

# Protocol of Quarantine Treatment through application of Methyl Bromide fumigation in Nepal



Government of Nepal

Ministry of Agriculture and Livestock Development

Plant Quarantine and Pesticide Management Centre, Hariharbhawan, Lalitpur

August, 2025



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"The National Plant Protection Organization of Nepal (NPPO) gratefully acknowledges the Australian Department of Agriculture, Fisheries and Forestry for granting permission to use and cite content from the *Methyl Bromide Fumigation Methodology Version 3.0.*" in the development of "*Protocol of Quarantine treatment through application of Methyl Bromide fumigation in Nepal.*"



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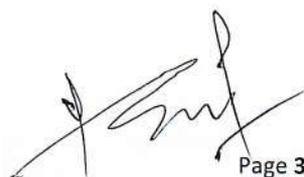
## Endorsement

This document entitled "**Protocol of Quarantine Treatment through application of Methyl bromide fumigation in Nepal**" is prepared by the Plant Quarantine and Pesticide Management Centre (PQPMC), Hariharbhawan, Lalitpur for **undertaking all** quarantine treatments of plants and plant base commodities by Methyl Bromide fumigation from PQPMC and registered Private Fumigation Companies to **ensure that the treatment activities are performed strictly in accordance with the procedures laid down in this protocol**. This protocol **provides guidance on proper application of Methyl Bromide treatments to eliminate quarantine pests to minimize the risk associated with import/export of agriculture commodities and other regulated articles.**

This Protocol is duly approved by the Head of NPPO-Nepal in accordance with the Clause (b) of Sub-section (2) of Section 6 of Plant Quarantine and Protection Act, 2007 and Clause (b) of Rule 4 of Plant Quarantine and Protection Regulation, 2010 for adoption on the 3<sup>rd</sup> of August 2025.



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Bhoj Raj Sapkota  
Head, NPPO-Nepal



## 1. INTRODUCTION:

Fumigation is an approved treatment method extensively used for controlling pest infestation in agricultural products in many countries of the world. Although the Methyl bromide fumigation is acknowledged having potential negative impact on environment, yet so far it is considered as the most appropriate treatment method in eradication of pest infestation in plants and plant products. In view of its effectiveness on all life stages of insect- pests, the use of methyl bromide is allowed for pre-shipment treatments and quarantine purposes including ISPM-15 compliance under Montreal protocol and any other critical use exemptions subject to the approval by the United Nations Environment Protection Agency. The phytosanitary regulations of many countries require certain commodities to be fumigated just prior to export and require the fumigation treatment to be endorsed on the phytosanitary certificate or the fumigation certificate issued by competent quarantine authority of respective country or from an approved fumigation company to be accompanied the consignment clearly detailing the treatment that has been undertaken. Further ISPM-15 recognizes the Methyl bromide fumigation as one of the approved treatments for wood packaging material including dunnage and requires that treated wood material should be affixed with appropriate mark in compliance with ISPM-15.

This protocol outlines the procedures for the application of methyl bromide treatment for quarantine and pre-shipment purposes to ensure that exported goods are free from pests. Additionally, it aims to prevent the introduction and establishment of exotic pests through imported consignments. The Plant Quarantine and Pesticide Management Centre (PQPMC) and all registered fumigation service providers must ensure strict compliance with the guidelines and procedures specified in this protocol during the execution of any fumigation activity.

## 2. PURPOSE:

The purpose of this protocol is:

- to clearly outline and explain the minimum standards that apply to treatments carried out to meet the phytosanitary regulatory requirements;
- to provide registered fumigation company access to information to the quarantine requirements so that they can effectively treat consignments for allowing import into Nepal; and
- to facilitate pest-free exports from Nepal conforming to the current phytosanitary requirements of importing country



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### 3. GLOSSARY:

Terms	Definition
Ambient temperature	The air temperature of the surrounding area where the fumigation will be performed.
Ambient temperature fumigation	When the enclosure being fumigated is subject to environmental ambient temperatures or outdoors.
Carton	Box, often cardboard or polystyrene, in which perishable commodities are packed for transport and sale.
Chloropicrin	A strong-smelling chemical commonly added to the odourless methyl bromide to indicate the presence of gas.
Commodity	The item or goods that are being exported or imported.
Concentration	The amount of methyl bromide present at a certain point in the fumigation enclosure, usually expressed as grams per cubic metre (g/m <sup>3</sup> ).
Concentration sampling tube	A small diameter tube used to draw a sample of gas/air mixture from within a fumigation enclosure to measure the methyl bromide concentration.
Consignment	Refers collectively to the commodity, any packing materials used and the mode of transport such as sea container.
Controlled temperature fumigation	When an artificial heat source is used to heat and maintain the temperature of an enclosure during a fumigation.
Dose	The amount of methyl bromide injected to a fumigation enclosure.
Dose rate	The prescribed concentration of methyl bromide to be used per unit of volume and the exposure period (temperature adjusted if applicable).
Enclosure	Any gas-tight space intended to contain sufficient concentrations of methyl bromide for a period of time. Common examples of fumigation enclosures used for QPS fumigations are (but not limited to), semi-permanent or permanent structures, sheeted enclosures, and silo.
Equilibrium	An even distribution of methyl bromide throughout the enclosure.
Exclusion zone	The area around the enclosure to which access is restricted to personnel wearing personal protective equipment.
Exposure period	The amount of time, in one continuous block, that the consignment must be exposed to sufficient concentration levels of methyl bromide to be lethal to the targeted pests.
Fit for purpose	Equipment that is suitable and appropriate for its intended use. That is, capable of measuring methyl bromide or temperature specifically and in the concentration or temperature ranges necessary to meet the requirements of this methodology.
Fumigant	A chemical, which at a particular temperature and pressure can exist in a gaseous state in sufficient concentration and for sufficient time to be lethal to insects and other pests.

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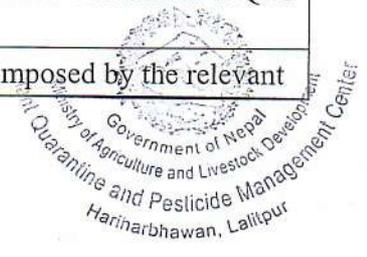
Fumigation chamber	A gas-tight fumigation enclosure with an inbuilt extraction system. All requirements for fumigation chambers specified in section <u>4.3 Fumigation chambers</u> .
Fumigation documentation	Documents and records associated with particular fumigations that is not a record of fumigation. May be hardcopy or softcopy.
Fumigation sheets	A sheet (or tarpaulin) used to create a sheeted enclosure that is made of material impermeable to methyl bromide.
Fumigation operator	An individual responsible for conducting fumigation activities under the supervision of fumigation experts
Fumigation expert	The licenced and/or accredited individual that is responsible for the conduction of the fumigation at the time specific fumigation activities are undertaken.
Goods	Goods includes an animal, a plant, a sample or specimen, a pest, mail or any other article, substance or thing (including, but not limited to, any kind of moveable property).
Good working order	State of an item, system or equipment is deemed to be functioning properly, without significant defects or impairments that hinder its intended operations or performance.
Impermeable package and wrappings	Intact and solid plastic films and wrappings that prevent or impede gas exchange.
Load factor	Specifies the maximum volume of space that the commodity can occupy in the enclosure to achieve rapid fumigation circulation. Normally expressed as a percentage (for example, maximum load factor of 50%)
Manufacturer's instructions	Specific details on equipment produced by the equipment manufacturer. May include instruction manuals, operating instructions, and conditions of use or calibration information.
Maximum top-up concentration	The concentration used to calculate the amount of methyl bromide to be added to the enclosure when topping-up.
Minimum top-up concentration	The absolute minimum concentration below which levels methyl bromide concentration must not be below to allow top-up at the end of the exposure period.
Pascal (Pa)	The standard international unit for pressure. Standard atmospheric pressure is 101.325 kPa.
Perishable commodities	Commodities such as, cut flowers, fresh fruit, fresh vegetables, fresh leaves, fresh herbs, fresh fungi and nursery stock that will deteriorate rapidly if not stored or transported under suitable conditions.
Pest	Any animal, plant or other organism that may pose a threat to the community or the natural environment.
Quarantine pest	A pest of potential economic and/or environmental importance to an area where it is not yet present or is present but not widely distributed and is being officially controlled.
Quarantine and	1) 'Quarantine applications', with respect to methyl bromide, are treatments to

Pre-shipment (QPS)	<p>prevent the introduction, establishment and/or spread of quarantine pests (including diseases), or to ensure their official control, where:</p> <p>a) Official control is that performed by, or authorised by, a national plant, animal or environmental protection or health authority.</p> <p>b) Quarantine pests are pests of potential importance to the areas endangered thereby and not yet present there, or present but not widely distributed and being officially controlled.</p> <p>2) 'Pre-shipment applications' are those non-quarantine applications applied within 21 days prior to export to meet the official requirements of the importing country or existing official requirements of the exporting country.</p> <p>This definition is based on the Montreal Protocol on Substances that Deplete the Ozone Layer. Non-QPS uses of methyl bromide is prohibited under the Montreal Protocol unless a specific exemption is approved by Parties to the Montreal Protocol.</p>
Record of fumigation	An official document or electronic record that records the information of section 12 to demonstrate the fumigation complied with requirements.
Relevant authority	The government authorities responsible for the regulation and use of methyl bromide
Risk Assessment	An assessment performed and recorded according to any instructions on the product label, safety data sheet or jurisdictional licence requirements. In the absence of this, a visual inspection to meet the requirements of this methodology that the fumigator-in-charge can verbally describe.
Sheeted enclosure	An enclosure created under a gas-proof sheet that is covering/enclosing the commodities to be fumigated.
Sheeted stack	Any sheeted enclosure over free standing goods.
Sea container	Standardised transportation units that can be moved from one mode of transport to another without needing to unload the contents.
Standard concentration	The methyl bromide concentration below which the fumigation will not be effective unless additional fumigation is added to the enclosure to compensate.
Target of fumigation	The specific object or area that is intended to be treated through the fumigation process. The target of fumigation may be the commodity, packaging material, container, or conveyance or combination of these.
Threshold limit value (TLV)	TLV is the maximum concentration of methyl bromide that a person can be repeatedly exposed to in the workplace without harmful effects. This figure is based on an 8-hour day, 40-hour working week.
Treatment	Application of a set of specified requirements intended to kill pests and diseases that may be associated with a consignment.
Timber	Processed wood harvested from trees, often processed into beams and planks.
Timber products	Any product made from timber or wood.
Treatment provider	An entity or company that is responsible for the effective conduct of a QPS treatment.
Treatment schedule	Specific treatment rates, exposure period and rules as imposed by the relevant

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	authority – usually the importing jurisdiction.
Treatment temperature	The temperature at which the applied dose rate is calculated.
Vacuum chamber	A rigid enclosure from which air and other gases are removed by a vacuum pump. This results in a low-pressure environment within the chamber.
Verifiable weather source	Reliable source of weather data that can be independently confirmed and validated at audit.

