

The time-dependent distribution of ^{137}Cs in the sediments of Lake Michigan

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The spatial inventory of ^{137}Cs in Lake Michigan has been assessed in 1972, 1982, 1992, and 1994 - 1996. Early results indicated that by 1972 there had been extensive focusing of the atmospheric input into depositional zones corresponding to area where sediment had deposited since glacial times. Between 1972 and 1982, a period with little or no new inputs of ^{137}Cs , inventories in these zones increased to values greater than found in 1972. Between 1992 and 1996 in a definitive lakewide survey (134 sites within "depositional areas), cores collected were quantitatively sectioned into 1 cm intervals and mass per unit area, ^{210}Pb and ^{137}Cs measured for each section. Sedimentation and mixing rates, and mixing depths, were determined from the ^{210}Pb data. They were used to deconvolve the ^{137}Cs profiles into monthly (1955 to 1995) focusing factors (FF) (where $\text{FF} = \text{ratio of decay corrected inventories (dpm.cm}^{-2}\text{) and mean integrated atmospheric deposition of }^{137}\text{Cs}$), and these values were contoured. Over the whole lake, the average value of FF must equal 1. Within depositional areas, average FF increased from < 0.5 in the 50's to > 4.0 in the 90's. Mass balance requires values of FF in "non-depositional" areas which extend outward from the shore (uncorable areas, 60% of lake surface) to decrease exponentially from 1.78 to ~ 0.5 respectively with a time constant of 37 years. These results will be discussed in terms of the geochemical properties of ^{137}Cs and scavenging from the water, resuspension and redistribution processes involved in this long-term transport of particles, and implications for recovery of closed systems from pollution episodes.