiling level 11 mg/m ³ (skin ³) or 10 ppm
Phosphine	0.0003 mg/m ³ (chronic exposure) 0.01 mg/m ³ (ceiling level)		8 hour TWA: 0.42 mg/m ³ or 0.3 ppm 15 minute STEL: 1.4mg/m ³ or 1ppm
Chloropicrin	0.0004 mg/m ³ (chronic exposure)		8 hour TWA: 0.67 mg/m ³ or 0.1 ppm
1,3-dichloropropene	0.02 mg/m ³ (chronic exposure)		8 hour TWA: 4.5 mg/m ³ (skin ³) or 1 ppm

WES are set to provide guidance on airborne concentrations in the workplace that should prevent adverse health effects. The WES should not be seen as boundaries between 'safe or not-safe', as individual susceptibility is wide it is possible that some workers may develop adverse health effects at levels below the WES. In all cases, workplace exposures should be kept as far below the WES as is practicable. There are 4 different kinds of WES:

- WES-TWA : an average over 8 hours. If the exposure or shift is greater than 8 hours, the WES must be adjusted to account for the longer exposure period and shorter recovery time.
- WES-STEL: The 15 minute average exposure.
- WES-GEL: Where there is not enough toxicological data to establish a STEL, a level of 3 times the 8 hour TWA is to be used as the 15 minute WES.
- WES-Ceiling: A one off concentration that should never be exceeded at any time.

For substances that can be absorbed through the skin, caution must be taken when applying the WES, as the WES only refers to airborne concentrations and does not

³ the reason for skin notation is to alert people to the fact that if they are getting exposed via skin as well as air then the airborne level may be underestimating their exposure.

account for additional exposure via the skin. In this case, airborne monitoring may underestimate exposure and the WES may be too lenient.

It is not appropriate to use the WES to determine public exposure risk as WES apply to healthy, working adults and does not include the very young, elderly or ill.

2.2.9 Managing Emergencies

The HSNO Act has requirements for operators to ensure that any emergency arising during a fumigation operation is managed at all stages of the operation to alleviate any ongoing effect on workers involved in the process, on people lawfully in the vicinity or on the environment.

Under the HSNO controls, details are contained in the Hazardous Substances (Emergency Management) Regulations 2001. These provide for three levels of management depending on the quantities of substances that are held.

- Level 1 requires basic first aid information and contact details if an emergency occurs. These must be available on the container label.
- Level 2 requires SDS documentation, which must be available within 10 minutes and also fire extinguishers.
- Level 3 requires signage, Emergency Response Plans, and containment of spills.

All fumigation operators must have Emergency Response Plans prepared and in place for each fumigation. This will normally be included in the company's operational manual or policy documents. An ERP is designed to evaluate and prepare for an emergency before it occurs and also covers what to do in an emergency.

Ensure the on-site availability of emergency services information, together with all emergency contact numbers, for use by those services in the event of an incident. Information about medical treatment must also be available on site.

Operators must have a detailed emergency procedure guide which sets out the actions to take in the event of an emergency. These procedures should be reviewed regularly using scenario-based techniques to ensure any likely incident is covered. A useful reference is the NZCIC Code of Practice on Management of Emergencies.

The emergency response plan must:

1. Describe all of the reasonably likely emergencies that may arise from the breach or failure of the controls.
2. For each reasonably likely emergency:
 - a. Describe the actions to be taken to—
 - a. warn people at the place, and in surrounding areas that may be adversely affected by the emergency, that an emergency has occurred; and
 - b. advise those people about the actions they should take to protect themselves; and
 - c. help or treat any person injured in the emergency; and
 - d. manage the emergency so that its adverse effects are first restricted to the area initially affected, then as soon as practicable reduced in severity, then if reasonably possible eliminated; and

- e. if any of the substances concerned remain, re-establish the controls imposed on it when it was approved; and
 - (b) Identify every person with responsibility for undertaking any of the actions described in paragraph (a) (or any part of any of those actions) and give information on—
 - a. how to contact the person; and
 - b. any skills the person is required to have; and
 - c. any actions that person is expected to take; and
 - (c) specify—
 - a. how to obtain information about the hazardous properties of and means of controlling the substance or substances that may be involved; and
 - b. actions to be taken to contact any emergency service provider; and
 - c. the purpose and location of each item of equipment or material to be used to manage the emergency; and
 - d. how to decide which actions to take; and
 - e. the sequence in which actions should be taken.
3. The emergency response plan must specify the type and location of the fire extinguishers.
4. and must describe all equipment, materials and

The emergency response plan must be made available to every person responsible for executing any or all of the plan. It must be tested at least every 12 months and within 3 months of a change in the procedure, person or action specified in the plan.

Reference can be made to the ERMA emergency response flip chart at

<http://www.ermanz.govt.nz/Publications/ERMA-Flip-Chart.pdf>

2.2.9.1 Major Leakage

In the event of an emergency during fumigation, for example if a delivery pipe breaks or becomes disconnected and leakage of fumigant occurs, wear RPE and if it is safe to do so, close the main cylinder valve (if the fumigant is being released from a cylinder) and then withdraw from the risk area. In the event of a major leakage call the emergency services to inform them of the situation and seek their assistance. After a period of ventilation and wearing RPE, check the concentration of fumigant in the risk area. No unprotected person may enter the risk area until the concentration is below the WES.

2.2.9.2 Fire or Hazardous Substances Emergency

If a fire or hazardous substances emergency occurs in or near a fumigation or risk area the Fire Service should be called using the 111 system. The Communications Centre should be told which fumigant (preferably including its UN number) is being used. On arrival the Fire Service will take charge of the incident but will need information (SDS, Approved Handler) on managing the hazards of the fumigant. Ensure that people in the vicinity are evacuated to safety. The Fire Service Officer in Charge is required to stabilise the situation and render the scene safe. To do this the person in charge or approved handler must be able to ensure safety within the risk area by the use of test equipment if appropriate.

2.2.9.3 People Affected by a Fumigant

Remove anyone who may have been affected by a fumigant into the fresh air. Seek medical advice and show the product label or SDS to the doctor. If breathing stops or shows signs of failing, administer artificial respiration using oxygen and a suitable mechanical device such as a bag and mask. **Do not use mouth-to-mouth resuscitation.** **ANNEX 3** provides further advice on how to deal with those who may have been affected by methyl bromide or phosphine.

2.2.10 Additional safety procedures before commencing the fumigation

Before any fumigation is commenced the following additional issues must be checked;

- Provision of appropriate RPE, which is suitable for the type of fumigant being used (Part three, 3.5).
- Monitoring equipment, which is suitable for the fumigant, and which has been properly calibrated and maintained (Part three, 3.3)
- PPE for all staff. (Part three, 3.5)
- Arrangements have been made to handle any emergency that may arise during the fumigation, such as provision for resuscitation and emergency treatment (see 1.2.14).
- The availability of suitable antidotes for the fumigants being used. This may require consultation with the hospital or ambulance service.

2.2.11 An Approved Handler must take the following precautions as a minimum:

- a) Evacuate the fumigation area (removing and securing any non-target animals, plants etc) and restrict the risk area to fumigation operators;
- b) Remove absorbent liquids, water supplies and foodstuffs and, where possible, other absorbent solids (other than those intended to be fumigated) from the fumigation area (e.g. bedding);
- c) Extinguish fires and naked lights; remove other sources of ignition (and allow hot elements to cool) in the fumigation and risk areas;
- d) Seal the fumigation area, checking for unusual escape routes for the gas, e.g. sumps, drains, holes around ducting, ducting shafts, pipe work, connections behind false ceilings etc; Shut down ventilation equipment.
- e) Disconnect any unnecessary electrical supply to the fumigation area;
- f) Secure the risk area against unauthorised entry; Collect all keys or ensure that key holders are aware of the fumigation by written advice and signage;
- g) Erect site warning notices at the fumigation area and all points of access to the risk area. These must be adequate size and be visible at all times from a reasonable distance in the circumstances that prevail for each specific fumigation site. All notices must comply with the HSN0 control on signage; (See also **ANNEX 6** for examples of signs suitable for fumigation).
- h) If undertaking fumigation of a ship extra care must be taken to ensure that there are no stowaways or unauthorised people on board. Checks of all areas of a ship where persons could be must be undertaken;
- i) Ensure that sufficient emergency equipment such as portable resuscitators (and oxygen if required) is available on site. Information about the correct emergency treatment for the fumigants being used must be visible and available on site.

2.2.12 Actions to be Taken During and After the Fumigation

2.2.12.1 Applying the Fumigant

Operators will need to take the following actions for the fumigation:

- a) They should restrict the amount of the fumigant to the minimum necessary to carry out the fumigation both effectively and safely, albeit in compliance with MAF Quarantine rates as directed; and/or any other rates prescribed by a 'Country of Import' (e.g. Australian Quarantine Inspection Service AQIS).
- b) They must check for and repair any leaks from the fumigation area or the application equipment and piping outside the fumigation area, especially at joints and couplings. Use a suitable detection device for monitoring (see Best Practice Document, Section 3.3 Monitoring and Equipment). If leaks are detected, an operator wearing RPE must deal with it before the fumigation is continued. If it is not possible to seal a leak, extend the fumigation and risk areas; and
- c) If atmospheric monitoring indicates that there is no leakage and the risk area can safely be reduced, operators should consider allowing normal work to resume in parts of a building previously evacuated and absent of fumigant. Conversely, if the risk area has to be extended, additional areas must be evacuated where necessary.

2.2.12.2 Following Application of the Fumigant

Following application, equipment and surplus fumigant must be removed from the site:

- a) Ensure that any cylinder valves are closed and valve caps and helmets are in position;
- b) Ventilate all equipment and inspect it for residues while wearing appropriate RPE and PPE before loading it into transport or placing it in store; and
- c) Remove any contaminated clothing and equipment (including RPE) and air it in a well-ventilated place until free of fumigant.
- d) During phosphine fumigations, skin and hair may have been contaminated by spent phosphide dust. This spent dust is largely made up of inert harmless carrier compounds but to err on the safe side brush all residues off in a well-ventilated place after work and before washing, eating, drinking or smoking.

2.2.12.3 Venting Procedures

Ventilate the fumigation area and risk area at the end of the fumigation period and test the atmosphere until residual concentrations of the fumigant are as low as possible and at least to below the relevant WES (see 2.2.8.3).

The person, who carried out the fumigation, and wearing appropriate RPE, should do this. Take special account of materials in the fumigation area, which may continue to release small amounts of gas after the fumigation operation is over. An approved handler must be satisfied that all areas are safe for reoccupation.

If there are enclosed vessels or confined spaces in a fumigation area, do not enter them but pay particular attention to checking that they are clear of gas, with forced ventilation if necessary.

Where work requires entry into the fumigation area before thorough ventilation (e.g. to aid ventilation of large buildings, ships etc), the use of positive pressure self-contained

breathing apparatus must be used. A filter/canister, which has a more limited protection capacity, is not to be used in this situation.

Always take care when venting enclosed spaces, such as shipping /freight containers where it is not possible to sample the air throughout the fumigation space. When necessary to ensure safe conditions, install fans to aid ventilation. Refer to 2.2.14.7 of this COP for more detailed information about fumigation and ventilation of freight containers.

The dissipation of gases and the dilution rate available is influenced by the atmospheric and meteorological conditions at the time of ventilation. This may change due to circumstances i.e. windy conditions versus calm conditions, sunlight, and the site of fumigation. Generally speaking methyl bromide and phosphine will dissipate readily once released but operators must be aware of the likelihood of changed atmospheric conditions, which may cause a build up of gas residues in the local area. Ventilation must be managed to control the levels of the fumigant outside of the risk area in accordance with 2.2.3. The emergency plan prepared as part of managing emergencies (see 2.2.9) must include provision for monitoring and mitigation of any hazardous build up of gas that may occur.

2.2.12.4 After Venting

Following venting of the risk area, operators must:

- a) Remove equipment from the site:
 - Air off gas proof sheeting until free of fumigant before folding, rolling, and storing for future use. Similarly, air off unwanted sheets before disposal.
- b) Dispose of empty tins, containers and residues in accordance with the requirements of the Hazardous Substances (Disposal) Regulations and the label directions. See also section Part two, 2.1.5 on disposal.
 - In the case of a fumigation using phosphine, the residues remaining at the end of the fumigation consist of inert metal hydroxide and a small amount of unreacted metal phosphide, which will continue to decompose and generate phosphine very slowly. Remove these residues from the fumigation and risk areas and render them safe for disposal, e.g. by total immersion in water containing 2% detergent by volume (to aid mixing) until gas is no longer generated.
 - Avoid heaping spent packets of loose phosphide residues or closing them in any receptacle or plastic bag as this may result in fire or an explosion.
 - Remove and air off any contaminated clothing and equipment.
 - Brush skin and hair free of spent phosphide residues.

Ensure HCN discoids are removed from the fumigation area. Collect spent discoids in plastic rubbish bags. Burn or bury in compliance with local refuse disposal bylaws.

Each person who carries out:

- space fumigation,
- fumigation in a glasshouse, ship, commodities on a ship, aircraft, silo
- fumigation of grains or loose material in small bins or in bulk on the floor of a building or other structure
- fumigation in a fumigation cell, shipping container or under sheets

must take all reasonable steps to ensure that the fumigation area is properly ventilated so that at the completion of the fumigation

1. in the opinion of the approved handler, fumigant used to carry out the fumigation has dispersed from all parts of the fumigation area (including all confined spaces in the fumigation area), and
2. the maximum concentration of the fumigant used in the risk area is reduced to the lower of:
 - a. the workplace exposure standard or
 - b. the lowest level practicable.

Prior to allowing any person access to the risk area, the approved handler must be satisfied that the risk area is safe for such persons to enter it.

2.2.12.5 Certificate of Clearance

The HSNO controls require that when complete, the person carrying out the fumigation must give notice of completion to those parties originally notified (see Section 2.2.6) This notification can be done by way of a “certificate of clearance”, which can also be provided to other parties concerned with the fumigation. Each individual operator should develop their own procedures to ensure that clearance has been issued and all safety issues addressed. An example of a certificate of clearance is provided in **ANNEX 7**.

A certificate of clearance must only be issued when all areas have been demonstrated to be safe for reoccupation.

