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WHO

REGIONAL OFFICE FOR EUROPE

REVISION OF THE WHO GUIDELINES FOR DRINKING-WATER QUALITY

Report on the
First Review Group Meeting
on Pesticides

Busto Garolfo (Milan), Italy
25–30 June 1990

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EUR/HFA TARGET 20

This activity was organized by the WHO Regional Office for Europe
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TARGET 20

WATER POLLUTION

Index terms

DRINKING WATER
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[a] *Targets for health for all.* Copenhagen, WHO Regional Office Europe, 1985 (European Health for All Series, No. 1).

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Introduction

The recommended values contained in the WHO Guidelines for Drinking-Water Quality issued in 1984 (referred to henceforth as the Guidelines) are based on toxicological and other support data available up to 1981. Since that time new toxicological and other relevant data have become available for some of the substances for which guidelines or tentative guidelines were established in the 1984 Guidelines as well as for other compounds for which there had been insufficient data available to establish guideline values. In addition, concern has been expressed regarding a number of substances which had not previously been considered.

A Consultation to initiate the work on the revision of WHO Guidelines for Drinking-Water Quality was convened by WHO-HQ in Rome from 17-19 October 1988. The principal objective of this Consultation was to discuss and agree upon the principles under which the revision of the guidelines would be carried out. The consultation reaffirmed the concept of WHO Guidelines including approaches to risk assessment, and produced specific recommendations regarding assumptions and techniques which should be used during the process of development of the guidelines. Furthermore, the consultation determined a common format for the evaluation of drinking-water contaminants and finalized the list of substances for which evaluation should be undertaken.

With the scientific principles of the revision agreed upon at the Rome consultation, it appeared useful to have a small coordination group meet at periodic intervals to elaborate detailed practical arrangements for the drafting of evaluation documents and for the organization of the review meetings. Participation was limited to the scientific coordinators for organics and inorganics and principal investigators of institutes which would host the review meetings. Two consultations of this coordinating group were organized so far, the first one in Copenhagen, 4-5 September 1989, and the second in Geneva 13-14 March 1990.

Based in the established principles for the preparation and review of the draft evaluations of individual substances, and based on the assessment of actual and/or expected availability of draft evaluation documents, detailed arrangements for review meetings in 1990 and tentative plans 1991 were made during the Geneva meeting in March 1990.

The First Review Group Meeting on Pesticides was convened by the WHO Regional Office for Europe in Busto Garolfo (Milano) Italy, 25-30 June 1990 with the Financial support of DANIDA. The Consultation was attended by 17 experts, Drs Burin and Plestina of IPCS, WHO Headquarters, two representatives from CEC, 8 observers and Dr D. Kello, Regional Officer for Toxicology and Food Safety, who represented the Regional Office for Europe of the WHO. Dr Emil Poulsen was elected Chairman of the meeting with Mr J. Fawell as Rapporteur. The participants were welcomed by Hon. Maria Pia Garavaglia, Deputy Minister of Health of Italy, by Dr R. Lonati, President of the Local Health Unit 69 in Parabiago and Professor M. Maroni, Director of the International Centre for Pesticide Safety. Dr Kello welcomed the participants on behalf of WHO, and introduced the work of WHO on drinking-water quality guidelines. Dr Kello reiterated that the responsibility for carrying out the work would be shared between WHO Headquarters and its Regional Office for Europe, underlining the scope and purpose of the present consultation, as well as the principles which should be followed during the process of revision of the guidelines. Draft documents were prepared by the Istituto Superiore di Sanita of Italy, Health and Welfare Canada, the United States EPA, the Water Research Centre in the United Kingdom and RIVM in the Netherlands. The purpose of this meeting was to review the draft evaluation documents in the light of the comments received, to advise on proposed guideline values and to prepare summary statements on each substance considered for the evaluation.

