INVENTORY OF DDT IN SEDIMENTS

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DDT is one of the most important of the known contaminants of southern California waters. Therefore, in 1972 and 1973, we conducted a detailed investigation into the quantity and character of DDT residues in bottom sediments around the major known source, the Whites Point submarine outfalls. We also compared the concentrations off Palos Verdes with those around the other four major municipal wastewater outfall systems in southern California.

BOTTOM SEDIMENTS OFF PALOS VERDES

Nineteen short gravity cores, collected off the Palos Verdes Peninsula during June 1972 were sectioned into 2 cm layers and analyzed by election capture gas chromatography. Figure 1 shows the region sampled and the total DDT contours for the surface sediment layer (0 2 cm).* Sampling Region A (37 sq km between 25 180 m contours) includes the cores collected in June 1972. Sampling Region B (25 sq km extending beyond the 180 m contour) represents an expansion of our study area the samples from this region were 3 inch barrel cores collected by Andrew Soutar, Scripps Institution of Oceanography, in July 1972. The combined region was contoured at 2 cm intervals down to 30 cm, and the estimated quantity of total DDT at each level was calculated; the results are shown in Table 1.

Using the Wilcoxon signed rank test, we found that the two sets of data are significantly different at the 95 percent level, with the Shipek samples having higher values. It does not seem likely that the DDT concentrations have increased in the sediment during the year between samplings, especially as the discharge of DDT by JWPCP* has steadily decreased since 1971. The discrepancies probably result from the different sampling techniques used and the fact that a different degree of immediate surface material is lost with each method.

We hope that an improved sediment collection method, such as the use of a convenient box corer, will be uniformly adopted in the outfall monitoring programs throughout the Bight. Such a device is now under development by the Project

Numerous studies off southern California have shown that the principal DDT compound found in marine organisms is p,p'DDE: This substance is also the dominant form of DDT in sediments from the Palos Verdes shelf. In our analysis of the data from the 1972 cores, each of the six isomers summed for the "total DDT" value (o,p' + p,p' DDE, o,p' + p,p' DDD, o,p' + p,p' DDT) were quantified in each layer of the cores, and median values for the percent contribution of each constituent were calculated as a function of depth. The results show that p,p' DDE constitutes approximately 75 percent of the total DDT measured in the upper 5 cm, and about 60 percent of the total below 10 cm. The percent

of the other DDE isomer, o,p' DDE, also decreases with depth, changing from 11 percent in the top 5 cm to 8 percent below 10 cm. The other isomers tend to increase with depth: o,p' DDD, from 2.0 to 4.6 percent; p,p' DDD, from 8.9 to 15 percent; and p,p' DDT, from 2.6 to 5.6 percent. The residue p,p' DDT has a major peak of 18 percent at 12 to 14 cm, and o,p' DDT contributes less than 1 percent to the total DDT value at all depths.

The data in Table 1 indicate that there are still more than 200 metric tons of DDT compounds in the upper 30 cm of bottom sediments on the Palos Verdes shelf, and that 85 percent of this total is found within the top 12 cm. In contrast, the present annual input of DDT to the area from the JWPCP outfalls, a point source, is about 3 metric tons, and the total annual diffuse input from aerial fallout to our coastal waters ;s about 1 metric ton. Surface runoff inputs appear to be an order of magnitude lower.

In an attempt to determine if there have been any large changes in the quantity of total DDT in the upper layer of these bottom sediments since June 1972, we have analyzed 1973 concentrations in the upper 5 cm of 40 Shipek grab sediment samples collected within the monitoring region. These data were provided by the County Sanitation Districts of Los Angeles County. Fifteen of the Shipek sampling locations corresponded directly with the 1972 coring locations; these stations are presented in Figure 2. Table 2 presents the concentrations for both sampling periods at each station. (As the 1972 cores were analyzed at 2 cm intervals, concentrations for the top two layers were combined and averaged

COMPARISON OF SEDIMENTS AROUND THE OUTFALL SYSTEM

Figure 3 shows a comparison of total DDT in sediments from around the five major outfall systems in southern California. The concentrations shown are the median values of all cores taken around each outfall at the given layers. The dates of sampling and the type of core varied.* However, we believe that the comparison does illustrate existing differences in the magnitudes of the sediment DDT concentrations at the various submarine discharge sites.

