MeBr Fumigation and ISPM-15

an Overview

W.M.D.H. Kulatunga
Seed Certification & Plant Protection Centre
Goals of Plant Quarantine Treatment

- Minimize the risks of pest introduction and spread in to uninfested areas. (Country or Locally)

- Reduce pest risk to a level adequate to provide quarantine security
Treatment Policy

- Required only in situations of actual infestation or infection
- When prescribed as a condition of entry under the regulations
- When prescribed as a condition for export
About Quarantine Treatment in General

- Treatment provide a means whereby trade in not generally impeded, but which allows the entry of commodity that would otherwise be denied of entry.

- Treatment is a plant quarantine activity that is intended to safely eliminate 100% of the pests infesting plant materials or related articles.
Contd..

➢ Treatment for which there are published schedules are designed to achieve effectiveness when the treatment is performed according to proper procedures

➢ A treatment is to be avoided unless there is sound biological reason to treat plant material or related commodities
Contd..

➢ Treatment program is directed at eliminating the pests and diseases that accompany import and provide pest sanitation for export.
Method of Quarantine Treatments

- Chemical Treatment
- Physical Treatment
Method of Quarantine Treatment

- Chemical treatment can be well represented by fumigation with methyl bromide, aluminum phosphine and hydrogen cyanide and/or carbon dioxide.
- Fumigation is a method of treatment in which fumigation is introduced directly into an enclosed space.
Commodity Treatment

Chemical Treatments
- Fumigation
- Chemical Spraying
- Dipping in Chemicals
- Micronized dusting

Physical treatments
- Vapor Heat Treatment
- Cold Treatment
- Hot water dipping
- Irradiation
Chemicals used as fumigants

- Ethylene Di Bromide (EDB)
- Ethylene Oxide (ETO)
- Hydrocyanic acid (HCN)
- Methyl Bromide (MB)
- Phosphine (PH)
- Sulphuryl Fluoride (SF)
## Properties of fumigants in common use for insect control

<table>
<thead>
<tr>
<th></th>
<th>Mol. Wt</th>
<th>B.P. °C (at 760 mm)</th>
<th>Solubility in water g/100ml</th>
<th>Flammability (% by volume in air)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethylene dibromide</td>
<td>187.88</td>
<td>131.0</td>
<td>0.43 at 30 °C</td>
<td>Non flammable</td>
</tr>
<tr>
<td>CH₂Br₂.CH₂Br</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethylene oxide</td>
<td>44.05</td>
<td>10.7</td>
<td>Very soluble at 20 °C</td>
<td>3-80</td>
</tr>
<tr>
<td>CH₂OCH₂</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrocyanic acid gas</td>
<td>27.3</td>
<td>26.0</td>
<td>6-41</td>
<td></td>
</tr>
<tr>
<td>HCN</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methyl Bromide</td>
<td>94.95</td>
<td>3.6</td>
<td>1.3 at 25 °C</td>
<td>Non Flammable</td>
</tr>
<tr>
<td>CH₃ Br</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phosphine</td>
<td>34.04</td>
<td>-87.4</td>
<td>Very slightly soluble</td>
<td>Highly inflammable</td>
</tr>
<tr>
<td>PH₃</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulfuryl Fluoride</td>
<td>102.6</td>
<td>-55.2</td>
<td>slight</td>
<td>Non flammable</td>
</tr>
<tr>
<td>SO₂F₂</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
During fumigation the commodity will be exposed to a certain concentration of the fumigant (which exist as a gas) for a certain period of time in a closed system, in order to kill the pests.
Fumigants

- Wide spectrum pesticides
- Volatile pesticides whose vapor enter the insects body through the body wall or breathing system
- Penetrate to many areas of a building not reached by sprays or dusts
- Penetrate to the burrows of wood infesting insects, as well as to the center of tightly packed commodities
- does not leave unsightly, odorous or hazardous residues if the site is properly aerated after fumigation
<table>
<thead>
<tr>
<th>Fumigant</th>
<th>Odor</th>
<th>effects on metals</th>
<th>General</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methyl bromide</td>
<td>No odor at low concentration. Strong musty or sweet at high concentrations.</td>
<td>Reacts with aluminium, may damage electronic equipment</td>
<td>discharged from cylinders or 1 lb cans</td>
</tr>
<tr>
<td>Phosphine</td>
<td>Garlic like or carbide due to impurities</td>
<td>copper, brass, gold and silver severely damaged; electronic equipment damaged. Other metals slightly affected in high humidity.</td>
<td>evolved from aluminium phosphide or magnesium phosphide preparations</td>
</tr>
</tbody>
</table>
Methyl Bromide

