

# Facts about ProFume<sup>®</sup> and Methyl Bromide

More similarities than differences

 Dow AgroSciences

**ProFume<sup>®</sup>**

Gas Fumigant

©Trademark of Dow AgroSciences LLC

Both ProFume® gas fumigant and methyl bromide are effective fumigants that:

- Control a wide spectrum of pests
- Are non-flammable and odorless
- Have similar specific gravities and molecular weights
- Are non-corrosive in vapor phase
- Utilize a Concentration x Time (CT) dosage relationship

Another similarity between ProFume and methyl bromide is their Half-Loss Times (HLTs). This is because Graham's law states gases of similar molecular weights tend to have similar HLTs ("Dosages of Fumigants Lethal to Insects," NPMA, 1998). ProFume has an approximate molecular weight of 102 and methyl bromide has an approximate molecular weight of 95. HLT similarity was evidenced in one of the only mills for which there is scientific data for fumigations done at the same site, at the same time of year, during similar weather conditions. The HLT in the mill when fumigated with methyl bromide was 6.9 hours, and when fumigated with ProFume was 6.3 hours.

However, there are also some notable differences between ProFume and methyl bromide: ProFume® is a better penetrant, has lower sorption, more rapid aeration, and low potential for off-odors. Perhaps most importantly, ProFume does not deplete the ozone layer, and unlike methyl bromide, is therefore not subject to global phase out under the Montreal Protocol.

Methyl bromide is a highly effective fumigant. Nonetheless, no fumigant, including methyl bromide, is perfect at all times across the broad range of conditions and target pests for which it is intended. Focusing on one life stage or species of insect is not an accurate reflection of efficacy. Product performance is based on total population control and length of control.

In fact, at about 80 F, methyl bromide requires a CT product of 251 oz-hr/Mcf to achieve 100 percent kill of confused flour beetle pupae, and at 60 F requires a CT of 255 oz-hr/Mcf to produce 100 percent kill of red flour beetle larvae and pupae (Bell et al., *J Stored. Prod. Res.* Vol. 24 (2). 115-122). It is important to note that these CT products are above the recommended methyl bromide dosage of 200 oz-hr/Mcf (Great Lakes Chemical Company Fumigation Guide, 1998).

To illustrate further: For control of adult grain weevils at about 80 F, methyl bromide requires a CT product of 28 oz-hr/Mcf and ProFume requires only 17.5 oz-hr/Mcf. Likewise, for control of adult confused flour beetles at 80 F, methyl bromide requires a CT product of 64 oz-hr/Mcf, and ProFume requires only

55 oz-hr/Mcf ("Dosages of Fumigants Lethal to Insects," NPMA, 1998).

It is true that methyl bromide generally requires lower CTs to kill the eggs of a number of stored product pests (*Great Lakes Initiatives*, Vol 11, Issue 1, April 2005). This fact is well known and presents no new information; but more importantly it does not present the full picture. Compared to ProFume or methyl bromide, phosphine commonly requires much lower doses (in parts per million) to control insects. Yet this data certainly does not mean that, overall, phosphine is the most effective fumigant. Such data simply does not translate to one fumigant being better than another. In real world settings, ProFume consistently provides effective, broad-spectrum pest control.

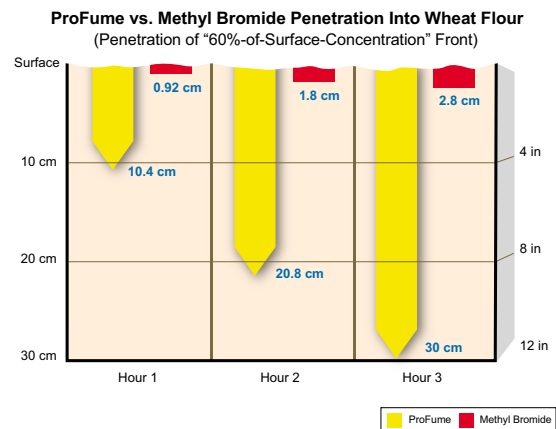
## Technical viability

Evidence exists for both ProFume® gas fumigant and methyl bromide that supports efficacy against all life stages of all major stored product insect pests. Both fumigants kill the insects as long as the appropriate CT is achieved. However, lab data is only one part of a measure of a fumigant's technical viability.