#### 4. GENERAL REQUIREMENTS

##### 4.1. Organization responsible for fumigation:

The Plant Quarantine and Pesticide Management Centre (PQPMC) which has been designated as National Plant Protection Organization (NPPO) of Nepal is main authority for the use and regulation of Methyl Bromide and also can give approval and license to the private fumigation service providers for methyl bromide fumigation for quarantine and pre-shipment purpose. These institutions involved in methyl bromide fumigation shall be followings:-

- the Plant Quarantine and Pesticide Management Centre and its quarantine offices
- the private fumigation service providers licensed by NPPO

Each of the above parties are responsible for themselves and to one another for the successful conduction of fumigation operations.

##### 4.2 Regulations governing fumigation treatments:

The plant quarantine and Protection act, 2007 and plant quarantine and protection regulation, 2010 and guideline and protocol of methyl bromide approved by NPPO are the governing act and regulation for the use of methyl bromide as fumigant in Nepal.

#### 5. SPECIFIC REQUIREMENTS

##### 5.1. Properties and Use of Methyl Bromide

###### 5.1.1. Physico-chemical properties

Methyl bromide is the most widely used fumigant for quarantine purposes. It is favoured in many countries for plant quarantine because of its reputation for having:

- good penetrating ability
- rapid action
- ovicidal
- high toxicity to a broad spectrum of insects and similar pests.

The basic properties of Methyl Bromide are as follows:



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Formula	CH <sub>3</sub> Br
Molecular weight	95 g
Boiling point	3.6 <sup>0</sup> C
Specific Volume at 30 <sup>0</sup> C (at 1 atm)	0,256 m <sup>3</sup> /kg
Specific gravity (gas) [air = 1.0]	3.40
Gas density at 30 <sup>0</sup> C (at 1 atm)	3.908 kg/m <sup>3</sup>
Vapour pressure at 30 <sup>0</sup> C	2.5 am
Conversion factor, g/m <sup>3</sup> to ppm (at 30 <sup>0</sup> C, 1 atm)	260
Flammability limits in air (% v/v)	13.5-14.5
Solubility in water (v/v)	3.4
Specific gravity at 30 0 C, 60% R.H. (liquid, kg/L)	1.7
Thresh hold limit	5 ppm (0.02 g/m <sup>3</sup> )

**Source:** Directorate of Plant Protection, Quarantine & Storage of Government of India, 2005.

## 6. FUMIGATION MANAGEMENT PLAN

**Note:** Prior to fumigation the fumigator must ensure they have trained personnel, suitable equipment, and suitable site to conduct fumigations.

### 1. READINESS FOR FUMIGATION

#### 1.1 Fumigation Operator

- 1.1.1 The fumigation operator must ensure the requirements of this methodology are complied with.
- 1.1.2 The fumigation operator must comply with the treatment schedule, as set by the regulating authority, for the goods being treated.

#### 1.2 Fumigation equipment

- 1.2.1 The equipment used for performing a fumigation must be fit for purpose and in good working order.
- 1.2.2 Electronic instruments used to measure temperature or methyl bromide concentration or to detect the presence of methyl bromide, must be calibrated and serviced in accordance with the manufacturer's instructions. If the manufacturer's instructions do not specify calibration frequency, equipment must be calibrated every 12 months.
- 1.2.3 Gas concentration measuring instruments must be fitted with any filters as specified by the manufacturer to suit the circumstances of the fumigation.
- 1.2.4 Equipment must be used in accordance with the manufacturer's instruction manual.
- 1.2.5 Temperature monitoring instruments must be accurate to within

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### 1.3 Site suitability

1.3.1 The fumigation site must:

- a) have adequate space to establish an exclusion zone around the enclosure in accordance with section 5.1 Establish an exclusion zone; and
- b) allow for safe ventilation; and
- c) be on a flat and even surface; and
- d) be well ventilated; and
- e) have power available, either via mains or a generator.

## 2 SAFETY

**Note:** Local jurisdictions may have safety legislation and regulations that govern the safe performance of a fumigation. The requirements contained in Section 2 may differ from the local laws, the fumigation operator must comply with the laws relevant to where the fumigation is being performed.

### 2.1 Safety considerations

2.1.1 Methyl bromide must be handled in a manner consistent with instructions on the product label, safety data sheet or relevant licence requirements.

### 2.2 Risk assessment

2.2.1 Before commencing fumigation, a risk assessment must be carried out to identify the risk of methyl bromide exposure to:

- a) fumigation personnel; and
- b) people in the vicinity; and
- c) occupants of surrounding buildings.

2.2.2 Before commencing fumigation, safety measures must be put in place to minimise all the risks identified in the risk assessment. These safety measures must minimise the risk of methyl bromide exposure to:

- a) fumigation personnel; and
- b) people in the vicinity; and
- c) occupants of surrounding buildings.

### 2.3 Personal protective equipment (PPE)

2.3.1 Respiratory protection equipment must be worn, at all times, by any person inside the exclusion zone, including during ventilation, from the time of injecting methyl bromide into the fumigation enclosure until the threshold limit value (TLV) is achieved.

2.3.2 Full-face respirators must be:

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- a) operated in accordance with the manufacturer's instructions; and
- b) fitted with a gas filter canister suitable for use with methyl bromide and replaced in accordance with the manufacturer's instructions; and
- c) maintained in accordance with the manufacturer's instructions, with all valves clean and intact; and
- d) able to form an airtight seal against the face of the fumigator.

2.3.3 Self-contained breathing apparatus must be:

- a) operated in accordance with the manufacturer's instructions; and
- b) used only by properly trained personnel; and
- c) maintained in good working order and in accordance with the manufacturer's instructions.

### 3 CONSIGNMENT SUITABILITY

#### 3.1 Target of fumigation

**Note:** The fumigation operator must determine if the consignment and target of fumigation is suitable for fumigation with methyl bromide. To be considered suitable consignments must meet the requirements of section 3 Consignment suitability.

- 3.1.1 The fumigation operator must record the target of fumigation on the record of fumigation (see section 12 Documentation).
- 3.1.2 If the consignment is not suitable for fumigation, remedial action must be taken to make the consignment suitable prior to fumigation. If the consignment cannot be made suitable, the consignment must not be fumigated with methyl bromide.
- 3.2 Impermeable packaging, wrappings and surface coatings**
- 3.2.1 The target of fumigation must not be covered by impermeable packaging, wrapping or surface coatings that impede methyl bromide distribution.
- 3.2.2 Impermeable packaging and wrappings that impede methyl bromide distribution or impede methyl bromide penetration into the target of fumigation must be removed, opened, slashed or made pervious prior to fumigation in accordance with the specifications set out at 3.2.3 and 3.2.4.
- 3.2.3 To be considered pervious, wrappings must have at least:
  - a) 4 holes of 6 mm diameter per 100 mm x 100 mm surface area, or
  - b) 5 holes of 5 mm diameter per 100 mm x 100 mm surface area, or
  - c) 6 pinholes per 10 mm x 10 mm surface area.
- 3.2.4 Pervious wrappings must be in a single layer, so the perforations are not blocked by the wrapping overlapping itself.



3.2.5 If penetration into the target of fumigation is required, the target of fumigation must not be coated in materials that may impede penetration of methyl bromide into the target of fumigation (for example: lacquers, paints, waxes, natural oils, veneers or plastic wraps).

### 3.3 Requirements for perishable commodity packaging

3.3.1 Section 3.3 requirements apply to perishable commodities.

**Note:** If the target of fumigation is in impermeable packaging, the impermeable packaging must be removed, opened or made pervious in accordance with section 3.2 Impermeable packaging, wrappings and surface coatings prior to fumigation.

3.3.2 Cartons must allow for methyl bromide to be distributed within the cartons and reach the target of fumigation.

3.3.3 To achieve the requirement under 3.3.2, prior to fumigation, all cartons must:

- a) be opened or have lids removed, or
- b) have holes created in the cartons that allow distribution of methyl bromide into the cartons and reach the target of fumigation (holes may be covered with insect-proof mesh).

3.3.4 Cartons must be arranged in a way that does not block holes or impede methyl bromide distribution.

3.3.5 All packaging material associated with consignments must be fumigated in accordance with the treatment schedule specific to the consignment.

### 3.4 Load factor requirements for perishable commodity fumigations

3.4.1 If the target of the fumigation is a perishable commodity, and the treatment schedule does not specify load factor requirements, the following load factor requirements apply:

- a) A maximum load factor of 80%.
- b) Packages must be placed on pallets or raised off the ground by at least 100 mm by other means.

### 3.5 Requirements for timber

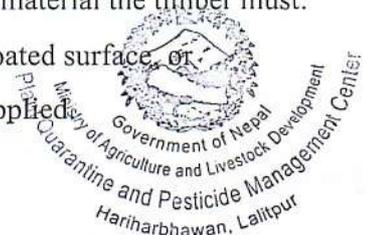
3.5.1 Section 3.5 requirements apply to timber and timber products.

**Note:** If the target of fumigation is timber, the methyl bromide must be able to penetrate every part of the timber. The accepted depth that methyl bromide can penetrate into timber is 100 mm from the surface of the timber.

3.5.2 If the target of the fumigation is uncoated timber, all internal points within the timber must be no greater than 100 mm from a surface of the timber.

3.5.3 If the target of fumigation is timber coated with an impermeable material the timber must:

- a) have one uncoated surface no more than 100 mm from the coated surface, or
- b) be fumigated before any impermeable surface coatings are applied.



- 3.5.4 Individual timber products must be separated by a minimum of 5 mm every 200 mm to create space for fumigant penetration along the entire length of the timber. This separation can be horizontal or vertical.

