chemicalWATCH Factsheet

MALATHION

Malathion is a nonsystemic, wide-spectrum organophosphate insecticide. First manufactured in 1956 by American Cyanamid, there are at least thirteen other producers worldwide, 342 registrants and 1218 separate registrations. These products are used in an wide range of locales against a variety of target pests on field corps, greenhouses and forests, as well as numerous indoor environments, from dog kennels to food processing plants, schools and hospitals.

Malathion is used to control aphids, mites, scale, flies, leafhoppers, leafminer, thrips, loopers, pear psylla, mealybugs, spittlebugs, corn earworms, chinchbugs, grasshoppers, armyworms, bollweevils, bollworms, lice, ticks, ants, spiders, and mosquitoes. It is applied to alfalfa, clover, pasture and range grasses, nonagricultural land, cereal crops, cotton, safflower, soybeans, sugar beets, corn, beans, blueberries, stored grain, and inside homes. Estimated use of malathion ranges from 10 to 15 million pounds of active ingredients used annually.

Health Effects

EPA has classified malathion as a toxicity class III pesticide, bearing the signal word "Caution." Despite the fact that malathion is one of the less acutely toxic synthetic pesticides, having a rat oral LD50 of 1522 to 1945 milligrams per kilogram of body weight (mg / kg), numerous human poisoning have been reported.
It is slightly toxic via the oral route and dermal route. It has been reported that single doses of malathion may affect immune system response.

Symptoms of acute exposure to organophosphate or cholinesterase-inhibiting compounds may include the following: numbness, tingling sensations, headache, dizziness, tremor, nausea, abdominal cramps, sweating, incoordination, blurred vision, difficulty breathing or respiratory depression, and slow heartbeat. Very high doses may result in unconsciousness, incontinence, and convulsions or fatality. The antidote is atropine.

Malathion is a nerve poison, which acts by inhibiting the enzyme acetylcholine esterase(AchE), and probably acts at other sites in the nervous system as well. Cases of long-lasting polyneuropathy (Petty, 1958 and Healy, 1959), and sensory damage (Harrell, et al., 1978) have been reported in humans, as well as behavioral changes. Corresponding indications of neurotoxicity are seen in animal studies.

The pesticide has been shown in animal testing and from use experience to affect not only the central nervous system, but the immune system, adrenal glands, liver and blood as well. Malathion is rapidly and effectively absorbed by practically all routes including the gastrointestinal tract, skin, mucous membranes, and lungs. Animal studies indicate it is eliminated through urine and feces with a reported half-life of approximately 8 hours in rats and approximately 2 days in cows.

In a 1976 U.S. Army study, it was found that the avoidance behavior of rats was significantly impaired at a dose which did not impair blood or brain AchE activity. In other words, malathion was found to cause behavioral changes at levels at which the standard hospital test for organophosphate poisoning would be negative.

Malathion has shown to be mutagenic in humans and animals. It has also been associated with birth defects in domestic and laboratory animals.

EPA's Pesticide Incident Monitoring System reported 962 incidents from 1960-80, and in California, malathion was the third most common cause of pesticide related illness from 1981 – 85, especially among applicators exposed during indoor application, usually due to inhalation of fumes. Other physiological changes reported include glycosuria and hyperglycemia (sugar in the urine or blood) and elevated levels of polymorpholeucocytes (white blood cells).

A memo written by a Health Statistician with the Health Effects Division in the Office of Prevention, Pesticides and Toxic Substances, U.S. EPA, stated that 5,222 unintentional residential exposures were reported to Poison Control Centers from 1993-1996.

A November 1999 report issued by the Center for Disease Control (CDC) recommended that Florida find alternatives to malathion to fight the Mediterranean fruit fly (Medfly). According to the CDC report, over 230 people had reported being sick after malathion was sprayed aerially during the previous Medfly Eradication Program. A Florida Public Health Department study of people exposed to malathion has linked the chemical to respiratory, gastrointestinal and central nervous system effects.

Cancer Controversy

There is ongoing controversy about whether or not malathion is or is not a carcinogen. A 1992 study published in *Cancer Research* linked the use of

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malathion by Iowa and Minnesota farmers to an increased risk of non-Hodgkin's lymphoma. Another study published in the *American Journal of Epidemiology* found similar increased risks in Nebraska farmers using malathion.

