Opinion of the Scientific Committee on Plants regarding the inclusion of Aldicarb in annex 1 to Directive 91/414/EEC concerning the placing of plant protection products on the market (SCP/ALDIC/041-Final) - (Opinion expressed by the Scientific Committee on Plants on 18 December 1998)

TERMS OF REFERENCE

In the context of the possible inclusion of aldicarb in Annex I to Council Directive 91/414/EEC concerning the placing on the market of plant protection products, the Commission consulted the Scientific Committee on Plants and submitted for response the following questions:

1. Dietary risk assessment.

a. Is the probabilistic approach presented by the notifier for assessment of the risk to consumers acceptable?
b. Taking into account the high acute toxicity of **aldicarb** (acute reference dose of 0.003 mg/kg), can it be concluded that the consumption by infants and young children of products from treated crops with particular reference to bananas, potatoes, carrots and oranges does not represent a health risk?

2. Environment risk assessment

a. Is the probabilistic approach presented by the notifier for the assessment of the risk to small birds acceptable?
b. Taking into account that one granule of the formulated product exceeds the LD_{50} for small birds, can it be concluded that the risk for small birds after consumption of granules arising from the soil incorporation outdoor uses is limited to exceptional cases when outdoor broadcast applications are revoked and when the application method employed must achieve a minimum of 99% over the whole treated area and must prevent an uneven distribution of non-incorporated granules (e.g. at the edge of fields)?
c. Can is be established from the submitted data for other ecotoxicological considerations (small mammals, earthworms, beneficial arthropods, aquatic organisms etc) that, pending the generation, submission and evaluation of additional data, the continued use of **aldicarb** in accordance with current Good Agricultural Practice (GAP) for a period of approximately three years, would not be prejudicial to the environment.
d. Can the Committee reconcile the soil leaching model predictions indicating that use scenarios exist which do not pose unacceptable risks for groundwater with the reported monitoring results showing residues arising from the use of **aldicarb** in groundwater. If yes, can the Committee nevertheless identify if any of the current GAPs would represent an unacceptable risk to groundwater?

3. Operator exposure

Can it be established that, pending the generation, submission and evaluation of additional operator exposure data, the continued use of **aldicarb** in accordance with current GAP, would not be prejudicial to operators?

BACKGROUND

Aldicarb is an existing active substance in the context of Directive 91/414/EEC concerning the placing of plant protection products on the market and is being one of the active substances covered by the first stage of the work program provided for under the Directive.

In order to complete its evaluation, the Scientific Committee on Plants had access to documentation comprising a dossier from the notifier Rhône-Poulenc Agrochemie, a monograph prepared by the United Kingdom Authorities as Rapporteur Member State, a review report prepared by the Commission services of the Directorate General for Agriculture and the Recommendations of the ECCO Peer Review Programme.

Aldicarb is an oxime carbamate insecticide, nematicide and acaricide which is formulated as granular products. It is effective against insects, nematodes and mites by contact and ingestion and is applied to the soil. It is absorbed by the plant's root system and is translocated throughout the plant, primarily through the xylem. It is authorised for use in certain Member States on a wide range of fruit, vegetable, ornamental and other non-food crops.

OPINION OF THE COMMITTEE

Question 1

Dietary risk assessment

a. **Is the probabilistic approach presented by the notifier for assessment of the risk to consumers acceptable?**
b. **Taking into account the high acute toxicity of aldicarb (acute reference dose of 0.003 mg/kg), can it be concluded that the consumption by infants and young children of products from treated crops with particular reference to bananas, potatoes, carrots and oranges does not represent a health risk?**

Background

In the Peer Review Programme under Directive 91/414/EEC there was concern regarding a number of issues, particularly consumer exposure to aldicarb.

The Rapporteur Member State calculated the long term intakes for adults, children and infants; the estimated daily intakes (NEDI [1]) on the basis of UK consumption data and of STMRs [2] and taking account reduction factors for peeling citrus and bananas and cooking potatoes, do not exceed the ADI [3] of 0.003 mg/kg bw/day.

