ABERDEEN, WASH.
WORLD
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FEB 6 1976

Students add to knowledge of volume, effects of BCB

OLYMPIA — Students at The Evergreen State College have added just one more piece to the puzzle — the puzzle scientists the world over are trying to complete on the volume, distribution and impact of the chemical pollutant known as PCB (polychlorinated biphenyls).

Over the past six months, eight young Evergreen scientists have been gathering data on PCB distribution at 18 points in Puget Sound — from the mouth of the Duwamish River to Bremerton, from Tacoma's Brown's Point to the Port of Olympia; from Shelton's Hammersley Inlet to Grapeview.

Their conclusions, reported to the National Science Foundation's Student Originated Studies Program which funded their research, indicate that PCB distribution is highest near areas of heavy industrialization and high population (Seattle and Tacoma), at moderate levels near areas with moderate industrialization (Bremerton) and lowest at areas farthest removed from industrialization and large population centers (Grapeview and Purdy).

Gathering that data took months of collecting specimens throughout the Sound and analyzing them in laboratories at Evergreen. But, interpreting the data to predict environmental consequences proves to be an even more demanding task.

PCBs are defined as "toxic aromatic chlorinated hydorcarbon pollutants," which are related to DDT and can be found on land and in the seas throughout the world. They are used widely for insulating fluids in capacitors and transformers and as hydraulic and heat transfer fluids. PCBs have also been used in sealants, adhesives, paints and printing inks, and even in pesticides.

Evidence indicates PCBs, once released into the environment, do not decompose. Estimates are that up to 80 tons of PCBs are lost or released into the environment per year — through vaporization and open burning of PCB-containing materials, through leaks and disposal of transformer oils, hydraulic fluids and lubricants, and through disposal at dumps and landfills.

NOT ONLY DO THESE PCBs not decompose, they biomagnify. Dr. Michael Beug, Evergreen faculty chemist and advisor to the student project, says biomagnification means "that higher organisms accumulate greater amounts of PCBs than lower organisms." For example, Dr. Beug says, data students gathered shows that PCBs are absorbed by 'primary consumers' (lower animals like limpets which are the first to absorb PCBs) at one level of concentration. But, when a 'secondary consumer' (an organism like a starfish which is higher in the food chain) eats or absorbs PCBs, the level of concentration increases.

Applying available research to the data they gathered, Evergreen students conclude that "PCB concentrations found in most of Southern Puget Sound probably do not approach recognized toxicity levels."

However, at the mouth of the Duwamish River — one-half mile downstream from where a transformer tipped over in September 1974 and released more than 300 gallons of fluid containing PCBs into the river — samples of mussels, bottom fish and surface sediments contained drastically higher levels of PCBs than those gathered at any other point in the Sound.

FOR EXAMPLE, THERE WERE 840 ppb (parts per billion) of PCBs found in cottids (bottom fish) taken at the mouth of the Duwamish, compared to 550 ppb of PCBs found in cottids from Commencement Bay near Ruston; 62 ppb of PCBs in fish from Shelton waters, and 21 ppb in cottids taken from Grapeview. Or, examined another way, the volume of PCBs found at the Duwamish was 38 times higher than those found at Grapeview.

To put that ppb figure in perspective, Dr. Beug points out that the Environmental Protection Agency will not permit the sale of any product for human consumption which has more than 5000 ppb of PCBs.

A check for PCBs in samples of sediment from the same four areas reveals even more dramatic statistics: 300 ppb of PCBs at the Duwamish; 17 ppb of PCBs near Ruston; 3.1 ppb at Shelton, and 0.65 at Grapeview. Or, the concentrations of PCBs at the Duwamish were 461 times greater than near Grapeview. The relationships between Shelton and Grapeview PCB concentrations shifted somewhat when samples were taken from mussels in the same four areas: 210 ppb of PCBs from mussels taken at the mouth of the Duwamish; 38 at Commencement Bay; 16 at Grapeview and 11 at Shelton.

The significance of these and similar figures in the 40-page report to NSF is not limited to comparative analysis among the 18 sites on the Sound, Dr. Beug said.

"WHAT'S IMPORTANT IS THAT data gathered by Evergreen students establishes present PCB distribution for these 18 sites. This means we will be able to compare this data with future information collected and determine what trends, if any, are appearing. The data also enables scientists worldwide to add our research to the pieces of information they've gathered."

PCBs have been reported in fish from all the major waterways of the United States, from the Rhine River, the coast of the Netherlands, and Tokyo, Japan; in seals near Scotland; pelican eggs from Panama; and penguin eggs from Antarctica.

"Now we can add data collected on Puget Sound marine life to that research," Dr. Beug concludes.

Obviously, more PCB research lies ahead for scientists throughout the world. They have yet to determine what the lethal and sub-lethal levels are for *most species, and what can be done to* prevent PCB pollution from endangering any more areas than it already has.

MONS 033059