



## INSTRUCTIONS AND GUIDELINES

**Title: OHS Hazard Instruction and Guideline  
– Fumigants  
Date: 1 July 2007**

**This Instruction and Guideline refers to:**  
**Practice Statement No: 2007/04 OHS Policy – OHS Risk Management – HSMA 2**  
**Published date: 17 October 2007**  
**Availability: Internal and external**

**BCS CLASSIFICATION: OHS\_POLICY\_HAZARDS\_FUMIGANTS**  
**FILE NUMBER: C02/07004**

**Subject:** OHS Hazard Guideline – Fumigants  
**Purpose:** To provide advice on managing the risk of fumigants  
**Owner:** National Director, People and Place Division  
**Category:** People

*The electronic version published on the intranet is the current Practice Statement.*

### **Summary of Main Points**

This OHS Hazard Instruction and Guideline provides additional guidance in implementing the OHS Risk Management Practice Statement when managing risks associated with fumigants. This Instruction and Guideline outlines:

- Legislative requirements for managing risks associated with fumigants in the workplace;
- Practical steps and tips that can be taken to manage fumigant risks and to develop local Standard Operating Procedures; and
- Additional references.

### **Introduction**

The intended policy outcomes of this document are to ensure that Customs meets its legislative obligations and duty of care to successfully manage risks associated with fumigants in the workplace and to ensure a safe and healthy work environment.

This Instruction and Guideline outlines the legislative requirements on Customs and its employees to manage risks associated with fumigants in the workplace. It describes several common fumigants and provides advice and suggestions on how to conduct OHS Risk Assessments to successfully deal with fumigants. It does not include specific procedures, as these will need to be developed locally in consideration of individual factors within each workplace.

### **Instructions and Guidelines**

Employees working in areas where fumigants may exist need a safe working environment and procedures, plus information necessary to protect them from substances that can impair health or cause undue annoyance.

Several work activities may expose employees to fumigants. The most common is when examining cargo in shipping containers. There is a risk of exposure when testing for fumigants, attaching venting equipment, opening and entering shipping containers, and also when examining container contents.

Customs applies the Worksafe Australia Standard (*NOHSC Exposure Standard for Atmospheric Contaminants 1003 (1995)*). This specifies exposure standards for airborne chemical concentrations in the worker's breathing zone which, on current knowledge, should neither impair the health of, nor cause undue discomfort to, nearly all workers.

Adhering to the exposure standards reduces the risk of injury or illness from fumigant exposure and is essential in hazard control.

The following information is provided to assist work areas conduct OHS risk assessment management processes for fumigants and to formulate SOPs.

## **Identify The Hazard**

The most likely hazard is fumigants used in shipping containers to control pests.

Testing the atmosphere inside the container is the main way to determine if fumigants are present in shipping containers. Checking the container documentation, or noting fumigant residue (pellets or powder) can also alert employees to a hazard.

Testing determines whether any fumigants are in the container and their concentration. By applying the NOHSC Exposure Standards employees can determine if the container atmosphere is hazardous, and forms part of the hazard identification process. Customs currently uses the *Voice100* selected ion flow tube mass spectrometer (*SIFT-MS*), and in some cases the Draeger fumigant detection tubes, to test for fumigants in shipping containers. Testing equipment is regularly reviewed and Customs may adopt better equipment as it becomes available. Operators must follow manufacturer's instructions for using the test equipment to ensure accurate results are obtained.

## **Assess the Risk**

Employees must assume all containers could contain unsafe levels of fumigants. Testing and applying the Exposure Standards helps to determine the actual risk.

### *NATIONAL EXPOSURE STANDARDS*

Exposure standards specify limits to long-term exposure to a substance over an eight-hour day, for a five-day working week, over an entire working life. These standards are expressed as three separate quantities: *Time Weighted Average (TWA)*; *Short Term Exposure Limits* *Time Weighted Average (STEL)*; and *Peak Limitation*.

