

STATE OF MINNESOTA
HOUSE OF REPRESENTATIVES

NEGATIVE EFFECTS OF DDT

House Research Department
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According to a report published by the President's Science Advisory Committee entitled Use of Pesticides, pesticides can enter the body by (a) ingestion, (b) absorption through the intact skin, (c) inhalation. This is true of all human and animal life. Among vertebrates, fish are generally more sensitive than birds, and birds are more sensitive than mammals. Reptiles and amphibians vary greatly from species to species but their susceptibilities usually fall between those of fish and birds.

The dangers of DDT can be seen in its varied effects on fish, birds, and man.

Effects on Fish

One of the best examples of fish destruction in the United States took place in 1955 as a result of spraying in and near Yellowstone National Park. By the fall of that year, so many dead fish had been found in Yellowstone River that sportsmen and Montana fish-and-game administrators were alarmed. About 90 miles of the river were affected. In one 300-yard length of shoreline, 600 dead fish were counted. Stream insects, the natural food of trout, had disappeared.

Forest Service officials declared they had acted on advice that one pound of DDT to the acre was "safe." A cooperative study was begun in 1956 by Montana Fish and Game Departments and two federal agencies. Spraying in Montana that year covered 900,000 acres.

The pattern over lakes and streams was similar wherever DDT spraying occurred; the smell of DDT over the forests, an oil film on the water surface, dead trout along the shoreline. All fish analyzed whether taken alive or dead had

stored DDT in their tissues. As in eastern Canada, one of the most serious effects of spraying was the severe reduction of food organisms. In this particular stream, game fish had been reduced by 80%.

The fish do not necessarily die immediately. In fact, delayed mortality may be more extensive than the immediate kill, and as the Montana biologists discovered, it may go unreported because it occurs after the fishing season. Many deaths occur in streams among autumn spawning fish, including brown trout, brook trout, and whitefish. This is not surprising because in time of physiological stress the organism, whether fish or man, draws on stored fat for energy. This exposes it to the full lethal effect of the DDT stored in the tissues.

The fact that DDT may cause blindness in fish is confirmed by various studies. A Canadian biologist who observed spraying on northern Vancouver Island in 1957 reported that cutthroat fingerlings could be picked out of the streams by hand, for the fish were moving sluggishly and made no attempt to escape. On examination, they were found to have an opaque white film covering the eye indicating that vision had been impaired or destroyed. Laboratory studies by the Canadian Department of Fisheries showed that almost all fish not actually killed by exposure to low concentrations of DDT (3 parts per million) showed symptoms of blindness with marked opacity of the lens.

The widespread contamination of DDT is harming wildlife, not necessarily by killing it outright, but by producing subtle metabolic changes, unsuspected until recently, that

are gradually eliminating various species, the scientists say. Kenneth Macek, a biologist for the U.S. Department of Interior fish-pesticide laboratory at Columbia, Missouri, reported his research shows that feeding low, sublethal doses of DDT to brook trout causes a higher mortality among their offspring and makes the trout more susceptible to environmental stresses.

An entire year's production of young salmon was nearly eliminated in the Miramichi River in New Brunswick in 1954 and 1956. This resulted from DDT applications of 1/2 pound per acre for control of the spruce birdworm. Stream insects, which are a most important food for young salmon, disappeared and failed to return within 2 years. Surviving young salmon were very thin. In British Columbia, mortality of coho salmon approached 100% in at least four major streams after the surrounding forests were sprayed with one pound of DDT per acre.

Coho
Salmon

Effect on Birds

Mortalities among birds have approached 80% in areas heavily treated with DDT for Dutch elm disease control, and with heptachlor for imported fire ant control. University of Wisconsin wildlife ecologist Joseph Hickey testified that since 1950 there has been a plunge in populations of birds of prey, such as the eagle, osprey, and peregrine falcon. 1967 research showed the birds were laying thinner-shelled eggs that were breaking and failing to hatch. Because the change occurred after 1947, the start of DDT use, scientists theorized that DDT somehow was upsetting the bird's calcium metabolism involved in eggshell formation. This theory is

well documented. During the hearings in Wisconsin, researchers found that DDT, even in small amounts, activates liver enzymes in rats, rabbits and some birds. Enzymes generally control the body's chemical functions; those involved in this instance affect estrogen, a hormone important in calcium metabolism. Researchers argue that in this subtle way, DDT exacts its toll.

