

EUROPEAN COMMISSION
HEALTH & CONSUMER PROTECTION DIRECTORATE-GENERAL

Directorate D - Food Safety: Production and distribution chain
Unit D.3 - Chemicals, contaminants and pesticides

Chlorpyrifos

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FINAL

Review report for the active substance **chlorpyrifos**

Finalised in the Standing Committee on the Food Chain and Animal Health at its meeting on
3 June 2005

in view of the inclusion of chlorpyrifos in Annex I of Directive 91/414/EEC

1. Procedure followed for the re-evaluation process

This review report has been established as a result of the re-evaluation of chlorpyrifos, made in the context of the work programme for review of existing active substances provided for in Article 8(2) of Directive 91/414/EEC concerning the placing of plant protection products on the market, with a view to the possible inclusion of this substance in Annex I to the Directive.

Commission Regulation (EEC) No 3600/92⁽¹⁾ laying down the detailed rules for the implementation of the first stage of the programme of work referred to in Article 8(2) of Council Directive 91/414/EEC, as last amended by Regulation (EC) No 2266/2000⁽²⁾, has laid down the detailed rules on the procedure according to which the re-evaluation has to be carried out. Chlorpyrifos is one of the 90 existing active substances covered by this Regulation.

In accordance with the provisions of Article 4 of Regulation (EEC) No 3600/92, Indofil Chemicals Co on 12 July 1993, United Phosphorus Ltd on 26 July 1993, DowElanco Europe on 15 July 1993, Marubeni UK plc on 23 July 1993, Gharda Chemicals Ltd on 19 July 1993, Cequisa on 23 July 1993, Markhteshim Agan on 20 July 1993, Barclay Chemicals on 25 July 2003, Chimac-Agriphar SA on 27 July 1993, ACI International on 30 July 1993, Iberotam on 26 July 1993, AgriChem on 15 July 1993, Portman Agrochemicals on 26 July 1993, Helm AG on 23 July 1993, Calliope SA on 21 July 1993, Industrias Afrasa on 27 July 1993, Ellagret SA on 29 July 1993, B.V. Luxan on 21 July 1993, Cheminova Agro A/S on 28 July

¹ OJ No L 366, 15.12.1992, p.10.

² OJ No L 259, 13.10.2000, p.27.

1993, and Sanachem GmbH on 4 May 1995 notified to the Commission of their wish to secure the inclusion of the active substance chlorpyrifos in Annex I to the Directive.

In accordance with the provisions of Article 5 of Regulation (EEC) No 3600/92, the Commission, by its Regulation (EEC) No 933/94⁽³⁾, as last amended by Regulation (EC) No 2230/95⁽⁴⁾, designated Spain as rapporteur Member State to carry out the assessment of chlorpyrifos on the basis of the dossiers submitted by the notifiers. In the same Regulation, the Commission specified furthermore the deadline for the notifiers with regard to the submission to the rapporteur Member States of the dossiers required under Article 6(2) of Regulation (EEC) No 3600/92, as well as for other parties with regard to further technical and scientific information; for chlorpyrifos this deadline was 31 October 1995 and 30 April 1996 for notifiers established in Austria.

DowElanco Europe on behalf of the chlorpyrifos task force (comprising DowElanco Europe and Maktheshim Agan), Industrias Afrasa (that transferred the notifier's rights and obligations to Sinon EU Corporation), Portman Agrochemicals Ltd., Cequisa., Gharda Chemicals Ltd. submitted each in time a dossier to the rapporteur Member State. However, according to the Spanish Regulation (Article 4 of Orden del Ministerio de la Presidencia de 28 de Marzo de 1996 – BOE 3.04.96) Portman Agrochemicals Ltd., as notifier of the active substance chlorpyrifos should have paid the fees for doing the assessment of its dossier, as Portman Agrochemicals Ltd. did not pay these fees, Portman Agrochemicals Ltd. must not be considered as notifier for the inclusion of the active substance chlorpyrifos in Annex I to the Directive.

DowElanco Europe on behalf of the chlorpyrifos task force (comprising DowElanco Europe and Maktheshim Agan), submitted a dossier to the rapporteur Member State which did not contain substantial data gaps, taking into account the supported uses. Therefore, DowElanco Europe being the designated representative of the chlorpyrifos task force, was considered to be the main data submitter.