#### 4 FUMIGATION ENCLOSURES

##### 4.1 All enclosures

4.1.1 All fumigation enclosures must be:

- a) sufficiently gas-tight to retain the methyl bromide for the duration of the exposure period; and
- b) prepared to safely inject and ventilate methyl bromide; and
- c) sealed to minimise methyl bromide escape; and
- d) prepared to ensure even methyl bromide distribution throughout the enclosure and the target of fumigation; and
- e) monitored for temperature if applicable.

4.1.2 Each individual enclosure is a separate fumigation and must be recorded on its own record of fumigation.

##### 4.2 Sheeted enclosures

4.2.1 Section 4.2 requirements apply to sheeted enclosures.

4.2.2 Surfaces on which sheeted enclosures are constructed must be impermeable to methyl bromide or covered with a gas-proof sheet to make it impermeable.

4.2.3 Fumigation sheets must be weighed down to seal it against the surface and hold it securely in place. The seal must be:

- a) created using materials that can follow the contour of the surface; and
- b) arranged so there are no gaps or breaks in the seal around the entire enclosure.

4.2.4 All sea containers fumigated in a sheeted enclosure must have at least one door fully open during the fumigation.

##### 4.3 Fumigation chambers

4.3.1 Section 4.3 requirements apply to fumigation chambers.

4.3.2 A fumigation chamber must:

- a) be permanently sealed along all joins between the walls, ceiling and floor; and
- b) be gas-tight once the door is closed without the need to use tape, sand snakes or any other means; and
- c) not have anything, such as concentration sampling tubes, supply pipes or electrical leads, enter the chamber that will interfere with the seal; and
- d) have an inbuilt extraction system that actively removes methyl bromide from the enclosure; and

- e) pass a pressure test at least every six months in accordance with section 4.4 Pressure testing a fumigation chamber.

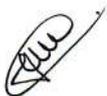
#### **4.4 Pressure testing a fumigation chamber**

- 4.4.1 Pressure testing must be performed with all concentration sampling tubes, supply pipes and electrical leads in place as they would be for fumigation.
- 4.4.2 To perform a pressure test, the pressure within the enclosure must be raised by 250 pascals (Pa) relative to atmospheric pressure. To pass the pressure test, it must take 10 seconds or more for the pressure in the enclosure to fall from 200 Pa to 100 Pa relative to atmospheric pressure.
- 4.4.3 If the pressure falls from 200 Pa to 100 Pa in less than 10 seconds, the enclosure has not passed the pressure test and an exclusion zone must be maintained throughout the exposure period in accordance with section 5.1 Establish an exclusion zone.
- 4.4.4 A record of the pressure test must be completed for every pressure test and kept for a minimum of two years.
- 4.4.5 All following information must be recorded on a record of pressure test:
- Location – the site address where the pressure test is performed.
  - Chamber identification details.
  - Time and date the pressure test is performed.
  - The name and signature of the person who performed the pressure test.
  - The time taken for the pressure in the enclosure to fall from 200 Pa to 100 Pa.
- 4.4.6 A record of pressure test must be completed accurately.

### **5 PREPARING TO FUMIGATE**

#### **5.1 Establish an exclusion zone**

- 5.1.1 An exclusion zone must be established around the fumigation enclosure and equipment used for methyl bromide injection.
- 5.1.2 The exclusion zone must have a physical barrier at all points where the enclosure is accessible.
- 5.1.3 The exclusion zone barrier must be in place when the exclusion zone is in force.
- 5.1.4 The exclusion zone barrier must have warning signs that:
- are visible from all angles of approach; and
  - display symbols indicating danger and/or toxic gas is in use; and
  - are in a language spoken by staff at the fumigation site.
- 5.1.5 The size of the exclusion zone must not be less than:



- a) 3 metres from the enclosure, if the enclosure is located outdoors, or
  - b) 6 metres from the enclosure, if the enclosure is located inside a building or structure.
- 5.1.6 The exclusion zone must be in force from immediately prior to methyl bromide injection and until the enclosure has been ventilated and the methyl bromide concentration is verified at or below the TLV in accordance with section 11 Ventilating the fumigation enclosure.
- 5.1.7 If the enclosure is a fumigation chamber, compliant with section 4.3 Fumigation chambers, the exclusion zone may be removed once the methyl bromide has been injected and the doors are locked.
- 5.1.8 If the exclusion zone is removed in accordance with requirement 5.1.7, the exclusion zone must be re-established prior to ventilation and remain in-place until the methyl bromide concentration is verified at or below the TLV in accordance with section 11 Ventilating the fumigation enclosure..00+606

## 5.2 Gas concentration monitoring equipment

- 5.2.1 Gas concentration monitoring equipment must be able to detect methyl bromide concentrations within the treatment dose range for all treatment schedules applied and be in good working order.
- 5.2.2 Gas concentration monitoring instrument must be operated, calibrated and serviced according to the manufacturer's instructions.
- 5.2.3 If using concentration sampling tubes that extend outside the enclosure, each concentration sampling tube must:
- a) be clearly identified according to their location within the enclosure; and
  - b) be free from kinks and blockages; and
  - c) be of a diameter suitable to fit the inlet of the concentration measuring instrument.
- 5.2.4 If gas concentration monitoring instruments are placed within the enclosure each instrument must:
- a) allow for readings to be read outside of the exclusion zone; and
  - b) be clearly identified according to their location within the enclosure.

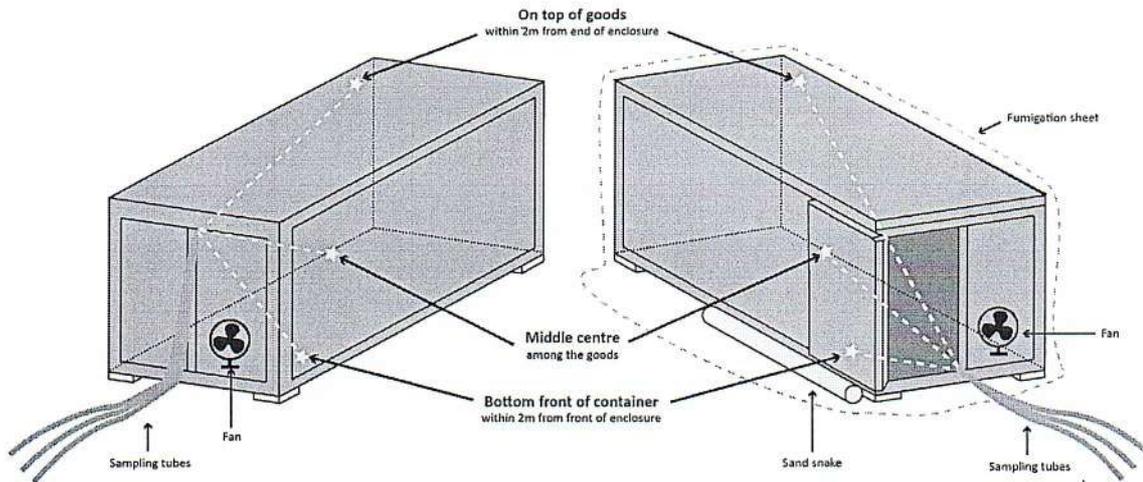
## 5.3 Gas concentration monitoring locations

**Note:** Section 5.3 does not apply to perishable commodities. See section 5.4 for gas concentration location requirements for perishable commodities.

- 5.3.1 Enclosures less than 30 m<sup>3</sup> in volume must have at least one gas concentration monitoring location. The monitoring location must be on the top-centre of the goods.
- 5.3.2 Enclosures equal to or greater than 30 m<sup>3</sup> in volume must have at least three gas concentration monitoring locations. The monitoring locations must be:
- c) on top of the goods within 2 metres of the end of the enclosure; and

- d) no more than 250 mm above the floor of the enclosure and within 2 metres of the opposite end from the top gas concentration monitoring location; and
- e) in the middle centre of the enclosure among the goods and at least 2 metres from the other gas concentration monitoring locations.

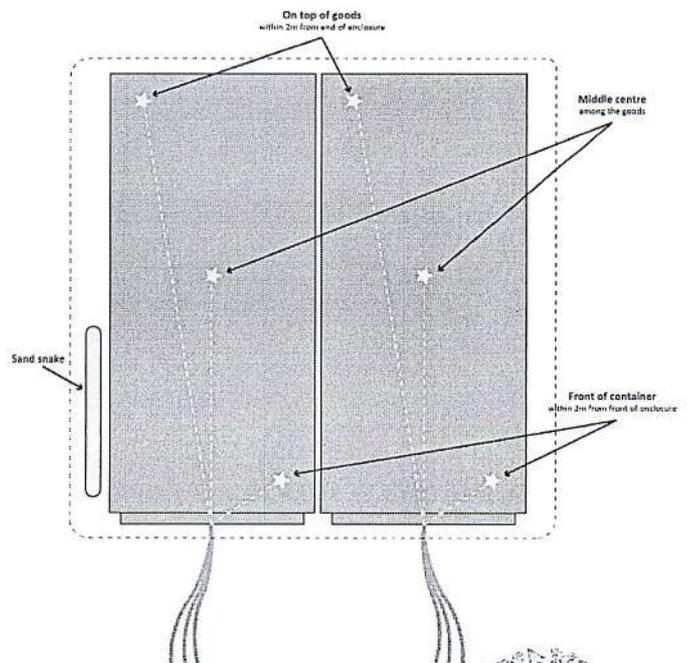
**Figure 1 Monitoring locations for a sheeted enclosure with one sea container**



**Source:** Methyl Bromoide Fumigation Methodology Version 3.0. Australian Department of Agriculture, Fishries and Forestry, 2025.

5.3.3 If a sheeted enclosure contains multiple sea containers, each sea container must have at least three gas concentration monitoring locations in accordance with requirement 5.3.6.

