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Product Stewardship Summary

CAS: 74-83-9
Formula: CH₃Br

Methyl Bromide

Also known as bromomethane and monobromomethane

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Introduction

Methyl bromide is an important compound that is used world-wide to control insects, weeds and damaging soil organisms. It protects high-value crops in the field and after harvest, and is essential to disease-free growth of many certified seeds and transplants. It reduces insect and rodent contamination during shipping and storage of commodities, and also is used for quarantine purposes in export/import facilities. Although methyl bromide is being phased out because of its potential for damage to the earth's protective ozone layer, it remains an essential tool in global commerce and food production thanks to its unmatched effectiveness and the lack of suitable alternatives.



Description and Properties

Methyl bromide is a colorless, transparent gas that is heavier than air. Although it becomes a volatile liquid below 3°C (37.4°F), it has no flash point and is generally considered to be nonflammable. Methyl bromide mixes easily in most organic solvents. It has

no distinctive odor to warn of its presence except in very high concentrations, when it may smell slightly sweet, musty or chloroform-like. A warning agent called chloropicrin is sometimes mixed with methyl bromide to give it a distinctive, irritating aroma.

Uses

Methyl bromide is an important agricultural pesticide that is used as a soil fumigant to control insects, diseases, nematodes and weeds by sterilizing the soil prior to planting. It also is used as an area fumigant for insect control in commodities such as rice and pet food being transported by freight car or by ship, during storage in warehouses, and in quarantine treatments. Plant nurseries rely on it to produce certified seed and

transplants, and manufacturers of wood products use it to eliminate borers and other insects.

Methyl bromide is valued for its stability and ability to penetrate most non-metallic materials, as well as its cost-effectiveness and lack of trace residues – especially important on edible fruits and vegetables. It is

typically applied as a pressurized liquid that becomes a gas as it is injected into the soil or released into storage containers or enclosures. By law, it may only be used by licensed applicators.

More than 80 percent of methyl bromide is used in agriculture. A number of high-value crops such as strawberries, tomatoes and peppers depend heavily on methyl bromide, but orchards and nurseries also count on it for effective control of pests that are difficult or impossible to manage with any other pesticide.



Agricultural usage data in the following table are projections from the US Environmental Protection Agency's 2008 Nomination for Critical Use Exemptions:

Sector	Kilograms	% of Total
Tomatoes	1,840,100	28.7%
Strawberry Fruit	1,604,669	25.0%
Peppers	919,006	14.3%
Other Fruits and Vegetables	668,495	10.4%
Orchard Replant	405,666	6.3%
Food Processors	362,952	5.7%
Other Uses	614,272	9.6%
TOTAL	6,415,160	100.0%

Methyl bromide can penetrate up to 7 inches of solid wood, performance that is superior to any other known fumigant. As a result, it is widely used to fumigate wooden packaging such as pallets and crates that may harbor invasive insects. In 2001, the federal government used methyl bromide as a fumigant to kill anthrax spores in postal facilities and government buildings.

Methyl bromide is an intermediate compound used to manufacture other important agricultural pesticides, as well. Some of these control broadleaf weeds and grasses in soybeans, corn, potatoes, alfalfa and other crops that would otherwise reduce yields. Others control fungus diseases in cereal

grains, beans and sugarcane that reduce yields and contaminate harvested crops.

Global commerce depends on reliable quarantine and pre-shipment treatments with methyl bromide to eliminate insects and other pests from grain, wood and other vital trade products. Left unchecked, such pests would destroy valuable commodities, spread disease, and damage the environment by displacing native plants and animals. These issues are particularly sensitive in

developing economies that rely heavily on agricultural exports.

There are currently no known alternatives with equivalent cost-effectiveness. Without methyl bromide it has been estimated that U.S. producers, exporters and consumers would sustain economic losses of \$1.3 to \$1.5 billion annually, and harvests of high-value crops such as tomatoes and strawberries would decline from 50 to 70 percent in some areas. Crops such as cucumber, eggplant and pepper could no longer be farmed successfully in certain regions. Exports and imports of these and other foodstuffs would also decline for lack of effective fumigation to eliminate invasive pests.

Alternatives include shifting production to higher-cost, soil-less greenhouse environments and other pesticides, many of which are subject to their own regulatory restrictions. Crop rotation, resistant varieties, steam and composting are under consideration, but suitability varies by region and



often entails higher costs and/or losses of valuable crops to uncontrolled pests and weeds.

Health Information

Methyl bromide is highly toxic to humans and animals, both by inhalation and by absorption through the skin, and it causes irreversible poisoning and severe burns to the skin, eyes, digestive tract and airways. Airway damage can result in a condition called "delayed chemical pneumonia" in which fluid accumulates in the lungs, potentially resulting in heart failure and death.

Early symptoms of overexposure include dizziness, headache, nausea and vomiting, weakness and collapse. Lighter exposures can cause symptoms similar to alcohol intoxication, including stumbling, blurred vision and balance problems that may disappear after a period of no exposure.