In accordance with the provisions of Article 7(1) of Regulation (EEC) No 3600/92, Spain submitted on 07 May 1999 to the Commission the report of its examination, hereafter referred to as the draft assessment report, including, as required, a recommendation concerning the possible inclusion of chlorpyrifos in Annex I to the Directive. Moreover, in accordance with the same provisions, the Commission and the Member States received also the summary dossier on chlorpyrifos from DowElanco Europe being the designated representative of the chlorpyrifos task force, on 06 July 1999.

In accordance with the provisions of Article 7(3) of Regulation (EEC) No 3600/92, the Commission forwarded for consultation the draft assessment report to all the Member States on 30 August 1999 as well as to DowElanco Europe being the designated representative of the chlorpyrifos task force on 08 September 1999.

The Commission organised an intensive consultation of technical experts from a certain number of Member States, to review the draft assessment report and the comments received thereon (peer review), in particular on each of the following disciplines:

- identity and physical /chemical properties ;

³ OJ No L 107, 28.04.1994, p.8.

⁴ OJ No L 225, 22.09.1995, p.1.

- fate and behaviour in the environment ;
- ecotoxicology ;
- mammalian toxicology ;
- residues and analytical methods ;
- regulatory questions.

The meetings for this consultation were organised on behalf of the Commission by the Biologische Bundesanstalt für Land und Forstwirtschaft (BBA) in Braunschweig, Germany, from November 1999 to July 2000.

The report of the peer review (i.e. full report) was circulated, for further consultation, to Member States and the main data submitter on 15 June 2001 for comments and further clarification.

In accordance with the provisions of Article 6(4) of Directive 91/414/EEC concerning consultation in the light of a possible unfavourable decision for the active substance the Commission organised the first tripartite meeting with the main data submitter and the rapporteur Member State for this active substance on 23 October 2000.

According to the Decision 2001/134/CE⁵, the Commission specified the deadline for the notifiers with regard to the submission to the rapporteur Member States of the additional data with regard to further technical and scientific information; for chlorpyrifos this deadline was 30 April 2002.

The Commission organised a second intensive consultation of technical experts from a certain number of Member States, to review the draft assessment report and the assessment of the additional data submitted before the deadline and the comments received thereon (peer review), in particular on each of the following disciplines:

- identity and physical /chemical properties ;
- fate and behaviour in the environment ;
- ecotoxicology ;
- mammalian toxicology ;
- residues and analytical methods ;
- regulatory questions.

The meetings for this consultation were organised on behalf of the Commission by the Biologische Bundesanstalt für Land und Forstwirtschaft (BBA) in Braunschweig, Germany, from November 2002 to July 2003.

In accordance with the provisions of Article 6(4) of Directive 91/414/EEC concerning consultation in the light of a possible unfavourable decision for the active substance the Commission organised the second tripartite meeting with the main data submitter and the rapporteur Member State for this active substance on 03 February 2004.

In accordance with the provisions of Article 7(3) of Regulation (EEC) No 3600/92, the dossier, the draft assessment report, the peer review report (i.e. full report) and the comments and clarifications on the remaining issues, received after the peer review were referred to the **Standing Committee on the Food Chain and Animal Health**, and specialised working

⁵ OJ No L49, 20.2.2001, p13.

groups of this Committee, for final examination, with participation of experts from all Member States. This final examination took place from July 2003 to November 2004, and was finalised in the meeting of the **Standing Committee** on **3 June 2005**.

The review did not reveal any open questions or concerns which would have required a consultation of the Scientific Committee on Plants.

The present review report contains the conclusions of the final examination; given the importance of the draft assessment report, the peer review report (i.e. full report) and the comments and clarifications submitted after the peer review as basic information for the final examination process, these documents are considered respectively as background documents A, B and C to this review report and are part of it.

2. Purposes of this review report

This review report, including the background documents and appendices thereto, has been developed and finalised in support of the Directive 2005/72/EC⁶ concerning the inclusion of chlorpyrifos in Annex I to Directive 91/414/EEC, and to assist the Member States in decisions on individual plant protection products containing chlorpyrifos they have to take in accordance with the provisions of that Directive, and in particular the provisions of article 4(1) and the uniform principles laid down in Annex VI.

This review report provides also for the evaluation required under Section A.2.(b) of the above mentioned uniform principles, as well as under several specific sections of part B of these principles. In these sections it is provided that Member States, in evaluating applications and granting authorisations, shall take into account the information concerning the active substance in Annex II of the directive, submitted for the purpose of inclusion of the active substance in Annex I, as well as the result of the evaluation of those data.

In accordance with the provisions of Article 7(6) of Regulation (EEC) No 3600/92, Member States will keep available or make available this review report for consultation by any interested parties or will make it available to them on their specific request. Moreover the Commission will send a copy of this review report (not including the background documents) to all operators having notified for this active substance under Article 4(1) of this Regulation.