2. Summary statements

2.1 Aldicarb

Aldicarb is a systemic insecticide used to control nematodes in soil and insects and mites on a variety of crops. It is very soluble in water and is highly mobile in soil. It degrades mainly by biodegradation and hydrolysis, with a time of persistance from weeks to months. It has been frequently found as a contaminant in groundwater.

Aldicarb is one of the most acutely toxic pesticides in use, although the only consistently observed toxic effect with both long term and single dose administration is acetylcholinesterase inhibition. It is metabolized to the sulphoxide and sulphone.

The weight of evidence indicates that aldicarb is not genotoxic or carcinogenic.

The FAO/WHO Joint Meetings on Pesticide Residues (JMPR) (1982) recommended a maximum ADI (acceptable daily intake) of 0.005 mg/kg-bw, based on a 6-month study in rats, with a NOAEL (no-observed adverse effect level) of 0.125 mg/kg-bw and an uncertainty factor of 25. For the purposes of deriving a guideline for drinking-water, a 29-day study in rats, in which a 1:1 mixture of aldicarb sulphoxide and aldicarb sulphone (the mixture most commonly found in drinking-water) was administered in drinking-water was used. The NOAEL was 0.4 mg/kg body weight per day based on acetylcholinesterase inhibition.

An uncertainty factor of 100 (10 for interspecies extrapolation, 10 for intraspecies variation) was applied giving and ADI of 0.004 mg/kg body weight. No allowance was made for the short duration of the study in view of the extremely sensitive and rapidly reversible biological endpoint used. Although actual dietary exposure is relatively low, the potential for contamination of food due to the illegal use of aldicarb on certain crops was also taken into consideration by the allocation of 1% of the ADI to water. The guideline proposed is therefore 1.2 µg/l.

2.2 Aldrin/Dieldrin

Aldrin and dieldrin are chlorinated cyclodiene insecticides which are closely related with respect to their toxicology and mode of action. Under most environmental conditions, and in the body, aldrin is rapidly converted to dieldrin. Dieldrin is a highly persistent organochlorine, it has low mobility in soil and can be lost to the atmosphere. It is occasionally found in water. Dietary exposure to aldrin/dieldrin is very low and decreasing.

Both compounds are highly toxic in experimental animals and cases of poisoning in humans are known. Aldrin and dieldrin do not have a single mechanism of toxicity. The target organs are the central nervous system and the liver. In long-term studies dieldrin has been shown to produce liver tumours in both sexes of two strains of mice. It did not produce an increase in tumours in rats and does not appear to be genotoxic.

IARC have classified dieldrin as group III, and it is considered that all the available information on aldrin and dieldrin taken together, including studies on humans, supports the view that for practical purposes these chemicals make very little contribution, if any, to the incidence of cancer in man. Therefore, an Acceptable Daily Intake (ADI) approach can be used to calculate a guideline value.

The FAO/WHO Joint Meetings on Pesticide Residues (JMPR) (1982) have recommended a maximum ADI of 0.1 µg/kg body weight (combined total for aldrin and dieldrin). This was based on NOAELs of 1 mg/kg diet or 0.5 mg/kg diet in the dog and rat, respectively. For both species, this is equivalent to 0.025 mg/kg bw. The uncertainty factor of 250 was based on the concern for the oncogenicity observed in the mouse.

This ADI was reaffirmed. Although the levels of aldrin/dieldrin in food have been decreasing and manufacture has ceased, dieldrin is highly persistent and is bioaccumulated. There is also potential for exposure from the atmosphere of houses where it is used for termite control. The guideline value is therefore based on allocating 1% of the ADI to water giving a value of 0.03 µg/l. This reaffirms the 1984 guideline.

2.3 Atrazine

Atrazine is a selective pre- and early post-emergent herbicide. It has been found in surface water and in ground water due to its mobility in the soil. It is relatively stable in soil and aquatic environments with a half life measured in months but it is degraded by photolysis and in soil by microbial degradation.