We obtain profiles of the DDT concentrations in the sediments around three of the outfall systems. In the case of the Palos Verdes sediments, the average concentration fell by about a factor of ten at a depth of 12 cm, and by another order of magnitude at 22 to 24 cm. The largest values for both concentrations and horizontal and vertical gradients of DDT compounds were observed in the bottom sediments off Palos Verdes. This comparison indicates that these sediments constitute by far the largest known local benthic reservoir of these chlorinated hydrocarbons along the southern California coast.

* A time dependent laboratory standardization error was discovered in 1973, indicating that previously reported DDT and PCB concentrations in sediment and flatfish were too low by factors of between 1.1 and 1.6. All chlorinated hydrocarbon data presented here have been corrected for this error. Also, all other chlorinated hydrocarbon sediment data reported in the Project's 3 yr report (1973), as well as sediment data collected more recently have now been corrected and will be reported in a technical memorandum.

* Joint Water Pollution Control Plant, Los Angeles County Sanitation Districts.

*Oxnard, August September 1971, box cores; Los Angeles City 7 mile outfall, July 1971, box cores, and 5 mile outfall, Summer 1972, gravity cores; JWPCP, June 1972, gravity cores; Orange County, September 1971, box cores; Pt. Loma, August 1971, gravity cores.

FIGURES

Figure 1
Sampling regions and concentrations of total DDT (mg/dry kg) in surface sediments (O to 2 cm) off Palos Verdes.

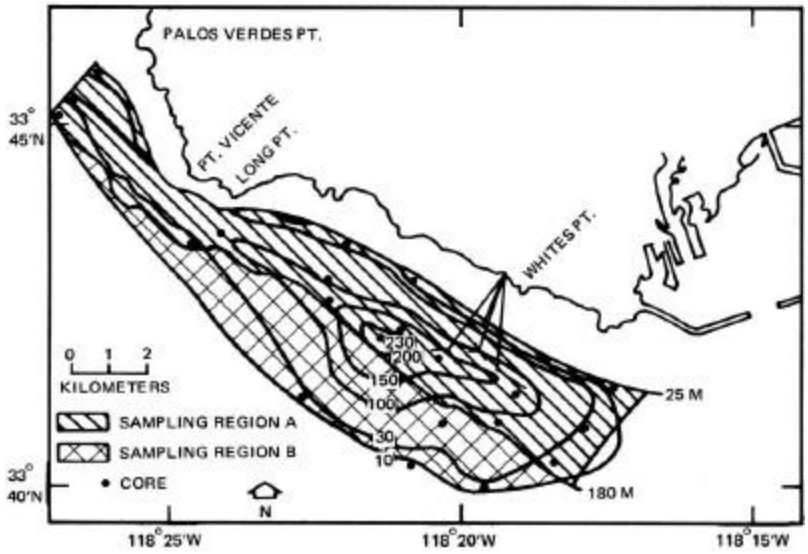


Figure 2
Sampling locations for 1973 Shipek grabs and 19 72 gravity cores.