The information in this review report is, at least partly, based on information which is confidential and/or protected under the provisions of Directive 91/414/EEC. It is therefore recommended that this review report would not be accepted to support any registration outside the context of Directive 91/414/EEC, e.g. in third countries, for which the applicant has not demonstrated to have regulatory access to the information on which this review report is based.

3. Overall conclusion in the context of Directive 91/414/EEC

The overall conclusion from the evaluation is that it may be expected that plant protection products containing chlorpyrifos will fulfil the safety requirements laid down in Article 5(1)(a) and (b) of Directive 91/414/EEC. This conclusion is however subject to compliance

with the particular requirements in sections 4, 5, 6 and 7 of this report, as well as to the implementation of the provisions of Article 4(1) and the uniform principles laid down in Annex VI of Directive 91/414/EEC, for each chlorpyrifos containing plant protection product for which Member States will grant or review the authorisation.

Furthermore, these conclusions were reached within the framework of the uses which were proposed and supported by the main data submitter and mentioned in the list of uses supported by available data (attached as Appendix IV to this Review Report).

Extension of the use pattern beyond those described above will require an evaluation at Member State level in order to establish whether the proposed extensions of use can satisfy the requirements of Article 4(1) and of the uniform principles laid down in Annex VI of Directive 91/414/EEC.

With particular regard to residues, the review has established that the residues arising from the proposed uses, consequent on application consistent with good plant protection practice, have no harmful effects on human or animal health. The Theoretical Maximum Daily Intake (TMDI; excluding water and products of animal origin) for a 60 kg adult is 3.98 % of the Acceptable Daily Intake (ADI), based on the FAO/WHO European Diet (August 1994). This TMDI covers only grape as supported use and the residue definition that was considered to perform the risk assessment for consumers was Chlorpyrifos + TCP + conjugates expressed as chlorpyrifos. Estimates of acute dietary exposure of adults and toddlers in grape do not exceed the Acute Reference Dose (ARfD).

The review has identified several acceptable exposure scenarios for operators, workers and bystanders, which require however to be confirmed for each plant protection product in accordance with the relevant sections of the above mentioned uniform principles.

The review has also concluded that under the proposed and supported conditions of use there are no unacceptable effects on the environment, as provided for in Article 4 (1) (b) (iv) and (v) of Directive 91/414/EEC, provided that certain conditions are taken into account as detailed in section 6 of this report.

4. Identity and Physical/chemical properties

The main identity and the physical/chemical properties of chlorpyrifos are given in Appendix I.

The active substance shall comply with the FAO specification and there seem not to be reasons for deviating from that specification; the FAO specification is given in Appendix I of this report.

The review has established that for the active substance notified by the main data submitter chlorpyrifos task force (comprising DowElanco Europe and Maktheshim Agan), the impurity O,O,O',O'- tetraethyl dithiopyrophosphate (Sulfotep) was considered, on the basis of information currently available, of toxicological or environmental concern and a maximum level of 3.0 g/kg was established in the technical specifications of chlorpyrifos. This level comply with FAO specification.

In accordance with the provisions of Article 13(5) of Directive 91/414/EEC, Spain is not satisfied, on the basis of the information currently available, that the substances notified by the other data submitters [Maktheshim Agan, Sinon EU Corporation, Cequisa, Gharda Chemicals Ltd] do not, in the meaning of Article 13(2) and (5) of the Directive, differ significantly in degree of purity and nature of impurities from the composition registered in the dossier submitted by the main data submitter.

5. Endpoints and related information

In order to facilitate Member States, in granting or reviewing authorisations, to apply adequately the provisions of Article 4(1) of Directive 91/414/EEC and the uniform principles laid down in Annex VI of that Directive, the most important endpoints were identified during the re-evaluation process. These endpoints are listed in Appendix II.

6. Particular conditions to be taken into account on short term basis by Member States in relation to the granting of authorisations of plant protection products containing chlorpyrifos

On the basis of the proposed and supported uses (as listed in Appendix IV), the following particular issues have been identified as requiring particular and short term attention from all Member States, in the framework of any authorisations to be granted, varied or withdrawn, as appropriate:

- Member States must pay particular attention to the protection of birds and mammals, aquatic organisms, bees and non-target arthropods and must ensure that the conditions of authorisation include, where appropriate, risk mitigation measures.

7. List of studies to be generated

Member States shall request the submission of further studies to confirm the risk assessment for birds and mammals.