The Rapporteur Member State calculated also the short-term intakes for individual crops according to the recommendations by a Joint FAO/WHO Consultation on Food Consumption and Exposure Assessment of Chemicals, 1997 (). In this point estimate calculation the short-term intakes of residues in potatoes (baked or boiled) exceed for adults and young children the

Acute Reference Dose (ARfD). But the intake will not exceed the NOAEL [4] for a transient inhibition of erythrocyte acetylcholinesterase activity in human.

Short term intake of aldicarb residues was already addressed by the Scientific Committee for Pesticides in 1995, which recommended an ADI and ARfD of 0.003 mg/kg bw/day on the basis of the NOAEL for inhibition of erythrocyte acetylcholinesterase activity in a human volunteer study, using a safety factor of 10 (). The WHO recommended the same level as ADI in 1992 () and ARfD in 1995 (). The Scientific Committee for Pesticides stressed that "the real significance of the intakes is (therefore) governed by the probability of these intakes actually occurring in the real life". In line with the recommendation of this Committee "use of statistical modelling techniques should enable information to be obtained about the distribution of the resultant aldicarb residue intake" and taking into account the recommendation of the Joint FAO/WHO Consultation on Food Consumption and Exposure Assessment of Chemicals (1) the Rapporteur Member State requested the notifier to submit a probabilistic dietary exposure analysis for aldicarb residues in food.

In this context infants are considered in the age range of 6 to 12 months and young children in the age range of about 1 to 4 years.

Question 1 a

Is the probabilistic approach presented by the notifier for assessment of the risk to consumers acceptable?

Answer

The submitted assessment was made assuming combined exposures from four crops identified as the main sources of potential dietary intake of residues: potatoes, bananas, carrots and citrus.

Data from field trials, adjusted to reflect market share information and import statistics, were combined with consumption data for the UK population. The assessment relevant to the UK was considered as a worst case for the probabilistic approach, because exposure to residues from carrots is specific to that country, consumption of potatoes is very high in the UK and the market share of aldicarb on potatoes is much higher in UK than in any other EU member state.

The presented assessment can be considered as conservative, because it is based on field trial data and it was assumed that all residues are in the most toxic form, as aldicarb parent, whereas field trial studies indicate that part of the residues consist of the less toxic component aldicarb sulfone, especially in tubers and roots.

The Committee noted that the consumption data input files and certain assumptions supporting the probabilistic approach were not part of the submitted document. Therefore it was not possible for the dietary intake calculations presented by the notifier to be validated or independently reproduced.

The submitted results indicate that the potential dietary exposures to aldicarb residues for adults and young children are below the ARfD of 0.003 mg/kg bw/day at selected high

percentiles of the exposure distribution; the reported estimates at the 99.9th percentile are 19.3 % and 33 % of the ARfD respectively.

The notifier also presented results at the 99.99th percentile that are well below the ARfD, but noted that the underlying data could be not sufficiently precise to give confidence in the extreme percentiles. The distribution of exposure that is calculated using the Monte Carlo Simulation (see Annex) does not have an automatic upper limit. However, caution needs to be taken in interpreting exposure at the upper end of the distribution since experience indicates that data uncertainty and variability become increasingly important consideration.

The Committee recognised that there were a number of outstanding questions with regard to the residue and consumption data used in the model. In addition, the Committee noted that there were very few European residue data available in which analyses were made of individual commodity units and recommended that further individual commodity residue data for the relevant crops should be generated from European field trials in the future.

Nevertheless the Committee agreed that based on the information presented to it, the probabilistic approach for the assessment of the risk to consumers and the acute dietary risk for adults and young children appear to be acceptable.

The Committee recommended for probabilistic assessments in the future that:

- the full input data are included in the report and all assumptions are clearly stated so that the probabilistic assessment can be validated and reproduced if necessary
- the analysis of the stability of the tail end of the distribution is included in the report
- sensitivity analysis for the major assumptions used in the probabilistic model is carried out
- point estimates (see Annex) using the same database should be calculated and submitted to facilitate the comparison of the results of the different assessments methodologies.