Where confined spaces or enclosed vessels are involved, ensure that the certificate of clearance makes it clear that if the confined space or enclosed vessel is resealed, traces of gas may desorb slowly and accumulate so that it may no longer be safe to enter without further ventilation.

After the certificate of clearance has been issued, remove any barriers and warning notices. These must not be removed until a certificate of clearance has been issued.

2.2.12.6 Records of Fumigation

The HSNO controls require certain information to be recorded in certain situations. The key driver for information recording is the requirement for fumigants to be tracked (see paragraph 2.2.7). In addition, some fumigation procedures require that a record of use is maintained when there is the potential for public or environmental exposures outside of the fumigation area (for example, during venting). HSNO requires that records of use be kept for a period not less than 3 years.

In practical terms, one means of compliance with tracking and records of use controls can be achieved by maintaining a register. It is already common for fumigators to maintain a register as part of their standard business practice, if only for commercial reasons. The use of such a register to record information for HSNO purposes will aid in compliance with the legislation and controls, and must be undertaken as standard for compliance with this Code.

Information to be recorded, which is complementary to the information requirements for tracking, should include:

- Details of the fumigation (e.g. of a ship, building etc), and related particulars;
- Name and address of the fumigator and licence holder;
- Parties notified of the fumigation;

- Fumigant to be used;
- Amount to be used;
- Date/time fumigation was commenced and completed;
- Details on the issue of a certificate of clearance.

Where fumigations are carried out for bio security reasons MAF requires specific information to be recorded. The base information should include such information as date, location, client, procedure, fumigant used and quantity, operator, and any other relevant details about the event. MAF will require further details such as treatment certificate number, product type, shipping details, etc. Refer to MAF Standard Approved Biosecurity Treatment for goods directed for treatment, BNZ-STD-TREAT 2007 version.

When methyl bromide is used as the fumigant, specific records must be kept as follows:

- (1) Where recapture technology is used, the:
 - (a) date and time of each application and recapture;
 - (b) location where the methyl bromide was applied and recaptured;
 - (c) amount of methyl bromide applied and recaptured;
 - (d) type of enclosed space to which the methyl bromide was applied;
 - (e) capacity of the enclosed space; and
 - (f) name of the person using methyl bromide and the physical address of their place of work.
- (2) Where recapture technology is not used, the: -
 - (a) date and time of each application and ventilation;
 - (b) amount of methyl bromide applied;
 - (c) location where the methyl bromide was applied and ventilated;
 - (d) wind speed and direction every 3 minutes at the location during ventilation;
 - (e) type of enclosed space to which the methyl bromide was applied;
 - (f) capacity of the enclosed space;
 - (g) name of the person using methyl bromide and the physical address of their place of work;
 - (h) for each monitoring location, exposure levels; and
 - (i) for each monitoring location, the type and location of the monitoring equipment used to record the exposure levels.
- (3) For each discharge of methyl bromide, the:
 - (a) date and time of each discharge;
 - (b) approximate amount of methyl bromide discharged;
 - (c) location where the methyl bromide was discharged;
 - (d) approximate wind speed and direction at the location when the discharge occurred;
 - (e) where the discharge occurred from;
 - (f) the reason why the discharge occurred;
 - (g) capacity of the enclosed space; and
 - (h) name of the person using methyl bromide and the physical address of their place of work.
- (4) The data required to be recorded by clause 2, must be recorded every 3 minutes from the start of ventilation until the exposure level is below 0.05 ppm for at least:
 - (a) 15 minutes, where 7 kg or more of methyl bromide is applied in a one hour period; or
 - (b) 3 minutes where less than 7 kg of **methyl** bromide is applied in a one hour period.

1 hour and 24 hour exposure levels	
(1)	(1)_ The person in charge of the site must, for each monitoring location, keep a record of the following information for every ventilation: 1 hour exposure level; and 24 hour exposure level.
(2)	(2) The person in charge of the site must notify Department of Labour and the relevant Medical Officer of Health as soon as practicable, but within 5 working days, if either the:
	(a)_ 1 hour exposure level exceeds the 1 hour TEL _{air} value for methyl bromide; or
	(b) 24 hour exposure level exceeds the 24 hour TEL _{air} value for methyl bromide.
Record keeping	
The records must be kept for not less than 7 years after the date that the fumigations to which they relate occurred and be available for inspection.	

2.2.13 Extra Precautions for Specific Fumigants

The following precautions are the recommended procedures for fumigations involving the application of methyl bromide, phosphine and cyanide. Similar principles may also be applicable to the use of other fumigants.

2.2.13.1 Methyl Bromide

Release from cylinders as a liquid

Locate cylinders outside the fumigation area, unless application is to be carried out by automation i.e. specially designed chambers/cells. Apply the fumigant through piping terminating in symmetrically placed spray devices. Methyl bromide must **never** be applied manually inside the fumigation area. If the pressure in the cylinder is below 10-15 bar and needs to be increased, use compressed nitrogen or other inert gas rather than compressed air, since oxygen and water vapour in the air will react with the methyl bromide.

Ensure that piping and fittings are compatible with the pressure of the methyl bromide in the cylinders.

Before disconnecting an empty cylinder and connecting a new one to the piping system, close the empty cylinder and purge the pipe work. This must also be done at the end of the fumigation and the piping sealed.

Methyl Bromide must only be applied into an enclosed place.

Release from cylinders using heat exchangers/vaporisers.

Locate vaporiser outside the fumigation area. Liquid fumigant should always be passed through a vaporiser to form a gas, which is then piped to the fumigation area. Do not allow liquid methyl bromide to pass into the distribution hose. A liquid trap may be fitted on the outlet side of the vaporiser to prevent this.

Where the vaporiser design includes a liquid trap, take particular care when disconnecting the apparatus, as all the liquid may not have evaporated. By adjusting the flow of liquid from the cylinder, accumulation of liquid in the trap can be avoided.

Air quality monitoring

Air quality monitoring is required for all fumigations using methyl bromide where recapture technology is not used. The purpose of air quality monitoring is to check compliance with the TEL values. This monitoring can be carried out using a photoionization detector (PID) (more detail is outlined in section 3.3.2.3).

Air quality monitoring must be carried out at the downwind edge of the buffer zone and should start from the beginning of the ventilation and continue at 3 minutes intervals until such time as air quality monitoring indicates that concentrations are below the limit of detection (<0.05ppm) for 3 minutes if less than 7 kg methyl bromide is being used per hour and 15 minutes if more than 7 kg methyl bromide is being used.

These data must be recorded and appropriately averaged so they can be compared to the 1 hour, 24 hour and annual average TEL values. More information about air quality monitoring requirements for methyl bromide fumigations can be found on the ERMA website at www.ermanz.govt.nz. In addition, the Stakeholders In Methyl Bromide Reduction (STIMBR) have published guidance on how air quality monitoring should be carried out. This guidance is available in appendix P of the following document.

<http://www.ermanz.govt.nz/search-databases/hsno%20application%20register%20documents/methyl%20bromide%20appendices%20to%20t.pdf>

Annual Monitoring report

The person in charge of a site where 500 kg or more of methyl bromide is utilized in one calendar year must produce an annual monitoring report. This is applicable irrespective of whether recapture technology is used.

The annual monitoring report shall contain the following information in respect of the calendar year:

- (a) the number of fumigations using methyl bromide carried out at the site;
- (b) the total amount of methyl bromide applied at the site;
- (c) the types of enclosed spaces to which methyl bromide has been applied;
- (d) the types of equipment used to carry out the monitoring of methyl bromide;
- (e) the annual exposure level;
- (f) approximate total amount of methyl bromide discharged;
- (g) the number of notifications made for exceeding the 1 hour or 24 hour exposure level, identified by each monitoring location;
- (h) how many times the exposure levels exceeded the TEL_{air} value;
- (i) if a breach of a TEL_{air} value has occurred, an outline of what risk mitigation measures have been or are being put in place; and
- (j) any accidents or other issues related to non-compliance with any of the controls under this approval.

The person in charge of the site must provide the annual monitoring report to ERMA New Zealand, Department of Labour, and the relevant Medical Officer of Health by 30 June of the following year.

Signage

A person who applies methyl bromide must ensure that signs are displayed at every point of access to the risk area and buffer zone.

The signs required by this clause must:

- (a) state that fumigation is being carried out; and
- (b) state that methyl bromide is being used; and
- (c) state that methyl bromide is toxic to humans; and
- (d) describe the general type of hazard associated with methyl bromide; and
- (e) describe the precautions necessary to prevent unintended ignition of methyl bromide; and
- (f) comply with regulation 34(1), (2), and (4), and regulation 35(1), (3), and (5) of the Hazardous Substances (Identification) Regulations 2001, but as if the distances referred to in regulation 35(3) were a distance of not less than 10 metres; and
- (g) identify the person in charge of the site and the person using methyl bromide and provide sufficient information to enable the persons to be contacted during normal business hours; and
- (h) state the date on which the fumigation commenced; and
- (i) be illuminated during the hours of darkness; and
- (j) be able to be readily seen by a person approaching the buffer zone, including, when applicable, persons approaching from a seaward direction.

The signs must be removed at the end of the buffer zone period.

Recapture

A person must not apply methyl bromide subsequent to September 2020 unless recapture technology is used.

A person who applies methyl bromide in a calendar year must provide a report to ERMA New Zealand by 30 June in the following year setting out that person's progress in introducing recapture technology.

2.2.13.2 Phosphine

Phosphine may be applied as a gas by direct release from cylinders containing typically a mixture of 2% v/v phosphine in liquid carbon dioxide. Alternatively, it can be generated from solid aluminium or magnesium phosphide preparations. Fumigations with phosphine typically last from 5 to 16 days and sometimes longer. High standards of proofing and use of low permeability sheeting are very important.

Release from cylinders

Take the same precautions as described above for methyl bromide (although a spray device may not be needed for this gas).

Release from other preparations

Metallic phosphide preparations generate phosphine at a rate dependent on temperature and relative humidity. This may take several days. The preparations should be applied as quickly as possible and in a manner that allows easy removal of spent residues. Take

particular care when handling magnesium phosphide preparations because they generate phosphine more rapidly than others.

All types of phosphide preparations will generate phosphine to a limited extent during storage. Because phosphine may be under pressure the mouth of the container must be pointed away from the face of the operator when opening. Calculate the total dose required to the nearest number of phosphide packages using information from the supplier. The entire contents of a container should be used, unless the container is designed for airtight resealing. For safety, it is better to under dose to a small extent if necessary.

Where possible, avoid direct contact with the commodity to be fumigated by placing tablets or pellets on trays or sheets of suitable material, e.g. plastic or metal, spacing them so that the tablets or pellets do not touch each other. This will assist retrieval of the residues at the end of the fumigation.

Bags, bag-blankets and plates etc may be placed on the surface of bulk or packaged materials and retrieved later. However, in the fumigation of bulk foodstuffs such as grain, tablets, pellets or bags may be mixed intimately with the foodstuff, and the residues subsequently removed by filtering processes at the end of the fumigation and subsequent ventilation.

2.2.13.3 Cyanide Discoids

Hydrogen cyanide discoids are usually contained in hermetically sealed cans (contents 1.5 kg). A special can opener is needed to open the can correctly. Calculate the total dose required to the nearest number of HCN cans using information supplied by the supplier. The entire contents of a can should be used, as cans of HCN are not able to be resealed safely.

For safety it is better to under dose to a small extent if necessary. Discoids are usually distributed evenly throughout the fumigation space on the floor. Hydrogen cyanide is lighter than air, and evolves from the discoid to rise and mix with the air in the fumigation space.

2.2.14 Extra Precautions for Different Types of Fumigation Locations

2.2.14.1 Buildings

Before commencing a fumigation, pay special attention to any absorbent materials that will be fumigated i.e. clothing, bedding, leather furniture, foam rubber, and wool items. Items such as these may continue to desorb gas for some time and may require additional ventilation. Such items should be removed before fumigation. The building to be fumigated must be made as gas-tight as possible. If the fumigation area is part of several interconnected buildings, it must be sealed off from the adjoining structures. Areas separated from the fumigation area only by a dividing wall must be considered to be part of the risk area. These areas must be evacuated during the period of fumigation. All windows, doors and other openings from the building must be sealed with masking tape or other suitable material, unless the building is to be enveloped completely by fumigation sheets of low permeability. Before any fumigant is released, the approved handler in charge must check the building to ensure it is clear of people and non-target animals and ensure that appropriate warning signs are erected as required by HSNO controls at the appropriate places. Refer to **ANNEX 6** for an example of appropriate warning signage

- In the case of fumigation with hydrogen cyanide all foodstuffs and liquids likely to be contaminated must have been removed from the fumigation area
- All keys must be in the possession of the approved handler in charge.
- All doorways must be taped off and have good highly visible placard signage in place.
- The risk area and any enclosed space in the adjoining area must be under effective supervision for the entire period of fumigation.
- Every point of access to the risk area must be controlled against unauthorised entry.

The approved handler in charge must carefully consider the number of operators needed. It may be necessary for them to work in pairs so that ventilation can be carried out safely. At the end of the fumigation period, the operators, wearing RPE, may break the seals and open doors and other openings accessible from outside the fumigation area and then withdraw beyond the risk area for the ventilation period.

Under instruction from the approved handler, and after testing the atmosphere, the operators may then enter the building and open the windows and other doors. In multi-storey or multi-section buildings, it may be necessary to leave the fumigation area as each storey or section is opened, to ensure an adequate ventilation period before proceeding to the next floor.

The duration of the ventilation period will vary according to the size and construction of the building and the weather conditions. When working inside the building, all personnel must wear RPE unless tests with the detection equipment have shown that concentrations of fumigant do not exceed the WES. Careful attention should be paid to areas that are difficult to ventilate, including basements and stairwells, where heavy gases such as methyl bromide may accumulate.

In the case of buildings to be occupied by people, a minimum ventilation period of 24 hours is recommended before reoccupation is permitted.

At the end of the ventilation period, disconnect, dismantle and remove all piping and application equipment from the fumigation area and risk areas. A certificate of clearance may be issued only after the approved handler has retested the atmosphere in all floors or sections, and is satisfied that it is safe for people to enter without respiratory protection.