Based on a wide variety of genotoxicity assays the weight of evidence indicates that atrazine is not genotoxic. There is evidence that atrazine can induce mammary tumours in rats. It is highly probable that the mechanism for this process is non-genotoxic. No significant increase in neoplasia was observed in mice. [The carcinogenicity of atrazine will be evaluated by IARC in October 1990].

An ADI approach can be used to calculate a guideline value. Based on a NOAEL of 0.7 mg/kg body weight/day in a long-term study in the rat and an uncertainty factor of 1000 (10 for interspecies extrapolation, 10 for intraspecies variation and 10 to reflect potential neoplasia), an ADI of 0.7 µg/kg bw was calculated. Recently submitted data indicate that exposure to atrazine from the diet is negligible and that an allocation of 10% of the ADI to drinking-water is appropriate. The guidelines value proposed is 2 µg/l.

2.4 Bentazon

Bentazon is a broad spectrum herbicide used for a variety of crops. It photodegrades in soil and water but it is very mobile in soil and is moderately persistent in the environment. It has been found in groundwater and has a high affinity for the water compartment.

Long-term studies conducted in rats and mice do not indicate a carcinogenic potential and a variety of *in vitro* and *in vivo* assays indicate that bentazon is not genotoxic.

Several recent studies were evaluated including new teratology and reproduction studies and a one year study in the dog. After consideration of all available data, the lowest NOAEL now appears to be 200 ppm, equivalent to 10 mg/kg bw/day, in a long-term study conducted in rat, based upon hematological effects observed at higher dose levels.

Based upon this NOAEL of 10 mg/kg bw/day and a 100 fold uncertainty factor, an ADI of 0.1 mg/kg was recommended. Based on uncertainties regarding dietary exposure, it was recommended that 1% of the ADI be allocated to drinking-water. Based on a 70 kg. adult drinking 2 litres per day, the guideline value proposed for bentazon is 35 µg/litre.

2.5 Chlordane

Chlordane is a broad-spectrum insecticide used since 1947. Recently the use of which has been increasingly restricted in many countries and whîch is now used mainly as a termiticide applied to the soil by subsurface injection.

Chlordane is a mixture of stereoisomers, with the cis- and trans-forms redominating. It is very resistant to degradation, is highly immobile in soil and migrates very poorly to ground water, where it has only rarely been found. It is readily lost to the atmosphere.

In experimental animals, prolonged exposure in the diet causes liver damage. It produces liver tumours in mice but the weight of evidence indicates that it is not genotoxic. Chlordane can interfere with cell communication *in vitro* which is characteristic of many tumour promotors.

IARC re-reviewed chlordane in 1987 and concluded that the available studies were inadequate for the evaluation of cancer risk to humans and that there was limited evidence of its carcinogenicity for animals, classifying it in Group III. On the basis of this classification, an ADI approach has been used to derive a guideline.

JMPR re-reviewed chlordane in 1986 and established an ADI of 0.0005 mg/kg bw/d derived from a dietary chronic study on rats, applying as uncertainty factor of 100 to a NOAEL of 0.05 mg/kg bw/d. This study was not available when WHO established a guideline value of 0.3 µg/l in 1984 based on an ADI of 0.001 mg/kg b.w.

Although levels of chlordane in food have been decreasing it is highly persistent and has a high bioaccumulation potential. The guideline value is therefore based on allocating 1% of the ADI to water giving a value of 0.17 µg/l.

2.6 Chlortoluron

Chlortoluron is a pre- or early post-emergence herbicide which is slowly biodegradable and mobile in soil, and which has been detected in water. There is only limited exposure to this compound from food.

Chlortoluron has not been previously evaluated and only summary data was available to the meeting.

However, the available summary data raised a number of outstanding questions which could not be resolved by the documents available to the group.

These were as follows:

(a) Toxicological endpoints relating to kidney damage were not clear.

(b) The basis for the species specificity of these lesions including species differences in pharmacokinetics was not clear.

