ENOSULFAN

Banned in Denmark, Germany, Netherlands, Sweden, Belize, Singapore, the Indian state of Kerala, and the Brazilian state of Rondonia. Colombia and Indonesia have been preparing for a ban. Its use is disallowed in rice fields in Bangladesh, Indonesia, Korea and Thailand. Use is restricted or severely restricted in Canada, Finland, Great Britain, Kuwait, the Philippines, Russia, Sri Lanka, Thailand and Madagascar. Campaigns have been going on worldwide for several years to ban endosulfan.

The neurotoxin endosulfan is rated by Environmental Protection Agency (EPA) as a Category I pesticide with Extremely High Acute Toxicity. Health effects of accidental exposure include central nervous system disorders such as dizziness, convulsions and loss of consciousness. Endosulfan exposure has been linked to dozens of deaths in the U.S. and around the world, and there is strong evidence that it is an endocrine disrupting chemical.

Classified as an organochlorine (the same family of pesticides as DDT and dieldrin), endosulfan and its breakdown products are persistent in the environment, with an estimated half-life of nine months to six years. It is known to bioaccumulate in humans and other animals, collecting particularly in the liver, kidneys and fatty tissue. Commercially produced endosulfan is generally composed of its two molecular forms (isomers), a -endosulfan and b -endosulfan.

The US Environmental Protection Agency classifies it as a Category 1b (highly hazardous). Easily absorbed by the stomach, lungs and through the skin. All routes of exposure can pose a hazard. Exposure may result from:

- breathing air near where it has been sprayed
- drinking water contaminated with it
- eating contaminated food
- touching contaminated soil
- smoking cigarettes made from tobacco with endosulfan residues
- working in an industry where it is used.

**ACUTE TOXICITY:** Endosulfan is highly toxic if ingested orally. It is very toxic when absorbed through skin. Stimulation of the central nervous system is the major characteristic of endosulfan poisoning. Symptoms noted in acutely exposed humans include: incoordination, imbalance, difficulty in breathing, gagging, vomiting, diarrhoea, agitation, convulsions, and loss of consciousness. Tests on rats show those deprived of protein are nearly twice as susceptible.

**CHRONIC TOXICITY:** Studies on animals show that sustained exposure over two years in rats caused reduced growth and survival, changes in kidney structure, and changes in blood chemistry. Organochlorine compounds are suspected to play a part in the decrease in the quality of semen, in the increase in testicular and prostate cancer, an increase in the defects in male sex organs, and increased incidence of breast cancer.

**REPRODUCTIVE EFFECTS:** Studies on mice show that chronic exposure endosulfan can damage to the reproductive organs of females. In male rats the weight of semen-bearing tubes, which comprise testicles, is lowered by the pesticide. Organochlorines are suspected of disrupting the endocrine system, resulting in harmful effects like reproductive and developmental defects and certain cancers.
TERATOGENIC EFFECTS: A teratogen is an agent that causes malformations in foetuses. A three-generational study on rats showed how endosulfan can lead to abnormalities in bone development in the offspring.

GENOTOXICITY: A substance is genotoxic when it directly affects the functioning of genes, causing changes in their functions. Both α-endosulfan and β-endosulfan have been shown to be genotoxic to human liver cells. The β-isomer is a more potent genotoxin.

MUTAGENIC EFFECTS: Mutagenicity refers to the induction of permanent changes in the amount or structure of genetic material of cells or organisms, which can be transmitted to the coming generations. Endosulfan has been shown to be mutagenic to bacterial and yeast cells. Endosulfan has also been shown to cause mutagenic effects in mammals. Evidence suggests that exposure to endosulfan may cause mutagenic effects in humans if exposure is great enough. Changes induced in cells by a mutagen can cause cancer, while damage to the egg and sperm can cause adverse reproductive and developmental outcomes.

CARCINOGENIC EFFECTS: In a long-term study on mice and rats, the males of both groups experienced such a high mortality rate that no conclusions could be drawn. The females of both species failed to develop any carcinogenic conditions 78 weeks after being fed diets containing up to about 23 ppm per day. Further testing is required to know if endosulfan is carcinogenic or not.

ORGAN TOXICITY: Animal studies have shown effects on the kidneys, liver, blood, and the parathyroid gland from longer-term exposure to low levels of endosulfan. The ability of animals to fight infection was also lowered, a phenomenon called immuno-suppression.

ENVIRONMENTAL FATE
Highly toxic to fish, birds, fowl, bees and wildlife. Breaks down faster than the other organochlorines, leaving the body fairly quickly. Despite rapid degradation in water, it can bind to soil particles and persist for a relatively long period. Doesn’t leach into groundwater, but is particularly prone to runoff immediately after spraying. Its half-life (the time it takes to dissolve into the body or the environment, becoming half the original mass) in water and in most fruits/vegetables is three to seven days. In sandy loam, its half-life is 60-800 days. Endosulfan in soil inhibits the degradation of other organochlorines.

BREAKDOWN PRODUCT
Endosulfan sulphate is more persistent than its parent compound, accounting for 90 per cent of the residue in 11 weeks. Sulphate formation increases with rise in temperatures.