2.2.14.2 Fumigation of Stacks of Commodities Under Gas-proof Sheets (Tent)

Only sheets of low permeability and in sound condition must be used for this type of fumigation. The sheets shall, when placed in position and sealed, be sufficiently gas tight to contain the fumigant for the period of the fumigation. If phosphine is used, new polyethylene sheeting, of at least 200 microns thickness (or laminated sheeting of lower permeability) is recommended.

Where more than one sheet is needed to cover a stack, the individual sheets must be sealed one to another. Rolling and clipping, use of spray-on adhesive or other suitable methods such as duct tape can do this. Allow sufficient width of sheet on the floor to permit effective weighting down with sand snakes, water tubes, or other material of sufficient weight and flexibility; a width of about 1 metre is normally adequate. In the case of phosphine fumigations, and where the stack is on pallets or dunnage, the

phosphide preparations may be placed underneath the stack.

If fumigation is under gas proof sheets inside buildings, the approved handler in charge must allow an adequate ventilation period for the building before sheets, piping or spent residues are collected. If using methyl bromide, this should be introduced into the stack in vapour form at the highest point. (Note: MeBr is not permitted for this use now except under special circumstances such as quarantine and pre-shipment use) Fans may be necessary to ensure adequate mixing with air to ensure better penetration throughout the fumigation area.

RPE must be worn when testing for leaks and when releasing sheeting fumigations.

The sheet must be:

- In good repair without tears, rips or visible holes; and,
- Made secure against likely weather conditions at the site; and
- Sealed with a border that is filled with heavy material.

The risk area and any enclosed space in the adjoining area must be under effective supervision for the entire period of fumigation and every point of access to the risk area must be controlled against unauthorised entry.

2.2.14.3 Ship Fumigation

Ship fumigation must be carried out in accordance with the relevant recommendations for fumigation described in this code of practice or the manufacturer's instructions. Where required by the Health Authorities, because of a moderate infestation of rodents, a ship may need to be fumigated for the issue of a Ship Sanitation Control Certificate (As required under the Health (Quarantine) Regulations 1983 Regulation 15). Fumigation firms can issue these fumigation certificates once the correct procedure has been carried out and this can be presented to the Health Authority who will issue a Ship Sanitation Control Certificate for the ship.

The risk area and any enclosed space in the adjoining area must be under effective supervision for the entire period of fumigation and every point of access to the risk area must be controlled against unauthorised entry.

2.2.14.4 At Berth or Anchor

Ensure the vessel is at a suitable location (check with the Port Authority), is in good condition and the compartment to be fumigated is capable of being sealed effectively. When the cargo space alone is to be fumigated, any openings to other compartments should be sealed. If this is impracticable, such compartments must be regarded as part of the fumigation area and they must be secured and sealed.

Do not normally allow anyone to enter the fumigation area during the fumigation and ventilation periods until tests show that fumigant levels are below the WES. Crewmembers may be allowed entry, to facilitate ventilation or to undertake monitoring to ensure that the compartments remain safe before the final certificate of clearance is issued. In this case they must wear appropriate PPE including RPE.

No fumigant must be applied until the vessel has been thoroughly searched (including for stowaways) and all people not connected with the fumigation are outside the risk area.

Lock and seal the entrance to the crew's quarters; unless:

- a) The quarters are outside the risk area during a cargo hold fumigation and evacuation of the crew is unnecessary, or
- b) The crew's quarters are also being fumigated.

All keys must be given to the approved handler in charge. It is recommended that the vessel is moored in a position which minimises the possibility of unauthorised access during the fumigation period, e.g. in mid-stream or at a wharf closed to the public.

A member of the fumigation team must be in attendance throughout the duration of the fumigation, and an appropriate warning notice must be placed at the shore end of the gangway. It is a HSNO control requirement that that this notice must be visible at night.

The approved handler in charge must carefully consider the number of operators needed for the fumigation of a ship. It may be necessary for them to work in pairs so that ventilation can be carried out safely. At the end of the fumigation period, allow operators wearing RPE to break seals and roll back sheets and tarpaulins, and lift hatch boards to assist ventilation and dispersal of the fumigant. Switch on forced ventilation if it is available, provided that it does not vent into any areas where people may have access. Take care to test the atmosphere for residual levels of fumigant. Operators must wear RPE when entering any part of the vessel for the purposes of ventilation and/or monitoring. On some vessels, the crew or shore riggers open the hatches manually; it may be necessary to allow them on board to do so. In such cases, they must be provided with the necessary PPE.

The atmosphere must be tested to ensure that no one is exposed to concentrations above the WES during the period of ventilation. After a preliminary period of ventilation, some of the crew may have to be allowed back on board to carry out necessary duties. They must not be allowed below decks unless tests have shown that fumigant levels are below the WES.

In the case of loaded vessels, it may not always be possible to test the lower levels below the cargo until the cargo is being unloaded.

2.2.14.5 Vessels in Transit

The in transit fumigation of logs for export is becoming increasingly common, and is likely to continue to be a growth area subject to the requirements of importing countries. Phosphide fumigants are ideal for this process. This practice should only be carried out after a thorough assessment of the hazards and the development of comprehensive procedural guidelines. The requirements of the IMDG code on Dangerous Goods and International Maritime Fumigation Organization Code of Practice will provide essential reading during this process.

Before the ship sails, trained technicians are taken on board and some crew are specifically trained to assist this technician. The ship's master must still assume full responsibility for the safety of his ship and crew so proper measures must be taken to ensure this. There must be adequate RPE and detection equipment on board to manage any emergency. Where the fumigation commences when the ship is moored in New Zealand waters, the relevant requirements for a ship at berth or anchor. Paragraph 2.2.12.4 above must be followed.

More guidance on fumigation of ships and cargo is available from the International Maritime Fumigation Organisation (IMFO) White Hall, Worthington, Woodbridge, Suffolk, UK IP13 7HW

- Recommendation on the safe use of pesticides in ships
- International Maritime Dangerous Goods (IMDG) Code, available from IMO, 4 Albert Embankment, London, SE1 7SR.

2.2.14.6 Aircraft fumigation

Although seldom required nowadays aircraft may need to be fumigated. For the whole of the fumigation and ventilation periods, the aircraft must be positioned in a safe place; with the risk area roped off and marked with warning notices to prevent access by anyone not directly concerned with the fumigation. Always consider the entire aircraft and an appropriate area around it as the risk area, even if only part of the aircraft is the fumigation area.

- The risk area and any enclosed space in the adjoining area must be under effective supervision for the entire period of fumigation.
- Every point of access to the risk area must be controlled against unauthorised entry.

Before any such fumigation is commenced consultation with the airline's technical agent will be necessary. The technical agent or engineering advice will need to be consulted about effective sealing of the air inlets, vents to water tanks etc. Leave the doors to cabins and holds until last so that the approved handler can make a final check that all unauthorised people have left the aircraft.

When the doors have been sealed and locked, place warning notices on them and at points of access to the risk area. Cargo holds may need to be fumigated separately.

Ensure that an operator remains where the risk area can be observed throughout the fumigation and ventilation periods. At the end of the fumigation period, operators wearing RPE may open the doors and begin the ventilation process. Continue ventilation if there is any likelihood of an increase in fumigant concentration by desorption.

2.2.14.7 Fumigation of Shipping/Freight Containers

MAF or other authority may require containers to be fumigated for bio security or other reasons. Ensure that the shipping/freight container (cargo or vehicle) to be fumigated in port is in a designated secure area, separate from the normal container park or working areas, or in an area clearly marked out by signage, warning tape or cones. **Fumigation of shipping containers must not be carried out in an area where the public may lawfully be present, such as public places, and the area must be secured against ready access by unauthorised persons.**

Before carrying out the fumigation, the state of repair of the container must be checked and the approved handler must decide whether it is suitable for treatment, paying particular attention to the door gaskets. Where a container is holed or damaged, or is otherwise impractical to seal effectively (e.g. open top, flatrack) it must be sheeted with impervious sheeting sealed to the ground. Report and repair any deficiencies, ensuring that the doors of the container are capable of being secured with a padlock or other device.

Always apply methyl bromide from outside the container.

Use monitoring equipment, paying particular attention to the seal around the doors. When satisfied that effective sealing has been achieved, lock or otherwise secure the doors. The approved handler in charge must retain the keys to the container.

Fix hazard-warning notices identifying the fumigant and stating the date of the fumigant application to the doors, ideally across the central door closure gasket. Keep records of the date of application. In some cases, it may be useful to also record the time of application. See **ANNEX 6** for the wording of typical signage.

Unless a container has been ventilated after fumigation so that those concentrations of residual gas are below the WES, containers under fumigation should be treated as hazardous cargo and must not be moved. Do not apply fumigants to a container once it has been loaded aboard the ship.

HSNO prohibits the movement or transport of a shipping/freight container that is under fumigation by road or rail, unless the container has been degassed and an approved handler has determined that the fumigation is complete. There is an exemption, which permits the moving of a container directly from a wharf onto a ship.

Shipping containers, which have been resealed following ventilation, may require further ventilation when reopened at the consignees premises because of the risk of desorption from some commodities. This is particularly important with 12 metre (40') containers and those that are tightly packed around the door opening, such as vehicle tyres, as it is possible that some gas may remain, trapped within the container. Such containers should have a notice attached advising that it has been fumigated.

Under normal conditions the venting time for a fumigated shipping container should be about 40 minutes minimum. After this the container doors must be closed and a warning notice attached as a seal stuck across the door. This seal will warn de-vanning staff, when they go to open the container, that the container has been fumigated with fumigant and that some residual fumigant may still be present. See **ANNEX 6** for an example of such a sign. A further ventilation period may be necessary before entering the container and RPE may be required

Forced ventilation into the back of the container with the door open may be necessary when de-vanning. This must only be done in a secure area, which the public and others do not have access. If there is doubt about the effectiveness of the ventilation process environmental monitoring may be needed for confirmation. Following ventilation, the residual concentration of the fumigant must be below the WES before workers can enter.

The practice of in-transit fumigation is carried out overseas and many containers arrive in New Zealand with levels of fumigant present. While not a direct responsibility of fumigation firms in New Zealand operators will often be asked for advice. Precautionary procedures should be followed where a container is suspected of being under fumigation when it arrives in New Zealand. Refer **ANNEX 9** of this Code.

2.2.14.8 Fumigation Chambers or Cells

For convenience purposes the fumigation of small items is often done using a purpose built fumigation cell or other suitable chamber complying with the definition of a fumigation cell.

The fumigation cell or chamber must be gas tight and should be fitted with a ventilation system, which discharges the fumigant outside and well away from any work areas or other areas where other people may be present. Such discharge may need to comply with the regional air quality plan of the local Regional Council, or may even require resource consent from the Council.

The use of shipping/ freight containers rather than a purpose built fumigation cell is now common practice. The requirements for these are specified in the above section of this Code.

Where such fumigations are carried out the container must be in an area secured against unauthorised entry. Before the approved handler permits unloading of the chamber, the level of residual concentration of fumigant inside the chamber must be tested to ensure that it is below the WES.

Special care is necessary where the nature of the fumigated commodities is such that desorption of fumigant may continue for some time after the container or chamber has been ventilated. If the chamber is closed before ventilation is completed, dangerous concentrations of the gas may accumulate and a further period of ventilation must be carried out before any persons enter and the commodities unloaded. Adequate, permanent, warning signage must be fixed in a prominent position on or near the chamber/container.

2.2.14.9 Grain in Small Bins or in Bulk on the Floor

This procedure is normally done by inserting phosphide preparations directly into the grain with the aid of probes or tubes or probing into the grain with retrievable sleeves or bags. Preparations may also be placed on the surface of the grain and in aeration ducts underneath. The surface of the grain must be covered with polyethylene sheet of low permeability or other equivalent gas-proof material.

Since the gas may evolve more slowly during grain fumigation, adjacent risk areas must be ventilated at all times. Particular care is necessary when only a dividing wall separates the grain store from living quarters or animal houses. Such areas must be evacuated during the whole period of fumigation and ventilation. Do not permit reoccupation of these areas until the approved handler is satisfied that they are safe for persons to enter and a certificate of clearance has been issued. See **ANNEX 7**

At the end of the fumigation period, uncover the grain and allow it to air naturally. Forced ventilation in the risk area will assist dissipation of the gas from the building or room where the grain has been fumigated. Where possible, remove fumigant residues manually or subsequently on filtering.

Small residues of gas will be present in the grain for some time after ventilation, and care should be taken when handling the grain.

2.2.14.10 Grain in Silos

Fumigation of grain in a silo is normally done with phosphine. The slides at the bottom of the silo and any other openings must be sealed to prevent leakage of the gas. To prevent premature discharge of the grain, the slides must also be clearly labelled and they must be locked in the closed position. Seal a fumigated silo completely before treating another. As much ventilation as possible should be given to working areas outside the silos being fumigated.

Normally the fumigant may be applied to the grain stream near the point of entry into the silo. This may be done by means of an automatic applicator, which dispenses phosphine pellets at predetermined intervals. It is possible that there may be some displacement of air containing phosphine from the silo. This must be tested regularly for the presence of phosphine. If the level of gas is higher than the WES appropriate measures must be taken such as donning RPE or increasing airflow.

No person should enter silos adjacent to those being treated until they have been ventilated and tests have shown that fumigant concentrations are below WES.

Treated grain should not be moved until at least five days after fumigation and until tests (probing into the grain) have shown that the concentration of phosphine is below the WES (See Part Two, 2.2.8) and there is no further accumulation due to desorption.

Although grain may not need to be moved for some weeks or months after fumigation, care must be taken that people are not exposed to harmful concentrations of phosphine in conveyor tunnels or other spaces through which the grain moves. If tablets or pellets have been used, make an assessment as to whether it is necessary for people working near the moving grain to wear RPE.

Operate silo ventilation fans to clear any gas that may be present in the ducting. The empty silo should be left open, top and bottom for at least 24 hours before permitting anyone to enter, and any residual level of fumigant must be below the WES. If the grain is turned into another bin, no persons must enter the space above the grain in the new bin unless tests have shown that levels of phosphine are below the WES. If bags have been used, pick these out from the grain stream either manually (using RPE) or by a sieving device.