That the tumours in kidney were secondary to these lesions could not be established without clarification of the above questions.

The appropriate studies will be evaluated when made available and presented to the next working group on pesticides.

2.7 1,2-Dichloropropane

1,2-Dichloropropane (1,2-DCP), also known as propylene dichloride has been used as a solvent for oils and fats, a solvent for dry cleaning and degreasing operations, and a component of soil fumigants. Due to its solubility and in spite of its high vapour pressure it can contaminate water.

There is a relatively limited data base on the toxicity of 1,2-DCP but it is a mutagen in some short-term assays in vitro.

When administered orally, 1,2-DCP produced statistically significant increases in the incidence of hepatocellular adenomas and carcinomas in both sexes of mice. There was marginal evidence of carcinogenicity in female rats.

IARC (1987) concluded that 1,2-DCP should be classified in group III. It is therefore appropriate to derive a guideline value using an ADI approach.

A LOAEL of 71.4 mg/kg/day was identified on the basis of a variety of systemic effects in a 13 week oral study in rat. An ADI of 0.007 mg/kg/day was calculated by applying an uncertainty factor of 10,000 (10 for interspecies extrapolation, 10 for intraspecies variation, 10 because a LOAEL is used and 10 to reflect limited evidence of carcinogenicity in animals and a limited toxicity data base particularly for reproductive studies).

Since there is no data on exposure from other sources only 1% of the ADI was allocated to water. The proposed guideline is 2.5 µg/1.

2.8 1,3-Dichloropropane

1,3-dichloropropane (1,3-DCP) has several industrial uses and may be found as a contaminant of 1,3-dichloropropane containing soil fumigants. 1,3-DCP is rarely found in water. It is of low acute toxicity. There is some indication that it may be genotoxic in bacterial systems. No short-term, long-term, reproductive or developmental toxicity data could be located. The available data were considered insufficient to recommend a guideline value.

2.9 1,3 Dichloropropene

1,3 Dichloropropene (1,3-DCP), is a soil fumigant, the commercial product of which is a mixture of cis and trans isomers. It is used to control a wide variety of soil pests, particularly nematodes in sandy soils. Notwithstanding its high vapour pressure it is soluble in water at the gram/l level and can be considered a potential water contaminant. Exposure to 1,3-DCP from food is negligible.

1,3-DCP is a direct acting mutagen which has been shown to produce forestomach tumours following long-term oral gavage to rats and mice. Tumours were also found in bladder and lung in female mice and liver in male rats. Long-term inhalation studies in the rat were negative. Inhalation studies in the mouse showed some benign lung tumours.

IARC (1987) have classified 1,3-DCP into group II B. There are no suitable studies to derive a NOAEL.

Based on the results from 2-year gavage studies in rats and mice, using the linearized multistage model the drinking-water concentration for an excess lifetime cancer risk of 10^{-4}, 10^{-5} and 10^{-6} is estimated to be 20, 2.0 and 0.2 µg/l, respectively.

2.10 Ethylene Dibromide (EDB)

EDB is used as an active additive in leaded gasoline, as an insecticidal fumigant and as an industrial chemical.

It is photodegradable with a short persistence in air however in other environmental compartments it can persist for much longer. It is volatile but its solubility and its resistance to degradation make this chemical a potential groundwater contaminant.

EDB is a bifunctional alkylating agent which induces a variety of effects including male reproductive effects. IARC re-evaluated the data on EDB in 1987 and concluded the evidence for carcinogenicity to humans to be inadequate but the animal data to be sufficient to establish carcinogenicity and assigned Group II A status to EDB.

On the basis of the IARC Group II A classification a low-dose extrapolation model has been applied to calculate a "reference risk". Using the multistage model values of 0.04 µg/l, 0.004 µg/l and 0.0004 µg/l for risks of 10^{-4}, 10^{-5} and 10^{-6} were calculated based on a long-term study by oral gavage in the rat.