#### **Time weighted average (TWA)**

The TWA means the average airborne concentration of that substance over an eight-hour working day, for a five-day week. During periods of continuous daily exposure to an airborne contaminant, these TWA exposures allow excursions above the exposure standard, *provided* they are compensated by equivalent excursions below the standard during the working day.

#### **Short-term exposure limits**

Some substances that act rapidly may induce effects after a relatively brief exposure ('acute exposure') to high concentrations. Short-term exposure limits (STELs) guide short-term exposure, and therefore supplement the eight-hour exposure standard. STELs are recommended for those substances only when there is evidence from human or animal studies that adverse health effects can be caused by high short-term exposure.

STELs are expressed as airborne concentrations of substances, averaged over a period of 15 minutes. You should not exceed this short-term limit at any time during a normal eight-hour day. Workers should not be exposed to STEL concentration continuously for longer than 15 minutes, or for more than four such periods in any working day. There should also be at least 60 minutes between successive STEL exposures.

## Peak Limitation

Averaging the airborne concentration is inappropriate for some rapidly acting substances and irritants. These can induce acute effects after relatively brief exposure to high concentrations, so exposure standards for these substances represent a **maximum** or *peak concentration* which workers can face [safely]. Workers must not face concentrations above these limits.

## Exposure standards - general excursion

Where a 'peak' or STEL is not specified for an exposure standard (see above table), and provided that the eight-hour TWA exposure standard is not exceeded, short term exposures should not exceed 3 times the TWA exposure standard for more than a total of 30 minutes per eight-hour working day. Under no circumstances should the short-term values exceed five times the exposure standard.

## Additive Effects

When a body is exposed to two or more fumigants, an additive effect is obtained when the fumigants have the same target organ or the same mechanism of action. The NOHSC Standard contains formulae for calculating additive effects. In simple terms the total effect upon the body equals the sum of effects from individual substances. By dividing the concentrations of individual fumigants by the exposure standards and adding the results together the additive effect can be measured.

For example, consider an atmosphere with

- Methyl Bromide 2ppm (exposure standard 5ppm)
- Chloropicrin 0.05ppm (exposure standard 0.1ppm)

$$\frac{2}{5} + \frac{0.05}{0.1} = 0.9$$

If the sum of the contribution of each fumigant does not exceed 1, the exposure standard for the mixture has not been exceeded.

**Table 1 - Exposure standards for fumigants currently identified in Customs workplaces (alternative names in brackets).**

(1) Substance	(2) TWA		(3) STEL	
	ppm	mg/m <sup>3</sup>	ppm	mg/m <sup>3</sup>
<b>Chloropicrin</b> (Trichloronitromethane)	0.1	0.67	-	-
<b>Ethylene dibromide</b> (1,2-dibromoethane, EDB)	0.5	3.9	-	-
<b>Ethylene oxide</b> (Oxirane )	1	1.8	-	-
<b>Formaldehyde</b>	1	1.2	2	2.5
<b>Hydrogen cyanide</b> (hydrocyanic acid)	10	11	peak limitation	
<b>Methyl bromide</b> (bromomethane)	5	19	-	-
<b>Phosphine</b>	0.3	0.42	1	1.4
<b>Sulphuryl fluoride</b> (Vikane)	5	21	10	42

Source: National Occupational Health and Safety Commission – Exposure Standards for Atmospheric Contaminants in the Occupational Environment

(1) **Substance** - The fumigant description

(2) **TWA** - Exposure standard - *Time Weighted Average*.

**ppm** - Parts of vapour or gas per million parts of contaminated air by volume  
**mg/m<sup>3</sup>** - milligrams of substance per cubic metre of air at 25°C and one atmosphere pressure. When entry is in this column only, the value is exact: when listed with a ppm value, it is approximate.

(3) **STEL** - Exposure standard - *Short Term Exposure Limit*.

Where the words 'peak limitation' appear in this column the exposure standard peak should be applied to the value listed in Column 2.