2.2.14.11 'In-bag' Fumigation of Individual Packages

Individual sacks or other small items can be effectively fumigated by placing items in gas-proof enclosures, such as a plastic bag, and adding an appropriate amount of the phosphide preparation. Because of the small volume to be fumigated and the flammability of phosphine, special care must be taken in calculating the approximate amount of fumigant required. The approved handler must take particular account of the permeability and portability of the plastic bag when defining the fumigation and risk areas.

2.2.14.12 Mammals Underground

The fumigation of mammals, such as rabbits, is common practice, done by placing fumigant material directly into the underground burrows or nesting site. Magnesium phosphide and aluminium phosphide can both be used for this purpose.

The HSNO controls for these phosphide preparations⁴ allows a person to hold not more than 3 kg at any one time (as an aggregate quantity if both types are held) without being an approved handler. They also do not need to keep tracking records or hold a licence.

Operators using these materials for underground fumigation must erect signage see **ANNEX 5** where such fumigations are undertaken on or adjacent to land where members of the public may lawfully be present e.g. close to or adjoining private dwellings, playing fields, reserves, or other public or amenity area. These warning signs must be clearly visible when approaching from any direction and should give the name of the fumigant the date laid and a contact number of the operator. Such signage must be removed after the fumigation process is complete.

⁴ Pellets containing 660 g/kg magnesium phosphide and pellets containing 570 g/kg aluminium phosphide (refer Annex 1 for the trade name products covered by these ERMA substance descriptions).

The fumigation of mammals underground should only be carried out in the open air and in dry weather. In addition to any relevant precautions described earlier, the following actions should be observed:

- a) Open fumigant containers out of doors;
- b) Wear suitable PPE and, where the risk assessment (**See ANNEX 10 Risk Management**) shows it to be necessary, have RPE available at all times;
- c) Whenever possible, use the entire contents of a fumigant container in one operation. If this is not possible ensure that the remaining contents are returned to and sealed in the original container and kept in secure storage.

Burrows or runs must never be treated within three metres of any building occupied by non-target animals or humans.

Part Three

3.1 Other Legislation that applies to the safe use of Fumigants

3.1.1 Introduction

The safe management of fumigant materials requires a thorough knowledge and understanding of important legislation as it applies to their hazardous nature. This part covers an outline of the Health and Safety in Employment Act 1992 and other legislation appropriate to the use of fumigants. It supplements Parts One and Two.

3.1.2 Health and Safety in Employment Act 1992

The object of the Health and Safety in Employment Act 1992 (HSE Act) is to prevent harm to all people at work and people in, or in the vicinity of a place of work.

To do this, the Act:

- promotes excellence in health and safety management;
- defines harm and hazards in a comprehensive way;
- imposes duties on those who are responsible for work, or do work;
- sets requirements that relate to taking all practicable steps to ensure health and safety, and that are flexible to cover different circumstances; and
- encourages employee participation in health and safety management and that the process is conducted in good faith by all those involved.

The Act covers all people connected with places of work – employers, employees, people gaining work experience, and sellers and suppliers of plant the self-employed, contractors and principals, visitors, volunteer workers.

3.1.3 Regulations

Regulations may, among other things, impose duties on employers, employees, designers, manufacturers, and others relating to health and safety. These regulations may apply with respect to places of work, plant, processes or substances and may deal with particular problems that have arisen.

The Health and Safety in Employment Regulations 1995 require the provision of facilities such as toilets, first aid, and washing of hands and body, and the provision of wholesome and sufficient drinking water. They also set a range of general health and safety requirements in addition to the Act, and restrict or require notification of particular types of hazardous work.

3.1.4 HSE Approved Codes of Practice

Approved codes of practice are provided for in the HSE Act. They are statements of preferred work practice or arrangements, and may include procedures, which could be taken into account when deciding on the practicable steps to be taken. Compliance with codes of practice is not mandatory. However, they may be used as evidence of good practice in Court.

3.1.5 Employers' Duties

Employers have a general duty to take all practicable steps to ensure the safety of employees while at work. In particular, they are required to take all practicable steps to:

- (a) Provide and maintain a safe working environment;
- (b) Provide and maintain facilities for the safety and health of employees at work;
- (c) Ensure that machinery and equipment is safe for employees;
- (d) Ensure that working arrangements are not hazardous to employees; and
- (e) Provide procedures to deal with emergencies that may arise while employees are at work.

Taking "all practicable steps" means doing what can reasonably be done in the circumstances, taking into account:

- (a) The severity of any injury or harm to health that may occur;
- (b) The degree of risk or probability of that injury or harm occurring;
- (c) How much is known about the hazard and the ways of eliminating, reducing or controlling it; and
- (d) The availability, effectiveness and cost of the possible safeguards.

A person is required to take all practicable steps in respect of circumstances that they know or ought reasonably to know about.

3.1.6 Hazard Management

Employers must identify and regularly review hazards in the place of work (existing, new and potential), to determine whether they are significant hazards and require further action. If an accident or harm occurs that requires particulars to be recorded, employers are required to investigate it to determine if it was caused by or arose from a significant hazard.

"Significant hazard" means a hazard that is an actual or potential cause or source of:

- (a) Serious harm (defined in a schedule to the Act); or
- (b) Harm (being more than trivial) where the severity of effects on any person depend (entirely or among other things) on the extent or frequency of the person's exposure to the hazard; or
- (c) Harm that does not usually occur, or usually is not easily detectable, until a significant time after exposure to the hazard.

Where the hazard is significant, the HSE Act sets out the steps employers must take:

- (a) Where practicable, the hazard must be eliminated.
- (b) If elimination is not practicable, the hazard must be isolated.
- (c) If it is impracticable to eliminate or isolate the hazard completely, then employers must minimise the likelihood that employees will be harmed by the hazard.

Where the hazard has not been eliminated or isolated, employers must, where appropriate:

- (a) Provide protective clothing and equipment and ensure that it is accessible and used;
- (b) Monitor employees' exposure to the hazard;

- (c) Seek the consent of employees to monitor their health; and
- (d) With informed consent, monitor employees' health.

3.1.7 Information for Employees and Health and Safety Representatives

Before employees begin work, their employer must inform them of:

- (a) Hazards employees may be exposed to while at work;
- (b) Hazards employees may create which could harm other people;
- (c) How to minimise the likelihood of these hazards becoming a source of harm to themselves and others;
- (d) The location and correct use of safety equipment;
- (e) Emergency procedures.

Employers are also required to inform employees of the results of any health and safety monitoring. In doing so, the privacy of individual employees must be protected. Where there are employee health and safety representatives, the employer must ensure that the representatives have ready access to sufficient information about health and safety systems and issues in the place of work to enable them to be able to carry out their functions effectively.

The provision of information about the safe use of hazardous substances is found in two places:

3.1.8 Managing emergencies.

The HSE Act has a general requirement to ensure that any emergency situation is effectively managed to protect workers and others from the adverse effects of fumigation operations. Complying with the HSNO requirements for managing emergencies will in all probability lead to compliance under HSE. See also Part two 2.2.9 of this code.

3.1.9 Information included on labels

All manufacturers must comply with packaging and labelling requirements for hazardous substances under the provisions of the HSNO Act. Labelling regulations set out minimum requirements in respect to information to be printed on or affixed to a package. This will identify the hazards of the substance and how to use or handle it safely. Further details can be found in the ERMA approved COP "Labelling of hazardous Substances" by NZCIC.

3.1.10 Information included in Safety Data Sheets (SDS)

All suppliers and manufacturers of hazardous substances must prepare and provide Safety Data Sheets (SDS) about their product. These must be made available to users. SDS contains information about the substance, its chemical and physical properties, health hazard information, precautions in use and safe handling information. Further details can be found in the ERMA approved COP "Preparation of Safety Data Sheets" by NZCIC.

The ERMA Approved Codes of Practice for Labels and SDS provide an acceptable means of compliance for anyone requiring it for the purposes of complying with the Health and Safety in Employment Act.

3.1.11 Training and Supervision of Employees

An employer must ensure that every employee who:

- does work of any kind, or
 - uses plant of any kind, or
 - deals with a substance of any kind,
- in a place of work has the knowledge and experience – or is supervised by someone who has -- so that they are not likely to suffer harm, or lead to the harm of others.

Every employee must be adequately trained in the safe use of all plant, objects, substances, and protective clothing and equipment that they are, or may be, required to use or handle.

3.1.12 Instruction

Employers, operators, person in charge or the approved handler in charge of a fumigation must ensure that sufficient and suitable instruction has been given to operators and other staff to ensure they do not endanger themselves or others through exposure to fumigants, fumigant-generating materials or residues. Approved handlers engaged in a fumigation operation must know what to do, what precautions are needed, and when they should be taken. Information about the chemicals being used and their safety can be found in Safety Data Sheets (SDS) obtainable from the supplier of the chemicals. The following issues must be observed:

- a) All the safe procedures to be followed and the precautions to be taken in organising a safe fumigation, applying a fumigant and making a fumigated area safe to re-enter;
- b) The ventilation and clearance procedures to be followed after the fumigation has been completed;
- c) The cleaning, transport, storage, maintenance and disposal procedures required for the equipment and fumigant-generating substances, why they are required and when they are to be carried out;
- d) The procedures to be followed in an emergency;
- e) The procedures, notification and documentation requirements of any other parties involved with commercial, monitoring, or enforcement interests such as the Communications Centre of the NZFS, MAF, port authorities, customs agents, importers etc.

3.1.13 Training of Fumigation Staff

Training programs must be designed to provide the trainee with the knowledge, skills and experience in fumigation, and to be able to meet the required standards for approved handler status as set out in the Hazardous Substances and New Organisms (Personal Qualifications) Regulations 2001. Such training must be completed before the employee undertakes any work, unless the employee is to be supervised by an experienced person who is an approved handler. Accurate records of training must be kept as support documentation for the qualification. Training can be undertaken by completing the Fumigation Elective part of Unit Standard 3263 "Urban Pest Management" National Certificate. Any application to a Test Certifier for a Controlled Substances Licence must also be retained in workers records.

Employers must ensure that, in relation to a particular fumigant, operators/staff are given adequate training in:

- a) The hazards of that fumigant
- b) The operational control of the fumigation, including safe work procedures, methods and practices;
- c) The use, maintenance, training and limitations of all types of Personal Protective Equipment including SCBA;
- d) The use of application equipment in accordance with manufacturer's instructions;
- e) The use of equipment for the detection and measurement of that fumigant in the atmosphere;
- f) The correct procedures to be followed in the event of a spillage;
- g) The action to be taken in an emergency including emergency contact numbers;
- h) The signs and symptoms of poisoning by that fumigant;
- i) First aid procedures in the event of such poisoning;
- j) Transport and secure storage of fumigants and fumigant-generating materials;
- k) The correct method of disposal of fumigant residues and packaging materials;
- l) The HSNO controls that apply for the use of that fumigant.

The nature of the risks involved in fumigation exercises is such that, until people have received the training outlined above and have the necessary licence (see Section 2.1.7), they should not be regarded as competent nor are they legally eligible to carry out fumigations on their own. However, this should not prevent a person who is not competent from taking part in fumigation operations for training purposes, provided they do so under the direct supervision of someone who holds a Controlled Substances Licence or who 11 mg/m³ is otherwise an approved handler.

3.1.14 Supervision of Staff

It is a requirement of the HSE Act that all untrained staff involved in fumigation operations be adequately supervised at all times. It is difficult to set a prescriptive control on the number of persons required to be in attendance during a fumigant operation.

However, a performance based HSNO control applies to substances used in the fumigation of ships, aircraft and buildings to require, that, throughout the duration of the fumigation operation, "the fumigation is adequately supervised, and every point of access to the risk area is controlled against unauthorised entry.

The risk area includes all that area surrounding the fumigation where a fumigant could penetrate if accidentally released. The approved handler in charge of the fumigation shall define the risk area for the fumigation and entry to the risk area must be restricted to fumigation operational staff.

The test for adequacy can be decided by asking the question "what supervision is necessary to ensure that no person will be affected by the fumigant". If the approved handler in charge is able to answer this question honestly after putting supervision in place then the level of supervision will be adequate. It may not be necessary for such supervision to be continuous by an approved handler after the release of the gas. For example, the use of security staff may be acceptable if the area can be secured against unauthorised entry.

3.1.15 Self-employed Operators

The HSE requires that self-employed people have received adequate instruction and are properly trained and are certified to carry out the work safely. All self-employed persons involved in fumigation activities will require a Controlled Substances Licence.

3.1.16 Employers to Provide Opportunities for Employee Participation

Employers must provide reasonable opportunities for employees to participate effectively in ongoing processes for improvement of health and safety in the place of work. Where there are more than 30 employees, or where an employee requests it, the employer must seek agreement on, develop, implement and maintain a system of employee participation. Where agreement cannot be reached on the system employee participation, there are default provisions set out in the Act.

Where employee health and safety representatives are elected, they are entitled to paid leave to attend approved training courses.

A trained employee health and safety representative may issue a hazard notice to an employer where they believe there is a hazard in the place of work, they have brought it to the employer's attention, and the issue has not been resolved.

Employers and employees must deal with each other in good faith while seeking agreement on, developing and maintaining a system of employee participation. The dispute resolution processes of the Employment Relations Act:2000 apply.

3.1.17 Duties of Employees

Every employee must take all practicable steps to ensure

- their own safety while at work (including, for example, using protective clothing and equipment they are provided with, being familiar with information contained on the labels of fumigant materials, SDS and other relevant documentation); and
- that no action or inaction of theirs while at work causes harm to any other person.

An employee has a corresponding right to refuse to undertake work that they consider likely to cause them serious harm.

3.1.18 Other People With Duties Under the Act

Self-employed people

Every self-employed person shall take all practicable steps to ensure that no action or inaction of the self-employed person while at work harms the self-employed person or any other person.

Principals

Principals to contracts are required to take all practicable steps to ensure that—

- (a) No employee of a contractor or subcontractor; and
- (b) If an individual, no contractor or subcontractor—
is harmed while doing any work (other than residential work) that the contractor was engaged to do.

Hirers, sellers and suppliers of plant

The Act places duties on people to ensure that any plant or equipment that is used in a place of work is designed and made, and has been maintained, so that it is safe for its intended use. The duties apply to people who:

- Hire, lease or loan plant to another person that could be used in a place of work; or
- Sell or supply plant (other than for hire, lease or loan); or
- Install or arrange plant in addition to either of the above.

