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TECHNIQUES FOR COLLECTING DDTAND PCB IN AERIAL FALLOUT

For several years, the Project has measured aerial fallout rates of chlorinated hydrocarbons on the Southern California Bight, using a glass plate sprayed with mineral oil as a collector. However, the substances of interest—in particular, 1242 PCB—are relatively volatile, and we have been concerned that, once trapped on the plates, these materials might vaporize and be lost as the plates are warmed by the sun. Therefore, at the suggestion of Professor J.D. Isaacs (chairman of our Consulting Board), we developed a fallout collector that is cooled with dry ice and compared its yield with that of the oiled plate collector. Although the comparison of 1242 PCB results could not be made, the results for total DDT and 1254 PCB, the synthetic contaminants most often found in our fallout surveys, confirmed our past data. We also have developed an air sampler to measure the partitioning of chlorinated hydrocarbons between the particulate and vapor phases; in general, the majority of the measurable chlorinated hydrocarbons were found in the latter state.

METHODS

Our usual method of collecting fallout is to expose a glass plate sprayed with a thin coat of mineral oil; at the end of the sampling period, the plate is scraped with a Teflon device to collect the particulates adhering to it. In recent surveys, we sampled in the usual manner but also employed the dry-ice-cooled collector. A 25-kg block of dry ice was set on a wooden piston and constrained to press against a cleaned aluminum pan by a spring. This produced a continuously cooled surface that would reduce volatilization of the components deposited by dry aerial fallout. The perimeter of the dry ice block was insulated so that the ice lasted 2 to 3 days in the field. The new high volume air sampler contains a glass-fiber filter that retains the particulates in the air and a series of polyurethane foam pads that trap the volatile components. The air is drawn through the sampler by a vacuum cleaner motor at the rate of about 85 cu m/hour.

RESULTS

During the fall of 1975, the sprayed glass plates and the dry ice sampler were compared in a series of six fallout collections made on the laboratory roof in El Segundo. The samples were analyzed, and the flux values for the two samplers were calculated. Resultant ratios of fallout rates obtained from the two types of samplers are presented in Table 1. (No glass-plate collector results were obtained for 1242 PCB—the gas chromatograph profile for this material did not resemble the standard because of interferences.)

When the total DDT flux rates for the dry ice sampler are plotted against the total DDT flux rates for the mineral oil sampler, the best-fit regression line may be drawn. Similarly a line may be drawn for the 1254 PCB flux data. The data for both total DDT and 1254 PCB fit the line at the 95 percent confidence level.

In March and April 1976, the air sampler was used for 2-day periods at each of five stations (El Segundo, La Jolla, Santa Barbara, Santa Catalina Island, and San Clemente Island). The samples were analyzed for each component. The ratios of the weight of the foam samples to those of the filter samples were then calculated for each component at each station. The results are presented in Table 2 (levels of some components in the island samples were not detectable).

The air samples were also analyzed for several chlorinated benzene compounds. Preliminary work indicates that the chlorinated benzenes are primarily trapped on the polyurethane foam rather than the glass-fiber filter.

CONCLUSIONS

There was good agreement between the total DDT and 1254 PCB values obtained with the dry ice sampler and those obtained with our regular sampler, the oiled plate. Thus, the measurements obtained in our past fallout surveys appear to be reliable (1975-76 results are discussed on Page 23), and revolatilization of these components from the glass plate collectors does not appear to be occurring to any significant degree.

Table 2 indicates that, at all stations measured, the ratio of volatile to particulate components is higher for p,p'-DDE than p,p'-DDT. This is to be expected since p,p'-DDE is more volatile than p,p'-DDT. The ratios also indicate that most of the chlorinated hydrocarbons measured are in the vapor phase as they are trapped on the foam sample. The ratios are lowest for the El Segundo station and highest at the island stations; this indicates that the compounds are associated with particulates to a higher degree in inland areas, and to the greatest degree in regions of high air pollution such as Los Angeles Basin.

Table 1. Rations of fallout rates measured by the dry ice and oiled plate collectors.*

Test No.	Ratio, Dry Ice Sampler to Oiled Plate, Total DDT	Ratio, Dry Ice Sampler to Oiled Plate, 1254 PCB
1	1.00	0.98
2	0.56	0.47
3	0.84	0.76
4	0.81	0.41
5	1.11	1.72
6	1.29	0.68
Average	0.94 ± 0.10 (SE)	0.84 ± 0.20 (SE)

*All samples were corrected for the blanks; the oiled plate samples were corrected by experimentally determined, time-dependent retention factors.

Table 2. Ratio of volatile material to particulate material in samples collected with the high volume air sampler.

Constituent	El Segundo	Scripps Pier	Santa Barbara	San Clemente Island	Santa Catalina Island
p,p'-DDE	17	45	145	147	–
p,p'-DDD	11	47	68	642	–
o,p'-DDT	6	20	39	348	51
p,p'-DDT	1.5	6	12	64	193
1254 PCB	11	79	101	–	300