**ppm and mg/m<sup>3</sup>** (see above)

### *Chloropicrin*

Small amounts of the chemical chloropicrin are sometimes mixed with methyl bromide or sulphuryl fluoride as a warning agent. Chloropicrin has an overpowering pungency with a sharp penetrating odour that should alert employees to its presence. If there is any suspicion that the chemical is present after initial venting, continue venting the container.

### *Ammonia*

Ammonia is used in the preparation of fertilizers and other products. Although rare, there have been reports of ammonia being present in shipping containers. Ammonia has a distinct, sharp intensely irritating odour that should alert officers to its presence. Customs does not do routine testing for ammonia, however if there is any suspicion that ammonia may be present in the container venting should take place to remove it.

## **Control the Risk**

### *Venting containers*

Where unsafe fumigant levels are detected, extraction equipment reduces the fumigant concentration to the exposure standards.

Containers are vented using approved extraction equipment, or other systems recommended by Border Technologies. Employees must understand and follow the operating instructions for the equipment. Supervisors must keep copies of these instructions where all employees involved in venting can use them.

To reduce the fumigant exposure risk, vent where the air disperses directly to the outside atmosphere.

### *Safety issues when using fumigant test & venting equipment*

Effective testing and venting is an essential element of risk assessment and control. It identifies chemicals present and informs decisions regarding safe working procedures, including the type of personal protection required.

To ensure the safest possible environment during testing:

- Training in using the testing equipment must be undertaken;
- All staff must understand what the exposure standards require;
- Use drill bit diameters that are only slightly larger than the testing probes or tubes.

### *Eye protection*

Although rare, incidents have been reported of glass shards lodging in an employee's eye when breaking the Draeger glass detection tubes. For this reason eye protection must be worn when breaking the tubes.

To ensure the safest possible environment during venting:

- Training in using extraction venting equipment must be undertaken;
- Determine the appropriate personal protective equipment (PPE) to use when connecting the equipment to the container (taking into account test results, type and concentration of fumigant detected). Wear protective gloves to prevent cuts and abrasions to hands when attaching or removing the device; and
- Disperse vented air away from any persons nearby.

### *Inability to satisfactorily lower fumigants levels – using PPE*

When fumigant levels within a container cannot be reduced to a safe level within a satisfactory time frame (taking into account local priorities and work procedures), employees must not open or enter the container without wearing self-contained breathing apparatus and full protective equipment.

### **Monitor and Review**

Effectively managing risks from fumigant exposure requires regular monitoring and review. Managers and supervisors can use several measures to evaluate control measure effectiveness, including:

- Investigate any reports of employees suffering the apparent effects from exposure to fumigant;
- Keep records of training in the use of test equipment and extraction equipment;
- Conduct regular walk-throughs of the work area to ensure employees use safe work practices;
- Consult staff on improvements to work practices; and
- Conduct a risk assessment before introducing any new equipment or process.

### **Key roles and responsibilities**

The Policy Owner for this Practice Statement is: National Director, People and Place.

### **Related Policies and references**

Practice Statements:

- *Customs OHS Policy Practice Statement – OHS Risk Management – HSMA 2*

Other Instructions and Guidelines:

- *Customs OHS Hazard Instructions and Guidelines*
  - *Dangerous Substances*
  - *Chemical Hazards*

Other Legislation and References:

- *Occupational Health and Safety (Safety Standards) Regulations 1994*

- *Worksafe Australia Standard (NOHSC Exposure Standard for Atmospheric Contaminants 1003 (1995)).*
- *National Occupational Health and Safety Commission (NOHSC) Hazardous Substances Information System (HSIS) [www.nohsc.gov.au](http://www.nohsc.gov.au)*
- *Material Safety Data Sheets;*
- *Fumigant Information Sheets (see attached)*

### **Key roles and responsibilities**

The Policy Owner for this Practice Statement is: National Director, People and Place.