3.1.19 Accidents and Serious Harm (Recording and Notification)

The HSE Act requires employers, the self-employed, and principals to contracts to keep a register of work-related accidents and serious harm. For employers, this includes every accident that harmed (or might have harmed):

- (a) Any employee or self-employed person at work;
- (b) Any person in a place of work under the employer's control.

Employers are also required to investigate all accidents, harm and "near misses" to determine whether they were caused by a significant hazard. "Serious harm" is defined in Schedule 1A of the Act.

Any occurrences of **serious harm** (Note; definition of serious harm is under review) of a kind that must be recorded must also be notified to the Secretary of Labour (in practice, the nearest DOL office), as soon as possible after the occurrence. In addition, the accident must also be reported on the prescribed form within 7 days. (Forms are available from the DOL website.) If a person suffers serious harm, the scene of the accident must not be disturbed unless to:

- (a) Save life or prevent suffering;
- (b) Maintain public access for essential services, e.g. electricity, gas;
- (c) Prevent serious damage or loss of property.

The DOL office will advise whether it wishes to investigate the accident and what action may be taken in the meantime.

3.2 Other legislation controlling the use of Fumigants

3.2.1 Ozone Layer Protection Act

Methyl bromide is classified as an ozone depleting substance under the Montreal Protocol and the Ozone Layer Protection Act 1996 and is one of the most serious ozone depleting substances still in use. The import of methyl bromide for quarantine and pre-shipment (QPS) purposes is exempted from the phase-out under the Protocol. However the import of methyl bromide is still controlled domestically and can now only be used to meet NZ's own bio security needs (for imported goods) and to meet other countries requirements (for exporters). Methyl Bromide was marked for phasing out as part of the commitment to the Montreal Protocol by 2005. There is provision under the protocol for critical use exemptions from phase out on the basis of special need. NZ was permitted two critical use exemptions for fumigation of soil for the strawberry industry from 2005 - 2007 but those have now finished and the import of methyl bromide for non QPS use is now prohibited.

It is expected that Parties to the Protocol should also endeavour to reduce methyl bromide emissions by encouraging producers and users to take appropriate measures to implement *inter alia* good agricultural practices and improved application techniques. (Decision VII/6)

A fumigation operator should take all precautionary measures practicable to prevent unnecessary release of methyl bromide into the environment during fumigation exercises.

3.2.2 Agricultural Compounds and Veterinary Medicines Act 1997

The Agricultural Compounds and Veterinary Medicines Act 1997 (ACVM Act) requires the supply of product information to consumers. In regulating agricultural compound products, the ACVM Group based in the NZ Food Safety Authority imposes labelling obligations to ensure that people using the products have sufficient information to use products appropriately and safely, and that the products are truthfully identified. Under the consumer information provisions of the Act, the ACVM Group can ensure that requirements of ERMA NZ and the Ministry of Health in terms of advice on safe storage, distribution, use and disposal are part of the approved label content when a product is registered. All Fumigants are registered under the ACVM Act as Vertebrate Toxic Agents and have conditions of use attached to their registration.

For more information visit the ACVM Group website (www.nzfsa.govt.nz/acvm) or contact the ACVM Group directly at:

ACVM Group
New Zealand Food Safety Authority
PO Box 2835
Wellington
New Zealand
Phone: 04 463 2550
Fax: 04 463 2566

3.2.3 Resource Management Act

The Resource Management Act provides for Regional Councils to set rules, including air quality standards for pollutants. Many Regional Councils have rules and standards that apply to fumigants including methyl bromide. Fumigation operators must ensure they are familiar with the Regional Air Plan for the areas in which they work. Some Regional Air Plans may require resource consents to be obtained for fumigation. Other air plans may allow fumigation without obtaining resource consent but only in accordance with certain standards. Fumigation operators must be aware of the rules that apply and ensure they comply with them at all times.

3.2.4 Previous Legislative Requirements

Previously, the use of most fumigants was controlled by the Fumigation Regulations 1967, which were established under the Health Act 1956. The Toxic Substances Act 1979 and Regulations covered the sale of fumigants and the Noxious Substances Regulations 1954 provided for the safe manufacturing process for a range of substances including fumigants.

3.3 Health and Safety Monitoring; Methods and Equipment

3.3.1 General Information about Monitoring

To ensure complete safety and to be confident that fumigations are carried out safely it is necessary to measure the concentration of gas in the locality around the fumigation, after the ventilation process has commenced, or to ensure safety for people to return to the area. To do this testing of the atmosphere is required. This is called monitoring and requires the use of specialist equipment. Comparison with exposure levels set out in Part 2.2.8 will provide guidance on acceptable levels.

All monitoring equipment must be inspected, calibrated and serviced regularly to ensure it is in effective working order. The instructions for maintenance issued by the manufacturers should be followed. In addition, the approved handler should examine the equipment immediately before carrying out the fumigation.

All operators must be properly trained in the use of monitoring equipment and understand the significance of any test result.

The methods for monitoring fumigant gases that have been used for many years (these were set out in the revoked Fumigation Regulation 1967) are no longer acceptable for workplace safety. Safe exposure levels have gradually been reduced over the years and more sensitive methods of monitoring is now required. The use of electronic monitoring devices should be the method of choice. The advantage is that the device gives a reading in real time i.e. the reading fluctuates as the actual levels fluctuate. Equipment is available for most fumigants and some have warning devices when the contaminant reaches dangerous levels. A device known as a Photo Ionisation Detector (PID) is available from at least one company in Auckland, Associated Process Controls Ltd 1/15 Puriri Street New Lynn Auckland. Fumigation operators need to become proficient in the use of correct monitoring methods. Other companies may also have similar equipment.

The following set out the processes involved, limitations, and procedures to be followed for commonly used fumigants. Always follow the instructions of the manufacturer when using monitoring equipment.

3.3.2 Methods of Detection

3.3.2.1 Portable Electronic Gas Detectors

Portable electronic gas detectors such as PID meters are the preferred method of choice when monitoring for residual levels of fumigant gases. These have solid-state diffusion type sensors, which respond to the presence of vapours. They are extremely sensitive but will also respond to some other organic vapours (not only the fumigant). Some give a continuous audible warning with the frequency depending on the concentration of the gas, while others have a visual display of light-emitting diodes and trigger a warning beep at concentrations above certain thresholds.

Other instrumental methods, based on electrochemical cells, or thermal conductivity analysers (TCA) can also be used. Take care, however, to ensure that other organic vapours do not interfere with the measurement of the fumigant.

It is recommended that expert advice be obtained if an operator is considering the acquisition of high tech monitoring devices.

3.3.2.2 Halide lamp

The Halide lamp is a convenient detection method available to use for detection of methyl bromide leaks or residual presence in a fumigation space. This device works by reacting in the presence of halogenated gases of which methyl bromide is one. The halide lamp is suitable for leak detection purposes, but it is not sensitive enough for general workplace exposure and safety purposes, and must not be used as such. Under these circumstances and provided its limitations of sensitivity are understood by the operator, Halide lamp readings should give an adequate indication of gas presence. Suitable safety margins will need to be provided during ventilation. If there is any doubt then operators should be using RPE.

The reason the halide lamp is not suitable for workplace exposure is the potential for individual variation in reading the colour of the flame. It is a well-known fact that many males are red/green colour blind and they have difficulty recognising minor changes in red/green colours. The halide test relies on colour determination in the green range, and therefore different and potentially dangerous errors could be made.

Halide lamps burn a butane flame that changes colour from blue to green in the presence of halides such as methyl bromide. The colour change occurs at around 20 to 30ppm therefore is not sensitive or accurate enough for measurements against the WES or TEL. Other limitations of the meter are that they do not distinguish between methyl bromide and other organic halogen gases, cannot be used in the presence of flammable gases (e.g. LOSP vapour), cannot be used in dusty atmospheres, and cannot be used by colour blind people.

When clearing a fumigation space for occupancy e.g. house, factory, vessel, other means of monitoring must be used throughout the space to facilitate detection and thorough ventilation to clear any pockets of gas before a final clearance is given.

3.3.2.3 Colourimetric (detector) tubes

These tubes are simple to use, although require thorough understanding of the principles. Glass tubes are attached to a hand/electric drawn sampling pump and air is drawn through the tubes over a specified time period (equating to a specified volume of air). The tubes contain a reagent that reacts in the presence of methyl bromide causing a colour change. The length of the colour 'stain' up the tube is measured against a graduated scale. Methyl bromide detection usually uses two tubes in line, the first (pre-treatment tube) converts methyl bromide to bromine (Br_2) and in the second tube, bromine is complexed with another chemical causing the colour change. The final concentration will depend on the number of pump 'strokes', as a correction factor needs to be applied. The correction factors and sampling times vary with different brands of tube. Other substances, especially other halogenated hydrocarbons can cause a colour change in the tube, thus the user has to be aware of possible interferences giving a false or incorrect result. The quantification limits for methyl bromide detector tubes vary but are reported as 0.2 to 600ppm. The accuracy of detector tubes is generally considered to be +/-25% of the reading (based on NIOSH criteria for accuracy of detector tubes). Thus a result of 5ppm should be treated as between 3.75 to 6.25ppm. Colourimetric tubes sample over very short periods of time (usually around 5 to 12 minutes) thus a result from a 5 minute sample cannot be directly compared to the 8 hour TWA. The 8 hour TWA can be estimated by using the equation given in Section 4.1.5. As with a non-datalogging PID, or PID readings taken non-continuously, a number of samples over the exposure period should be taken to determine average exposure level for that period.

It must be noted that this method of testing provides a snapshot only of the air being tested at that particular time, and as the concentration of gases are continually changing during ventilation it has limited value. Gas detector tubes can vary considerably in their accuracy and it is preferable to use tubes conforming to British Standard 5343 Gas detector tubes. Tubes must be used strictly in accordance with the manufacturer's instructions, particularly in relation to storage and expiry dates. A fresh tube is required for each determination.

There are long-term detector tubes available for most gases are used with pumps that draw in a measured amount of contaminated air over a period of hours. This can be a useful method of testing for clearance purposes.

3.4 Detection of Fumigants

3.4.1 Methyl bromide

Methyl bromide cannot be detected by smell at low concentrations. For this reason, chloropicrin may be added as an indicator or warning agent. Indicator agents, when present, give warning of leakage from cylinders and working spaces; but **they are not indicators of safe working conditions**. The electronic method of detection is the method of choice but care must be taken to ensure that the device is properly calibrated and correctly set up for the gas being measured.

3.4.2 Phosphine

There are not many monitoring devices available for detecting and measuring phosphine gas. Halide lamps and thermal conductivity analysers are not suitable for phosphine detection. The most commonly used device is the gas detector tube method, which measures hydrogen phosphide. If this method is to be used for clearance purposes the tube that measures phosphine to the lowest levels must be used. Electronic detection methods are now available using a PID meter such as a Multi rae. Care has to be taken to ensure that the device is properly calibrated and correctly set up for the gas being measured.

3.4.3 Hydrogen Cyanide

A gas detector tube is available for cyanide, which detects this chemical as hydro-cyanic acid levels. Electronic detection methods are now available for detection of hydrogen cyanide and care must be taken to ensure that the device is properly calibrated and set up for the gas being measured.

3.4.4 Chloropicrin

A gas detector tube for chloropicrin is available however the pungent odour is usually enough to detect even low levels of gas.

3.5 Personal Protective Equipment (Including RPE)

All personnel involved in a fumigation operation must use the personal protective equipment (PPE) indicated by the risk assessment and where directed on the fumigant label and SDS. While it is recommended that in the risk assessment other means of preventing exposure to fumigants are first considered, PPE, including respiratory

protective equipment (RPE), will usually be necessary at various times during the fumigation procedures.

The determination of which form of RPE is required must be based on the airborne concentration. The AS/NZS standard on the selection of respiratory protection works on this basis and must be followed. You might find that the air concentration of the fumigant is such that the mask does not provide enough protection and that BA is required.

3.5.1 Methyl Bromide

For methyl bromide fumigations, RPE will always be needed.

Where the concentration levels enable a full-face mask filter/canister respirator to be used, the correct filter for Methyl Bromide is a class AX filter for organic gas with a boiling point of less than 65 degrees C or a specific filter for methyl bromide marked MB. Any filter used for methyl bromide must be discarded after 8 hours use or sooner depending on concentration levels. If working in high levels discard the filter more regularly. Methyl Bromide has a boiling point of 3.6 degrees C. Note; All respirators used for methyl bromide must be made of silicone not rubber, as methyl bromide and rubber do not mix well.

The concentrations may dictate self-contained (positive pressure) breathing apparatus (SCBA). This provides a higher level of protection for when concentrations of gas are unknown or variable. Clothing, rubber gloves, surgical dressings etc can be penetrated by methyl bromide liquid or vapour and may cause severe blistering of the skin. Consequently, rubber gloves or rubber boots should not be worn while working with methyl bromide (in case liquid or concentrated vapour is trapped inside them). However, wear safety footwear when handling cylinders of methyl bromide. Overalls are not essential but, if worn, ensure that they are light and permeable.

3.5.2 Phosphine

As a minimum, filter/canister respirators (RPE) will be needed when using phosphine. Wear light and permeable coveralls and any type of boots or shoes to avoid direct contact with the solid fumigant. Synthetic rubber or PVC gloves are needed for phosphine fumigations.

3.5.3 Cyanide

For cyanide, the concentration levels may require RPE to be positive pressure closed circuit breathing apparatus or a full-face mask with approved filter/canister. Standard PPE items, gloves, overalls, boots etc will be necessary as a minimum.

3.5.4 General Advice About RPE for all Fumigants

Either positive pressure self-contained breathing apparatus or full-face filter/canister respirators may be appropriate RPE, depending on the circumstances. If you are using a filter/canister respirator, have spare unused canisters of an appropriate type immediately to hand and ready to use. Follow the manufacturer's instructions on filter/canister life. See also the "Guide to Respiratory Protection" published by OSH and on their website www.dol.govt.nz for information about an effective RPE program for staff.