In a letter by Harold T. Smith, a U.S. Department of Agriculture official, to Dr. Robert Simon, executive director, Environmental and Toxicology International, a lab that tests for pesticide residues, regarding a draft Environmental Impact Statement (EIS) on fruit fly control procedures, Simon was told that the EIS was being held up due to EPA's ongoing review of malathion. "Preliminary information received from EPA indicates that the EPA is considering changing the registration status of malathion because of studies that suggest that it could be a low-level human carcinogen. Such a change would require review of protection and mitigation measures," states Smith in his letter.

This is not the first time that malathion has been associated with a "cover-up" controversy. Just over a week before the EPA released its preliminary risk assessment for malathion, the agency was poised to classify the organophosphate pesticide as a suspected carcinogen, according Reuters newswire on May 10, 2000. Reuters's EPA source, speaking on condition of anonymity, revealed, "The EPA scientists' risk assessment finds that malathion is a suspected carcinogen. The risks are fairly small, but acceptable compared to other substances." However, when the risk assessment was published in the May 11, 2000 *Federal Register* (Vol. 65, No. 92), the EPA claimed there was "insufficient evidence" to assess the insecticide's cancer causing potential.

In 1978, the National Cancer Institute (NCI) funded five studies, which they concluded that malathion did not appear to be a carcinogen in experimental animals. Six years later, Dr. M. Adrian Gross, senior science advisor, Benefits and Use Division, Office of Pesticide Programs, EPA, reviewed the NCI studies and concluded that malathion does, in fact, behave as a carcinogen and presents an unacceptably high risk. His assessment of the data showed that malathion increased the rate of tumors in experimental animals, especially in the thyroid glands of rats and mice. Gross further concluded that, "It has been established that the upper limit on the cancer risk attributable to currently established tolerances for malathion is as high as 1 to 4 per 1,000 population … an unacceptably high limit." He referred to NCI's work as a "cover-up-job."

Environmental Effects

Malathion is a non-specific poison, is known to be highly toxic to bees, and available data suggest that it is highly toxic to many aquatic non-target species, such as freshwater fish, and moderately toxic to birds. Various aquatic invertebrates are extremely sensitive to malathion. Malathion is highly toxic to aquatic stages of amphibians and is toxic to many species of beneficial insects. It has a wide range of toxicities in fish, extending from very highly toxic in the walleye to highly toxic in brown trout and the cutthroat trout, and moderately toxic in fathead minnows.

Malathion has been determined to be the cause of the deaths of thousands of Staten Island fish by the New York Department of Environmental Conservation (DEC), as reported by the Queens Tribune. Tests conducted in two open water locations in Staten Island revealed that malathion is responsible for the deaths of close to 2,000 fish, said DEC spokesman Brian O'Conner. Preliminary tests found malathion levels in Willowbrook Lake water to be 5.8 part per billion (ppm) and 0.3 ppm in dead fish, says the Tribune.

Environmental Fate

Malathion is quite water-soluble (145 ppm at 25° C.), and preliminary data show that it is highly mobile in loam soils and thus a probable threat to groundwater. Malathion is of low persistence in soil with reported field half-lives of one to 25 days. Degradation in soil is rapid and related to the degree of soil binding. Breakdown occurs by a combination of biological degradation and nonbiological reaction with water. If released to the atmosphere, malathion will break down rapidly in sunlight, with a reported half-life in air of about 1.5 days. In river water, the half-life is less than one week, whereas malathion remained stable in distilled water for 3 weeks.

Toxic Contaminants

The Northwest Coalition for Alternatives to Pesticides (NCAP) states that the toxicity of malathion is compounded by its metabolites and contaminants. Malaoxon, a metabolite produced by the oxidation of malathion in mammals, insects, plants, and in sunlight is the primary source of malathion's toxicity and is 40 times more acutely toxixc than malathion. NCAP also states that over eleven chemical contaminants and analogues created in the production process have been found in technical malathion. These chemicals and the use of other pesticides can act synergistically with malathion to increase its toxicity.

Malathion Up for Review

Malathion is currently being evaluated by EPA to determine if current uses will remain on the market. As part of the ongoing implementation on the Food Quality Protection Act (FQPA),EPA has released the preliminary risk assessment for malathion and is requesting public comments.

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