

	Page
ENVIRONMENTAL HEALTH CRITERIA FOR DDT AND ITS DERIVATIVES	9
1. SUMMARY AND RECOMMENDATIONS FOR FURTHER STUDIES	11
1.1 Summary	11
1.1.1 Properties and analytical methods	11
1.1.2 Production and uses	11
1.1.3 Environmental concentrations and exposures	12
1.1.4 Metabolism	14
1.1.5 Experimental studies of the effects of DDT	16
1.1.6 Clinical and epidemiological studies on the effects of DDT	18
1.1.7 Dosage-effect relationships	19
1.1.8 Evaluation of risk	19
1.2 Recommendations for further studies	21
1.2.1 Fate in the environment	21
1.2.2 Monitoring of exposure and effects	21
1.2.3 Carcinogenicity	22
1.2.4 Mutagenicity	22
2. PROPERTIES AND ANALYTICAL METHODS	23
2.1 Physical and chemical properties of DDT and certain related compounds	23
2.1.1 Properties of DDT	23
2.1.2 Properties of DDT analogues	23
2.1.3 Formulations of commercial or technical DDT	25
2.2 Analytical procedures	25
2.2.1 Statistical criteria for assessing analytical methods	25
2.2.2 Limit of analytical detection	27
2.2.3 Confirmation of the identity of trace residues of DDT-type compounds	28
2.2.4 Sampling and extraction	29
2.2.5 Clean-up procedures	34
2.2.6 Quantification	35
2.2.6.1 Determination of DDT-type compounds	35
2.2.6.2 Determination of <i>p,p'</i> -DDA in urine	38
2.2.6.3 Method of reporting results	38
2.2.7 Validation of analytical methods for DDT-type compounds	39
2.2.8 Analytical methods for the evaluation of the biochemical effects of <i>p,p'</i> -DDT and its analogues	41
3. SOURCES OF ENVIRONMENTAL POLLUTION	42
3.1 Discovery and introduction	42
3.2 Production and use	42
3.3 Changing patterns of use	43
4. ENVIRONMENTAL TRANSPORT AND DISTRIBUTION	45
4.1 Local drift in air	45
4.2 Distant drift in air	46
4.3 Distribution in water	47
4.4 Bioaccumulation of DDT and its degradation in the environment	47

	Page
5. ENVIRONMENTAL EXPOSURE LEVELS	49
5.1 Exposure of the general population	49
5.1.1 DDT in air	49
5.1.2 DDT in water	49
5.1.3 DDT in food	50
5.1.4 Miscellaneous sources	52
5.1.5 Relative importance of different sources	53
5.2 Exposure of infants and young children	53
5.3 Occupational exposure	54
6. METABOLISM OF DDT	56
6.1 Uptake	56
6.1.1 Uptake by inhalation	56
6.1.2 Uptake from the gastrointestinal tract	56
6.1.3 Uptake from the skin	57
6.2 Distribution and storage	57
6.2.1 Human studies	57
6.2.1.1 Studies of volunteers	57
6.2.1.2 Studies of occupationally exposed workers	59
6.2.1.3 Studies of the general population	62
6.2.2 Animal studies	72
6.3 Elimination	75
6.3.1 Human studies	75
6.3.1.1 Studies of volunteers	75
6.3.1.2 Studies of occupationally exposed workers	75
6.3.1.3 Studies of the general population	76
6.3.2 Animal studies	81
6.4 Biotransformation	83
7. EXPERIMENTAL STUDIES ON THE EFFECTS OF DDT	88
7.1 Animal studies	88
7.1.1 Haemopoietic system and immunology	88
7.1.2 Nervous system and behaviour	89
7.1.2.1 Cause of death	93
7.1.2.2 Treatment of poisoning in animals	94
7.1.3 Renal system	97
7.1.4 Gastrointestinal tract, liver, and enzymes	97
7.1.4.1 Liver	97
7.1.4.2 Microsomal enzymes of the liver	97
7.1.4.3 Enzymes of intermediary metabolism	99
7.1.5 Cardiovascular system	101
7.1.6 Respiratory system	102
7.1.7 Reproductive system	102
7.1.8 Endocrine organs	104
7.1.9 Carcinogenicity	106
7.1.10 Mutagenicity	115
7.1.11 Teratogenicity	115
7.2 Acquisition of tolerance to DDT	116
7.3 Factors influencing DDT toxicity	116
7.3.1 Dosage-effect	116
7.3.1.1 Dosage-effect of DDT	116
7.3.1.2 Dosage-effect of metabolites and <i>o,p'</i> -DDT	118

	Page
7.3.2 Age and sex	119
7.3.3 Nutrition	120
7.3.4 Species	122
7.3.5 Other factors	122
7.4 Human studies	123
8. EFFECTS OF DDT ON MAN: EPIDEMIOLOGICAL AND CLINICAL STUDIES	127
8.1 Retrospective studies of DDT-exposed populations	127
8.1.1 Epidemiological surveillance of persons occupationally exposed to DDT	127
8.1.2 Epidemiology of DDT poisoning in the general population: accidents and suicides	131
8.1.3 Epidemiology of DDT poisoning in infants and young children	134
8.2 Clinical and epidemiological studies of the effects of DDT on specific organs and systems	134
8.2.1 Haemopoietic system and immunology	134
8.2.2 Nervous system	135
8.2.3 Renal system	136
8.2.4 Gastrointestinal system	136
8.2.5 Liver	136
8.2.5.1 Liver enzymes	137
8.2.5.2 Other biochemical observations	138
8.2.6 Cardiovascular system	139
8.2.7 Reproduction	139
8.2.8 Endocrine organs	139
8.2.9 Carcinogenicity	141
8.2.10 Mutagenicity	142
8.3 Factors influencing DDT toxicity	143
8.4 Treatment of poisoning in man	143
9. EVALUATION OF HEALTH RISKS TO MAN FROM EXPOSURE TO DDT AND RELATED COMPOUNDS	144
9.1 Relative contributions of food, water, air, and miscellaneous sources to total intake	144
9.1.1 Adult members of the general population	144
9.1.2 Infants and children	144
9.1.3 Occupational groups	145
9.2 Effects of exposure	146
9.3 Carcinogenicity and mutagenicity	147
9.4 Effects on microsomal enzymes	147
9.5 Reproduction and teratogenicity	148
9.6 Immunosuppression	148
9.7 Nutritional effects and other factors	149
9.8 Dosage-effect relationships	149
9.9 Recommendations on levels of exposure	150
REFERENCES	152
ANNEX	185
REFERENCES	193