Special precautions are necessary if a person has a punctured ear drum in the presence of fumigants. The gas can enter the respiratory system through the punctured eardrum and poisonous concentrations can build up. If it is necessary to continue working under these situations full protection can be obtained by using good quality non foam earplugs.

People with facial hair such as beards cannot get a good facial fit to provide adequate protection.

Dust filter respirators and disposable type respirators are unsuitable for use with any fumigants and must not be used under any circumstances.

A full-face mask with the appropriate filter/canister specified for use with the fumigant being used is the minimum protection required. Some filters are single use and must be discarded after each use.

Fit testing is an important requirement and must be undertaken. Refer to Section 8.1 of AS/NZS 1715.

Positive pressure SCBA must be used on all occasions where it is necessary to enter a fumigation space and adequate training and information on the risks of such work must be provided.

Always follow the manufacturer's instructions for testing and use. RPE must be inspected and tested regularly to ensure that it is in effective working order. It is recommended that this is at least once a month and more often when the conditions are particularly severe. This would be necessary for Positive Pressure SCBA and other types such as supplied air systems, but not so much for filtering face piece systems such as canisters. It may be possible to use the Fire Service to assist in this checking process on a local basis, as they are very experienced in the use of positive pressure SCBA. No one should work alone when wearing SCBA.

Before each fumigation, operators must check that their RPE is in sound condition, examining, for example, the head harness, face piece, exhalation valve, canister/air supply, breathing tube and testing for gas tightness (i.e. face fit). A simple test for good face fit is to close the air inlet lightly with a card and inhale gently after having put on the RPE and properly tensioned and adjusted the harness straps. The face piece should then collapse slightly against the face. Do not make equipment uncomfortably tight in order to pass the test. If the face piece does not collapse, this is a sign of excessive leakage; readjust the equipment and repeat the test. If the face piece still does not collapse, replace it, since it is unlikely that it will give full protection. Operators with facial hair or who wear glasses are unlikely to achieve a satisfactory face fit where a good seal is required. Operators should do fit tests for safety.

RPE should always be fitted and worn when opening cylinders, puncturing cans, changing pipe connections, and testing for leaks in container doors, sheet seals etc. At all other times during the fumigation carry RPE in such a way that it can be quickly donned in the event of equipment failure or if monitoring equipment indicates a concentration of gas above the WES.

For further information on respiratory protection consult the AS/NZS 1715:2004 Respiratory Protection Devices and AS/NZS 1716; 1994 Selection, Use and Maintenance of Respiratory Protective Equipment.

3.5.5 Other Measures to Protect Skin

Ensure that any recent cuts or abrasions are protected and the dressings changed immediately if they become contaminated.

3.6 Health Records and Medical Surveillance

Each company should have a system of retaining and storing medical records for staff that is secure and confidential. Keep health records for those involved in fumigation exercises and carry out regular medical surveillance where appropriate. The length of time that such records be kept is up to the employer but every attempt should be made to retain them for as long as possible. Normal business records must be kept for at least seven years.

Fumigation operators involved in frequent fumigations with methyl bromide should have six monthly bromide serum tests. These can be arranged through a local medical laboratory. The Biological Exposure Index (BEI) is a measure of the biological uptake of contaminants that anyone is exposed to. Levels are set for various substances and are contained in the DoL publication "Workplace Exposure Standards". Currently there is no BEI set for methyl bromide as no such level has been assigned by any overseas organisation whose guidelines NZ traditionally consults with but discussions are continuing. . In the meantime advice from the medical laboratory should be followed. There are no recognised BEIs for other fumigants either.

3.7 Reporting Incidents and Accidents

The Health and Safety in Employment Act 1992 (HSE) places an obligation on employers and other responsible persons to report incidents to the appropriate enforcing authorities. All workplace accidents must be recorded and if they have caused serious harm DoL must be notified.

The HSNO Act also requires notification of an incident involving hazardous substances, such as fumigants, to be made to an enforcement officer if he/she has not attended the incident. This applies to any incident resulting in serious harm or environmental damage. The ERMA maintains a register of incidents involving hazardous substances.

ANNEX 1

HSNO Approved Fumigants

Fumigants were transferred to HSNO on 1 November 2004. They included substances containing hydrogen cyanide, methyl bromide, phosphine, chloropicrin, aluminium phosphide, magnesium phosphide and 1,3-dichloropropene. Under the HSNO Act, approved substances may be reassessed and new substances may be approved. Methyl bromide has been reassessed.

The HSNO approved fumigants as at the date of approval of this code of practice are listed in the following table. This table provides:

- The ERMA substance description – this is the generic description used to define these substances in the Hazardous Substances (Fumigants) Transfer Notice 2004 (*New Zealand Gazette*, October 2004. Issue No. 140). (Two amendments have also been made.)
- Trade name products – a list of the current trade name fumigants covered by the ERMA substance description.
- Hazard classification – the HSNO classification for their flammability, toxicity and ecotoxicity hazards.
- ERMA variation code for those substances transferred under the Hazardous Substances (Fumigants) Transfer Notice 2004 (*New Zealand Gazette*, October 2004. Issue No. 140– the variation code from the ERMA Register of approved substances.

HSNO Approved Fumigants as at 1 May 2010

ERMA Substance Description	Trade Name Products	Hazard Classification	ERMA Variation Code
Liquid containing 1153 g/litre 1,3-dichloropropene	Telone Soil Fumigant	3.1B, 6.1C, 6.3A, 6.4A, 6.5B, 6.6B, 6.7B, 6.9B, 9.1A, 9.2D, 9.3B	2,3
Liquid containing 615 g/kg 1,3-dichloropropene and 345 g/kg chloropicrin	Telone C-35 Soil Fumigant	3.1B, 6.1A, 6.3A, 6.4A, 6.5A, 6.5B, 6.6B, 6.7B, 6.9A, 9.1A, 9.2A, 9.3B	2,3
Liquid containing 990 g/kg chloropicrin	Brimark Chloropicrin Pic-Fume Chloropicrin Soil Fume CP	6.1A, 6.3A, 6.5A, 6.9A, 8.3A, 9.1A, 9.2A, 9.3B	2
Discoid containing hydrocyanic acid	Cyanosil	6.1A, 6.3A, 6.4A, 6.5A, 6.5B, 6.8B, 6.9A, 9.1A, 9.2A, 9.3A, 9.4A	4
Gas containing 1000 g/kg methyl bromide	AG Fume MB Brima-Fume Methyl Bromide K&B Adams Methyl Bromide	2.1.1B, 6.1B, 6.1C, 6.6B, 6.8B, 6.9A, 8.2C, 8.3A, 9.1A, 9.2A, 9.3B, 9.4A	----
Gas containing 20 g/kg phosphine	ECO2FUME	6.1B, 6.4A, 6.9A, 9.1A, 9.3B, 9.4B	4
Pellets containing 570 g/kg aluminium phosphide	Gentoxin Genfume AP Quickphos	4.3A, 6.1A, 6.3B, 6.4A, 6.9A, 9.1A, 9.3A	1,4
Pellets containing 660 g/kg magnesium phosphide	Magtoxin	4.3A, 6.1A, 6.3B, 6.4A, 6.9A, 9.1A, 9.3A	1,4

ANNEX 2

Outline of the Hazardous Substances (Fumigants) Transfer Notice

The fumigant substances listed in **Annex 1** were transferred to the HSNO Act by notice in the *New Zealand Gazette* on 1 November 2004. This Transfer Notice sets out the hazard classifications for fumigants, and the HSNO regulations and controls that apply to the management of these substances in New Zealand. Readers should obtain a copy of the Transfer Notice 140, which is available from the Department of Internal Affairs website at:

[http://www.dia.govt.nz/pubforms.nsf/NZGZT/ERMAFumigants140Oct04.pdf/\\$file/ERMAFumigants140Oct04.pdf](http://www.dia.govt.nz/pubforms.nsf/NZGZT/ERMAFumigants140Oct04.pdf/$file/ERMAFumigants140Oct04.pdf)

and be familiar with its content.

Methyl Bromide and solutions of methyl bromide were transferred in this Gazette Notice but have subsequently been reassessed. The information concerning these substances in the Gazette Notice is not now applicable as it has been superseded. The controls on methyl bromide and the other fumigants are from the controls register on the ERMA New Zealand website at:

<http://www.ermanz.govt.nz/search-databases/Pages/controls-search.aspx>

A brief description of the main points is provided in this **ANNEX** for convenience. It is only a summary. The Transfer Notice and reassessments must be referred to before handling fumigants.

- 1 From 1 November 2004, the HSNO regulations and controls apply to the fumigants referred to in the table in Annex 2 of this COP, subject to any transitional provisions provided for in the Transfer Notice.
- 2 The Transfer Notice gives the Hazard Classifications for individual fumigant substances.
- 3 These classifications trigger default HSNO controls from the classification/controls matrix. These controls apply to all fumigants transferred. Some variations have been made to these controls and some new controls applied.
- 4 Variations to controls:
 - A Exceptions for approved handler requirements when a fumigant is being transported by rail, road, sea or air, provided other requirements are met, including compliance with the Land Transport Dangerous Goods Rule 1999 (Rule 45001).
 - B For aluminium and magnesium phosphide pellets, a new aggregate trigger quantity of 3 kg applies before any of the following are required:
 - Hazardous substance location;
 - Approved handler (provided the substance is secured when not in use)
 - Controlled substance licence
 - C A requirement that product labels and documentation for hydrocyanic acid discoids contain information on the flammability hazard of hydrogen cyanide gas liberated.
- 5 New controls

A Licence. A requirement for a licence (known as a Controlled Substances Licence – refer to Section 2.1.7 of this Code) for possession of a fumigant.

B Prohibition on movement of a shipping container. Prohibition on the movement of a shipping container while it is under fumigation except from a wharf to a ship or vice versa.

C Restrictions on fumigation in shipping containers. The fumigation of a shipping container can only be carried out in a place that is secured against ready access by unauthorised persons. It must not be fumigated in an area where the public may lawfully be present.

D Gas tightness of shipping containers. Before fumigating a container it must be inspected and found to be in good repair and gas tight. If the container is found not to be capable of retaining the fumigant then it can be modified or fumigated by the use of sheets.

D Gas tightness of fumigation cells. All fumigation cells used for fumigation must be capable of retaining the fumigant.

E Notification. Notification must be made to authorities and others about the intention to use a fumigant 24 hours before commencement. Table 2 in Section 6.1 of this Code provides further details. There is an exemption from notification if the fumigation is done in a fumigation cell or shipping container, or at an established location on a routine basis and the site can be secured against unauthorised entry. In these cases the Fire Service only needs to be notified on the first occasion.

F Signage. A requirement for warning signs when carrying out a fumigation. Key information must be able to be read from a distance of not less than 10 metres and contain information about the fumigant being used, the type of hazard to humans, the name of the fumigator, the date commenced, and emergency information. Except for soil fumigations and fumigations of mammals underground all signs shall be illuminated after dark. All signs must be removed after completion.

G Supervision. Certain types of fumigation must be supervised to ensure that for the period of the fumigation every point of access is controlled against unauthorised entry.

H Final safety precautions. There is a requirement to ensure that for all fumigations adequate measures are taken to ensure the fumigation area is properly ventilated and that the residual fumigant is reduced to as low a level as practical and in any case below the WES. The approved handler must be satisfied when it is safe for persons to re-enter the area.

I Completion of fumigation. The fumigation is completed when it has been ventilated to satisfy (i) above. When the fumigation is complete the person carrying out the fumigation must notify those that were notified about it in the first place.

ANNEX 3

Methyl Bromide, Phosphine, Cyanide and Chloropicrin: Properties and Emergency Measures

Technical properties of the common fumigants including symptoms of poisoning, antidotes, first aid measures and medical treatment. This Annex provides a summary of relevant properties only. For comprehensive details, refer to the Safety data sheet.

GENERAL

Fumigants can generally be divided into two main groups according to whether they boil above or below room or moderate temperature of 20 to 25 C. The lower the boiling point the greater the rate the fumigant volatilises. Generally, the boiling point rises with increases in molecular weight. The low boiling point fumigants such as Methyl Bromide are known as gaseous type fumigants. Those fumigants with high boiling points are described as the liquid or solid type of fumigant such as Chloropicrin.

Methyl bromide

At normal temperatures, methyl bromide is a colourless gas 3.27 times heavier than air. It boils at +4°C and the pure gas has a faint, sweetish smell. At atmospheric pressure, methyl bromide has explosive limits at about 10% to 16% by volume in air but can be ignited only by a high-energy source. Otherwise, for all practical purposes, mixture of methyl bromide and air can be considered to be non-flammable.

Pure methyl bromide does not corrode most metals, but aluminium and its alloys may be attacked by prolonged contact with liquid methyl bromide. Natural rubber is attacked strongly by liquid methyl bromide but of the common plastics, polythene, polypropylene and nylon appear to be affected least. The pure gas may similarly affect those materials which are attacked strongly by the liquid, but the dilute concentrations of vapour in air (usually below 1% by volume) used in fumigation have little effect so that it is possible, in fumigation practice, to employ sheeting coated with a variety of synthetic rubbers and other plastics.

Clothing, shoes, rubber gloves, surgical dressings etc, can be penetrated by methyl bromide and the vapour, if in contact with the skin, can cause severe blistering. The blisters are usually large and surrounded by areas of redness and swelling. They may take a long time to heal.

Methyl bromide is classified as toxic by inhalation and irritating to eyes, the respiratory system and skin. It may enter the body:

- a) By inhalation causing respiratory irritation, and later pulmonary oedema; or
- b) By absorption via the skin. In the case of prolonged skin contact with liquid methyl bromide, severe skin burns are to be expected.

Poisoning by methyl bromide can cause damage to the brain, nervous system, skin, lungs and the kidneys.

The TEL for methyl bromide in air is:

	TEL _{air}	
	ppm	mg/m ³
1 hour	1	3.9
24 hour	0.333	1.3

Chronic (annual average)	0.0013	0.005
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The TEL relates to exposure levels in the wider community rather than the workplace. The WES indicates workplace levels.

- Health Symptoms following significant inhalation may include:
 - Headache
 - Dizziness
 - Smarting of the eyes
 - Double or blurred vision
 - Nausea or Vomiting
 - Numbness of the feet.