### **Consultation**

#### **Industry Engagement**

Not applicable

#### **Internal Consultation**

All staff have been consulted in the development of this document as part of the development of Customs Health and Safety Management Arrangements in accordance with the OHS Act 1991. The National OHS Committee has endorsed the document for use within Customs.

### **Approval**

Approved on (\_\_/\_\_/2007) by:

Ian Grey

National Director People and Place

## FUMIGANT INFORMATION

The following information is taken from the material safety data sheets (MSDS) for each chemical. The information following is not comprehensive, but rather gives an overview of each fumigant's properties.

Always consult the complete MSDS for detailed information on each substance. MSDS can be obtained from the manufacturers, from subscription services such as Chemwatch or from intranet sites such as [www.msds.com.au](http://www.msds.com.au)

### *Information Sheet – AMMONIA*

*Company: Incitec Pivot Limited 1800 333 197 (toll free)*

**Introduction** – Used as a fertilizer and in preparation of fertilizers, chemical synthesis, condensation catalyst, latex preservative, manufacture of explosives, rocket fuel. Colourless gas with a sharp, intensely irritating odour.

**Effects of exposure** – Flammable. Toxic by inhalation. Causes burns. Risk of serious damage to eyes.

Inhalation causes irritation and is an irritant to the mucous membranes of the respiratory tract (airways). Exposure to concentrations above the Exposure Standard of 25 ppm may cause irritation to the eyes, nose and throat. Higher concentrations may cause breathing difficulty, chest pain, bronchospasm, pink frothy sputum and pulmonary oedema. This may further predispose the patient to the development of acute bronchitis and pneumonia.

Ingestion is not a likely route of exposure, however, swallowing liquid will result in freeze burns of the mouth, throat and stomach. Eye contact causes severe irritation. Substance is corrosive to eyes; contact can cause corneal burns. Contamination of eyes can result in permanent injury. Liquid splashes or spray may cause freeze burns to the eye. Contact with skin will result in severe irritation. Liquid splashes or spray may cause freeze burns. Corrosive to skin and may cause skin burns.

### *Information Sheet – CHLOROPICRIN*

*Company: Nufarm Australia Limited (24hr emergency) 1800 033 498*

**Introduction** – Used as a professional fumigant for cereals and grain and to control certain agricultural or soil borne pests and diseases. Also mixed in small amounts with methyl bromide or sulphuryl fluoride as a warning agent as these two chemicals are colourless and odourless. Chloropicrin has an overpowering pungency with a sharp penetrating odour that should alert employees to its presence.

**Effects of exposure** – Very toxic, especially by inhalation. Inhalation may result in lung oedema that can be delayed for some hours (and aggravated by physical effort). It is very irritating to eyes and mucous membranes. Considered toxic by ingestion, will cause vomiting and irritation to gastrointestinal tract. The chemical presents a high hazard by skin contact causing severe irritation and possibly blistering. Skin absorption not considered a serious hazard compared with external effects.



Symptoms of acute exposure include abdominal pain, coughing, diarrhoea, dizziness, headache, vomiting and weakness. First warning of exposure are tear formation and pain to the eyes. Lung oedema is possible and may be delayed.

### ***Information Sheet – ETHYLENE DIBROMIDE***

**Introduction** – Used in various manufacturing processes and as a grain fumigant and fumigant for tree crops. Colourless non-flammable liquid with a chloroform-like odour.

**Effects of exposure** – Ingestion is considered an unlikely route of entry in commercial or industrial environments.

The vapour is discomforting to the eyes. The liquid is highly discomforting to the eyes and is capable of causing pain and severe conjunctivitis. Repeated or prolonged exposure to irritants may produce conjunctivitis

The liquid is extremely discomforting to the skin and may cause dermatitis due to its degreasing effect and it is absorbed through intact skin. Bare unprotected skin should not be exposed to this material. The material may accentuate any pre-existing skin condition.

