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, desorbtion and vapours dissipate rapidly allowing the safe handling of commodities.

Methyl Bromide is used 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. Recapture is occurring at some ports and will be required for all fumigations starting in 2020.

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 in:

Official use of methyl bromide (PDF)

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 an MPI approved treatment supplier.

Approved handlers – WorkSafe New Zealand website

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 them.

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 MPI Approved Treatments schedule on the web site (Treatment suppliers) or new treatments may be submitted for approval. Alternatively the imported goods could be returned to origin or destroyed in an MPI approved manner.

Use in New Zealand

The majority of the 525 tonnes of gas used in New Zealand for 2014 was in association with forest products as a condition of market access, the volume of gas used is trade dependant and the balance on infested import goods.

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 Neuron 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 where 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 – it's ok at low levels in the open air unless in a high exposure area such as rush hour traffic, 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 parts of Christchurch and near busy 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/m^3 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 Worksafe guidance:

http://www.worksafe.govt.nz/worksafe/information-guidance/all-guidance-items/keeping-safe-from-harmful-substances/keeping-safe-from-harmful-substances.pdf

References:

Calvert GM, Mueller CA, Fajen JM, Chrislip DW, Russo J, Briggle 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**.

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)