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TECHNICAL BULLETIN

HEALTH EFFECTS INFORMATION

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TRIBUTYL TIN

(TBT)

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USES

In the 1950s, scientists first recognized tin compounds to have strong toxic properties against mollusks. TBT-containing products have been extremely effective as antifoulants on boats, ships, quays, buoys, crab pots, fish nets, and cages, by protecting these surfaces and structures from the growth of mollusks and other marine organisms. TBT is also used as a disinfectant and as a bactericide for cooling systems, pulp and paper mills, breweries, leather processing and textile mills. TBT has been used as an additive in paint and wood preservative to prevent the growth of mold and mildew, but was banned in 1988 from interior house paints because of the hazards it poses to humans.

CHEMICAL AND PHYSICAL PROPERTIES

Tributyltin (TBT) is part of a family of organotin compounds in which one to four carbon atoms are bonded to a tin atom. Tetrabutyltin is a precursor of tributyltin, while dibutyltin and monobutyltin are breakdown products. Tributyltin is the most toxic of the four compounds, affecting the immune, endocrine and central nervous systems. TBT at higher levels is also an extreme irritant to the skin and eye.

OCCURRENCE AND SOURCES OF TRIBUTYLTIN

High levels of TBT in water, sediment, and biota have been found close to pleasure boating activity especially in or near marinas, boat yards, dry docks, fish nets, and cages treated with these antifouling agents. It has been shown that TBT bioaccumulates in organisms such as shellfish, because of its fat soluble nature. Studies have indicated that the increasing concentration of TBT which leaches off of the structures it has been applied to leads to mortality of oysters, mussels and clams as well as reduced growth, shell thickening, and malformations. In studies done on snails, tributyltin has been shown to cause a condition known as "imposex," wherein the females of the species begin to develop male sexual characteristics. In 1987, uses of tributyltin in boat paints was greatly restricted to reduce these environmental impacts.

HEALTH EFFECT

A variety of toxic responses have been associated with exposure to TBT in animal studies. Acute effects of TBT include alterations in blood lipid levels, the endocrine system, liver and spleen. One characteristic toxic effect of tributyltin oxide (TBTO), a form of TBT commonly found in sea water, is on the immune system. TBTO appears to be toxic to the thymus, resulting in an impairment of T cell-mediated functions.

With respect to humans, there seem to be three primary routes of exposure to TBT: (1) occupational; (2) residential; and (3) ingestion of TBT-contaminated seafood. Although human health effect data are limited, occupational exposure to TBT has shown it to be a potent irritant of the eyes, lungs, and skin. The FDA lists the symptoms of high levels of tin exposure via ingestion to be nausea, abdominal cramping, diarrhea, and vomiting.

DRINKING WATER STANDARDS

The first indication of a connection between the use of TBT and its deleterious effects on the environment occurred in France when its use was linked to the destruction of oyster beds. This same problem became identified internationally.

Since that time, many countries have restricted or banned the use of TBT as an antifouling agent. However, these regulations vary from country to country, and even from state to state. Also, TBT is quite stable in the environment and may pose problems for years even though current use is restricted or prohibited.

As it was first marketed, TBT was mixed into paint in a form that allowed for free release of the compound. As used now, TBT is mixed into control-release paints, to allow for a slower leaching of the compound. Regulations in effect since 1987 have banned the use of TBT compounds on vessels under 25 meters in length. Some restrictions exclude boats with aluminum hulls, because the alternative copper compounds used would erode the aluminum.