2.11 Heptachlor and heptachlor epoxide

Heptachlor is a broad spectrum insecticide, the use of which has been banned or restricted in many countries. At present, the major use of heptachlor is as a termiticide which is applied by subsurface injections.

Heptachlor is quite persistent in soil where it is mainly transformed to its epoxide which is very resistant to further degradation. Heptachlor and heptachlor epoxide bind to soil particles and migrate very slowly. Heptachlor epoxide has some affinity for air. It is very rarely found in water.

Diet is considered to represent the major source of exposure to heptachlor, although intake is decreasing.

Prolonged exposures to heptachlor have been associated with damage to the liver and CNS toxicity.

IARC (1987) has reviewed heptachlor and classified it in group III. JMPR has reviewed heptachlor on several occasions and in 1970 established an ADI of 0.5 μg/kg bw/day for heptachlor and heptachlor epoxide on the basis of a NOAEL of 0.25 mg/kg bw/day in the rat and a NOAEL of 0.06 mg/kg bw/day in the dog incorporating an uncertainty factor of 100. In 1984, WHO established a guideline of 0.1 μg/l derived from the ADI established by JMPR in 1970.

Based upon the IARC classification, an ADI approach has been used to calculate a guideline value for heptachlor. The NOAEL of 0.06 mg/kg established by JMPR was selected to derive an ADI of 0.3 μg/kg bw/day by applying an uncertainty factor of 200 (10 for interspecies extrapolation, 10 for intraspecies variation, 2 because the studies on which the ADI are based do not meet current standards). 1% of the ADI was allocated to drinking water and a guideline value of 0.10 μg/l was established. This reaffirms the guideline value proposed by WHO in 1984.

2.12 Hexachlorobenzene

Hexachlorobenzene (HCB) has been used as a selective fungicide but its use is now uncommon. It is a by-product in several chemical processes and an impurity in some pesticides. HCB is strongly adsorbed by soil and sediments and has a half-life measured in years. It is a ubiquitous contaminant and is readily lost to the atmosphere. It is resistant to degradation, has a high bioconcentration potential and accumulates in the tissues of aquatic and terrestrial organisms.

Food is considered to be the major source of exposure to HCB. Atmospheric contamination may also contribute to the human intake of HCB. Drinking water contaminated with HCB has been only very rarely found.

IARC (1987) has reviewed and assigned HCB to Group II B. In addition, HCB has been shown to induce tumours in 3 animal species and at a variety of sites.

A linear low dose extrapolation model was therefore used to calculate a reference risk.

On the basis of results from a dietary study in rats, and applying the linearized multistage model a concentration in drinking-water of 2.0 µg/l, 0.2 µg/l and 0.02 µg/l corresponding to a risk of 10^{-4}, 10^{-5} and 10^{-6} was calculated.

This figure differs from the guideline value of 0.01 µg/l, corresponding to a risk level of 10^{-5} set by WHO in 1984. The earlier figure was derived using a model for ambient water which contained an exposure component for fish consumption and a factor for bioaccumulation in fish as well as exposure through drinking-water. The new figure only makes allowance for exposure from drinking-water.

2.13 Isoproturon

Isoproturon is a selective, systemic herbicide used in the control of annual grasses and broad leaved weeds in cereals. It can be photodegraded, hydrolyzed and biodegraded and persists from days to weeks. It is mobile in soil and has been detected in surface and underground water. There is evidence that exposure to this compound through food is low.

It is of low acute and chronic toxicity and does not possess significant genotoxic activity but it causes marked enzyme induction and liver enlargement. Isoproturon caused an increase in hepatocellular tumours in male and female rats but this was only apparent at doses which also caused liver toxicity. Isoproturon appears to be a tumour promotor rather than a complete carcinogen.

Based on this evaluation it is appropriate to derive a guideline by calculating an ADI using an uncertainty factor.