The Committee also recommended that the dietary exposure assessment for aldicarb residues should be repeated if:

- more individual commodity residue data are available
- the registration status at member state level will be changed
- the market share of aldicarb on relevant crops has been increased

Question 1 b

Taking into account the high acute toxicity of aldicarb (acute reference dose of 0.003 mg/kg), can it be concluded that the consumption by infants and young children of products from treated crops with particular reference to bananas, potatoes, carrots and oranges does not represent a health risk?

Answer

For the probabilistic assessment of consumption by young children see question 1 a).

In the absence of adequate individual dietary intake data for infants the notifier used a bridging methodology for a probabilistic dietary exposure assessment. The Committee considered this bridging methodology as acceptable.

However, the general reservations made to the presented probabilistic approach mentioned under question 1 a) also apply to the assessment for infants.

The presented results indicate that the potential dietary exposures to aldicarb residues for infants are well below the ARfD of 0.003 mg/kg bw/day. The reported estimate at the 99.9th percentile of the exposure distribution was about 43 % of the ARfD.

In order to evaluate the health risk when a worst-case point estimate of aldicarb for infants and young children exceeds the acute reference dose (ARfD) (respectively 5-7 times) a number of toxicological findings have to be considered.

The ARfD is based on a NOAEL in adult human volunteers of 0.025 mg/kg bw (erythrocyte cholinesterase inhibition < 20 %). Transient depression in cholinesterase activity > 20 % was seen in erythrocytes at a dose of 0.05 mg/kg bw, and only one subject at a dose of 0.075 mg/kg bw developed clinical symptoms which could be related to the aldicarb exposure.

Reproduction studies in rats and rabbits indicate that effects on the progeny were observed at higher dose levels than the maternal toxicity defined as cholinesterase inhibition in erythrocytes and /or brains. No recordings of cholinesterase activities in erythrocytes and/or brain were specifically reported.

Neurotoxicity studies show that the NOAEL for neurotoxic and neuropathological effects is higher (at least 5 times higher) than the NOAEL for brain and erythrocyte cholinesterase inhibition (and in one case motor activity depression).

Delayed neurotoxicity testsin hens and neurobehavioural studies in rats with relevant high dose levels did not reveal any effects.

Studies with aldicarb in three age groups of rats, 17 day old, 27 day old and adult rats showed when comparing highly toxic doses as well as cholinesterase inhibition (brain and whole blood) that the young rats are only twice as sensitive as adults. Behavioural alterations were not as prominent as in the adults and it was speculated that this may be due to differences in degree of maturation of the nervous systems (). Moreover in the series of pesticides studied by Durham and Mitchell (1987) () there were 11 compounds which were more than two-fold less toxic to the weaning animals than to adults while there were none which were as much as two-fold more toxic to the weaning than to the adult.

With respect to human data it is noted that the main detoxification pathway for aldicarb is through the action of acetyl and butyril cholinesterases. The oxidative pathway is not a major detoxification pathway as it forms metabolites which are themselves cholinesterase (ChE) inhibitors (aldicarb sulfoxide and sulfone) which are, however, less potent ChE inhibitors than the parent compound. With respect to the human sensitivity of brain to cholinesterase it can be noted that the current ADI affords a 10 * margin of safety for cholinesterase inhibition. As shown in the study from which the ADI and the ARfD is derived, there is very little inter-individual difference in sensitivity. There is little information in the literature concerning brain effects of significant doses of ChE inhibitors in children or infants as compared to

adults. On the other hand, there are data on blood ChE inhibiting drugs which are used in infants, children and adults. For example Fisher et al. () have reported on neostigmine pharmacology in infants and children. In 12 infants (3 to 48 weeks) and 15 children (1 to 8 years) he calculated an ED50 (dose which produces 50 % antagonism to d-tubocurarine induced neuromuscular depression) of 13.1 µg/kg in infants and 15.5 µg/kg in children to be compared to a value of 22.9 µg/kg in adults. The time for 30 %, 50 % and 70 % of peak antagonism was similar in adults, children and infants. Elimination half-life was shorter in infants and children than in adults. Although renal function may not be at the adult level at six months of age, this is of negligible importance as the kidney mainly excretes inactive metabolites.

