ChemicalWatch Factsheet

A Beyond Pesticides/ NCAMP Factsheet

Structural Fumigants: Methyl Bromide and Sulfuryl Fluoride

Whole-house fumigation is a commonly used technique employed to eliminate a variety of structural pests such as drywood termites, powder post beetles and carpenter ants over the short-term. The house is covered with an impermeable covering and a toxic gas is pumped in. A couple of days later the house is vented, aired and the air is sampled to make sure that the gas has dissipated.

Methyl bromide (MeBr) is an odorless, colorless gas, widely used both as a soil-sterilant and to control wood-infesting insects such as drywood termites, carpenter ants, and powderpost beetles. Recent evidence has shown that MeBr is a direct-acting carcinogen in the rat, where it causes stomach cancer. In humans and animals, death results from pulmonary irritation and edema; non-lethal exposures can produce muscle weakness, abnormal reflexes, visual disorders, headache and malaise.

Vikane (sulfuryl fluoride) is another highly toxic and odorless structural fumigant. Very little is known about the toxic effects of Vikane, and even the polyethylene sheeting commonly used to protect articles in the home during applications is permeable to the chemical. Residues, consisting of inorganic fluoride, have been found on such soft household goods as rubber, feathers, rayon and wool as long as 40 days after fumigation. Still, these residues are not likely to be toxic.

When used as a structural fumigant, MeBr and Vikane are mixed with another fumigant, chloropicrin, which serves as a warning agent to those handling either gas by irritating the eyes and nose. (Chloropicrin is also registered as a pesticide used to fumigant grain). Under a 1982 data call-in, EPA asked that registrants supplement the extremely deficient database on both MeBr and Vikane with new and more complete residue data. Sub-chronic and chronic animal study requirements were waived. Until review of other data is completed, no tolerances exist for residues on food commodities.

A National Institutes of Occupational Safety and Health (NIOSH) study of 103 soil and structural fumigators differentially exposed to MeBr, sulfuryl fluoride, or a combination of the two, shows that fumigant exposure causes subtle neurological damage. Researchers W. K Anger et al. found significant impairment of finger sensitivity, increased parasthesias (tingling, loss of feeling) in hands, and decreased

chemicalWATCH Stats
Methyl Bromide:

CAS Registry Number: 74-83-9
Chemical Class: Halogenated organic
Use: Pre-plant soil fumigations; structural, industrial, and residential uses; post-harvest food commodity uses; other specialized fumigations
Toxicity rating: Highly Toxic
Signal Word: Danger
Health Effects: Neurological damage, developmental toxicity
Environmental Effects: Ozone depleting chemical

chemicalWATCH Stats
Sulfuryl Fluoride:

CAS Registry Number: 2699-79-8
Chemical Class: Inorganic
Use: Fumigant used in structures and for treatment of stored food crops
Toxicity rating: Highly Toxic
Signal Word: Danger
Health Effects: Neurological damage, developmental and reproductive toxicity
Environmental Effects: Although there is a lack of data, label statements include: "Do not expose to non-target organisms. This pesticide is toxic to fish and wildlife."

memory-related cognitive ability, particularly in the group exposed to both fumigant pesticides. This study provides a prime example of the little-studied problem of "chemical synergism" where chemicals in combination exert effects greater than either alone.

The Anger study suggests that more long-lasting effects of exposure may have been overlooked thus far. The changes noted are so subtle that workers themselves might not readily recognize they had occurred.

Although deaths as a result of exposure to structural fumigants are uncommon, they have occurred. Orkin Exterminating Co. was found guilty August 8, 1988 of violating federal pesticide law on charges connected with the deaths use of Vikane in September, 1986 a t a residence in Galax, VA. An elderly couple died days after they reentered their fumigated home. The pesticide applicators were found to have failed to check the air for Vikane residues.

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Update, *November 2007:*
Methyl Bromide

Methyl bromide is banned in much of the world under the Montreal Protocol on Substances that Deplete the Ozone Layer. President Reagan signed onto the Protocol in 1987, and methyl bromide was supposed to be phased out in industrialized countries by 2005. However, for the past several years, the Bush administration has requested exemptions from the phase-out for a variety of agricultural uses. The European Union has already banned methyl bromide and proven the efficacy of a number of alternative products, evidence the U.S. has ignored while manufacturing more of the chemical and building large stockpiles.

Fortunately, recent reports show a steady decrease in the U.S.'s methyl bromide inventory. In May 2007, EPA released data from 2006, showing a reduction of over 3,000 metric tons held by U.S. companies since 2005, down to a total of 7,671 metric tons held by 35 companies. Further reduction, however, is needed before the U.S. can successfully fulfill its commitment to the Montreal Protocol. However, a 2006 pesticide use statistics report showed that methyl brmide use was up for strawberries.

