



Methyl Bromide Information

What is methyl bromide?

The insecticidal value of methyl bromide was first reported by Le Goupil (1932) in France and since then it has been widely and successfully used for over 70 years for quarantine purposes. Chemical composition is CH_3Br and it is also known as bromomethane. It is produced from both human sources and natural ones – in the ocean; marine organisms are estimated to produce 1-2 billion kilograms annually.

The properties of methyl bromide make this an effective and versatile fumigant used to kill unwanted pests. The most important advantage is its ability to penetrate quickly and deeply into sorptive materials at normal atmospheric pressure. Also, at the end of a treatment, desorption and vapours dissipate rapidly allowing the safe handling of commodities.

Methyl Bromide is used most commonly in New Zealand for the eradication of quarantine pests from import and export cargo. While it still remains a useful tool at the border, it is an ozone depleting substance and efforts are being made to reduce both the use and emissions of the gas.

Under the Montreal Protocol countries are required to phase out methyl bromide use for non quarantine use and New Zealand has ceased to import the gas for non quarantine use. Official quarantine and pre-shipment use is still allowed but countries are encouraged to reduce the amount used. Guidance on what is classified as official use is available at:

<http://www.biosecurity.govt.nz/commercial-transport-and-border-management/facilities/official-use-of-methyl-bromide>

Methyl bromide is a colourless, odourless, nonflammable and non-explosive gas under ordinary circumstances. It is three times heavier than air and can accumulate in poorly ventilated or low-lying areas. However the application methods of heating the gas on input and circulation by fans in the enclosure assist in the even distribution of the gas.

All fumigators are required to have a controlled substance license, be an approved handler under the Hazardous Substances Act 1996 and be a MAF approved treatment supplier.

<http://www.ermanz.govt.nz/hs/compliance/guides/fumigants.html>

Reactions with commodities

The fumigation of some foodstuffs or other items with methyl bromide may result in the creation of undesirable taints or odours. In some instances these may be attributed to reactions with sulphur or sulphur compounds originally present or added during processing. These odours usually persist indefinitely and, in most cases, there is no practical way to remove these. The following materials should not be exposed to methyl bromide, or should be exposed only after conducting preliminary tests with small samples (FAO Fumigation Manual):

- iodized salt, stabilized with sodium hyposulphite;
- certain baking sodas, salt blocks used for cattle licks or other foods containing reactive sulphur compounds;
- full fat soya flour;

- sponge rubber
- foam rubber as used in rug padding, pillows, cushions and mattresses;
- rubber stamps and similar forms of reclaimed rubber;
- furs, horsehair and pillows (especially feather pillows);
- leather goods, particularly white kid or any other leather goods tanned with a sulphur process;
- Woollens, especially angora; some adverse effects have been noted on woollen socks, sweaters and yarn;
- viscose rayons, made by a process using carbon disulphide;
- cinder blocks or mixtures of mortar; mixed concrete occasionally picks up odours;
- charcoal, which not only becomes contaminated but sorbs great amounts of methyl bromide and thus reduces effective fumigant concentrations;
- paper that has been cured by a sulphide process and silver polishing papers;
- photographic chemicals, not including cameras or films;
- rug padding, vinyl, cellophane;
- any other materials that may contain reactive sulphur compounds.

If imported or export goods need fumigating and there are any concerns over the suitability of the product for fumigation, check with the fumigation company. Alternatives to methyl bromide may be available for treating imported goods, check the MAF Biosecurity New Zealand Approved Treatments schedule on the web site (<http://www.biosecurity.govt.nz/regs/trans/treat>) or new treatments may be submitted for approval. Alternatively the imported goods could be returned to origin or destroyed in an MAF approved manner.

Use in New Zealand

The majority of the 227 tonnes of gas used in New Zealand during 2007 was used in association with forest products as a condition of market access and the volume of gas used is trade dependant. For 2007 the following categories of commodities were fumigated for biosecurity purposes.

Types of Items Treated 2007	%
Bulb, corms, tubers and rhizomes (intended for planting)	0.02%
Cut flowers and branches (including foliage)	0.11%
Fresh fruit and vegetables	1.93%
Grain and cereals for consumption including rice (not intended for planting)	0.29%
Dried foodstuffs (including herbs, nuts, dried fruit, coffee, cocoa)	0.14%
Nursery stock (plants intended for planting other than seed)	0.02%
Seeds (intended for planting)	0.13%
Wooden packaging materials, other packaging materials, pallets & dunnage	5.24%
Wood (including round sawn, sawn wood, wood chips)	10.87%
Whole logs (with or without bark)	67.89%
Hay, straw, dried animal fodder (other than grains and cereals listed above)	0.50%
Cotton and other fibre crops and products	0.29%
Buildings (including dwellings, factories, storage facilities)	0.10%
Equipment (including used agricultural machinery & vehicles); and empty shipping containers	6.43%
Tyres (used)	0.82%
Personal effects, furniture, crafts, artifacts, hides, fur and skins	2.45%
Other	2.78%

Health Effects

The effect of methyl bromide on humans and other mammals appears to vary according to the intensity of exposure. At concentrations not immediately fatal, this chemical produces neurological symptoms. High concentrations may bring about death through pulmonary injury and associated circulatory failure. The onset of toxic symptoms is delayed, and the latent period may vary between 0.5 to 48 hours, according to the intensity of the exposure and the personal reaction of the patient (von Oettingen, 1955). Contact of the human skin with the liquid or strong concentrations of the gas may cause severe local blistering (Watrous, 1942). Serum bromide levels can be used to document that exposure did occur only if it is done within 1 to 2 days following exposure (EPA). However, bromide levels in the blood do not accurately predict the clinical course as bromide also occurs naturally in the blood.