**Figure 2 Monitoring locations for a sheeted enclosure with more than one sea container**



**Source:** Methyl Bromoide Fumigation Methodology Version 3.0. Australian Department of Agriculture, Fishries and Forestry, 2025

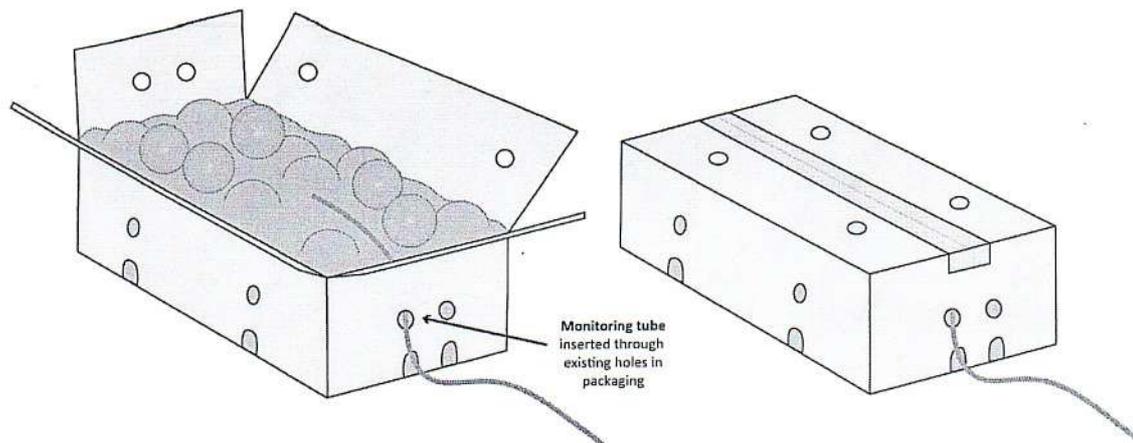
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- 5.3.4 Additional gas concentration monitoring locations must be used if mandated by import conditions
- 5.3.5 Enclosures less than 30 m<sup>3</sup> in volume must have at least one gas concentration monitoring location. The monitoring location must be on the top-centre of the goods.
- 5.3.6 Enclosures equal to or greater than 30 m<sup>3</sup> in volume must have at least three gas concentration monitoring locations. The monitoring locations must be:
- a) on top of the goods within 2 metres of the end of the enclosure; and
  - b) no more than 250 mm above the floor of the enclosure and within 2 metres of the opposite end from the top gas concentration monitoring location; and
  - c) in the middle centre of the enclosure among the goods and at least 2 metres from the other gas concentration monitoring locations.
- 5.3.7 Additional gas concentration monitoring locations must be used if mandated by import conditions.
- 5.4 Gas concentration monitoring locations – perishable commodities**
- 5.4.1 If there is one type of commodity and packaging, and the total enclosure volume is less than 5 m<sup>3</sup> the gas concentration must be monitored in at least one location. The gas concentration monitoring location must be inside a carton:
- a) in the centre of the stack, or
  - b) in the middle of the enclosure, if the cartons are not stacked.
- 5.4.2 If the enclosure is equal to or greater than 5 m<sup>3</sup> in volume the gas concentration must be monitored in at least three locations. The gas concentration monitoring locations must be inside a carton:
- a) at the top of a stack within 2 meters of the end of the enclosure; and
  - b) no more than 250 mm above the floor of the enclosure and within 2 metres of the opposite end from the top gas concentration monitoring location, and
  - c) in the middle centre of the enclosure halfway up a stack.
- 5.4.3 If the target of fumigation is packaged inside one or more layers of packaging, the gas concentration monitoring locations must be located inside the packaging next to the target of fumigation.



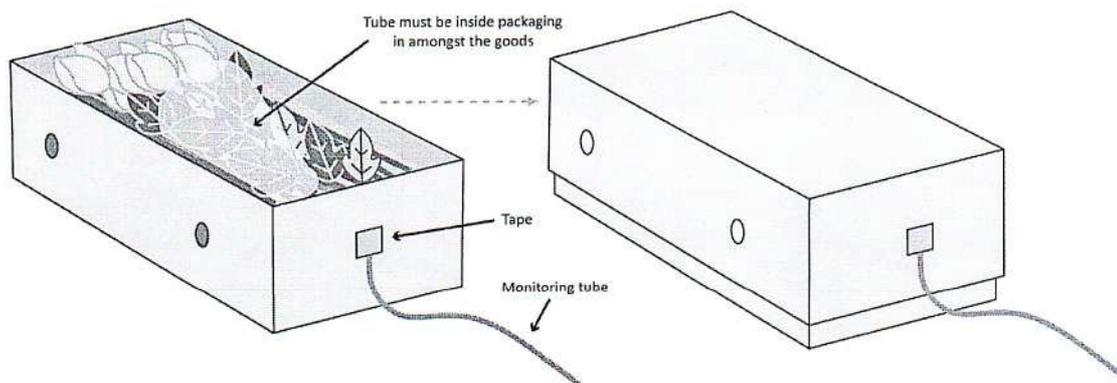
**Figure 3 Monitoring locations in a perishable fruit package**



**Source:** Methyl Bromide Fumigation Methodology Version 3.0. Australian Department of Agriculture, Fisheries and Forestry, 2025.

5.4.4 If the target of fumigation is cut flowers, leaf, stem material or bulbs imported as nursery stock, the gas concentration monitoring location must be located within the bunch in the middle of a carton.

**Figure 4 Monitoring locations in a package of cut flowers**



**Source:** Methyl Bromide Fumigation Methodology Version 3.0. Australian Department of Agriculture, Fisheries and Forestry, 2025.

5.4.5 The placement and installation of gas concentration monitoring equipment within cartons or packaging must not change the gas penetration properties of the carton or package.

5.4.6 If there are different types of packaging in the consignment, there must be one gas concentration monitoring location inside each of the different packaging types. The minimum number of monitoring locations and position of the monitoring locations must be in accordance with section 5.4.2. If there are more than three different types of packaging, the number of gas monitoring locations must be the same as the number of different packaging types.

5.4.7 Additional concentration monitoring locations must be used if mandated by import conditions.

## 5.5 Temperature monitoring instrument locations

5.5.1 Section 5.5 requirements apply to perishable commodity fumigations and controlled temperature fumigations.

5.5.2 The temperature of the enclosure must be monitored with a digital thermometer in at least one location within the enclosure.

5.5.3 If heaters are used, the temperature monitoring instruments must be placed within the enclosure as far away as practical from the heat source.

5.5.4 Temperature monitoring instruments must:

- a) allow for readings to be read outside of the exclusion zone; and
- b) be identified.

## 5.6 Methyl bromide supply pipes

5.6.1 If a sheeted enclosure contains multiple containers, at least one supply pipe must be placed in each container.

5.6.2 For sheeted enclosure fumigations, the supply pipes must be left in position for the duration of the exposure period.

5.6.3 Supply pipes left in place must be sealed once the methyl bromide has been injected.

## 5.7 Heaters and fans

5.7.1 If fans are used to circulate the gas, enclosures must have at least one fan for each 100 m<sup>3</sup> of volume or part thereof.

5.7.2 Multiple containers fumigated in a single enclosure must have at least one fan placed in each container.

5.7.3 If heaters are used, they must be positioned in such a way to raise and maintain the air temperature throughout the entire enclosure above the treatment temperature used for the dose calculation.

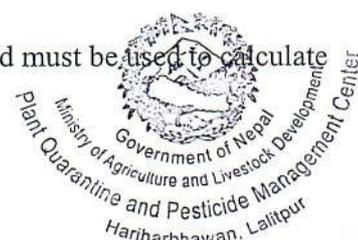
## 6 TEMPERATURE USED TO CALCULATE THE DOSE

### 6.1 Ambient temperature fumigations

6.1.1 Section 6.1 requirements apply to ambient temperature fumigations.

6.1.2 A weather forecast for the location closest to the fumigation site must be obtained from a verifiable weather source to determine the forecast temperature during the fumigation exposure period.

6.1.3 The lowest forecast minimum temperature for the exposure period must be used to calculate the dose as specified in section 8.2 Calculating the dose.



- 6.1.4 The forecast minimum temperature must be sourced no earlier than the previous day of the start of exposure period and a record of the source of the information must be retained with the fumigation documentation.
- 6.1.5 The forecast minimum temperature must be recorded on the record of fumigation.

**Note:** If the ambient temperature is forecast to be 10°C or lower the fumigation cannot be performed as an ambient temperature fumigation. The temperature of the enclosure will need to be raised and maintained meaning the controlled temperature fumigation requirements will apply.

## 6.2 Controlled temperature fumigations

- 6.2.1 Section 6.2 requirements apply to controlled temperature fumigations.
- 6.2.2 The minimum temperature within the enclosure during the exposure period must be predicted. This predicted temperature must be used to calculate the dose in accordance with section 8.2 Calculating the dose.

## 6.3 Perishable commodity fumigations

- 6.3.1 Section 6.3 requirements apply to perishable commodity fumigations.
- 6.3.2 Dose calculations must be based on the core temperature specified in the treatment schedule.
- 6.3.3 Prior to applying the dose:
- the fumigator must measure the core temperature of the goods; and
  - the core temperature of the goods must be at or above the temperature specified in the treatment schedule.
- 6.3.4 The minimum number of temperature readings required in 6.3.3 is the same as the number of concentration monitoring locations required in section 5.4 Gas concentration monitoring locations – perishable commodities.
- 6.3.5 Temperature readings must be obtained:
- from the same positions as the concentration monitoring locations, or
  - with at least one temperature reading from each different type of perishable commodity within the enclosure.
- 6.3.6 If the target of fumigation is fruit or vegetables, the pulp temperature must be measured. The temperature measuring instrument must be:

- a) inserted into the centre of the fruit or vegetable, or adjacent to the pit; and
  - b) covering the whole temperature instrument probe (multiple pieces of fruit may be inserted onto the instrument if the fruit is small); and
  - c) placed into the largest sized commodity in mixed consignments; and
  - d) placed in the middle of the carton.
- 6.3.7 If the target of fumigation is cut flowers, leaf, stem material or bulbs imported as nursery stock, temperature readings must be placed within the bunch in the middle of a carton.
- 6.3.8 Dose compensation for temperature variation does not apply to perishable commodities unless specified by the treatment schedule.
- 6.3.9 If the treatment schedule allows dose compensation for temperature variation, the temperature used for dose compensation must be the lowest of:
- a) the temperature of the goods, or
  - b) the expected minimum temperature within the enclosure during the exposure period and compliant with section 6.1 Ambient temperature fumigations or 6.2 controlled temperature fumigations.