All the other items are equally relevant for infants as well as for children. Nevertheless, infants below the age of 12 months split their daily food intake into more meals than do older children. Due to the rapid reversal of cholinesterase inhibition after aldicarb intake, this represents an additional mitigation factor for the actual exposure. Both the animal experimental data and the available human data do not justify additional concern with respect to cholinesterase inhibition than adults, thus no additional safety (uncertainty) factor is needed. From the previous observations the Committee concludes that it is very unlikely that the NOAEL for young children and infants would differ from the NOAEL based on such sensitive parameter as the transient inhibition of acetyl cholinesterase in erythrocytes (> 20 %) in adult volunteers in biological relevant proportions. On the basis of the above considerations and in conjunction with the fact that intake levels of aldicarb as derived by a probabilistic approach at selected high percentiles of the exposure distribution are below the ARfD the Committee concluded that on the basis of the presently available intake data there is no appreciable health risk for young children and infants.

However, the Committee recommended, that for further dietary intake assessments of relevant compounds like aldicarb data on cholinesterase inhibition in young individuals should be provided.

CONCLUSION DIETARY RISK ASSESSMENT

The Committee recognised that not the full consumption data with regard to the residue and consumption data used in the probabilistic assessment were included in the report. Nevertheless, the Committee agreed that based on the information presented to it, the probabilistic approach for the assessment of the risk to the consumer is acceptable.

After consideration of a number of toxicological findings and in conjunction with the fact that the potential dietary exposure to aldicarb residues for adults, young children and infants as derived by the probabilistic approach at selected high percentiles of the exposure distribution are below the ARfD, the Committee concluded that based on the available information there is no appreciable health risk for adults, young children and infants.

Question 2 a and b

Environment risk assessment

- Is the probabilistic approach presented by the notifier for the assessment of the risk to small birds acceptable?

- Taking into account that one granule of the formulated product exceeds the LD_{50} for small birds, can it be concluded that the risk for small birds after consumption of granules arising from the soil incorporation outdoor uses is limited to exceptional cases when outdoor broadcast applications are revoked and when the application method employed must achieve a minimum of 99% over the whole treated area and must prevent an uneven distribution of non-incorporated granules (e.g. at the edge of fields)?

Answer a and b

Field application of aldicarb granules will be made mainly by tractor-mounted equipment which applies the product to the soil via downward placement and immediate incorporation into the soil. The risk assessment for the exposure of small birds to granules critically depends on the assumption that more than 99% of the granules are incorporated into the soil. Whilst this may be achieved under ideal conditions, the Committee believes that this high degree of incorporation is not consistently achievable under normal agricultural use. The Committee therefore advises that a reassessment is necessary.

Rather than the deterministic risk assessment (see Annex) supplied by the notifier, a probabilistic risk assessment should be undertaken using distributions for the variable input parameters and not selected point estimates as used in the current model. The Committee is aware of the development and international evaluation of suitable and relevant models for this purpose. For example, the Ecological Committee on FIFRA [5] Risk Assessment Methods (ECOFRAM), set up by the EPA [6] in the USA, is currently examining methods to estimate pesticide intake in birds via the ingestion of granules using individual-based, probabilistic (Monte Carlo) models (;).

The Committee notes that broadcast applications using centrifugal-type-spinning discs are not being supported by the notifier. Particular care should be taken to avoid exposed spillage and exposed granules should be incorporated immediately.

Question 2 c

Can it be established from the submitted data for other ecotoxicological considerations (small mammals, earthworms, beneficial arthropods, aquatic organisms etc) that, pending the generation, submission and evaluation of additional data, the continued use of aldicarb in accordance with current Good Agricultural Practice (GAP) for a period of approximately three years, would not be prejudicial to the environment.