A single small exposure from which a person recovers quickly is not likely to cause delayed or long-term effects. After a serious exposure that causes lung or nervous system-related problems, permanent brain or nerve damage can result. No severe effects on the nervous system for those exposed to low-level concentrations of methyl bromide, over a long period of time, have been noted in humans, however animal studies have shown injury can occur. No links between methyl bromide and motor neuron disease have been found in medical literature by the Ministry of Health or Environmental Science and Research (Cluster Investigation into Motor Neurone Disease Nelson, Nelson Marlborough District Health Board 2005).

The current Workplace Exposure Standard for MeBr at 5ppm over 8 hours is 30 times below any known affect over a 5-7 week inhalation study according to the EPA Methyl Bromide Risk Assessment conducted in 2005. The workplace exposure standards apply to long-term exposure to a substance over an eight-hour day, for a five-day working week. Calvert et al 1998 studied 123 structural fumigation applicators in Florida and concluded "few health effects were associated with methyl bromide exposure" and those that they found were associated with the physical nature of the job. The workplace exposure standards apply to long-term exposure to a substance over an eight-hour day, for a five-day working week.

An interesting comparison is with carbon monoxide (CO) that we are exposed to every day from vehicles and other sources. Fumigation gas is similar to car exhaust - you don't run a car in a closed shed but its ok in the open air unless in a high exposure area such as rush hour traffic or Christchurch winter, similarly you don't enter a fumigation enclosure during a fumigation but it dilutes to safe levels very quickly in the open air.

A report on New Zealand's air quality says on CO "However, the guideline values are regularly exceeded at the Khyber Pass Road traffic site and at residential monitoring sites in Christchurch.

There may be some health affects as a result of exposure to CO concentrations in Christchurch and near to roadsides in Auckland and Wellington, including a significant decrease in work capacity in healthy adults, decreased exercise capacity at onset of angina, and increased duration of angina in people with ischaemic heart disease. Similarly prolonged exposure to concentrations measured at these sites and other sites (e.g. Dominion Road and Khyber Pass) could impact on developing foetuses, resulting in reduced birth weight in non-smokers."

Carbon monoxide poisoning is the most common type of fatal poisoning in many countries. Poisoning signs include confusion, disorientation, visual disturbance and seizures. The most common symptoms of carbon monoxide poisoning can resemble the flu, including headache, nausea and vomiting, dizziness, lethargy and a feeling of weakness. Exposures can lead to

significant damage to the heart, central nervous system and can also have severe effects on the foetus of a pregnant woman.

Typical situations that produce high levels of carbon monoxide are 5,000 ppm from a chimney of a home wood fire and 7,000 ppm from an undiluted warm car exhaust without a catalytic converter. The air quality report recommends a CO level of 10 mg/m³ averaged over an eight-hour period or 8.1ppm. The current Workplace Exposure Standard for MeBr is 5ppm over 8 hours

In an enclosed environment, such as a shipping container, secondary venting (preferably with a fan) is advised before unloading as gas in the air space can occur from the slow release from some commodities. Elevated levels of gas can occur after initially being cleared down to 5ppm by the fumigator and the container closed then subsequently reopened for unpacking.

Call your doctor or the Emergency Department if you develop any unusual signs or symptoms within 24 hours, especially:

- coughing or wheezing
- difficulty in breathing, shortness of breath, or chest pain
- difficulty in walking
- numbness of hands or feet
- confusion, dizziness, or fainting
- increased pain or a discharge from exposed eyes
- increased redness or pain or a pus-like discharge in the area of a skin burn

Also read the ERMA Fact Sheet: <http://www.biosecurity.govt.nz/files/regs/treat/safety-precautions-for-fumigated-containers.pdf>

References:

Calvert GM, Mueller CA, Fajen JM, Chrislip DW, Russo J, Briggie T, et al. 1998. Health effects associated with sulfuryl fluoride and methyl bromide exposure among structural fumigation workers. *Am J Public Health* 88:1774-1780.

Cluster Investigation into Motor Neurone Disease Nelson, Nelson Marlborough District Health Board 2005.

FAO manual of Fumigation Control. (<http://www.fao.org/docrep/X5042E/x5042E00.htm>)

Gordon W. Gribble “The diversity of naturally occurring organobromine compounds” *Chemical Society Reviews*, 1999, volume 28, pages 335 – 346.

Health effects, (excerpt from Toxicological Profile for Bromomethane, ATSDR 1992), (<http://www.ecousa.net/toxics/brometh.shtml>) cited *Terr-o-gas 57*, Methyl Bromide, Bromomethane; Human Toxicity Excerpts, **peer reviewed**. (<http://www.frankmckinnon.com/terr.htm>).

Methyl Bromide Hazard Summary-Created in April 1992; Revised in January 2000; EPA. (<http://www.epa.gov/ttn/atw/hlthef/methylbr.html>)

Medical Management Guidelines for Methyl Bromide; USA Department of Health and Human Science. (<http://www.atsdr.cdc.gov/mhmi/mmg27.html>)

Proposed National Environmental Standards for Air Quality 2004. <http://www.mfe.govt.nz/publications/air/nes-air-standards-analysis/nes-air-standards.pdf>