## 7 TEMPERATURE DURING THE EXPOSURE PERIOD

### 7.1 Ambient temperature fumigations

7.1.1 Section 7.1 requirements apply to ambient temperature fumigations.

7.1.2 The minimum ambient temperature must be obtained using:

- a) a verifiable weather source, or
- b) temperature monitoring equipment compliant with section 1.2 Fumigation equipment.

7.1.3 During the exposure period:

- a) the minimum temperature must be equal to or above the temperature used for dosing, or
- b) if dose calculations for temperature variation is permitted and the minimum temperature is above 10°C, all concentration readings must be equal to or above the standard concentration requirements in Appendix V: Methyl bromide monitoring tables for the minimum temperature obtained.

**Note:** If the temperature obtained during the exposure period is equal to or below 10°C the fumigation has failed.

### 7.2 Controlled temperature fumigations

7.2.1 Section 7.2 requirements apply to controlled temperature fumigations.

7.2.2 The temperature within the enclosure must be monitored with a minimum of one temperature instrument.



- 7.2.3 The temperature within the enclosure must be monitored and recorded at least once every 15 minutes for the entirety of the exposure period. These records must be retained with the fumigation documentation.
- 7.2.4 The temperatures recorded within the enclosure during the exposure period must be equal to or above the temperature used for dosing.
- 7.2.5 The minimum temperature recorded within the enclosure during the exposure period must be recorded on the record of fumigation.

**7.3 Perishable commodity fumigations**

- 7.3.1 Section 7.3 requirements apply to perishable commodity fumigations.
- 7.3.2 The temperature of the enclosure must be monitored and recorded at least once every 15 minutes for the entirety of the exposure period. These records must be retained with the fumigation documentation.
- 7.3.3 The temperatures recorded during the exposure period, including enclosure temperature and all core/pulp temperatures, must be equal to or above the temperature used for dosing.
- 7.3.4 The minimum temperature of the goods achieved for the exposure period must be recorded on the record of fumigation.

**8 PERFORMING THE FUMIGATION**

**8.1 Dose rate compensation for temperature variation**

- 8.1.1 If the treatment schedule or import conditions allow dose compensation for temperature variation, and the enclosure temperature is expected to fall below the temperature specified in the treatment schedule, the dose rate may be adjusted to compensate for the lower temperature.
- 8.1.2 If the treatment schedule allows dose compensation for temperature variation (in accordance with requirement 8.1.1), and the treatment schedule does not specify dose compensation requirements, the following calculation must be used: for each 5°C, or part thereof, the temperature is expected to fall below 21°C add 8 g/m<sup>3</sup> to the prescribed dose rate.

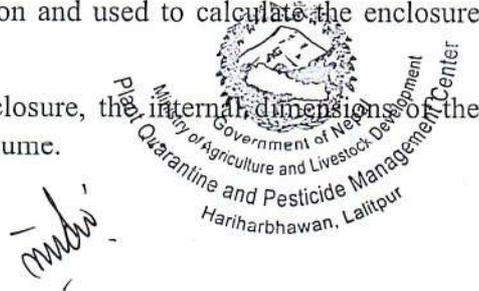
**8.2 Calculating the dose**

- 8.2.1 The weight of methyl bromide needed to achieve the prescribed concentration must be calculated by multiplying the dose rate (temperature adjusted in accordance with section 8.1 Dose rate compensation for temperature variation) by the volume of the enclosure. The formula is:

$$\text{Dose (g)} = \text{Enclosure Volume (m}^3\text{)} \times \text{Dose Rate (g/m}^3\text{)}$$

- 8.2.2 If the fumigation is performed as a sheeted enclosure, the external dimensions of the enclosure must be measured prior to each fumigation and used to calculate the enclosure volume.
- 8.2.3 If the fumigation is performed in a fixed-sized enclosure, the internal dimensions of the enclosure must be used to calculate the enclosure volume.

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8.2.4 If the methyl bromide is mixed with another gas, compensation must be made to the dose amount, so the full amount of methyl bromide required is injected into the enclosure. For methyl bromide supplied with 2% chloropicrin the formula is:

$$\text{Dose (g)} = (\text{Enclosure Volume (m}^3\text{)} \times \text{Dose Rate (g/m}^3\text{)}) \div 0.98$$

8.2.5 Once the dose has been calculated, the injected dose must be rounded up to the next increment that can be accurately measured by the equipment used to dispense methyl bromide. If methyl bromide is supplied in cans, the dose must be rounded up to the next full can.

### 8.3 Injecting methyl bromide into the fumigation enclosure

8.3.1 A vaporiser must be used when methyl bromide is injected into the enclosure. The vaporiser must maintain a water temperature of at least 65°C while the methyl bromide is being injected to the enclosure.

8.3.2 A fan(s), or alternate way of evenly distributing the gas, must be used while injecting methyl bromide into the enclosure.

8.3.3 Supply cylinders and the vaporiser must be inside the exclusion zone while methyl bromide is being injected into the enclosure.

8.3.4 The time methyl bromide injection is completed must be recorded on the record of fumigation.

### 8.4 Checking for leaks

8.4.1 During the injection of methyl bromide, the supply system must be checked for leaks. If a leak is detected the problem must be rectified before continuing to inject the dose.

8.4.2 The fumigation enclosure must be checked for leaks (unless the fumigation is being performed in a pressure tested enclosure). If leaks are detected, they must be rectified.

### 8.5 Even methyl bromide distribution

8.5.1 The methyl bromide must be evenly distributed throughout the enclosure. This is verified by equilibrium.

8.5.2 Equilibrium is achieved when the highest concentration reading is within 15% of the lowest concentration reading.

**Note:** Equilibrium result is expressed as a percentage and is equal to the highest concentration reading minus the lowest concentration reading, then divided by the lowest concentration reading, and then multiplied by 100. The calculation for equilibrium is pictured:

$$\text{Equilibrium \%} = \frac{\text{Highest reading} - \text{Lowest reading}}{\text{Lowest reading}} \times 100$$

- 8.5.3 If the result of this calculation is more than 15%, equilibrium has not been achieved and additional time is needed to allow the methyl bromide to further distribute throughout the enclosure.

**Note:** Once equilibrium has been achieved it is not required at any other time.

## 8.6 Exposure period

- 8.6.1 The fumigation exposure period must not start until:
- a) all concentration readings are equal to or above the retention rate in the treatment schedule or, in the absence of specific retention information, the retention rates in Table 1, and
  - b) equilibrium has been achieved in accordance with section 8.5 Even methyl bromide distribution.

**Table. Time of concentration readings after methyl bromide injection and required retention rate of initial dose rate**

Time after methyl bromide injection	Retention rate of initial dose rate concentration
15 to 30 minutes	85% or more
30 minutes to 1 hour	75% or more
More than 1 hour	70% or more

**Note:** See Appendix V

Methyl bromide monitoring tables for the retention rates for a range of initial dose rates at different time increments.

- 8.6.2 Retention rates and standard concentrations must be determined based on actual dose rate applied.
- 8.6.3 If additional methyl bromide needs to be added before start point has been reached, the amount must be calculated by subtracting the lowest concentration reading from the initial dose rate and multiplying that by the volume of the enclosure.

**Additional dose (g) = Enclosure volume (m<sup>3</sup>) x (Initial dose rate – Lowest concentration reading)**

- 8.6.4 If additional methyl bromide needs to be added before start point has been reached and the formulation contains less than 100% methyl bromide, the amount must be calculated in accordance with section 8.2.4.
- 8.6.5 If additional methyl bromide is added to the enclosure before the start of the exposure period, the time the injection of additional methyl bromide is completed becomes the new injection time for determining the required start time concentration.
- 8.6.6 The elapsed time between the start time and the end time of the fumigation must not be less than the exposure period prescribed in the treatment schedule.

- 8.6.7 After the specified exposure period has elapsed, final concentration readings must be taken from all monitoring locations. The readings and the time they are taken must be recorded on the record of fumigation.
- 8.6.8 At the end of the exposure period all concentration readings must be equal to or above the concentration in the treatment schedule or, in the absence of specific retention information, the standard concentrations in Appendix V: Methyl bromide monitoring tables.

## 9 MONITORING THE FUMIGATION

### 9.1 Gas concentration monitoring

- 9.1.1 Fans used to circulate methyl bromide must be turned off before taking gas concentration readings.
- 9.1.2 Gas concentration readings must be taken from all gas concentration monitoring locations at the start of the exposure period and at the end of the exposure period.
- 9.1.3 If the exposure period is longer than 24 hours, concentration readings must be taken from all concentration monitoring locations at least every 24 hours in addition to the start and end point readings.
- 9.1.4 All gas concentration readings must be recorded on the record of fumigation at the time they are taken. This includes readings taken prior to achieving start time or optional readings during the exposure period. Readings from additional concentration monitoring locations that are mandated by import conditions must also be recorded.
- 9.1.5 The time each set of concentration readings is taken must be recorded. If there is more than one reading in a set, the time the last reading is completed must be the time recorded.

**Note:** Additional readings can be taken at any time during the exposure period to check concentrations are equal to or above the levels required for an effective treatment.

## 10 TOPPING-UP METHYL BROMIDE LEVELS

### 10.1 Topping-up during the exposure period

- 10.1.1 Additional methyl bromide may be added to the enclosure at any time during the exposure period if:
- all the concentration readings are equal to or above the standard concentration (Appendix V: Table 3 Methyl bromide monitoring table, fumigation phase) and
  - the lowest concentration reading is below the maximum top-up concentration (Appendix V: Table 3 Methyl bromide monitoring table, fumigation phase), and
  - the treatment schedule allows top-ups.
- 10.1.2 If a top-up is performed during the original exposure period, no extension of the exposure period is required.
- 10.1.3 Multiple top-ups are permitted during the exposure period.

## 10.2 Topping-up at the end of the exposure period

- 10.2.1 If the lowest concentration reading at the end of the exposure period is below the standard concentration but not below the minimum concentration to allow top-up (Appendix V: Methyl bromide monitoring tables), additional methyl bromide may be added to the enclosure.
- 10.2.2 If a top-up is performed at the end of the exposure period, the fumigation must be extended for the minimum time specified in the treatment schedule. If no time extension is specified, the minimum time extension is four hours.
- 10.2.3 After the minimum four-hour extension time, readings must be taken from all sampling lines and the concentrations must be equal to or above the standard concentration required for the original exposure period, if not, the fumigation has failed.
- 10.2.4 Only one top-up at the end of the exposure period is permitted.
- 10.2.5 Topping-up the concentration at the end of the exposure period is not permitted if:
- a) the lowest concentration reading is below the minimum concentration to allow top-up (Appendix V: Table 3 Methyl bromide monitoring table, fumigation phase); or
  - b) the treatment schedule prohibits topping-up.