Method of evolution as fumigant:

From steel cylinders under natural or added pressure

Also dispensed from 1 lb (454 g) cans
Fumigation

➢ The use of poisonous gases to kill pests in an enclosed area

The most effective way to reach pests in their most remote hiding places is through fumigation
Why Fumigation

➢ To reduce the risk of introducing pests and diseases in to Importing / Exporting country

Fumigant is a ➢ GAS

➢ Lethal to

INSECTS

ANIMALS

PLANTS

FUNGI

When Exposed to sufficient CONCENTRATION

For a sufficient length of TIME
Fumigation of exports

- As a requirement of an importing country
- To eradicate the pests to issue Phytosanitary certificates (certification purpose)
- To treat the wooden pallets (ISPM 15)
Fumigation properties of Methyl Bromide

- Good penetration – up to 100 mm into timber
  - will not penetrate plastics, paints, lacquered surfaces
- Fast acting
- Effective against broad range of pests
- Can only be used if the temperature is above $10^0\text{C}$
Fumigation properties of Methyl Bromide (Cont)

- Liquid under pressure in cylinders and cans
- Solvent organic materials
- **Reacts** with Aluminium, Magnesium, Zinc and strong alkalis when **liquid**
Nature of Methyl Bromide

- Colourless and odourless Gas
- Boiling point - 3.6°C
- 1 kg - 577ml
- 1 kg of liquid expands to 257 litres of gas
- 3.27 heavier than air
- Non flammable at fumigation concentrations
Gas Penetration

Effective gas penetration may be prevented by

- Timber thickness > 200 mm
- Impervious coating such as paint, lacquers, laminates.
- Impervious packaging such as plastic wrapping.
Selection of Methyl bromide as a fumigant

Advantages:
- Quick and deep penetration
- Effective against all stages of insects and mites
- High plant tolerance
- Effective over wide range of temperature
- Nonflammable; non-explosive
- Readily detected
Disadvantages:

- Diffuses laterally and downward rapidly, but slowly upward
- Odorless
- Requires volatilizing
- Some plants not tolerant when dormant
- High sulfur content articles develop off odors
Contd..

- Seed germination affected
- Fruits and vegetables affected
- High mammalian toxicity
- Lacks antidote
- Relatively expensive
Commodities that can be treated with MeBr

- Timber and timber products
- Agricultural products
- Empty containers
- Food stuffs
- Seeds
- Perishable commodities (live plants, cut flowers, fresh fruits and vegetables)
Perishable commodities

- The minimum acceptable temperature for fumigation of perishable commodities is 10°C.

- Living plants are likely to be damaged if fumigated at temperatures above 30°C.

- When fumigating fresh fruit and vegetables, the fumigator must use the fruit pulp temperature for dosage calculations.
Fumigation of commodities with impervious packing/shrink wrapping

- the goods covered with or packed in gas impervious materials (such as plastic wrapping or laminated plastic films, lacquered or painted surfaces, aluminium foil, tarred or waxed paper) must have the coverings or packaging opened, cut or removed, prior to fumigation.