The no observed adverse effect levels in a 90 day study in dogs and a two year feeding study in rats were approximately 3.0 mg/kg body weight. An ADI of 0.003 mg/kg body weight can be calculated by applying an uncertainty factor of 1000 (10 for interspecies extrapolation, 10 for intraspecies variation, 10 because there is evidence of non-genotoxic carcinogenicity in rats). Significant exposure from sources other than water is not likely and a guideline can be calculated by allocating 10% of the ADI to water. The guideline value proposed for isoproturon is 10 µg/l.

2.14 Lindane

Lindane (gamma-hexachloroyclohexane) is an insecticide which has been used for a very long time. Apart from agricultural uses on plants and animals it is also used in public health and as a wood preservative.

Lindane is a persistent compound with a relatively low affinity for water, a low mobility in soil and that slowly volatilize into the atmosphere. It has been detected in water since it is a ubiquitous environmental contaminant.

Exposure of humans occurs mainly via food but this is decreasing.

Lindane causes liver tumours in mice given very high doses but there is evidence that this is a result of tumour promotion IARC (1987) classified lindane in Group II B. Moreover JMPR (1989) concluded after reviewing all available in vitro and in vivo short-term tests that there was no evidence of genotoxicity and proposed an ADI of 0.008 mg/kg bw based on liver and kidney toxicity observed in a short-term study in the rat.

Based on the same study and NOAEL used by JMPR, but using a compound intake estimate considered to be more appropriate in the light by additional data, an ADI of 0.005 mg/kg body weight can be estimated by applying a uncertainty factor of 100 (10 interspecies extrapolation 10 for intraspecies variation). It was not considered necessary to include an additional uncertainty factor to allow for the promoting potential in view of the substantial data base, and numerous international evaluations of this compound supporting the ADI.

Although exposure from food is decreasing there may be substantial exposure from its use in public health and as a wood preservative, therefore only 1% of the ADI was allocated to water. The guideline proposed is 1.75 μg/l.

This figure represents a revision of the previous drinking-water guideline of 3 μg/l based on the old ADI of 0.01 mg/kg body weight.

2.15 Permethrin

Permethrin is a synthetic pyrethroid insecticide which is widely used in crop protection and in public health. It is used in water reservoirs for mosquito larvae control and for control of infestation of water mains by aquatic invertebrates. It has a marked affinity for soil and sediment with a low affinity for water and it is not likely to be lost to the atmosphere. It can be photo and biodegraded and it persists for times varying from days to weeks.

Permethrin does not accumulate in mammals due to its rapid metabolism in mammalian systems. Exposure to permethrin in food and through household and public health use will be high.

Permethrin is of low mammalian toxicity. It is usually used as a mixture of the cis and trans isomers, but the cis isomer which is the active component is more toxic than the trans. It is not genotoxic and although there was a small increased incidence of benign lung tumours in male mice in one study, this was only at the highest dose and was not considered to indicate any significant carcinogenic potential for permethrin.

An ADI approach can be used to calculate a guideline value. (JMPR) (1982) have recommended a maximum ADI for 2:3 and 1:3 cis/trans permethrin of 0.05 mg/kg body weight based on the application of an uncertainty factor of 100 to a no-observed effect level for liver toxicity of 100 ppm, equivalent to 5 mg/kg bw per day. This figure was reaffirmed.

Because there is significant exposure to permethrin from the environment only 1% of the ADI is allocated to water therefore the guideline value proposed is 17.5 μg/l.

However if permethrin is to be used as a larvicide in drinking-water sources, the share of the ADI allocated to drinking-water may be increased.

3. Recommendations

3.1 This first review meeting identified specific areas of concern related to consistency in applying the guidelines from the Rome Consultation.

(a) Basis for allocating a proportion of the ADI to drinking-water.

(b) Use of safety factors in ADI derivations for substances classified as II B by IARC.

(c) More precise guidelines on the appropriateness of and justification for the application of hypothetical mathematical models in cancer risk assessment.