EPA signed the "Report of Food Quality Protection Act (FQPA) Tolerance Reassessment and Risk Management Decision (TRED) for Methyl Bromide, and Reregistration Eligibility Decision (RED) for Methyl Bromide's Commodity Uses" in August 2006. The document reassessed and approved 128 tolerances for commodity uses of methyl bromide. A RED for soil fumigant uses is scheduled for May 2008, when EPA has finalized its risk assessment of, and management decisions for, five soil fumigants including: chloropicrin, dazomet, metam sodium, and iodomethane (methyl iodide). "[Methyl bromide] is considered a non-food use chemical for soil fumigation uses since it is quickly degraded or metabolized in the soil, and subsequently incorporated into natural plant constituents," according to the EPA.

As a restricted-use pesticide, methyl bromide can only be applied by certified applicators, yet there are significant human health risks posed both to workers and bystanders from inhalation exposure. Symptoms of significant exposure to methyl bromide include throat and eye irritation, skin lesions, weakness, despondency, headache, nausea, and vomiting. Later, numbness, defective muscular coordination, tremor, muscle spasms, lack of balance, extreme agitation, coma, and convulsions may occur. High levels of exposure can result in central nervous system failure, respiratory failure, and death. Methyl bromide is listed as a chemical known to cause developmental toxicity on California's Proposition 65 list. In the 2006 TRED and RED, EPA did not perform ecological risk assessments, as the document pertains to indoor uses, and ecological risks from outdoor soil fumigation will be addressed in the reregistration decision for those uses, due in 2008.

Update, *November 2007*:
Sulfuryl Fluoride

The Reregistration Eligibility Decision (RED) for sulfuryl fluoride was signed in September 1993. At the time, there was only one end-use product, Vikane. Vikane, 99% sulfuryl fluoride, is a "Restricted Use" pesticide due to inhalation hazards. Dow Agrosciences produces sulfuryl fluoride as an alternative to methyl bromide even though the two are toxicologically similar and other options are available.

In January 2004, after intensive lobbying by Dow, EPA approved the use of sulfuryl fluoride as a fumigant on a raw foods, and in July 2005, that approval was extended to all processed foods. For these uses, the Agency approved two tolerances for residues on food- fluoride and sulfuryl fluoride. According to estimates released by EPA in January 2006, the use of sulfuryl fluoride as a food fumigant could become the second largest daily source of fluoride exposure in the US. Fluoride is identified as the major toxicological endpoint of concern for exposure to sulfuryl fluoride.

EPA set an allowable dosage of fluoride for infants that is five times higher than for adults. This was the first time that EPA had set a tolerance level higher for children than for adults, and the decision disregards EPA's mandate, under the Food Quality Protection Act, to be more, not less, protective of a child's exposure to pesticides. Fluoride is persistent and bio-accumulates in the human body, posing the risk of a number of health problems to the public, including arthritis, hip fractures, bone cancer, kidney damage, infertility, and brain disorders. It is unclear how much fluoride people are being exposed to in addition to that which is added to drinking water, as fluoride is naturally occurring and finds its way into foods processed with fluoridated water, as well as foods exposed to sulfuryl fluoride.

In June 2006, Beyond Pesticides, along with other advocacy groups, filed a petition to the EPA calling for a "stay", or immediate suspension, of all food-uses of sulfuryl fluoride pending a full evidentiary hearing. After receiving the petition, the EPA issued a request for public comment noting that "the request for a stay raises complex science issues of great public interest." In response to EPA's request, the New York State Attorney General's Office, the Union representing EPA's scientists and professionals in Washington DC, and over 7,000 citizens wrote to EPA expressing their support for the petition and urged the Agency to terminate the food uses of sulfuryl fluoride.

Sulfuryl fluoride is acutely moderately toxic by oral exposure (Toxicity Category II) and slightly toxic for acute inhalation (Toxicity Categories III and IV) and dermal vapor toxicity (Toxicity Category IV). Residents and workers are at risk for neurotoxic effects from acute exposure. Subchronic studies on rats have indicated effects on the nervous system, lungs, and brain. Developmental and reproductive effects have also been noted in relevant studies on rats. According to the National Research Council, fluorides might also increase the risk of developing Alzheimer's disease, and boys exposed to fluoride in drinking water are five times more likely to develop osteosarcoma , a rare form of bone cancer.

Since sulfuryl fluoride was only registered for use as a fumigant for existing infestations, EPA waived the environmental fate data requirements for reregistration in 1993 and did not consider ecological risks. The Agency expects that non-target organisms would not likely be exposed to sulfuryl fluoride and that the pesticide would not leach to groundwater or persist in the environment for any significant amount of time.

Methyl Bromide & Sulfuryl Fluoride *chemicalWATCH* Factsheet Bibliography

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