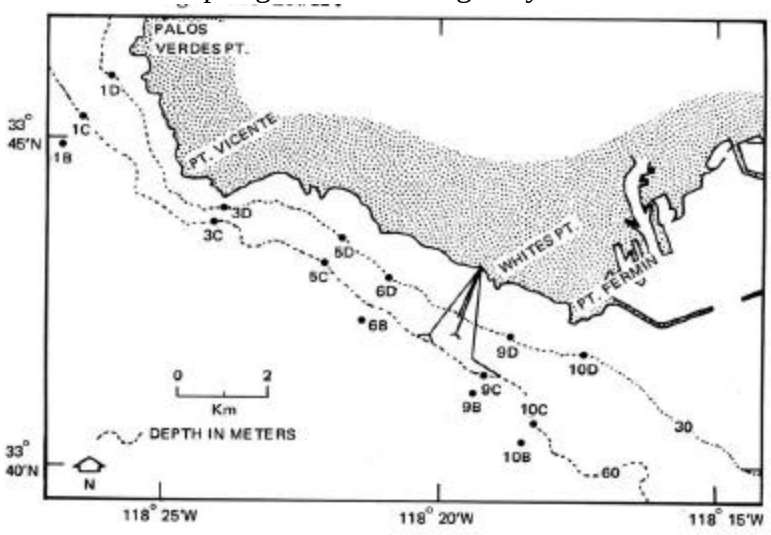
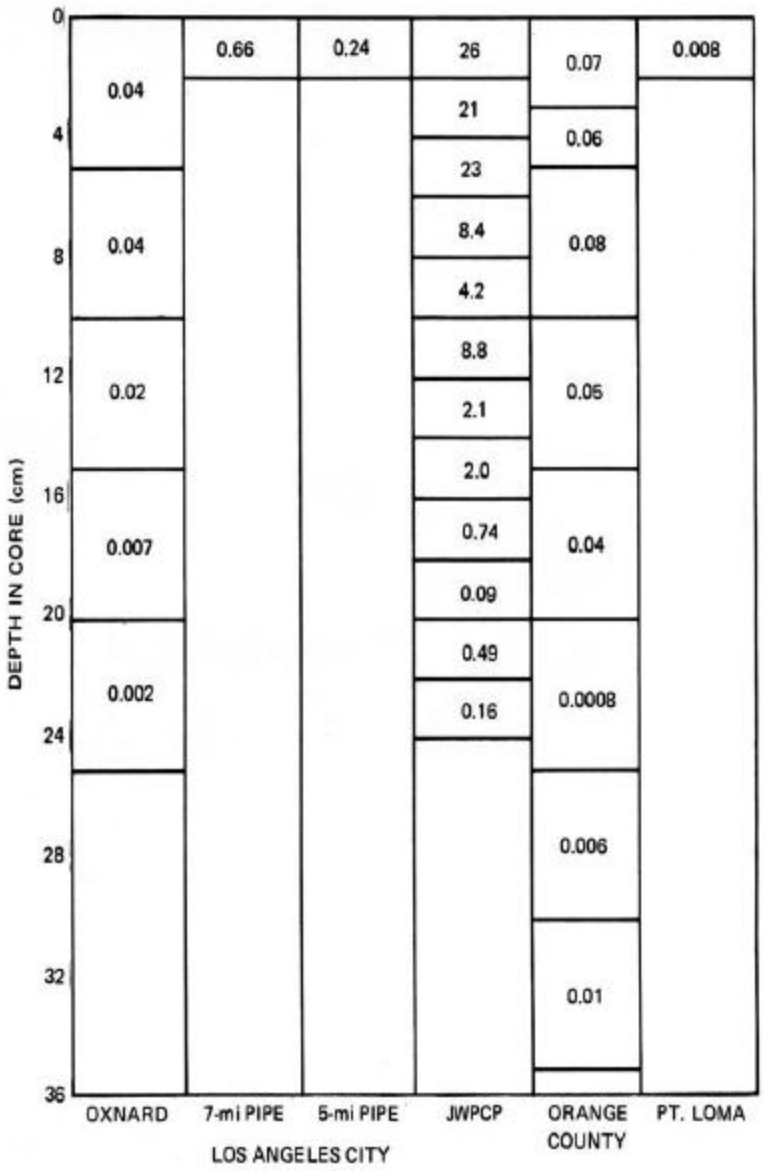


Figure 3
Median concentrations of total DDT (mg/dry kg) in sediments around five major outfall systems.<



TABLES

Table 1.
Total DDT (metric tons) in Palos Verdes bottom sediments, 1972.

Depth (cm)	Region A, 37 sp km	Region B, 25 sq km	Total, 62 sq km
0--12	136	52	188
12--20	24	5	29
20--30	1	0.1	1
Total	**161**	**57**	**218**

Table 2.
Comparison of total DDT concentrations (mg/dry kg) in surface sediments collected in 1972 and 1973 off Palos Verdes.

Station*	1973 Grab	1972 Core	Station*	1973 Grab	1972 Core
1B	6.4	5.4	6D	30	6.2
1C	37	32	9B	95	104
1D	5	2.9	9C	94	74
3C	101	128	9D	16	16
3D	11	15	10B	21	14
5C	184	114	10C	54	16
5D	147	195	10D	40	7.4
6B	195	190			
*Station locations shown on Figure 2.					