Environmental Health Criteria 9

DDT and its Derivatives

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World Health Organization

INTERNATIONAL PROGRAMME ON CHEMICAL SAFETY

ENVIRONMENTAL HEALTH CRITERIA 9

DDT and its Derivatives

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NOTE TO READERS OF THE CRITERIA DOCUMENTS

While every effort has been made to present information in the criteria documents as accurately as possible without unduly delaying their publication, mistakes might have occurred and are likely to occur in the future. In the interest of all users of the environmental health criteria documents, readers are kindly requested to communicate any errors found to the Division of Environmental Health, World Health Organization, Geneva, Switzerland, in order that they may be included in corrigenda which will appear in subsequent volumes.

In addition, experts in any particular field dealt with in the criteria documents are kindly requested to make available to the WHO Secretariat any important published information that may have inadvertently been omitted and which may change the evaluation of health risks from exposure to the environmental agent under examination, so that the information may be considered in the event of updating and re-evaluation of the conclusions contained in the criteria documents.

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ENVIRONMENTAL HEALTH CRITERIA FOR DDT AND ITS DERIVATIVES

A WHO Task Group on Environmental Health Criteria for DDT and its Derivatives met in Geneva from 8-14 November 1977. Dr V. B. Vouk, Chief of the Control of Environmental Pollution and Hazards Unit opened the meeting on behalf of the Director-General. The Task Group reviewed and revised the second draft criteria document and made an evaluation of the health risks from exposure to DDT and its derivatives.

Dr W. J. Hayes, Jr and Dr J. Robinson, Sittingbourne Research Centre, Kent, England, assisted the Secretariat in preparing the first and second drafts of the DDT criteria document. Comments on which the second draft was based were received from the national focal points for the WHO Environmental Health Criteria Programme in Australia, Belgium, Canada, Finland, France, Greece, Israel, New Zealand, Pakistan, and USA and from the International Agency for Research on Cancer (IARC), the International Labour Office (ILO), the International Union of Biological Sciences (IUBS), the International Union of Pure and Applied Chemistry (IUPAC), the United Nations Industrial Development Organization (UNIDO), and from the United Nations Environmental Programme International Register of Potentially Toxic Chemicals.

Comments were also received from Dr V. Benes, Czechoslovakia, Dr S. Gabor, Romania, and Dr P.M. Newberne, USA.

Two subgroups reviewed the major part of the second draft (sections 2 to 6 and 7 to 8, respectively) and their comments were accepted as those of the whole group. Sections 1 and 9 were redrafted and approved at the plenary sessions.

The collaboration of these national institutions, international organizations, WHO collaborating centres, and individual experts is gratefully acknowledged. Without their assistance this document would not have been completed. The Secretariat wishes to thank, in particular, Dr W. J. Hayes, Jr for his help in all phases of preparation of the document.

This document is based primarily on original publications listed in the reference section. However, several comprehensive reviews on the health effects of DDT have also been used including publications by the US Environmental Protection Agency (1975), Müller (1959), and Mrak (1969).

Although the ecological aspects of DDT, including its possible accumulation in some components of the food chain, its metabolism in microorganisms and plants, as well as its effects on terrestrial and aquatic ecosystems are, no doubt, of great interest and importance,

this document is concerned mainly with the discussion of its metabolism and effects in experimental animals and man that have direct implications for human health.

Details of the WHO Environmental Health Criteria Programme including some of the terms frequently used in the documents may be found in the general introduction to the Environmental Health Criteria Programme published together with the environmental health criteria document on mercury (Environmental Health Criteria 1 -- Mercury, World Health Organization, 1976), now also available as a reprint.

1. SUMMARY AND RECOMMENDATIONS FOR FURTHER STUDIES

1.1 Summary

1.1.1 Properties and analytical methods

DDT which is an acronym for dichlorodiphenyltrichloroethane is the prototype of broad action, persistent insecticides. It is stable under most environmental conditions and is resistant to complete breakdown by the enzymes present in soil microorganisms and higher organisms. Some of its metabolites, notably 1,1'-(2,2-dichlor-ethenylidene)-bis[4-chlorobenzene] (DDE), have a stability equal to, or greater than that of the parent compound. The persistence of DDT and DDE in the environment is mainly due to the fact that they are soluble in fat and virtually insoluble in water.

Two techniques have played a major role in the quantitative analysis of DDT-type compounds. The original Schechter-Haller colorimetric method introduced in 1945 was modified in 1953 making it possible to measure both DDT and DDE in the same sample. A second more reliable and versatile method for the simultaneous analysis of DDT, DDE and a number of other organochlorine insecticides began to be used extensively in about 1962. This consisted of gas-liquid chromatography with destructive and non-destructive detector systems using multicolumns for the separation of mixtures. Both methods require understanding and care in the selection, extraction, clean-up, and subsequent analysis of samples. Later, gas-liquid chromatography was combined with mass spectrometry, which added a dimension of mass for each component of a mixture and provided a more reliable technique for confirmatory analyses.

Analytical methods, their execution, and the reported results have not been satisfactory in a number of papers. However, good agreement has been achieved by analysing paired aliquots by the colorimetric and gas chromatographic method. In the majority of cases, analytical errors involving human samples have been small compared with the real differences, either between individual samples or between groups of samples drawn from populations with substantially different histories of exposure. This situation is different with environmental samples