- At higher or more prolonged exposure unconsciousness or serious delayed pulmonary and central nervous system effects may result
 - Loss of appetite
 - Abdominal pain
 - Impaired, slurred speech
 - Mental confusion
 - Weakness in the legs
 - Delayed impaired vision, hearing and balance
 - Convulsions
 - A rapid outpouring of fluid into the lungs (pulmonary oedema) can occur up to 30 hours after exposure.

Further detailed information on medical treatment for patients affected by exposure to methyl bromide can be found at <http://www.atsdr.cdc.gov/MHMI/mmq27.html>

Phosphine

Phosphine or hydrogen phosphide (PH₃) is a gas under normal conditions but can be liquefied at low temperatures and high pressures. The boiling point at atmospheric pressure is -87°C. Its density is 1.2 (air = 1). As normally manufactured, it is colourless and odourless. Any 'fishy' or 'garlic-like' smell is due to impurities. It is generally held that very pure phosphine is not spontaneously flammable except at low pressures. Nevertheless, phosphine will ignite at a temperature of about 100°C and, with air, it will form an explosive mixture when the phosphine content exceeds about 1.8% by volume. Using metal phosphides specially formulated for fumigation purposes may reduce the fire/explosion risk associated with phosphine.

Phosphine is slightly soluble in cold water, has low solubility in most solvents and is not strongly absorbed onto wood, plastics or textiles. It reacts with certain metals, eg copper and its alloys, the reaction being more rapid in the presence of moisture and at high temperatures.

Phosphine and phosphides are hazardous materials. They may enter the body by:

- a) Inhalation of phosphine gas or particles of phosphide dust; or
- b) Swallowing phosphide preparations.

Health Symptoms following inhalation of phosphine include:

- Slight or mild poisoning
 - Physical weakness and fatigue
 - Nausea, vomiting and diarrhoea

- Buzzing in the ears
 - Headache
 - Pressure in the chest and breathing difficulty.
- Medium to severe poisoning
 - Dry cough
 - Choking attacks
 - Intense thirst
 - Reeling gait
 - Severe pains in limbs
 - Enlarged pupils
 - Rapid onset of stupor.

The serious complication of pulmonary oedema may occur, usually within 24 hours of exposure, but is occasionally delayed for a few days.

Hydrogen Cyanide

Cyanide is one of the most toxic of insect fumigants and has been used for many years successfully for a range of applications. Cyanide is available in two forms for fumigation purposes in New Zealand. Calcium cyanide in granular form and Sodium cyanide impregnated into porous cardboard discs, hermetically sealed in cans.

At normal temperatures hydrogen cyanide is a highly toxic colourless gas with the unique feature that it is the only fumigant lighter than air with a specific gravity of 0.9 (SG air = 1.0). It has a boiling point of 26°C and has a strong almond smell. At atmospheric pressure hydrogen cyanide forms a flammable mixture with air at 6-41% by volume. Levels of hydrogen cyanide are usually below 1% during fumigation but explosive levels have been known to occur during fumigation, so all gas mixtures should be regarded as flammable.

Hydrogen cyanide is water-soluble (infinite solubility at all temperatures). Moisture content of product is therefore a critical factor during fumigations with hydrogen cyanide. Dosage and fumigation time recommendations must be strictly adhered to particularly with produce fumigations such as bananas. Hydrogen cyanide is used worldwide for deratting of ships.

Hydrogen cyanide is extremely toxic by inhalation or absorption through the skin. Complete PPE, a full-face mask with approved filter/canister, or positive pressure breathing apparatus must be used at all times when exposure to hydrogen cyanide is a risk. In man and warm-blooded animals Hydrogen cyanide rapidly causes death (within a few minutes) by impeding or completely preventing oxygen supply to body cells. Hydrogen cyanide can enter the body through the mouth, lungs or the pores of the skin. The latter is more likely upon exposure to high concentrations of gas in excessive heat. A concentration of 50 ppm for 20 minutes causes serious disturbances and 200 ppm causes death in a few minutes.

Poisoning by hydrogen cyanide can cause damage to the brain, nervous systems and other vital organs. The toxic action is reversible and this means that a person who is completely unconscious from the effects of cyanide but whose heart is still beating may still recover if suitable antidotes and remedial measures, such as the administration of oxygen, are applied in time.

The ERMA TEL for cyanide in air is 0.009 mg / m³. The workplace STEL is zero.

Warning symptoms following exposure may include:

- Irritation to the mucus membranes of the eyes, throat and upper respiratory tract
- Burning sensation on the tongue
- Metallic taste in the mouth
- Feeling of pressure in the forehead
- Sharp pains in the head
- Giddiness and disturbed equilibrium
- Nausea and vomiting
- Convulsions and unconsciousness will follow upon continued exposure.

Chloropicrin

Chloropicrin is a powerful fumigant and is widely used as tear gas to control riots in some overseas countries. It is one of the most toxic compounds to insects. It is sometimes added in small concentrations to other fumigants such as cyanide and methyl bromide to act as a warning agent.

Chloropicrin can cause rapid death in man at a concentration of 2.4 grams per cubic meter. A concentration of as low as 1 ppm will produce severe smarting of the eyes.

Chloropicrin is usually used in liquid form in specially made containers for safety reasons.

Application of chloropicrin is difficult and for this reason it is not commonly used other than for soil fumigations using special applicators.

Because of the severe tear gas effect a person will be unable to remain in a dangerous concentration of chloropicrin for more than a few seconds. If there is any doubt about leakage of gas appropriate RPE must be worn.

FIRST AID MEASURES FOR FUMIGANTS

General

Take a person who may have been affected by any fumigant into the fresh air at once and keep them quiet and warm. Seek medical attention promptly (dial 111) and show the product label or SDS to the doctor. If breathing stops or shows signs of failing, administer artificial respiration using oxygen and a suitable mechanical device such as a bag and mask. **Do not use mouth-to-mouth resuscitation.**

Methyl bromide

Remove any clothing that may have become contaminated with the liquid fumigant immediately and flood the contaminated part of the skin with water and wash it thoroughly. Keep a plentiful supply of clean water near fumigation areas for this purpose. Seek medical advice immediately, explaining the circumstances of exposure. If reddening of the skin or blistering occurs before this is possible, cover the affected parts loosely with sterile dressings.

One of the main dangers of methyl bromide is the delay between exposure and the onset of symptoms of poisoning. If any symptoms of poisoning are observed, take the person to hospital immediately.

Phosphine

Brush skin and hair, which may have been contaminated by spent phosphide dust free of residues in a well ventilated place after work and before washing, eating, drinking or smoking.

If the symptoms of poisoning are observed seek urgent medical attention.

Cyanide

Remember oxygen administration is the best antidote for cyanide poisoning. A portable oxygen cylinder with a flow gauge and facemask must be available when carrying out cyanide operations. Fast administration of oxygen soon after exposure will generally be successful in reviving a patient affected by Cyanide. Amyl nitrate pearls/capsules should be available in the first aid kit during all cyanide fumigations. In the event of an emergency pearls/capsules can be used by holding a one in a handkerchief or clean cloth close to the victims nose and breaking the pearls/capsules so that the fumes can be inhaled. Supplies of amyl nitrate are only available on prescription.

Chloropicrin

Remove affected person or patient to fresh air and keep quiet and still. In most case this will be sufficient for revival. However always seek medical attention immediately and watch for signs of distress. If breathing stops or shows signs of failing administer artificial respiration using oxygen or mechanical means but not mouth to mouth.

MEDICAL TREATMENT

General

Ensure that notes on the treatment of poisoning for the guidance of medical practitioners are available during fumigations and send them with a patient to the doctor or hospital. Such notes are usually supplied with the fumigant by the manufacturer or in an SDS. Advice on medical treatment may also be obtained from:

National Poisons Information Centre, Dunedin. 0800 POISON (0800 764 766).

Methyl Bromide

If clinical or radiological signs or pulmonary oedema are evident treat with 100% oxygen and if condition is advancing use intermittent positive pressure breathing. Give intravenous aminophylline (0.5 grams) slowly. Adrenergic amines administered by aerosol should help to relieve accompanying bronchospasms. Convulsions should be treated by conventional anti-convulsion drugs particularly phenytoin in adequate dosage. Watch for evidence of renal and/or hepatic failure and treat accordingly.

Phosphine

Individuals exposed to phosphine run the risk of pulmonary oedema even if they do not appear to be seriously affected. Keep them under medical supervision for several days. There is no specific antidote. Treatment is similar to that for pulmonary oedema due to other toxic gases. Absolute rest is necessary in seriously ill patients.

Hydrogen Cyanide

If oxygen administration has not been successful administration of cyanide treatments recommended by the Poisons Information Centre in Dunedin is recommend. Some changes to the treatment of cyanide poisoning have occurred over recent years so up to-date information is required. This can be obtained from the National Poisons Centre.

Chloropicrin

For skin exposure begin decontamination with running water. Flush for minimum of 15 minutes. Remove affected clothing. For eye exposure flush the victim's eyes with running water for a minimum of 15 minutes. It may be necessary to hold the eyes open.

For inhalation the patient should be removed to the open air, remove gross contamination to avoid exposing rescuers and provide assisted ventilation to assist pulmonary function if necessary. If ingested do not induce vomiting. Rinse mouth with water and drink plenty of water.

ANNEX 4

Example of Warning Sign for Pesticide Store

Warning Sign: Black exclamation mark on a yellow triangular background with black edging. Relevant text on a yellow background may be used as appropriate.

Prohibition Signs: Black 'no smoking' pictogram on white circular background with red edging and diagonal line. Relevant text on a red background may be used as appropriate.

Black 'no naked flames' pictogram on white circular background with red edging and diagonal line. Relevant text on a red background may be used as appropriate.

HAZCHEM signage description is orange and black identifying the fumigants stored.

For further detail on signage information, refer to the NZ Chemical Industry Council Approved Code of Practice: Signage for Premises Storing Hazardous Substances and Dangerous Goods.

ANNEX 5

Wording to be included in signage to be erected when applying fumigants for the control of mammals underground. The sign shall be erected at the perimeter of the risk area.

- 1 Description of fumigant to be used and the words "Warning Poisonous Fumigant "
- 2 Name of the fumigant and its hazard,
- 3 Name and contact details of person (or body) responsible for applying the fumigant
- 4 Date of operation and when the area is likely to be closed for entry.

Such notice shall be displayed in a conspicuous place able to be readily seen by persons approaching the area.

ANNEX 6

Examples of Signs to be used at the Entrance to Fumigation Areas, Risk Areas and Buffer Zones.

The dimensions, colorimetric and photometric features of signboards must be such that they can be easily seen and understood. Some typical examples suitable as warning signage for fumigants are:

Fumigation: The sign must state that fumigation is being carried out.

Fumigant: The fumigant must be stated.

Warning Sign: The sign must state that the fumigant is toxic to humans. Include the black skull and crossbones with black edging
Text may be on yellow background; DANGER: TOXIC GAS

General type of hazard: the sign must include the general types of hazards associated with the fumigant.

Respiratory equipment: the sign should include white 'respiratory equipment' pictogram on a blue circular background with white edging.

Text on blue background; RESPIRATORY PROTECTION MUST BE WORN

Prohibition Sign: Black 'no access' pictogram on white circular background with red edging.

Text on red background; NO ENTRY

Flammable Fumigant: If the fumigant is flammable, the sign must describe the precautions necessary to prevent unintended ignition of the substance.

Adjacent Text: FUMIGANT: (NAME)







CONTACT: (NAME, ADDRESS, PHONE)

Emergency information; The words "In an emergency Dial 111 Fire Brigade" should appear at the bottom right corner







Methyl Bromide as a Fumigant.

In addition to the above, signage at the entrance to buffer zones where methyl bromide is used must include contact details for the person in charge:

Example of Signage at entry to buffer zone for Chloropicrin:

<p>FUMIGATION TAKING PLACE</p>  <p>FUMIGANT: CHLOROPICRIN</p> <p>CONTACT: FUMIGATOR: PHONE:</p>	    
<p>Date of Fumigation: / /</p> <p>In an emergency Dial 111 Fire Brigade</p>	

Example of Signage for entrance to buffer zone for methyl bromide

<p>FUMIGATION TAKING PLACE</p>  <p>FUMIGANT: METHYL BROMIDE</p>	    
<p>CONTACT: FUMIGATOR: PHONE: PERSON IN CHARGE: PHONE:</p>	
<p>Date of Fumigation: / /</p> <p>In an emergency Dial 111 Fire Brigade</p>	
<p>NO SMOKING; NO NAKED FLAMES; NO IGNITION SOURCE</p>	

Examples of Freight Container Signage

<p style="text-align: center;">DANGER</p> <p style="text-align: center;"><i>UNDER METHYL BROMIDE FUMIGATION</i></p> <p style="text-align: center;"><u>COMPANY</u></p> <p style="text-align: center;">PHONE:</p>
--

<p style="text-align: center;"><u>COMPANY</u></p> <p style="text-align: center;"><i>CERTIFY</i></p> <p style="text-align: center;"><i>THIS CONTAINER HAS BEEN FUMIGATED WITH METHYL BROMIDE GAS. IT HAS BEEN VENTILATED FOR _____ HOURS AND IS CONSIDERED SAFE TO ENTER.</i></p> <p style="text-align: center;"><i>Released from Fumigation:</i></p> <p><i>DATE:</i> _____</p> <p><i>SIGNATURE:</i> _____ <i>PHONE:</i> _____</p>

Example of a notice to be fixed to a Freight Container, which may have residual gas remaining inside.

Company logo

This container has been **fumigated** using **Methyl Bromide/ Phosphine**, and has been cleared of gas to safe levels.

Further release of gas from the contents in the container **MAY** occur following door closure.