## 10.3 Performing the top-up

- 10.3.1 The weight of methyl bromide for top-up must be calculated by subtracting the lowest concentration reading from the maximum to allow top-up concentration contained in Appendix V: Methyl bromide monitoring tables, and multiplied by the volume of the enclosure.
- Top-up amount (g) = Enclosure volume (m<sup>3</sup>) x (Maximum to allow top-up – Lowest concentration reading)**
- 10.3.2 The top-up amount for formulations that contain less than 100% methyl bromide and round up must be performed in accordance with section 8.2 Calculating the dose.
- 10.3.3 The top-up amount must be injected into the fumigation enclosure in accordance with section 8.3 Injecting methyl bromide into the fumigation enclosure.
- 10.3.4 When the additional methyl bromide has circulated, a concentration reading must be taken from the monitoring location that had the lowest reading to verify that the methyl bromide is at or above the standard concentration.
- 10.3.5 Top-up details (amount, time and concentration readings) must be recorded on the record of fumigation.
- 10.3.6 If top-ups are performed equilibrium is not required.

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## 11 VENTILATING THE FUMIGATION ENCLOSURE

### 11.1 Threshold limit value (TLV)

- 11.1.1 The TLV is 5 parts per million (ppm) for methyl bromide unless a lower concentration is imposed by the relevant authorities in the jurisdiction where the fumigation takes place or the consignment destination.
- 11.1.2 The equipment used for measuring TLV must be able to measure the actual concentration, not just the presence of methyl bromide, to at least 1 ppm.
- 11.1.3 If stain tubes are used to detect methyl bromide, they must be used:
- in accordance with the manufacturer's instructions; and
  - in conjunction with the sampling pump specified by the manufacturer; and
  - before the expiry date.

### 11.2 Releasing methyl bromide from the enclosure

- 11.2.1 At the end of the exposure period, the methyl bromide must be fully ventilated from the enclosure in a controlled and safe manner.
- 11.2.2 A risk assessment must be performed to manage the ventilation process and ensure it is safe by considering:
- prevailing wind direction; and
  - location and proximity of unprotected personnel; and
  - extension of the exclusion zone (see section 5.1 Establish an exclusion zone) around the enclosure if required to prevent unprotected personnel in the vicinity from being exposed to methyl bromide levels above the TLV.
- 11.2.3 Personnel who are not wearing PPE (in accordance with section 2.3 Personal protective equipment (PPE)) are not permitted to enter the exclusion zone until the fumigator-in-charge verifies the concentration in the area and throughout the enclosure is at or below the TLV.
- 11.2.4 The enclosure must be ventilated until the concentration of methyl bromide within the enclosure remains at or below the TLV.
- 11.2.5 If the consignment is fumigated in the sea container(s) that will be used to transport the goods, each container must be checked individually to verify concentration at or below the TLV.
- 11.2.6 If the consignment is fumigated in an un-sheeted sea container, the sea container must not be moved until the methyl bromide concentration inside the enclosure is at or below the TLV.
- 11.2.7 If the consignment is a perishable commodity fumigation, packed in cartons and/or bags that have been opened during fumigation, the cartons and/or bags can only be closed once the methyl bromide concentration inside the cartons and/or bags is under the TLV.
- 11.2.8 The TLV readings and the time they are taken must be recorded on the record of fumigation.

### 11.3 Releasing the consignment from the control of the fumigation operator

11.3.1 Following a fumigation, the consignment can only be released from the control of the fumigation operator once the following requirements have been met:

- a) the fumigation complies with the requirements of this methodology and the methyl bromide concentration has been verified at or below the TLV, or
- b) the fumigation has failed, and it is subsequently unsuitable for further fumigation with methyl bromide and the methyl bromide concentration has been verified at or below the TLV.

## 12 DOCUMENTATION

### 12.1 Retainment of fumigation documents

12.1.1 The fumigation service providers must keep a copy of all fumigation documentation

### 12.2 Record of fumigation

12.2.1 A record of fumigation must be produced to demonstrate the fumigation complied with the requirements of this methodology.

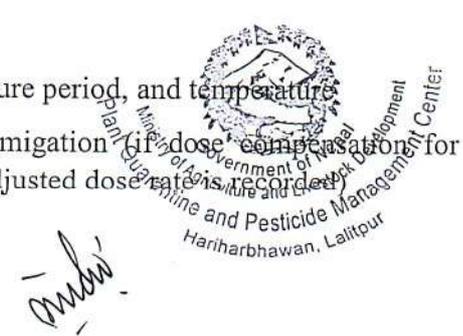
12.2.2 The record of fumigation must be completed on the fumigation site as the tasks are performed.

12.2.3 The record of fumigation must be retained by the fumigation service providers for a minimum of two years.

12.2.4 False or misleading information must not be recorded on a record of fumigation.

12.2.5 At a minimum the record of fumigation must include:

- a) Fumigation service providers (PQPMC/Fumigation company) identification
- b) client name
- c) start date and time of the fumigation
- d) location – the site address where the fumigation is performed
- e) a description of the consignment
- f) the target of fumigation
- g) consignment identification - container number(s), bill of lading, silo/shed number or other means to clearly identify the consignment
- h) a declaration that the consignment complies with the treatment schedule, import conditions, and all requirements of the Methyl Bromide Fumigation Methodology
- i) type of enclosure used
- j) enclosure volume
- k) the specified treatment schedule - dose rate, exposure period, and temperature
- l) dose rate used – the dose rate used for the fumigation (if dose compensation for temperature variation is applied the temperature adjusted dose rate is recorded)



- m) calculated dose – dose rate used multiplied by the enclosure volume, expressed as weight of methyl bromide
  - n) amount methyl bromide applied - the actual volume of methyl bromide injected into the enclosure, expressed as weight of methyl bromide
  - o) the time the methyl bromide injection into the enclosure is complete
  - p) the concentration readings from each concentration monitoring location and the time they are taken
  - q) result of the equilibrium calculation
  - r) serial number of the gas concentration monitoring device(s) used (minimum last 4 digits of the serial number)
  - s) the TLV readings and the time and date they are taken
  - t) the name and signature of the fumigation operator
  - u) initial or signature of the fumigator at each concentration reading stage and TLV reading,
- 12.2.6 If the fumigation is an ambient temperature fumigation (section 6.1 ambient temperature fumigations), the forecast minimum temperature must be recorded on the record of fumigation.
- 12.2.7 If the fumigation is a controlled temperature fumigation (section 6.2 Controlled temperature fumigations), the minimum temperature achieved within the enclosure must be recorded on the record of fumigation.
- 12.2.8 If the fumigation is a perishable commodity fumigation or if the temperature of the goods must be verified (section 6.3 Perishable commodity fumigation), the temperature of the goods must be recorded on the record of fumigation.
- 12.2.9 If the fumigation is a perishable commodity fumigation (section 6.3 Perishable commodity fumigation), the load factor and retention rate must be recorded on the record of fumigation.
- 12.2.10 If additional fumigant is added to the fumigation (in accordance with section 10 Topping up the methyl bromide levels), the top-up amount, time and concentration must be recorded on the record of fumigation.
- 12.2.11 If additional fumigant is added (in accordance with section 8.6 Exposure period), the additional amount and time injected must be recorded on the record of fumigation.

**Note:** An example record of treatment is provided at Appendix I: Example record of fumigation and Appendix III: Example record of fumigation perishable commodity.

### 12.3 Fumigation treatment certificate

- 12.3.1 A fumigation treatment certificate is issued once the fumigator-in-charge determines the fumigation has complied with requirements of this methodology.
- 12.3.2 False or misleading information must not be recorded on a fumigation treatment certificate.
- 12.3.3 At a minimum the fumigation treatment certificate must include:



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- a) Fumigation service provider's letterhead including physical address
- b) Fumigation service provider's identification
- c) certificate number
- d) name of fumigant
- e) target of fumigation
- f) description
- g) quantity
- h) consignment link (such as container number, bill of lading, invoice number)
- i) country or origin
- j) port of loading
- k) country of destination
- l) date and time fumigation commenced
- m) date and time fumigation completed
- n) place of fumigation (site registration number if applicable)
- o) type of enclosure used
- p) treatment schedule [prescribed dose rate/ specified dose rate ( $\text{g}/\text{m}^3$ )]
- q) exposure period (hours)
- r) forecast minimum temperature ( $^{\circ}\text{C}$ ) or minimum temperature achieved in the enclosure or commodity core temperature.
- s) applied dose rate ( $\text{g}/\text{m}^3$ )
- t) final TLV reading (ppm)
- u) a declaration that the consignment complies with the treatment schedule, import conditions, and all requirements of the Methyl Bromide Fumigation Methodology
- v) the signature of the fumigator-in-charge and date of signing
- w) date the certificate is endorsed and issued.

**Note:** An example fumigation treatment certificate is provided at [Appendix IV: Example fumigation treatment certificate](#)

12.3.4 The treatment provider must make all fumigation documentation available on request, by the relevant authorities, for audit and registration purposes.

12.3.5 The fumigation treatment certificate must be clearly linked to the consignment.

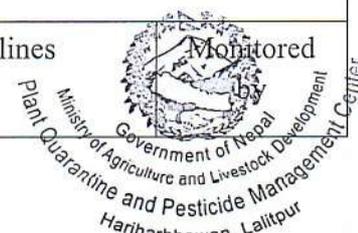





**Appendix I:**

**Example record of fumigation**

Fumigation record						
Fumigation company name:				Registration No.		
				Date:		
Description of goods fumigated						
Commodity	Quantity	No. of packages	Mode of packing:	Container no.		
Shipment Particulars						
Vessels name:	Port of loading	Country of export	Foreign port of shipment	Name of exporter	Name of importer	
Details of Fumigation Treatment						
Fumigants	Doses (g/m <sup>3</sup> )	Date/time of starting of fumigation	Date/time of ending of fumigation	Temperature in 0 <sup>c</sup>	Quantity of fumigant	Volume/type of fumigation enclosure
If Containers are not sheeted, the Pressure Decay (gas- tightness) value for 200-100 Pascals (in. seconds)						
Record of Monitoring Gas Concentration				Gas Monitor type Used: Serial number of Gas Monitor:		
Date	Time	Time interval	Reading of sampling lines			



			S1	S2	S3	
		0.5 hr				
		1hr				
		2 hrs.				
		4 hr.				
		12 hrs.				
		24 hrs.				
		48 hrs.				
Particulars of top up of fumigant at the end point of fumigation, if any undertaken						
Ventilation process conducted: Yes/ No				TLV achieved: Yes / No		
				TLV Value:		
Name & Signature of accredited Fumigation Operator with date/Accreditation Number						

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**Appendix-II**  
**Check Sheet of Fumigation**

Use this check sheet and MB Ready Reckoner along with fumigation record to identify procedures and actions before, during and after each fumigation.