The vapour is highly discomforting to the upper respiratory tract. Inhalation hazard is increased at higher temperatures. The vapour is a severe respiratory tract irritant producing coughing, wheezing, shortness of breath and chest pain. Prolonged exposure to high concentrations may cause bronchial or laryngeal oedema, chemical pneumonitis and pulmonary oedema. Systemic effects include nausea, vomiting, diarrhoea, abdominal cramps or pain, weakness and headache.

### ***Information Sheet – ETHYLENE OXIDE***

*Company: Ensign Laboratories Pty Ltd: Ph (03)9573 3112  
BOC Gases (Commonwealth Industrial Gases Ltd) (02) 8874 4400 (03) 9287 8444*

**Introduction** – Fumigant for foodstuffs and textiles; to sterilize surgical instruments; agricultural fungicide; in organic syntheses, especially in the production of ethylene glycol and higher glycols.

Colourless liquid or vapour with an ether-like, pungent (irritating) odour (sickening at moderate concentrations). Odour and irritating effects cannot be relied on to warn of dangerous concentrations.

**Effects of exposure** – The liquid is highly discomforting to the gastro-intestinal tract and may be fatal if swallowed. Ingestion is considered an unlikely route of entry in commercial/industrial environments.

The liquid is extremely discomforting to the eyes and is capable of causing pain and severe conjunctivitis. The liquid is corrosive to the skin and may cause chemical burns Sensitisation may result in allergic dermatitis responses including rash, itching, hives or swelling of extremities.

If inhaled the vapour is highly discomforting to the upper respiratory tract and lungs. Respiratory sensitisation may result in allergic/asthma like responses; from coughing and

minor breathing difficulties to bronchitis with wheezing, gasping. Acute vapour inhalation in humans has produced eye, nose and throat irritation, loss of taste and smell, headache, nausea, protracted vomiting, drowsiness, weakness, incoordination, dyspnea, cyanosis and pulmonary oedema.

### ***Information Sheet – FORMALDEHYDE***

**Introduction** – Used in various manufacturing processes and as disinfectant, germicide and fungicide for plants and vegetables. Used to prevent mildew and spelt in wheat and rot in oats.

Formaldehyde is a gas; however all references are to the commercially available form of the material which is a solution of the gas in water; which is a clear, water-white liquid with a suffocating pungent highly irritating odour.

**Effects of exposure** – Principal routes of exposure are usually by inhalation of vapour and skin contact/absorption.

The liquid is extremely discomforting to the eyes and is capable of causing pain and severe conjunctivitis. The vapour is highly discomforting to the eyes and may cause lachrymation (tears) and burning sensation. The liquid is highly discomforting to the skin and may cause chemical burns if exposure is prolonged

Inhalation of vapour at relatively low concentrations may cause a tingling sensation in the nose and upper respiratory tract. Slightly higher concentrations may cause a burning sensation, headache. High vapour concentrations are capable of causing chest constriction, bronchiopneumonia, dysphagia, oedema, spasms of the larynx and dyspnoea

The vapour is highly discomforting to the upper respiratory tract and repeated exposure may cause sensitisation and/or allergic reactions. Respiratory sensitisation may result in allergic/asthma like responses, from coughing and minor breathing difficulties to bronchitis with wheezing, gasping.

### ***Information Sheet - HYDROGEN CYANIDE***

**Introduction** – Large volume industrial chemical. Manufacture of acrylonitrile, acrylates, adiponitrile, cyanide salts, dyes, chelates, rodenticides, pesticides. DANGEROUS POISON

Hydrogen Cyanide is a colourless, toxic gas that has a faint odour of almonds which may be perceptible to some. It is an extremely quick acting poison which acts by combining in tissues with the enzymes associated with cellular oxidation causing oxygen depletion in the tissues and death through asphyxiation. Small concentrations are still extremely hazardous and the characteristic odour cannot be wholly relied upon. Hydrogen Cyanide is occasionally used in the fumigation of ships.

**Effects of exposure** – The intensity and time of exposure determines the effects / symptoms. Short-term inhalation of 20 to 40 ppm may result in slight symptoms, while a concentration of 270 ppm can be fatal.