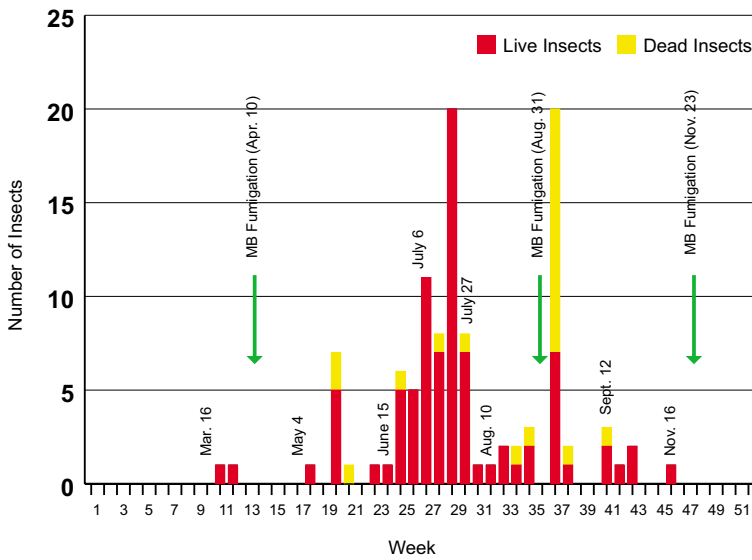
Documented scientific data regarding total population control over time in mill conditions is rare. However, the graphics on the following page illustrate population control and rebound following multiple standard methyl bromide fumigations in a Midwestern mill. The arrows indicate fumigation events and the bars represent insect population rebound within the mill.

Mill conditions are important to consider, because there is no guarantee that during fumigation the needed CTs will be achieved. In particular, methyl bromide can be impaired by lower penetration and higher sorption, potentially resulting in insect rebound. Even though monitoring shows a sufficient CT product, the fumigant may not reach required levels inside the commodity where insects are harbored ("Dosages of Fumigants Lethal to Insects," NPMA, 1998).

Research conducted by Central Sciences Laboratories demonstrates that ProFume penetrates wheat flour substantially farther and faster than methyl bromide

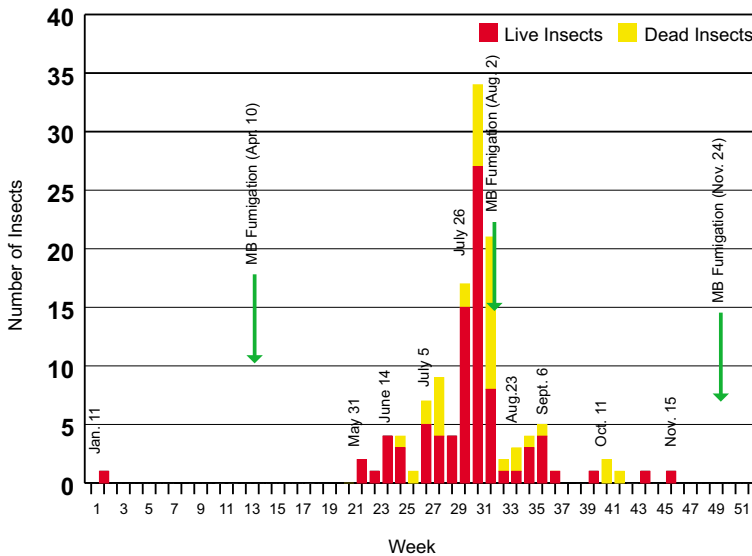


### 1998 Tailings Summary for a Midwestern Mill Fumigated with MB\*



\*Midwest, USA. Tailings checked every day.

### 1999 Tailings Summary for a Midwestern Mill Fumigated with MB\*



\*Midwest, USA. Tailings checked every day.