Answer

Considering the long period of commercial experience in the use of **aldicarb** in those countries which have a national monitoring scheme to investigate wildlife deaths, significant negative impact on birds has not been demonstrated to have arisen from the approved use of granular products. However, the Committee is unaware of any widespread, effective monitoring of soil organisms, beneficial arthropods or aquatic organisms to provide equivalent information. Considering the length of use of the compound, the Committee is surprised to find that the available ecotoxicological data is inadequate in relation to the following:

· Although the risk of leaching and the stability of the two main metabolites (aldicarb sulfone and sulfoxide) is known, no data were submitted on the long-term toxicity of those metabolites to aquatic organisms. As to the acute toxicity values for the metabolites to fish and Daphnia, they are either unreliable or in the same range as for the active substance, which clearly requires long-term testing with those metabolites. Further, the possible contamination of surface waters via drainage was addressed neither for the aldicarb nor for the metabolites.

· Although the mobility and stability of the two main metabolites (aldicarb sulfone and sulfoxide) in soil is known, no data were submitted on the long-term toxicity of either aldicarb or those metabolites to soil-dwelling organisms.

· Of two ground-dwelling non-target (beneficial) arthropod species tested, one suffered 100% mortality, thus exceeding the Annex VI criterion. Data on more arthropod populations, of which ground-dwelling species are likely to receive the highest exposure from the intended applications of aldicarb to the soil.

· Honey bees and other species feeding on parts of the treated crop plants are likely to be exposed to aldicarb and its metabolites from oral intake (aldicarb is systemic). Although the contact toxicity of aldicarb to honey bees is extremely high (LD50 0.029 microgram), the applicant did not submit any data on oral toxicity, nor was an appropriate exposure assessment performed. The submitted field observations from 1972 on bees in aldicarb-treated alfalfa cannot be considered relevant for the intended uses [7] .

The Committee is therefore not able to assess from the data available whether the use of aldicarb should continue pending the generation, submission and evaluation of additional data.

Question 2 d

Can the committee reconcile the soil leaching model predictions indicating that use scenarios exist which do not pose unacceptable risks for groundwater with the reported monitoring results showing residues arising from the use of aldicarb in groundwater. If yes, can the Committee nevertheless identify if any of the current GAPs would represent an unacceptable risk to groundwater.

Answer

The Scientific Committee on Plants has considered the data submitted by Rhône-Poulenc Agrochemie concerning soil-leaching predictions indicating that use scenarios for aldicarb do exist which do not pose unacceptable risks for groundwater. It has also reviewed field monitoring results and data from lysimeter studies.

The committee was concerned that the PRZM modelling predictions carried out by Rhône-Poulenc did not provide the expected results as observed with leaching predictions carried out in other previous research or regulatory investigations and as monitored in a number of field leaching studies.

In response to the Committee's concerns Rhône-Poulenc submitted an additional document [8] explaining the difference between the predictions of PRZM and PESTLA. Despite both models, using the same scenario, model users input distinctly different parameters for

climatological data, soil properties and the degradation behaviour of aldicarb. Rhône-Poulenc claims that the differences were due to choice of parameters not the choice of model.

Table 2, page 8 of the Rhône-Poulenc report summarises the results of the PRZM simulations. The Committee notes that scenarios 5 and 11 are identical except for the climatological parameters. Maximum annual average leachate concentrations are 8.5 and 0.03 µg/l respectively. This indicates the sensitivity of the model to rainfall since the weather conditions between the two climatic scenarios are not particularly different (860mm annual average for scenario 5 and >675mm annual average for scenario 11). The committee also notes that the sensitivity of PRZM and PESTLA to soil texture differs significantly. Scenarios 1 and 3 or 2 and 4 are identical except for changes in soil texture, yet the prediction of maximum annual average leachate concentration varies by factors of approximately 20 and 80 respectively. Predictions with PESTLA show that the equivalent variation is a factor of approximately 1.5. This indicates that PRZM is more sensitive to changes in soil texture than PESTLA.