Additional support came from Lucille Stickel at the Interior Department's wildlife research center in Maryland. She fed small amounts of DDT to mallard ducks. The result was thinner eggshells and increased breakage.

Robin populations declined drastically after Dutch elm disease spraying in certain communities in Wisconsin and Michigan. Earthworms, resistant to DDT, were fed on fallen elm leaves that had accumulated substantial amounts of the pesticide. Robins, for whom worms are a principal food, fed on the worms and died. Dr. Roy Barker of the Illinois Natural History Survey reports a cycle in the fate of a robin. The trees are sprayed in the spring (usually at the rate of 2-5 pounds of DDT per 50-foot tree, which may be the equivalent of as much as 23 pounds per acre where elms are numerous). In fall the leaves decompose and worms swallow the insecticide. Dr. Barker found deposits of DDT throughout the digestive tracts of worms, their blood vessels, nerves and body wall. In the spring robins eat the worms and 11 large earthworms can transfer a lethal dose of DDT to a robin. The sterility of the birds is affected.

Though robins are most susceptible because they feed on earthworms, other birds are also affected. There is a

general rule of thumb that 5 pounds of DDT per acre will kill nesting bird life; 1 pound per acre will not; and 2 pounds per acre applied annually for 5 years will eventually be troublesome.

Effect on Rats

Science Service reports that DDT causes fatal nervous system breakdown in wildlife by invading the synapses or tiny gaps between nerve cells, thus blocking transmission impulses. After 5 years of research, Dr. Matsumura of the University of Wisconsin has traced the movement of DDT in the nervous system of rats, finding that DDT destroys neural impulse relay stations. A chemical and ion imbalance then occurs in nerve cells, leaving them in a perpetual state of excitement unable to transmit impulses.

Another study conducted on rats by Dr. Richard Welch, a biochemical pharmacologist at Burough-Wellcome Research Laboratories showed alterations in the sexual mechanisms of both male and female rats and further showed that DDT interfered with effects of some commonly used drugs. Among the effects of the chemical on rats were induction of enzymes, increases in the weight of the female uterus and deposition of dextros in the uterus, and stimulation of estrogen. According to Dr. Welch, "If one can extropolate data from animals to man then one can say this change in animals probably does occur in man."

Effect on Man

Unlike birds, DDE levels (DDE is a component of commercial DDT and is also formed in organisms by a breakdown of

DDT taken through the diet) in mammals tend to reach a plateau and remain relatively constant. The "plateau" in man is 12 parts per million and at that concentration they (DDT compounds) are capable of inducing enzymes. Senator Gaylord Nelson reported that 10,000 DDT manufacturers are producing more than 100 million pounds of DDT, enough to give a half-pound to every person in the nation. He said the U.S. Public Health Service reported that the average American has accumulated 12 parts per million of DDT in his fat tissues and that infants receive .08 of a part per million in milk from nursing mothers.

DDT is only one of many drugs that cause changes in the metabolic capability of the liver. These changes are relatively nonspecific, and the rapid destruction of steroid hormones appears to be a coincidental byproduct of the liver cells' adaptation to DDT.

To test the effect of DDT on humans, British investigators exposed themselves to DDT. Two scientists at the British Royal Navy Physiological Laboratory invited absorption of DDT through the skin by direct contact with walls covered with a water soluble paint containing 2% DDT, overlaid with thin film of oil. They testified, "The tiredness, heaviness, and aching of limbs were very real things, and the mental state was also most distressing . . . [there was] extreme irritability . . . great distaste for work of any sort . . . a feeling of mental incompetence in tackling the simplest mental task. The joint pains were quite violent at times."

Progress of Pesticide Legislation in Other States

Last summer, Illinois, Wisconsin, Michigan and Indiana signed an agreement calling for stricter controls on all pesticides, DDT included, that are polluting Lake Michigan. The Illinois legislature is considering a bill banning the use of DDT. In Pennsylvania, a state senate committee recommended a ban on its use in fields and forests. March 12, the Wisconsin Natural Resources Board ordered a temporary ban on the spraying of DDT for Dutch Elm. The ban is to continue until the Natural Resources Department hearings are concluded on the issue of a permanent ban on all uses of DDT in the state.

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