Item of Activity	Details of check	Status
Inspection of Fumigation site	Intact floor without cracks	
	floor not undulated, no pebbles or stones	
	Located in a safe working area	
	Well ventilated	
	Sheltered area, rain and wind protected as for as possible	
Preparation of commodity	Stacked to allow good circulation leaving enough space around (2 m)	
	Impervious wrapping removed or slashed	
	Commodity not covered in impervious wrapping	
	Not forbidden commodity	
Preparation and instalment of equipment	Vaporizer filled with water and heating	
	Sheets of correct size & specification	
	Gas distribution line installed	
	Gas sampling tubes installed (minimum of 3 per enclosure & 1 per container)	
	Fan installed and working checked (one in each container and 2 per enclosure)	
	Cover the enclosure with sheet and make gas-tight sealing at the ground with two rows of sand snakes	
	Measure enclosure volume and calculate dosage	
	Establish and mark out hazardous area and place dangerous signs	

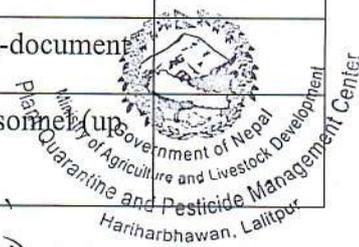


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Preparation to gas enclosure	Ensure risk area and surrounds free of unprotected personnel (up to 3m)	
	Turn on fans	
	Test leak checker for working	
	Wear and test the respirator for correct fitness	
	Position gas cylinder/can on scale and connect to inlet of vaporizer and the out let to gas distribution line	
	Release small quantity of gas and test fittings for gas leak and correct if necessary	
Application of gas to enclosure	Check vaporizer water boiling	
	Release required quantity of gas from the cylinder or dispenser	
	Check for hot gassing	
	Check for gas leakages around enclosure and correct leakages if any	
Initial monitoring	Turn off fan after 30 min	
	Measure gas levels on all monitor lines	
	Check to ensure all readings are above standard	
	Calculate if equilibrium achieved	
	Turn-on fans, if necessary-repeat until equilibrium achieved	
	Ensure levels still above standard-record and document	
End point monitoring	Measure gas levels on all monitor lines	
	Check to ensure all levels above standard	
	Carry out "top-up" procedures, if appropriate	
	Declare fumigation successful or failed, as appropriate-document	
	Ensure risk area and surrounds free of unprotected personnel (up to 3m)	



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Degassing	Turn-on fans	
	Wear gas mask and test for fitness	
	Open enclosure and allow ventilation	
	Test for Thresh hold limit value (TLV)-Continue aeration until gas level below TLV	
	Remove warning signs and risk area demarcation	
Documentation	Complete all documentation and release fumigated goods after ensuring gas- free	

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### Appendix III

#### Example Record of Fumigation Perishable commodity

{Insert your business logi or letter head}											
<b>Record of treatment-Methyl bromide fumigation (Perishable commodity)</b>											
Section A: Fumigation expert Full Name:					Accrediation number:						
<b>Section B: Job details</b>											
Fumigation Service provider name:					Clints name:						
Registration Number:											
<b>Location of fumigation:</b>											
Address					Description of Consignment:						
City:					Target of Fumigation:						
Country:											
Postcode:											
<b>Sction C: Fumigation details</b>											
Consignment suitability (section 3 of methodology)					Enclosure volime (m <sup>3</sup> )						
Was the consignment suitable for fumigation?					length	Height	Width				
<input type="checkbox"/> Yes= consignment suitbale		<input type="checkbox"/> No= remedial action taken			Total volume						
If no, what action?					Dose:						
Specified treatment schedule					Dose rate used			(g/m <sup>3</sup> )			
Dose rate (g/m <sup>3</sup> ):		Esposure period (hrs):			Calculated dose:			(g)			
Temperrature (0 <sup>c</sup> ):					Chloropicrin <input type="checkbox"/> yes <input type="checkbox"/> no			If yes: (%)			
Retention rate (%):		or CT product			Amount CH <sub>3</sub> Br applied			(g)			
TEMPERATURE PROBE LOCATION					Load factor:						
<input type="checkbox"/> Inside packaging		<input type="checkbox"/> Inserted into pulp			Maximum (%)			Estimated (%)			
<b>Section D: Concentration and temperature readings</b>											
<b>Temperature readings (0<sup>c</sup>): each reading must be signed by the fumigator (s) who took the reading</b>											
1	2	3	4	5	6	7	Date (dd/mm)	Time (hh:mm)	Fumigator (s) Signature		
								am/pm			
								am/pm			
								am/pm			
								am/pm			
								am/pm			
<b>Monitoring readings by loations: each reading must be signed by the fumigator (s) who took the reading</b>											
Serial number of Monitoring device (c)											
	1	2	3	4	5	6	Equilibrium result (%)	Standard (g/m <sup>3</sup> )	Date (dd/mm)	Time (hh/mm)	Fumigator (S) signature
Time and date: Fumigant injection finished										am/pm	
Start							%			am/pm	
							%			am/pm	
During										am/pm	
										am/pm	
End										am/pm	
										am/pm	

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Final TLV readings (all)	PPM	PPM	am/pm
Section E: Fumigator declaration: To be completed by the fumigation expert name in section A of this record			
I, the fumigation expert declares that the fumigation was conducted in accordance with the treatment schedule and all the requirements in the Protocol of Quarantine Treatment through the application of Methyl Bromide Fumigation in Nepal, and the information I have found is true and correct.			
Signature: .....		Date: (dd/mm/yyyy): .....	
Officer from PQPMC if supervised:			
Name: .....		Signature: .....	






## Appendix IV

### Example of fumigation treatment certificate

{Insert your business logi or letter head}		Issued date: (dd/mm/yyyy)-----	
<b>Treatment Certificate -Methyl bromide fumigation</b>			
<b>Certiacte number:</b>		<b>Fumigation service provider's registration number:</b>	
<b>Consignment details</b>			
Consignment link (Container number if appliation)			
Seal number (s) if applicabile			
Client name:			
Client address:			
Commodity description:			
Commodity country of origin:		Commodity quantity	
Port of loading		Destination country	
<b>Target of Fumigation (pick all that apply)</b>		<b>Enclosure type (pick one)</b>	
<input type="checkbox"/> Commodity	<input type="checkbox"/> Container	<input type="checkbox"/> Packaging	<input type="checkbox"/> Sheeted enclosure <input type="checkbox"/> Fumigation Chmaber <input type="checkbox"/> Un-Sheeted container
<input type="checkbox"/> other (provide details).....		<input type="checkbox"/> other (provide details).....	
Treatment schedule (prescribed/specified treatment schedule)			
Dose rate: ( g/m <sup>3</sup> )	Exposure period (hrs)	Temperature:	(oC)
<b>Fumigation details (treatment applied)</b>			
Applied dose:	Exposure period (hrs)	Temperature:	(oC)
Place of fumigation (full address)	Province/district/ward no./city		
	Country:	Postcode:	
Date and time of fumigation commenced (dd/mm/yyyy-HH-MM)		am/pm	
Date and time of fumigation completed (dd/mm/yyyy-HH-MM)		am/pm	
Final TLV reading (PPM)		PPM	
<b>Declation</b>			
I, the fumigation expert declares:			
1. The fumigation certified was conducted in accordance with the treatment schedule, import conditions, and all the requirements in Protocol of of Quarantine Treatment through application of Methyl Bromide Fumigation in Nepal 2. The information I have provided is in true and correct.			
Signatur (sign your name):			
Full name:			
Date (dd/mm/yyyy): .....		Accredired number: .....	
<b>Additional declarations:</b>			



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Appendix V

Methyl bromide monitoring tables

Table 1. Methyl bromide monitoring table, gas distribution phase

Category	Timing	Dose <sup>a</sup>	32	40	48	56	64	72	80	88	128
Initial dose	0 hours	100%									
Start point	¼ to ½ hour	85% or more	27.2	34	40.8	47.6	54.4	61.2	68	74.8	108.8
	½ to 1 hour	75% or more	24	30	36	42	48	54	60	66	96
	More than 1 hour	70% or more	22.4	28	33.6	39.2	44.8	50.4	56	61.6	89.6

<sup>a</sup> % of initial dose

Notes: Dosing is complete once the required amount of gas has been applied to the enclosure. Start Point is achieved when all concentration readings are at or above the standard. Maximum top-up concentration is 100% of initial dose.