At low doses, symptoms of hydrogen cyanide exposure may be weakness, headaches, confusion, nausea and vomiting. Normal blood pressure with rapid pulse is usual in mild

cases. The respiratory rate varies with the intensity of exposure: rapid with mild exposure, or slow and gasping with severe exposure.

Symptoms of mild exposure are completely reversed when exposure ceases.

Cyanide poisoning is relatively uncommon and unless Hydrogen Cyanide has been positively identified in the area of operations it is more likely that the individual(s) is suffering from something else.

Chronic/repeated exposure to cyanides at levels too low to produce clinical complaints may cause throat irritation, muscular cramps, weight loss, dermatitis, itching, scarlet rash, papules, perforation of nasal septum, and enlargement of the thyroid gland

### ***Information Sheet – METHYL BROMIDE***

*Company: Atofina (Australia) Pty Ltd, Address: Building 10, 658 Church Street, Richmond VIC 3121. Telephone: (03) 9425 7777*

**Introduction** – Poisonous, colourless non-flammable gas with a sharp burning taste when impure. In high concentrations it has a chloroform-like odour. Highly toxic to insect pests and rodents. Widely used insect fumigant for soils, grain silos, mills, warehouses, vaults, ships and rail cars.

**Effects of exposure** – The material is considered to be harmful by all exposure routes. Principal routes of exposure are usually by inhalation of vapour, skin contact with the material and skin absorption of the material.

The gas is discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/ or other transient eye damage/ ulceration.

The gas is mildly discomforting to the skin and may cause transient staining of the skin and it is absorbed through the skin. Toxic effects may result from skin absorption. Absorption by skin may readily exceed vapour inhalation exposure. Symptoms for skin absorption are the same as for inhalation. Bare unprotected skin should not be exposed to this material

Reactions may not occur on exposure but response may be delayed with symptoms only appearing many hours later. The gas is extremely discomforting to the upper respiratory tract and lungs and may be toxic if inhaled and even fatal if exposure is prolonged. Exposure may cause nausea, vomiting, headache, dizziness, visual disturbances, lethargy, and faintness.

### ***Information sheet – SULPHURYL FLUORIDE***

*Company: Dow Chemical  
Address: Ste 1, 1st Fl., 1-7 Jordan St Gladesville NSW, 2111 - Ph (02) 9879 6066*

**Introduction** – Colourless, odourless, non-flammable gas. Commercial gas has up to 1% of highly irritating chloropicrin added to provide warning properties. Used in the fumigation of structures against drywood termites. Insects die due to acute fluorosis.

**Effects of exposure** – The only significant exposure route into the body is by inhalation. This can result in mild irritation at low concentrations or death at high concentrations. Principle areas affected being the lungs and central nervous system.

The gas is discomforting to the upper respiratory tract and lungs and may be harmful if inhaled and may even be fatal if exposure is prolonged.

Absorption through the eyes and skin is not considered to be a problem, nor is ingestion. The only significant entry route into the body is through inhalation. The gas is highly discomforting to the eyes and is capable of causing pain and severe conjunctivitis.

### ***Information Sheet – PHOSPHINE***

*Company: BOC Gases (Commonwealth Industrial Gases Ltd) (02) 8874 4400 (03) 9287 8444*

**Introduction** – Used as grain fumigant, rodenticide when produced by action of a moist atmosphere on aluminium phosphide, zinc phosphide or magnesium phosphide.

**Effects of exposure** – Inhalation is the most significant entry route to the body. Reactions may not occur on exposure but response may be delayed with symptoms only appearing many hours later. The only signs during exposure may be mild respiratory irritation although some victims report dyspnea, weakness, tremor and convulsions.

The gas is highly discomforting to the eyes and is capable of causing pain and severe conjunctivitis.

Overexposure may cause tightness of chest and cough, headache, dizziness, nausea, vomiting, tremor, loss of coordination, diarrhoea.