The modelling predictions used by Rhône-Poulenc are the foundation of the argument presented that aldicarb can be used in certain scenarios without risk of groundwater contamination. However the Committee has identified that the magnitude of the uncertainty associated with the use of predictive models from this active substance is too large. The view of the Committee is supported by leaching data from existing lysimeter and field studies

The Committee acknowledges that aldicarb and its metabolites have previously been detected in groundwater and wishes to confirm that certain use scenarios are recognised to be more vulnerable than others, for example, sandy soils with shallow groundwater levels, pH below 6.5, organic matter in the plough layer below 5% and with a temperate climate. This type of scenario is clearly not acceptable for the future use of aldicarb.

Conclusion

The Committee cannot reconcile the differences between leaching prediction and field monitoring results. However, based on expert judgement and evidence from existing data, the Committee believes that use scenarios will exist where there will be an acceptable risk to groundwater. These might include soils with high organic matter or where the water table is at sufficient depth to allow degradation of residues in the subsoil.

Nevertheless, the Committee could not identify whether any of the current GAPs would represent an acceptable risk to groundwater. The proposed GAPs are crop specific but the crops listed can be grown on a wide range of soil types and in different climatic situations. Whilst good spatial data on soil and climatic variability and aquifer vulnerability are available in some countries the level of detail at the EU scale is insufficient to provide consistent unequivocal advice concerning leaching risk.

Question 3

Operator Exposure

Can it be established that, pending the generation, submission and evaluation of additional operator exposure data, the continued use of aldicarb in accordance with current GAP, would not be prejudicial to operators?

Answer

When addressing questions related to operator exposure, the SCP notes that uniform and scientifically agreed set of criteria and procedures for the risk assessment of operators, bystanders and agricultural workers are not yet available in the European Union. Therefore, the SCP has decided to make case-by-case evaluations of the plant protection product, accepting the various procedures adopted by the different evaluation groups as long as they do not show major conflicts with the generally acceptable scientific criteria for health risk assessment.

The data available for aldicarb at present are **not** adequate to allow a comprehensive health risk assessment to be made for operator exposure.

While the available toxicological information supports the setting of a AOEL value of 0.0025 mg/Kg bw (based on a NOEL from human volunteer study with an assessment factor (A.F) of 10), exposure predictions for the various scenarios of use are uncertain, pending the submission of specific field studies conducted under relevant conditions.

Due to the particular mode of application of this plant protection product, specific information is needed on external exposure for the various techniques of application used in the EC Member States and the effectiveness of protection provided by the recommended personal protection devices.

In conclusion, there is not at present sufficient information on exposure to make a scientifically sound and documented health risk assessment about the use of aldicarb in accordance with current GAPs.

ANNEX

PROBABILISTIC MODELLING FOR THE ESTIMATION OF THE DIETARY INTAKE OF PESTICIDE RESIDUES

Introduction

Estimates of dietary intake are calculated both nationally and internationally, in accordance with WHO guidelines [9] by multiplying the pesticide residue concentration in the food by the consumption value for each food commodity and then summing the dietary intakes, as given by:

Dietary Intake = S **Food Chemical Concentration x Consumption**

Consumer Bodyweight

The estimated dietary intake is then compared to the corresponding pesticide's Acceptable Daily Intake (ADI) or Acute Reference Dose (ARfD) in order to determine whether the consumer risk is acceptable.

Point estimates

Dietary intake estimates of pesticide residues have historically been "point estimates" where a single high residue concentration has been multiplied by a single consumption value for each food commodity and divided by a single consumer bodyweight value. Thus a single value for the estimation of dietary intake is derived. This "point estimate" methodology has proved extremely useful since the estimates are simple to make and relatively easy to understand. With this methodology, several worst case assumptions are usually incorporated in order to ensure that the consumer is adequately protected.