### Time between MB Fumigations and Incidence of Insects for Midwestern Mill over 3 years

Event	Spring	Summer	Fall
Days between fumigations	90	120	150
Days no insects detected after fumigation	45	16	112

(Bell et. al., 2002. *Proc. 8th IWC on Stored Product Protection*. pp 910-915.)

In addition, ProFume has proven that it delivers effective results in over 100 research and commercial fumigations across the globe, under all conditions, against all life stages of numerous insects, over a period of years.

### Higher CTs do not equal higher pounds

It is critical to understand that higher CTs do not equal higher pounds. There are several factors that go into a dosage calculation. With ProFume® gas fumigant, these factors are taken into account by the Fumiguide™ program, which gives the fumigator the flexibility to calculate the pounds needed to achieve the CT desired. For example, if fumigating a 1-million-cubic-foot structure, with a HLT of 7 hours, at 80 F for 24 hours, for red flour beetle at the low dosage, then 2,404 pounds of ProFume are required. The ProFume low dosage kills all adults, pupae, larvae and a significant portion of the eggs targeted.

If we calculate using the high dosage for ProFume, which targets all the remaining eggs, then the pounds required initially goes up. However, if minor changes are made, the number of pounds drops tremendously. For example, if the HLT is increased from 7 to 10 hours and the temperature is raised slightly to 85 F, then the amount of fumigant required drops by over 50 percent. Furthermore, if the fumigator has the flexibility to extend the fumigation by 12 hours, then approximately another 10 percent savings can be gained. The combination of all three of these Precision Fumigation™ techniques brings the high dosage for ProFume within three cylinders of what is required for the low dosage. Therefore, twice the CT does not necessarily mean twice the fumigant.

### Economic viability

Since pounds of fumigant needed are an important consideration in the economics of any fumigation, their overall impact is critical to understand. In general, fumigant cost is estimated to comprise only one-third of the total cost of fumigation. Labor cost and profit impact comprise the remaining two-thirds. In addition, it should be noted that ProFume® gas fumigant is generally priced lower per pound than methyl bromide.

Based on actual fumigations conducted throughout the United States after ProFume was registered in 2004,



the average use rate for ProFume is 2.6 lbs/Mcf. This average, when compared with an average use rate of 1.5 pounds of methyl bromide/Mcf, results in a 21 percent increase in the wholesale cost of the fumigant. However, this 21 percent rise translates to only a 7 percent increase in the overall cost of the fumigation because the labor costs remain the same.

Labeled use rates for commodities vary for both ProFume and methyl bromide, resulting in some fumigations actually costing less with ProFume. For instance, given the recommended use rate of methyl bromide for rice is 3 lbs/Mcf (Great Lakes Meth-O-Gas 100 label), then for a 1-million-cubic-foot structure, 3,000 pounds of methyl bromide are required. If the HLT is 10 hours and the temperature is 85 F, then ProFume requires only 3,500 pounds at the high dosage. This results in the overall cost of the fumigant being 15 percent less for ProFume, which translates into a total cost reduction of 5 percent for a job using ProFume compared to one performed with methyl bromide.

## Investing in sustainability

ProFume® gas fumigant and methyl bromide are both excellent fumigants that are fully capable of delivering desired insect control to the end user. ProFume and methyl bromide have more similarities than differences. However, a pound-for-pound performance comparison misses the point.

Total population control is a complex situation. To focus on one insect species or one life stage ignores the multitude of factors that contribute to a successful fumigation. Precision Fumigation™ techniques, when applied using the Fumiguide™ program, take these factors into account and actually encourage analysis that can result in using less gas and lowering expense.

ProFume is a technically and economically viable fumigant. Moreover, ProFume is a sustainable alternative which is not being phased out under the Montreal Protocol. Count on ProFume® gas fumigant to get the job done.



®Trademark of Dow AgroSciences LLC



[www.ProFume.com](http://www.ProFume.com)

®™ Trademark of Dow AgroSciences LLC  
ProFume is a federally Restricted Use Pesticide.  
Always read and follow label directions.