Exposure Potential

Under the law, methyl bromide may only be applied by licensed applicators or those under their direct supervision. Licensed applicators must meet strict

criteria governing safe handling, storage and use of the compound, which helps to reduce exposure potential.

Workers involved in methyl bromide application or the removal of containment after fumigation are likely to have the highest risk of exposure, followed by those workers who first re-enter the area

after fumigation. To reduce this risk, regulations restrict re-entry to application sites and require personal protective clothing and equipment for people who handle the product.

Because methyl bromide is absorbed by the soil and readily dissipates in the atmosphere, bystanders such as farm workers in adjacent fields and those who live or work nearby are likely less at risk. Even so, depending on soil and

weather conditions and proximity to the application site, bystanders may come into contact with residues as the compound disperses.

Environmental Information

Methyl bromide has been identified as an ozone-depleting substance that reacts with and destroys atmospheric ozone. Scientists believe that the earth's ozone layer absorbs ultraviolet light that would otherwise reach the surface, potentially causing damage to plant and animal life, including humans.

The same volatility that allows methyl bromide to disperse into the atmosphere reduces the likelihood of accumulation in soil, water and foodstuffs. The small amounts of methyl bromide that may remain in the soil have a half life of approximately 55 days. (Half life is the time required to reduce the amount of methyl bromide by 50 percent.) Run-off is extremely unlikely from agricultural use, but if methyl bromide does contact surface waters, its half-life is estimated to be between 6 and 7 hours under field conditions.

Physical Hazards

Methyl bromide reacts with strong oxidizers, aluminum, magnesium, zinc (including galvanized steel), and alloys. Reaction with aluminum produces a compound that bursts into flame in the presence of air. Moisture and damp air should be avoided because methyl bromide becomes very corrosive in the presence of water. High temperatures and open flame can result in the formation of toxic gases.

Derivation/Manufacturing

Methyl bromide can be made directly from elemental bromine or obtained as a by-product from other chemical manufacturing processes. It is currently produced only in the United States, Israel, Japan and China.

Regulatory Information

Methyl bromide is a restricted-use pesticide that is governed by a variety of federal and state regulations designed to protect people and the

environment from improper use while ensuring effectiveness as a pesticide. Because methyl bromide has been identified as an ozone-depleting substance, it was scheduled for phase-out by 2005 under the U.S. Clean Air Act and the Montreal Protocol, an international treaty designed to protect the earth's ozone layer.

Usage is therefore declining significantly, especially in the European Union, the United States and other developed countries. Elsewhere, international agreements allow continued use by developing nations until 2015.

The lack of cost-effective alternatives has led the U.S. Environmental Protection Agency to issue critical use exemptions where there are no alternatives that are technically or economically feasible. These exemptions are issued only to users with prior government approval for quarantine, pre-shipment use, or agriculture, and only after a rigorous review process that can take up to 3 years.

Those who apply the product must be licensed, and the U.S. Environmental Protection Agency requires detailed reporting and record keeping. Many states impose additional requirements, including registration and site-specific permits prior to each use.

Product Stewardship

Albemarle Corporation is committed to manage methyl bromide so that it can be safely distributed and used by our customers. We work with them to minimize the risks of leakage and personnel exposure by specifying appropriate containers and protective equipment, and we require transportation firms to meet strict safety standards before transporting the product. In addition, we provide detailed guidance to our customers in proper handling and storage

techniques and systems, along with emergency response procedures.

Prior to selling methyl bromide to any potential customer, Albemarle reviews the firm's previous experience with the product and intended use. Depending on the results of this review, an on-site evaluation may be conducted in which Albemarle will interview the firm's management and employees, review their documentation and inspect their facilities. The process covers industrial hygiene, safety, environmental considerations, process and transportation equipment, emergency preparedness, record keeping and regulatory compliance.

Customers are subject to follow-up on-site audits on a schedule that depends on their membership in methyl bromide industry panels and associations (which impose their own standards) and safety record. Albemarle does not take responsibility for customer safety programs, but does make safety recommendations as deemed necessary by these audits. Customers also are surveyed annually and follow-up visits are scheduled as required based on the findings. Albemarle will not ship methyl bromide to firms that do not address significant issues raised in our reviews and surveys.



Conclusion

Methyl bromide is a valuable pesticide and chemical intermediate that remains an essential tool for farmers, shippers and others who serve vital national and international interests and lack suitable alternatives. In view of its toxicity and ozone depletion potential, regulation and careful product stewardship are essential to maintain public safety while protecting the quality of our foodstuffs and commodities until suitable alternatives are discovered.

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Albemarle Corporation is a member of the American Chemistry Council and, through ACC's participation with the International Council of Chemical Associations (ICCA), has prepared this document to improve product stewardship within the chemical industry and with suppliers and customers.

This document provides general information about methyl bromide and does not supplant or replace required regulatory and/or legal communication documents, nor is it intended to provide an in-depth discussion of health and safety information. Always consult the product's material safety data sheet, product label and technical data sheet before using the chemical.