- This must be sufficient to allow adequate gas penetration into the consignment and subsequent airing.
Few commodities for which problems may occur when fumigated with Methyl Bromide

- Butter, Lard and fat
- Iodized salt
- Bone meal
- Furs and articles of hair or feather
- Leather goods
- Woolens
- Photographic chemicals
- Rubber goods
- Charcoal
Methyl Bromide is very dangerous

- Toxic to Live animals, Human, Insects, Fungi
Health risks of Methyl Bromide

- Affects the nervous system
- In liquid form burns the skin

Exposure to MB may cause following symptoms

- Headaches
- Blurred vision and slurred speech
- Tiredness
- Dizziness and staggering
- Loss of appetite
- Abdominal pains, nausea and vomiting
- Delayed reaction to exposure may occur from 8-24 hours later
Ex: AQIS standard

- Australian Quarantine and Inspection Service has published standard for Methyl Bromide Fumigation.
- Australian quarantine treatment required goods to be treated according to the AQIS std.

www.aqis.gov.au/icon
www.aqis.gov.au
Concentration

- Amount of fumigant present in a known volume
- High concentrations are usually expressed in as weight per unit of volume
  - grams per cubic meter (g/m$^3$)
- Lower concentrations as
  - Parts per million (ppm)
# Common Standard Dosages for MeBr Fumigation

<table>
<thead>
<tr>
<th>Pest/ Commodity</th>
<th>Required Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Giant African Snail</td>
<td>128g/m³ at 21 °C for 24 hours at Normal Atmospheric Pressure (NAP)</td>
</tr>
<tr>
<td>Khapra beetle</td>
<td>80g/m³ for 48 hours with a minimum concentration of 24g/m³ after 24 hours at NAP</td>
</tr>
<tr>
<td>Stored Product Pest of Quarantine Concern</td>
<td>32g/m³ at 21 °C for 24 hours at NAP</td>
</tr>
<tr>
<td>Timber</td>
<td>48g/m³ at 21 °C for 24 hours at NAP</td>
</tr>
</tbody>
</table>
The fumigation site

- Site requirements

  - Be able to be isolated from unprotected personnel
  - Be well ventilated
  - Be sheltered from high winds
  - Have a smooth gas impervious floor
  - Have a power supply available
Site floor

- The fumigation site floor must be **impermeable** to the fumigant if fumigation under **gas proof sheets** is to be carried out.
Fumigation enclosure

- Must be gas tight
- A pressure test have to be performed and pressure decay time should be calculated
  - \(200\text{Pa} - 100\text{Pa}\) if the pressure decay time is less than 10 seconds, gas proof sheets should be used
ISPM 15 Standards

- **International Standards For Phytosanitary Measures No. 15 (ISPM 15)** is an International Phytosanitary Measure developed by the *International Plant Protection Convention (IPPC)*.

- It directly addresses the need to treat wood materials of a thickness greater than **6mm**, used to ship products between countries.
Wood packaging material made of unprocessed raw wood is a pathway for the introduction and spread of pests. As origin of wood is often difficult to be determine. Therefore approved measures are required.

They are based on:

- Range of pests that may be affected
- Efficacy of the measure
- Technical and/or commercial feasibility

Wood packaging material subjected to the approved measure display a specified mark.
Official Mark (ISPM 15)

- XX = Country code
- 000 = Code assigned by the NPPO
- YY = Treatment applied
Approved measures associated with wood packaging materials
- Heat treatment (HT)

Wood packaging material has to be heated in accordance with a specific time-temperature schedule that achieves a minimum wood core temperature of 56 °c for a minimum of 30 minutes.
Methyl Bromide (MB) Fumigation for Wood Packing Material

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Dosage (g/m³)</th>
<th>2hrs.</th>
<th>4hrs.</th>
<th>12hrs.</th>
<th>24hrs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>21°C or above</td>
<td>48</td>
<td>36</td>
<td>31</td>
<td>28</td>
<td>24</td>
</tr>
<tr>
<td>16°C or above</td>
<td>56</td>
<td>42</td>
<td>36</td>
<td>32</td>
<td>28</td>
</tr>
<tr>
<td>10°C or above</td>
<td>64</td>
<td>48</td>
<td>42</td>
<td>36</td>
<td>32</td>
</tr>
</tbody>
</table>

Minimum temperature - > 10°C

Minimum exposure 24 hours
Kiln-Drying (KD)
Chemical Pressure Impregnation (CPI)

Irradiation
- Gamma radiation
- X-rays
- Microwaves
- Infra red
- Electronic beam treatment
The End

Fumigation will Facilitate Trade

Thanks For The Patience

Awareness Seminar-Sri Lanka Shippers’ Council – 1st June 2012