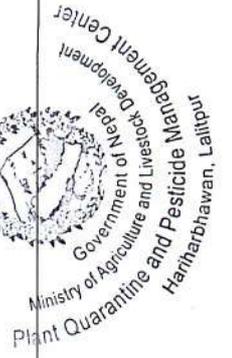
Source: Methyl Bromide Fumigation Methodology Version 3.0. Australian Department of Agriculture, Fisheries and Forestry, 2025

Table 2 Methyl bromide monitoring table, fumigation phase

Timing	Dose <sup>a</sup>	Concentration (category)	Concentration (g/m <sup>3</sup> )														
0 hours: initial dose	100%	Standard	32.0	40.0	48.0	56.0	64.0	72.0	80.0	88.0	128.0						
2 hours	60% or more	Standard	19.2	24.0	28.8	33.6	38.4	43.2	48.0	52.8	76.8						
		Minimum to allow top-up	14.2	19.0	23.8	28.6	30.4	35.2	40.0	44.8	68.8						

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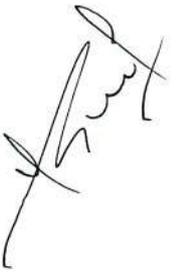
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Timing	Dose <sup>a</sup>	Concentration (category)	Concentration (g/m <sup>3</sup> )									
4 hours	50% or more	Maximum top-up	24.2	29.0	33.8	38.6	46.4	51.2	56.0	60.8	84.8	
		Standard	16.0	20.0	24.0	28.0	32.0	36.0	40.0	44.0	64.0	
		Minimum to allow top-up	11.0	15.0	19.0	23.0	24.0	28.0	32.0	36.0	56.0	
12 hours	35% or more	Maximum top-up	21.0	25.0	29.0	33.0	40.0	44.0	48.0	52.0	72.0	
		Standard	11.2	14.0	16.8	19.6	22.4	25.2	28.0	30.8	44.8	
		Minimum to allow top-up	6.2	9.0	11.8	14.6	14.4	17.2	20.0	22.8	36.8	
24 hours	30% or more	Maximum top-up	16.2	19.0	21.8	24.6	30.4	33.2	36.0	38.8	52.8	
		Standard	9.6	12	14.4	16.8	19.2	21.6	24	26.4	38.4	
		Minimum to allow top-up	4.6	7.0	9.4	11.8	11.2	13.6	16.0	18.4	30.4	
48 hours	25% or more	Maximum top-up	14.6	17	19.4	21.8	27.2	29.6	32.0	34.4	46.4	
		Standard	8.0	10.0	12.0	14.0	16.0	18.0	20.0	22.0	32.0	
		Minimum to allow top-up	3.0	5.0	7.0	9.0	8.0	10.0	12.0	14.0	24.0	
		Maximum top-up	13.0	15.1	17.0	19.0	24.0	26.0	28.0	30.0	40.0	

<sup>a</sup> % of initial dose

**Notes:** Dosing is complete once all the required amount of gas has been applied to the enclosure. Start point is achieved when all concentration readings are at or above the standard. The duration of the fumigation is measured from when the start point is achieved. For example, if a 24-hour fumigation reaches start point 1½ hours after dosing, the fumigation is completed 25½ hours after applying the dose and all concentrations are at or above the standard specified for 24 hours.





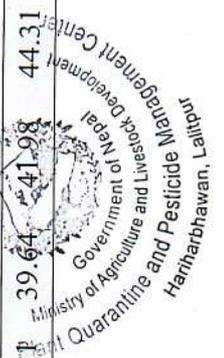
Source: Methyl Bromide Fumigation Methodology Version 3.0. Australian Department of Agriculture, Fisheries and Forestry, 2025

Table 3. Methyl bromide minimum standard concentrations

Timing (hours)	Retention (%)	Minimum standard concentration required (g/m <sup>3</sup> ) <sup>a</sup>														
		0 <sup>b</sup>	32	48	56	64	72	80	88	96	104	128	136	144	152	
½	75.00	24.00	36.00	42.00	48.00	54.00	60.00	66.00	72.00	78.00	84.00	90.00	96.00	102.00	108.00	114.00
1	70.00	22.40	33.60	39.20	44.80	50.40	56.00	61.60	67.20	72.80	78.40	84.00	89.60	95.20	100.80	106.40
2	60.00	19.20	28.80	33.60	38.40	43.20	48.00	52.80	57.60	62.40	67.20	72.00	76.80	81.60	86.40	91.20
3	54.80	17.54	26.30	30.69	35.07	39.46	43.84	48.22	52.61	56.99	61.38	65.76	70.14	74.53	78.91	83.30
4	50.00	16.00	24.00	28.00	32.00	36.00	40.00	44.00	48.00	52.00	56.00	60.00	64.00	68.00	72.00	76.00
5	47.80	15.30	22.94	26.77	30.59	34.42	38.24	42.06	45.89	49.71	53.53	57.35	61.18	65.01	68.83	72.66
6	45.70	14.62	21.94	25.59	29.25	32.90	36.56	40.22	43.87	47.53	51.18	54.83	58.48	62.13	65.78	69.43
7	43.70	13.98	20.98	24.47	27.97	31.46	34.96	38.46	41.95	45.45	48.94	52.43	55.92	59.41	62.90	66.39
8	41.80	13.38	20.06	23.41	26.75	30.10	33.44	36.78	40.13	43.47	46.82	50.16	53.50	56.85	60.19	63.54
9	40.00	12.80	19.20	22.40	25.60	28.80	32.00	35.20	38.40	41.60	44.80	48.00	51.20	54.40	57.60	60.80
10	38.30	12.26	18.38	21.45	24.51	27.58	30.64	33.70	36.77	39.83	42.89	45.95	49.01	52.07	55.13	58.19
11	36.60	11.71	17.57	20.50	23.42	26.35	29.28	32.21	35.14	38.06	40.99	43.92	46.85	49.78	52.70	55.63
12	35.00	11.20	16.80	19.60	22.40	25.20	28.00	30.80	33.60	36.40	39.20	42.00	44.80	47.60	50.40	53.20
16	33.35	10.67	16.01	18.68	21.34	24.01	26.68	29.35	32.02	34.68	37.35	40.02	42.69	45.36	48.02	50.69
20	31.65	10.13	15.19	17.72	20.26	22.79	25.32	27.85	30.38	32.92	35.45	37.98	40.51	43.04	45.58	48.11
24	30.00	9.60	14.40	16.80	19.20	21.60	24.00	26.40	28.80	31.20	33.60	36.00	38.40	40.80	43.20	45.60
28	29.15	9.33	13.99	16.32	18.66	20.99	23.32	25.65	27.98	30.32	32.65	34.98	37.31	39.64	41.98	44.31

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Timing (hours)	Retention (%)	Minimum standard concentration required (g/m <sup>3</sup> ) <sup>a</sup>															
32	28.31	9.06	13.59	15.85	18.12	20.38	22.65	24.91	27.18	29.44	31.67	33.90	36.13	38.36	40.59	42.82	45.05
36	27.47	8.79	13.19	15.38	17.58	19.78	21.98	24.17	26.37	28.57	30.76	32.95	35.14	37.33	39.52	41.71	43.90
40	26.64	8.52	12.79	14.92	17.05	19.18	21.31	23.44	25.57	27.71	29.84	31.97	34.10	36.23	38.36	40.49	42.62
44	25.82	8.26	12.39	14.46	16.52	18.59	20.66	22.72	24.79	26.85	28.92	30.99	33.05	35.12	37.18	39.25	41.32
48	25.00	8.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00	38.00	40.00

**a** If the concentration measuring instrument used can only read in whole grams then the minimum standard concentration must be rounded up to the nearest whole number. **b** Initial dose.

**Notes:** Minimum concentration to allow top-up is 5 g/m<sup>3</sup> below the standard concentration for initial doses of 32 to 56 g/m<sup>3</sup>. Minimum concentration to allow top-up is 8 g/m<sup>3</sup> below the standard concentration for initial doses of 64 to 152 g/m<sup>3</sup>. Maximum top-up concentration is 5 g/m<sup>3</sup> above the standard concentration for initial doses of 32 to 56 g/m<sup>3</sup>. Maximum top-up concentration is 8 g/m<sup>3</sup> above the standard concentration for initial doses of 64 to 152 g/m<sup>3</sup>. Concentration readings must be equal to or above the required concentrations specified for the hour preceding the reading – for example, a reading taken at 2½ hours must be equal to or above the concentrations specified at 2 hours.

**Source:** Methyl Bromide Fumigation Methodology Version 3.0. Australian Department of Agriculture, Fisheries and Forestry, 2025






**Table 4. Methyl bromide minimum concentrations for fumigations that require 80% retention**

Concentration	Minimum standard concentration required (g/m <sup>3</sup> ) <sup>a</sup>												
Starting	32	48	56	64	72	80	88	96	104	128	136	144	152
Minimum	25.6	38.4	44.8	51.2	57.6	64.0	70.4	76.8	83.2	102.4	108.8	115.2	121.6

<sup>a</sup> If the instrument used only reads in whole grams, the standard concentration must be rounded up to the nearest whole number.

**Source:** Methyl Bromide Fumigation Methodology Version 3.0. Australian Department of Agriculture, Fisheries and Forestry, 2025

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**Table 5. Methyl bromide monitoring ready reckoner**

Dosing Phase	Initial Dose	32 g/m <sup>3</sup>	40 g/m <sup>3</sup>	48 g/m <sup>3</sup>	56 g/m <sup>3</sup>	64 g/m <sup>3</sup>	72 g/m <sup>3</sup>	80 g/m <sup>3</sup>	88 g/m <sup>3</sup>	128 g/m <sup>3</sup>	Dosing is complete once ALL the required amount of gas has been applied to the enclosure.	
Gas Distribution Phase	¼ - ½ hr 85% or more of initial dose	32	40	48	56	64	72	80	88	128	Start Point is achieved when ALL concentration readings are at or above the Standard.	
	½ - 1 hr 75% or more of initial dose	32	40	48	56	64	72	80	88	128		
	> 1 hr 70% or more of initial dose	32	40	48	56	64	72	80	88	128		
Fumigation Phase	2 hrs 60% or more of initial dose	21.2	29	33.8	38.6	46.4	51.2	56	60.8	84.8	The duration of the fumigation is measured from when the Start Point is achieved. For example, if a 24 hr fumigation reaches Start Point 1 ½ hrs after dosing, the fumigation is completed 25 ½ hrs after applying the dose and ALL concentrations are at or above the standard specified for 24 hrs.	
	4 hrs 50% or more of initial dose	21	25	29	33	40	44	48	52	72		
	12 hrs 35% or more of initial dose	16.2	19	21.8	24.6	30.4	33.2	36	38.0	52.8		
	24 hrs 30% or more of initial dose	14.6	17	19.4	21.8	27.2	29.6	32	34.4	46.4		
	Methyl Bromide Concentration After Start Point	48 hrs 25% or more of initial dose	13	15	17	19	24	26	30	30		40
			3	5	7	9	8	10	12	14		24



A = Standard Concentration  
 B = Minimum concentration to allow top-up  
 C = Maximum top-up concentration

Source: Methyl Bromide Fumigation Methodology Version 3.0. Australian Department of Agriculture, Fisheries and Forestry, 2025  
 Ministry of Agriculture and Livestock Development  
 Plant Quarantine and Pesticide Management Centre  
 Hariharbhawan, Lalpur

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