Before de-vanning the container

- 1) Vent the container for no less than two hour by forced ventilation to circulate existing air
- 2) Ensure both doors are open
- 3) Appropriate respiratory protection (Full face mask) must be worn when spending long periods of time de-vanning container

General Information: _____ Gas Applied / /

Phone: _____

Emergency Information: _____ Gas Released / /

ANNEX 7

Fumigation: Certificate of Clearance

Example of a fumigation certificate of clearance:

<u>FUMIGATION: CERTIFICATE OF CLEARANCE</u>			
Container No:			
Seal No:			
Container Size:		Type:	
STC:			
Exporter:			
Consignee:			
Vessel:		Voyage:	
Destination:			
Fumigant:		Dosage:	g/m³ Hours
Fumigated Under Gas Tight Sheets:			
Minimum Temperature:			
Fan Capacity:			
Fumigated at:			
Date of Fumigation:			
Certified Free of Gas:			
Operator (Approved handler) Signature:			
		<i>Client:</i>	
		<i>Ref/Order No:</i>	
		<i>Contact:</i>	

ANNEX 8

Compliance Guide for Fumigants

Fumigants are used to control a variety of pests including:

- fungus in soil,
- spiders in grape imports,
- mites in grain, and
- rabbits in burrows.

Different fumigants are:

- injected into the soil,
- used to treat timber,
- used to treat export and import goods,
- used to debug buildings and ships, and
- used extensively by the agriculture and horticulture industries and other pest management services.

If your pest control business wants to use fumigants, the law requires you to have the right Test Certificates.

You may need to be an Approved Handler, hold a licence or possess a Location Test Certificate for your premises.

Approved Handlers

Fumigants are highly toxic poisons that, in some instances, can be extremely harmful to people.

An Approved Handler must make sure that certain chemicals are handled safely, that they do not harm people, nor damage the environment.

All fumigants listed in the table below are required to be under the control of an Approved Handler at all times, except when the fumigant is safely locked away.

Not all employees in a pest control business need to be Approved Handlers. Fumigants may be handled by a person who is not an Approved Handler if:

- an Approved Handler is present at the place where the fumigant is being handled,
- the Approved Handler has provided guidance to the person for the handling, and
- the Approved Handler is available at all times to provide assistance if necessary.

For more information about obtaining an Approved Handler Certificate, please refer to the ERMA New Zealand web site: www.ermanz.govt.nz

Licences

All persons who possess fumigants will need to have a licence for the fumigants they hold. To obtain a licence you will need several things including:

- a full Approved Handler Certificate, and
- a fit and proper person check by the Police (if you hold a Firearms Licence this will be OK).

If you do not have a licence you may possess a fumigant only if a licence holder is present and immediately available to you.

Full details on how to obtain a licence will be published by March 2005.

Location Test Certificates

You will need a Location Test Certificate if you are using and/or storing flammable fumigants above certain minimum quantities. They are listed in the table below.

For information about obtaining Location Test Certificates, please refer to the ERMA New Zealand web site: www.ermanz.govt.nz

How to get Test Certificates

You must obtain your certificates from a Test Certifier. To find your nearest Test Certifier check the register at:

<http://www.ermanz.govt.nz/search-databases/Pages/testcertifiers-search.aspx>

Tracked chemicals

The most hazardous chemicals need tracking, and you will need an Approved Handler in order to use them. To buy them your supplier will need to confirm there is an Approved Handler who will take responsibility for them, and that you have a Location Test Certificate if needed.

All the fumigants in the table below are tracked. Tracking means recording what happens to the fumigant, which you possess. The record must show specific details including quantities at each stage of its lifecycle. Also needed are:

- the name and some details of the fumigant you possess,
- who you transfer it to,
- how you use it; and
- how you dispose of unused fumigant or its waste.

Further Information

You can also contact a hazardous substance enforcement officer at the Department of Labour Workplace Group (Occupational Safety and Health Service), in your district.

Register of Test Certifiers at:

<http://www.ermanz.govt.nz/search-databases/Pages/testcertifiers-search.aspx>

ERMA New Zealand
PO Box 131
Wellington
Tel: 04 916 2426 or 0800 376 234 (HS Compliance Line)
Email: pesticidesinfo@ermanz.govt.nz
Website: www.ermanz.govt.nz

At a glance

You should recognise the fumigants that you use in this table. Fumigants below are listed by their trade name. The table shows what certificate or licence is required, or whether the fumigant is required to be tracked for each specific product.

Fumigant, with Trade Name Products	Location Certificate	Hazardous Atmosphere Zone	Licence/ Approved Handler	Tracking	Fire Extinguishers	Emergency Response Plan
1,3-Dichloropropene Telone Soil Fumigant	Yes >100 L	Yes > 100 L	Yes	Yes	Yes > 250 L 2 of	5 Kg
1,3-Dichloropropene and chloropicrin Telone C-35 Soil Fumigant	Yes >100 L	Yes > 100 L	Yes	Yes	Yes > 250 L 2 of	5 Kg
Chloropicrin Brimark Chloropicrin Pic-Fume Chloropicrin Soil Fume CP	No	No	Yes	Yes	No	5 Kg
Hydrogen cyanide Cyanosil	No	No	Yes	Yes	No	5 Kg
Magnesium or aluminium phosphide Magtoxin Gentoxin Genfume AP Quickphos	Yes >3 kg	No	Yes >3 kg	Yes >3 kg	No	5 Kg
Methyl bromide AG Fume MB Brima-Fume Methyl Bromide K & B Adams Methyl Bromide	Yes >100 kg	Yes > 100 Kg	Yes	Yes	Yes > 200 Kg 2 of	5 Kg
Methyl bromide and chloropicrin Brima-Fume Methyl Bromide Fumigant Bromafume Soil Fumigant Israel Bromine K & B Adams Methyl Bromide Fumigant Soil Fume MBC 33	Yes >100 kg	No	Yes	Yes	No	5 Kg
Phosphine ECO2FUME	No	No	Yes	Yes	No	5 Kg

Precautions for Fumigated Freight Containers

Introduction

The use of freight containers or ISO containers has increased over the last 20 years to a point where nearly all freight is now carried this way. Regulatory authorities around the world are increasingly aware of the need for good biosecurity practices to prevent the spread of disease and unwanted pests between countries. Fumigation of freight containers is an effective biosecurity control when used correctly and in accordance with accepted standards.

Labelling and documentation can't always be relied on

Unfortunately the presence of fumigant residues in freight containers is a common occurrence. Its presence is often undeclared, undocumented, and external warning signs either not applied or removed. Employees and others, including inspection staff from MAF or Customs, who open or enter containers, are therefore potentially exposed to the fumigant gas. This publication provides information for the development of safe working practices.

Common fumigants

The most commonly used fumigants in freight containers are Methyl Bromide or Phosphine. Both these fumigants are highly toxic in small quantities.

Methyl Bromide - is used as gas and has a general lack of odour therefore provides little warning of its presence in a container.

Phosphine - has a garlic type odour and therefore is more easily detected. Phosphine gas is generated by a reaction from moisture in the air to Aluminium or Magnesium Phosphide, which are usually in pellet form. The residue from these pellets is a greyish white powder and must also be treated with care.

Fumigation practice

Containers can be fumigated at different times in the transport chain. If done offshore before shipment, the container will usually be aerated or ventilated before loading on a ship. Under international maritime rules containers under fumigation are only permitted on a ship at the discretion of the master, who will usually require them to be aerated or ventilated. Even if these containers are aerated before shipping, some residue of fumigant is likely to remain because of the slow release of gas absorbed into the cargo. Documentation about fumigation of a container such as treatment certificates, customs declaration or warning labels may not be a reliable indication that fumigation has been carried out. Therefore anybody required to open a container must do so with great care and take appropriate precautions to prevent exposure to possible toxic gases. Fumigation after arrival in New Zealand is a common occurrence for biosecurity reasons. The controls placed on the use of fumigants under the Hazardous Substances and New Organisms (HSNO) Act requires that all fumigated containers must be ventilated at the completion of the fumigation period. It is usual to place a warning sticker on the outside of the container giving

fumigation details. The container will be locked and there should be signage around the fumigated container.

Hazard assessment

Potential exposure to fumigants in containers should be identified and managed as part of normal health and safety measures by all personnel involved in unloading or accessing cargo in containers. This means:

- carrying out a hazard assessment before opening a container
- identifying the likely presence of a fumigant in the container using appropriate safety precautions
- being aware that the cargo may emit an odour, which may be confused with fumigants. This applies in particular to furniture or other cargo that may have been treated with organic solvent materials such as paint.

Safety precautions

If a container shows signs of having been fumigated, either offshore or in New Zealand then:

- anyone involved with these containers must be careful when opening them
- all workers must be protected against exposure, this may involve wearing appropriate respiratory protection
- assess whether a secondary ventilation period may be required to remove any residual gas
- ventilation should only be carried out in a secure but open area which the public and others do not have access.

Ventilation procedures

There is a view that a venting period of 4 hours is recommended before de-vanning a fumigated container. The DoL does not specify the venting period, as the actual time needed to reduce exposure levels below the Workplace Exposure Standard (WES) is dependent on the:

- concentration of methyl bromide in the container,
- ventilation rate (whether forced ventilation using fans or natural ventilation is used),
- rate of methyl bromide desorption from the container contents
- how densely the container is packed.

Given the variables described above, it is not possible to specify a single venting period as a 'rule of thumb'. The HSE Act does require hazards to be identified and assessed, and given the harm that methyl bromide can and does cause, it must be considered a significant hazard. Given that the hazard in this case cannot be eliminated, or isolated, careful attention must be given to considering what practicable steps are available, and can be taken, to minimise the hazard. There will always be a tension between the need to vent a shipping container for a reasonable period (either with forced ventilation or natural ventilation), and the need to unload and distribute cargo to meet the demands of customers. For this reason, employers should have suitable procedures in place, to deal with the hazards of fumigated shipping containers. These procedures should involve provision of appropriate protective equipment and monitoring employees exposure to the hazard.

Respiratory protection

Where respiratory protection is considered necessary because of the type of cargo, for example tightly packed or granular materials, then self-contained breathing apparatus or air-supplied respirators offer the best form of protection. If the levels of gas can be determined by testing, and are lower than the Workplace Exposure Standard (WES), then a lesser level of respiratory protection can be used, such as a filter face piece using an appropriate filter for the gas. Care needs to be taken to ensure that the testing method and type of gas is properly identified. Most commercial fumigation companies have testing devices for this purpose and can be contracted to provide this service.

Conclusion

Always be aware that:

- a residual fumigant may be present in freight containers following legitimate fumigation
- other contaminate gases may also be present
- despite initial ventilation of the container the level of gas may still be sufficient to cause health effects to anyone opening or working in the container
- following sensible precautionary measures when opening a container will usually keep workers safe
- forced ventilation should clear the air to allow work to proceed safely
- if in doubt, workers should wear adequate respiratory protection.

Assistance with this procedure may be obtained from commercial fumigation companies who have experience working with these products.

ANNEX 10

Risk management

Overview of risk management

The main elements of risk management are described in the Standard AS/NZS4360-1999 Risk Management. This Standard defines risk management as a series of well-defined steps which, taken in sequence, support better decision-making by contributing insight into risks and their impacts. The management and measurement of risk involves considering:

- The consequences of an event, and
- The likelihood of such an event occurring.

Risk may be described qualitatively (or comparatively) as "low", "medium", "high" or "extreme".

Risk is usually evaluated in terms of

- "Acceptable" (or "tolerable") or
- "Unacceptable" levels or standards.

Adoption of risk management approach

While recognising the need for more research in this area, the Fumigation Code advocates the adoption of a structured risk management approach, in conjunction with the HSNO Regulations and controls, to reduce the risk of harm to people, property or the environment as the result of activity associated with fumigation activities.

Risk management involves three distinct steps:

- Recognition
- Evaluation
- Control

To complete a risk assessment:

Recognise:

Identify potential hazards in a given situation. This should be done in communication with those who must work in the situation, and should take any historical or research data available into account.

Then identify the at-risk population and any property or environmental elements that may be at risk and take into consideration the length and frequency of exposure to the hazard.

Evaluate:

Identify the item (task/area/equipment/ product) that could present a hazard. Specify the potential harm that could occur with no control measures in place to prevent the hazard.

Identify who or what is at risk from this hazard, i.e. people (staff or the general public), property or the environment.

Rate the likelihood of an accident if no control measures are put into place:

- Negligible
- Unlikely
- Possible
- Likely

Rate the potentially worst consequences of an accident involving that hazard:

- **Insignificant** no injuries, no release.
- **Minor** first aid treatment, on-site release immediately contained.
- **Moderate** medical treatment required, on-site release contained with outside assistance.
- **Major** extensive injuries, off-site release with no detrimental effects.
- **Catastrophic** death, toxic release off-site with detrimental effect.

Table 1 shows how correlating these two factors (likelihood and severity of consequence) give the Qualitative Levels of Risk:

L = LOW
M = MODERATE
H = HIGH
E = EXTREME

Table 1

	Likelihood	Negligible	Unlikely	Possible	Likely
Severity of consequence					
Insignificant	L	L	L	M	
Minor	L	L	M	M	
Moderate	L	M	H	H	
Major	M	H	E	E	
Catastrophic	M	H	E	E	

The qualitative levels of risk can indicate where to focus efforts for reducing risk to acceptable levels. The person undertaking the risk assessment and reduction should address all "E" (extreme risk) first, followed by "H" (high risk) and then "M" (moderate risk).

"L" (low risk) is an acceptable level of risk. Under certain circumstances, a moderate level of risk may be acceptable if the risk has been minimised as far as is reasonably practicable.

"E" and "H" are unacceptable levels of risk.

Control

Level One:

Eliminate the hazard; for example by using different products.

Level Two:

Reduce the impact of the hazard by:

- Isolation.
- Management control; for example by establishing safe work procedures and ensuring there are sufficient staff and facilities.

Level Three:

Use of Personal Protection Equipment (PPE)

This is the least favoured as it only reduces the handlers' exposure to the risk without actually eliminating or reducing the hazard.

ANNEX 11
Incompatible Substances

Substances incompatible with class 2, 3 and 4 substances.

Hazard Classification	Fumigant	Incompatible substances
2.1.1B	Methyl Bromide	All class 1 substances Class 2.1.2 substances All class 3 substances All class 4 substances All class 5 substances
3.1	1,3-Dichloropropene 1,3-Dichloropropene and chloropicrin	All class 1 substances All class 2 substances All class 3.2 substances All class 4 substances All class 5 substances
4.3A	Phosphine	All class 1 substances All class 2 substances All class 3 substances All class 4.1.1, 4.1.2, 4.1.3 and 4.2 substances All class 5 substances All class 8 substances Water