Chlorinated Hydrocarbon Residues in Ground Water

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INTRODUCTION AND OBJECTIVE

Chlorinated hydrocarbon residues and polychlorinated biphenyls are widespread in the environment. A large number of reports in the literature describe the presence of these compounds in earth's water resources, viz, rivers, lakes and oceans. Comparatively, less attention has been paid to study the residue level in ground water. Ground water is the only source of drinking water for the majority of the people living in the rural areas. Generally, people in the rural areas obtain drinking water from private supplies. The supplies are mainly wells, and the depth of such wells varies from as low as ten feet to well over a hundred feet. The purpose of this study is (i) to obtain information concerning the residue levels in these waters, (ii) to find out if the residue levels exceeded the Federal limits recommended for pesticides in drinking water (ROBECK, 1972), and (iii) whether the local use of pesticides has caused any significant rise of the level in the ground water of the rural and agricultural areas.

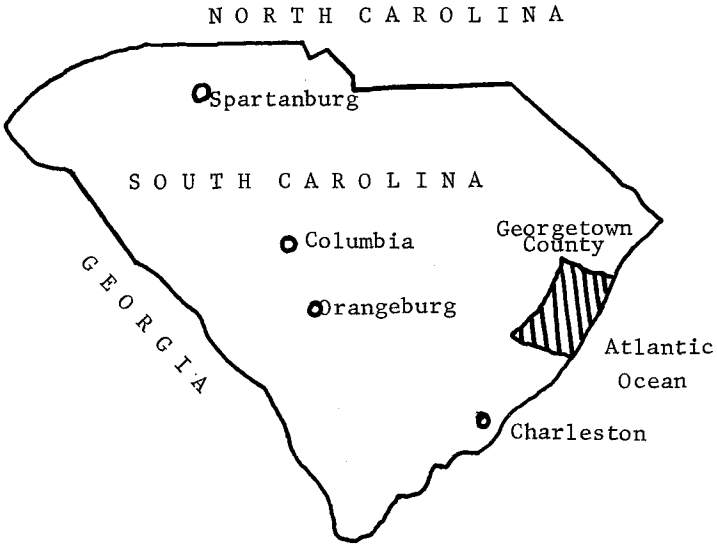

Figure - 1 Location of the study

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This study has been carried out in Georgetown County of South Carolina, the location of which is shown in the map of Figure 1. Georgetown County has a population of 33,606 of which 61% live in the rural areas (McLean, 1970). The county has 1,068 acres of tobacco, 4,000 acres of soybeans and 11,000 acres of corn and other vegetables. A substantial amount of pesticides and herbicides are used for crop protection. Geographically, the county is located in the lower coastal region bordered by Atlantic Ocean. It has a sandy soil, and the soil is highly perculative to water. Thus,the migration of pesticides from surface soil to ground water is a distinct possibility.

This is an extension of the previous report by ACHARI, et al (1973).

METHODS AND MATERIALS

Water samples were collected in glass bottles, and the inside wall of the screw caps were teflon lined to avoid any plastic contamination. The samples were chosen at random. The information was obtained concerning (i) the water supply system such as location, the depth of the well, proximity of river, creek or industrial dumps; (ii) the types and amounts of pesticides and fertilizers used in the vicinity.

The extraction, clean up and the analysis of the pesticides were carried out as described by BURKE, et al (1972). The analyses were carried out by EC-GLC. The chromatographic conditions were: columns: (i) 3% OV-1 on chromosorb-W, (ii) 5% QF-1 + 3% DC-200 on chromosorb-Q; oven temperature: 200°, detector: 275°, injector: 220°; carrier gas flow, nitrogen: 60 ml/min. for column (i), and 50 ml/min. for column (ii). Additional methods such as TLC (silufol plates, 10% ether-hexane as mobile solvent, u.v. visualization) and chemical derivational (COCHRANE et al, 1971) were used to confirm residue identity. The recoveries of the pesticides from fortified samples were:73-80% for lindane, 64-69% for aldrin, and 106-122% for DDT.

RESULTS AND DISCUSSION

The use of chlorinated hydrocarbon pesticides has severely been restricted in the last few years, but these compounds were the most popular pesticides for the last three decades. Due to the persistent nature of these compounds, it is likely that these compounds will remain in the environment for several years to come.

All the water samples analyzed in this laboratory were found to contain the chlorinated hydrocarbon residues in part per trillion level. The results are summarized in Table 1.

The results clearly indicate that the residue levels are well below the Federal limits recommended for pesticides in drinking water. DDT level has been found to be the highest in almost all samples, and on average it represented 74.5% of the total residue.

Residue content of the water supplies across the nation varies form 0-2 ppb according to the National Water Quality Network Reports (quoted by WESTLAKE and GUNTHER, 1970). Our results show

TABLE 1

Sample description	Pesticide content in water in ppt			% of DDT in total
	Lindane	Aldrin	DDT*	
# of samples:27 Average depth of the wells: 70' Range:21 - 100'	Average: 1.19 Range: N.D. - 21.1	Average: 7.11 Range: N. D. - 44.8	Average: 37.7 Range: 6.4 - 161	Average: 74.5 Range: 26.3 - 100
Federal limits (ROBECK, 1972)	in ppb			
	5.0	1.0	50.0	

N.D.: Not detected; *: total of o,p' - and p,p'-DDT, o,p' -DDT is caculated as p,p'-DDT

that the residue content of the water samples studied here is far below the above upper limit. Thus, it is possible that the accumulation of these pesticides in the ground water in the areas under investigation, is a part of general pesticidal pollution across the nation rather than due to the local use of pesticides.

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