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**TBT:
A Hidden Danger to Virginia's Waters**

by

Lynne J. Strobel

(The majority of information for this article was obtained through an interview conducted on April 3, 1987 with Dr. Robert J. Huggett, Assistant Director of the Virginia Institute of Marine Science, the School of Marine Science of the College of William and Mary.)

Tributyltin, commonly known as TBT, is an extremely effective compound used in anti-fouling paints. Compounds such as TBT are developed to prevent the growth of barnacles and other marine life on boat hulls, a process known as fouling. Restricting this growth serves two basic functions: 1) it allows a boat to move faster and with more maneuverability in the water, thus increasing productivity and reducing fuel costs, and 2) it reduces the non-productive and costly time a boat must spend in dry dock for cleaning. Boat owners heavily praised TBT when it came into extensive use, about twenty years ago. The product, mixed into undercoating paints, remains effective for about seven years, leaching off into the water surrounding the boat hull and killing barnacles and other aquatic life. In the late 1970's, however, scientists discovered that TBT was having an effect on more than just barnacles. As a result of studies, three nations, France, England and Japan, have restricted its use and several states have taken similar measures. A recently enacted Virginia amendment is serving as a model for pending legislative measures in New York and Maryland.

TBT has been used in the United States for a variety of purposes. Textile industries use it as a fungicide to rid its fabrics of odor causing fungus and bacteria. Paper mills and cooling systems utilize TBT as a slimicide. These uses may add to the level of TBT in water resources, but the greatest contributor to TBT levels in both fresh and salt water remains paint used on boat hulls, from which TBT's high toxicity is released directly into the water. The chemical is acutely toxic at one part per billion, but its effects may be seen on marine life in as little as two parts per trillion. (One part TBT per trillion is ap-

proximately equal to a teaspoonful in a city reservoir).

The effects of TBT are varied and still being discovered. Scientists in Great Britain and France produced evidence that "certain concentrations of TBT emitted from boat paints can cause a harmful thickening of oyster shells, a stunting of oyster growth and possibly death among a significant portion of the more sensitive larval, or young stages of oysters."¹ The changes in oyster shell formation is termed "balling," and, because of reduced meat production, renders the oysters unmarketable. No abnormalities have yet been found in Virginia oysters, but such a result would have disastrous effects on Virginia's substantial seafood industry. TBT is also one of the few chemicals that can cause imposed sexual characteristics. Female dogwelks were found to have taken on male characteristics, resulting in population reduction in as little as two parts TBT per trillion parts water.

Another important consideration in the use of TBT is its potential effects on humans. Shipyard workers who have handled the compound, both when painting boats and when making repairs on vessels painted with TBT, have complained of a variety of ailments, including skin irritation, respiratory problems, stomach aches, burning eyes, dizziness, fatigue, and frequent colds and flus.² Although these problems have not been scientifically linked to TBT, and the workers failed to wear protective clothing, further medical investigation is continuing. Scientists are also concerned with TBT entering the food chain and accumulating in increasingly greater amounts, a process called "biomagnification." "Aquatic animals could accumulate harmful, if not lethal concentrations

of TBT over a long period, and although measured levels of TBT in water may be low, levels in the flesh of seafood species may be hazardous to the humans who eat them."³

The Virginia Water Control Board (VWCB) has suggested several possible solutions to the threat posed to Virginia's waters by TBT. A total ban of TBT use is one alternative, but the Virginia Department of Agriculture and Consumer Services (VDACS), which controls pesticides, will probably not act until the federal government takes action.⁴ A second alternative would be the use of water quality standards, which would set maximum allowable TBT concentrations in the water. To set this standard, the VWCB would need scientific data accurately measuring TBT concentrations and its effects, which is not readily available.⁵ A third solution is to require Best Management Practices (BMP). This solution would not only set the minimum allowable TBT output, but would also instruct the industrial user on methods to attain this output.⁶ Although this would serve to control the TBT use in the industrial setting, it would be difficult to apply to boat owners, who remain the greatest source of TBT output. Finally, the VWCB proposed that the state institute a public awareness and education program.⁷

The VWCB's proposed solutions might eventually aid in an overall TBT reduction, but Virginia legislators believed more immediate action was required. On February 27, 1987, the Virginia General Assembly passed an amendment to the state constitution regulating TBT use that became effective March 31, 1987. The amendment does not provide for a total ban of TBT, but sets forth the following provisions: 1) TBT cannot be used on any vessels less than 25 meters (82.02 feet) in length unless it has an aluminum hull, and 2) the product used must have an "acceptable" release rate not exceeding 5.0 micrograms per square centimeter per day at steady state conditions. This would effectively eliminate the use of TBT on pleasure boats in Virginia, which account for approximately 70% of the TBT released into Virginia waters. The United States Navy presently

accounts for only 2% of the total TBT released. Current plans to treat the entire naval fleet with paint containing TBT have been forestalled pending further study.

Legislators determined a blanket ban on TBT use in Virginia would not be productive. Large vessels, most commonly cruise ships, would put up for dry dock maintenance at foreign ports that legally use paints containing TBT. Virginia's shipyards would lose a substantial amount of business, not only from hull scraping and painting, but from the regular maintenance and repair that takes place when a ship is in dry dock. Ships painted in foreign ports could not be prevented from entering Virginia's waters, and the only result would be jobs lost in Virginia's shipyards. In addition, large vessels are mostly at sea, far from the coastal waters where TBT appears to pose the greatest threat to aquatic life. Large vessels are also concentrated at a small number of ports equipped to handle their needs. TBT would therefore be eliminated from rivers, shallow bays and harbors. Although TBT does flow with the water currents, it does have a half-life and will dissipate into a much less toxic compound.

TBT is a dangerous substance not only because of its known harms, but also because of its potential harms. Scientists are only now beginning to examine and study TBT's impact on aquatic life as well as humans, and the harm may be more extensive than anyone anticipates. Virginia legislators took an important step toward the restriction of TBT, and other states should follow this measure to protect their natural resources. As other nations recognize TBT's harm, a worldwide ban will hopefully be forthcoming. Alternatives to TBT are currently available, including copper based paints. Copper, a natural element, has been used safely for years with a high success rate. Teflon is also being examined for future use on boat hulls. A teflon coating would create a smooth surface unsusceptible to the growth of barnacles. Although alternatives may be more expensive and less effective, the cost of continued TBT use is too great to measure.

END NOTES

¹Daily Press/The Times Herald, April 13 - 20, 1986, at 4. (A reprinted eight part special series by Bruce Reid).

²*Id.* at 3.

³*Id.* at 4.

⁴Ayers, *TBT Control in Virginia: A State Perspective*, OCEANS '86, 1302, at 1303.

⁵*Id.* at 1304.

⁶*Id.* at 1305.

⁷*Id.*