(d) The problem of how to consider the implication for public health of degradation products.

Therefore, it is recommended that the criteria applied in the derivation of guidelines will be reviewed to ensure consistency as well as accuracy based on the latest scientific findings.

3.2 It is recommended that WHO works toward further harmonization of the approaches and principles used in the evaluation of toxicity data.

3.3 It is recommended that in the future the consistent use of the terms of ADI and TDI should be clarified to differentiate between the residues in food and water resulting from deliberate use of compounds as opposed to their incidental contamination.

3.4 The organoleptic properties of many of the considered chemicals are not available although some data suggest that the taste or odour threshold level could be well below the toxicologically acceptable level for some substances. It is therefore recommended that organoleptic studies should be encouraged in order to provide necessary data for future evaluations.

3.5 It is recommended that WHO should encourage studies on the identification of those pesticides which are in wide use in developing countries and which may pose problems of public health significance due to their presence as contaminants.

ANNEX 1

PHYSICAL AND CHEMICAL PROPERTIES OF THE SUBSTANCES REVIEWED

	MW	WS g/l	vp Pa	Kow Log	H $\frac{Pa\ m^3}{mol}$	MODE OF DEGRADATION	PERSISTENCE		MOBILITY IN SOIL AFFINITY FOR WATER AFFINITY FOR AIR	DETECTED IN GROUND OR SURFACE WATER
ALDICARB	190	6	0,013	1	$4\cdot10^{-4}$	BIO-HYD	w-m	M	H, H, L	F
DIELDRIN	381	$0,25\cdot10^{-3}$	$0,4\cdot10^{-3}$	6	0.6	-	y	H	L, L, M-H	R
ATRAZINE	215	$30\cdot10^{-3}$	$0,4\cdot10^{-4}$	2,3	$1\cdot10^{-4}$	BIO	w-m	M	M, M, L	F
BENTAZONE	240	0,5	$<1\cdot10^{-5}$	Low	$<0,5\cdot10^{-5}$	BIO-PHOTO	d-w	L,M	M, H, L	M
CHLORDANE	410	$9\cdot10^{-6}$	$1\cdot3\cdot10^{-3}$	5,6	59	-	y	H	L, L, H	R
CHLORTOLURON	213	$70\cdot10^{-3}$	$1,7\cdot10^{-5}$	2,3	$0,5\cdot10^{-5}$	BIO	w-m	M	M, M, L	M
1-2 DICHLOROPROPANE	113	2,7	5600	2,3	234	PHOTO?	m?	M?	L, M H, H	(M)
1-3 DICHLOROPROPENE	112	1	3640	1,4	409	PHOTO?	m?	M?	L, M H, H	(M)
ETHYLENE DIBROMIDE	188	4,3	[illegible]	Low	64	PHOTO	d-y	L,H	L, M H, H	(M)
HEPTACHLOR EPOXIDE	389	$0,35\cdot10^{-3}$	0,04	4,4	44	-	y	H	L, L, H	R
HEXACHLOROBENZENE	285	$5\cdot10^{-6}$	[illegible]	6,0	80	-	y	H	L, L, H	R-M
ISOPROTURON	206	$72\cdot10^{-3}$	[illegible]	Low	$1\cdot10^{-5}$	BIO-HYD-PHOTO	d-w	L,M	M, M, L	M
LINDANE	291	$7\cdot10^{-3}$	$1\cdot10^{-3}$	3,8	1,6	-	y	H	L, L, M-H	R-M
PERMETHRIN	391	$0,2\cdot10^{-3}$	$1,4\cdot10^{-5}$	6,5	$8\cdot10^{-6}$	BIO-PHOTO	d-w	L	L, L, L	R
						BIODEGRADATION HYDROLYSIS PHOTODEGRADATION	Days Weeks Months Years	Low Medium High	Low Medium High	Frequently found Median frequency Rarely found

ANNEX 2

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