However, in reality residue concentrations are not single values since a distribution of values normally result from the registered use pattern of the pesticide? Similarly, the consumption of a food within the population is not a single value and consumption values actually range from those consumers who never eat the food to those that eat large amounts. Consumers also come in a large range of bodyweights.

Probabilistic modelling

taken into account and a dietary intake distribution produced gives both the likelihood and the magnitude of dietary intake levels. This dietary intake distribution is then compared with the ADI or ARfD in order decide whether the consumer risk from these residues is acceptable.

Probabilistic modelling, which is also commonly referred to as Monte Carlo analysis, is particularly useful in acute dietary intake estimates in that probability of a consumer eating more than one food each containing high pesticide residues during one meal or one day can be assessed. This contrasts with "point estimates" of acute dietary intake where it is only possible to consider one food at a time. Several commercially available software packages are now available which allow sophisticated probabilistic assessments to be carried. However, detailed residue and consumption data are required in order to utilise the full potential of this technique. Nevertheless, a joint FAO/WHO expert consultation [10] recognised that probabilistic modelling was a useful technique and recommended that it be considered for use in performing acute dietary intake estimates of pesticide residues.

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Environmental: Professor A Hardy (Chairperson), and Committee Members Dr H.G. Nolting and Professor A. Silva Fernandes and invited experts Professor V. Forbes and Drs J. Boesten, A. Carter

References

1 WHO 1997, Food consumption and exposure assessment of chemical, Report of the FAO/WHO Consultation, Geneva 1997. WHO/FSF/97.5

2 Report of the Scientific Committee for Pesticides on the toxicity of aldicarb, Addendum - Residue intake resulting from consumption of potatoes and bananas. DOC 8572/VI/95

3 WHO 1992, Pesticide residues in food, Toxicology Evaluations, Joint Meeting of the FAO Panel of experts on Pesticide residues in Food and the Environment and the WHO Expert Group on Pesticide Residues, Rome, 1992

4 WHO 1995, Report on the Joint Meeting of the FAO Panel of Experts on Pesticide Residues in Food and the Environment and the WHO Expert Group on Pesticide Residues, Geneva, 1995

5 Moser, V.C. Comparison of aldicarb and methamidophos neurotoxicity at different ages in the rat: Behavioural and biochemichal parameters. Submitted, 1998 to Toxicology and Applied Pharmacology (personal communication)

6 Durham, W.F. and Mitchell, C.T. (1987). Final Report: Health Effects Research for Youth in Agricultural Program. U.S. Environmental Protection Agency, Washington D.C.

7 Fisher, Dennis M. et al. The neuromuscular Pharmacology of Neostigmine in Infants and Children; Anesthesiology, 59: 220-225, 1983

8 Abt (Abt Associates Inc.) 1996. Regulatory "cluster analysis" of field corn pesticides. Vols I & II Report to EPA Office of Policy Analysis. EPA contract nos. 68-W1-0009, 68-D0-0020, 68-W4-0029

9 Dixon, K., S. Anderson and M. Hopper, 1997. An individual-based model of chlorpyrifos ingestion and mortality in avian species. Poster PWP058, SETAC Annual Meeting, San Francisco

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[1] National Estimated Daily Intake
[2] Supervised Trials Median Residue
[3] Acceptable Daily Intake
[4] No-observed-adverse-effect-level
[5] US Federal Insecticide, Fungicide, and Rodenticide Act
[6] US Environmental Protection Agency
[7] Monograph Annex B, section B 8.4 p. 253-255
[8] Mattaar 14 December 1998
[9] WHO 1997a. Guidelines for predicting dietary intake of pesticide residues, 2nd revised edition, GEMS/Food Document WHO/FSF/FOS/97.7, World Health Organisation, Geneva (1997)
[10] WHO 1997b. Food consumption and exposure assessment of chemicals. Report of a FAO/WHO Consultation. Geneva, Switzerland, 10-14 February 1997. World Health Organisation.