They shall ensure that the notifiers at whose request chlorpyrifos has been included in Annex I of Council Directive 91/414/EEC provide such studies to the Commission within 2 years from the entry into force of the Directive of inclusion.

Some other endpoints however may require the generation or submission of additional studies to be submitted to the Member States in order to ensure authorisations for use under certain conditions.

This may particularly be the case for additional studies on non-target arthropods for uses other than those supported.

8. Information on studies with claimed data protection

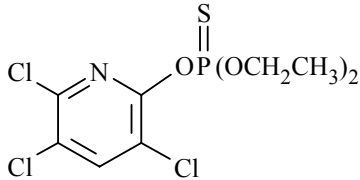
For information of any interested parties, Appendix III gives information about the studies for which the main data submitter has claimed data protection and which during the re-evaluation process were considered as essential with a view to Annex I inclusion. This information is

only given to facilitate the operation of the provisions of Article 13 of Directive 91/414/EEC in the Member States. It is based on the best information available to the Commission services at the time this review report was prepared; but it does not prejudice any rights or obligations of Member States or operators with regard to its uses in the implementation of the provisions of Article 13 of the Directive 91/414/EEC neither does it commit the Commission.

9. Updating of this review report

The technical information in this report may require to be updated from time to time in order to take account of technical and scientific developments as well as of the results of the examination of any information referred to the Commission in the framework of Articles 7, 10 or 11 of Directive 91/414/EEC. Such adaptations will be examined and finalised in the **Standing Committee on the Food Chain and Animal Health**, in connection with any amendment of the inclusion conditions for chlorpyrifos in Annex I of the Directive.

APPENDIX I**Identity, physical and chemical properties****CHLORPYRIFOS**

Common name (ISO)	CHLORPYRIFOS
Chemical name (IUPAC)	O,O-diethyl-O-3,5,6-trichloro-2-pyridyl phosphorothioate
Chemical name (CA)	O,O-diethyl-O-(3,5,6-trichloro-2-pyridinyl) phosphorothioate
CIPAC No	221
CAS No	2921-88-2
EEC No	EINECS: 2208644 EEC: 015-084-00-4
FAO SPECIFICATION	FAO/WHO Specification 221/TC (October 2004)
Minimum purity (g/kg)	970
Identity of relevant impurities (of toxicological, environmental and/or other significance) in the active substance as manufactured (g/kg)	O,O,O',O'- tetraethyl dithiopyrophosphate < 3.0g/kg (Sulfotep) Acetone insolubles < 5.0 g/kg
Molecular formula	C ₉ H ₁₁ Cl ₃ NO ₃ PS
Molecular mass	350.6
Structural formula	

Melting point	41-42 °C 97-99 %
Boiling point	Decomposes before boiling. Thermal decomposition 170-180 °C
Appearance	Tan, crystalline solid. Munsell colour notation 2.5Y 7/4 (94%) Mild mercaptan odour 99.6 %
Relative density	1.51 (98.1 %)
Vapour pressure	3.35·10 ⁻³ Pa at 25° C (99.8 %) 1.43 10 ⁻³ Pa at 20°C (99.8%)
Henry's law constant	0.478 Pa x m ³ x mol ⁻¹
Solubility in water	1.05 mg/l at 20° C in unbuffered solution. No pH dependency reported.
Solubility in organic solvents	Hexane 774 g / l (99.9 %) 20° C Toluene: >4000 g/l (99.9 %) 20° C Dichloromethane: >4000 g/l (99.9 %) 20° C Methanol: 290 g / l (99.9 %) 20° C Acetone: >4000 g/l (99.9 %) 20° C Ethyl acetate: >4000 g/l (99.9 %) 20° C
Partition co-efficient (log P_{ow})	log P _{ow} = 4.7 (20° C, neutral pH)
Hydrolytic stability (DT₅₀)	pH ≤ 7: 72 d (25° C) pH 9: 16 d (25° C)
Dissociation constant	Chlorpyrifos does not contain ionizable protons
Quantum yield of direct photo-transformation in water at λ >290 nm	0.0063
Flammability	Not flammable. Auto ignition 258 ± 5 °C
Explosive properties	Non explosive
UV/VIS absorption (max.)	No absorption maximum above 290 nm but there is significant absorption (ε > 10). λ _{max} = 202.7 nm, 230nm and 283.4 nm
Photostability in water (DT₅₀)	39.9 days (natural river water under natural sunlight) 29.6 days (pH 7, natural sunlight)

APPENDIX II

END POINTS AND RELATED INFORMATION

CHLORPYRIFOS

1 Toxicology and metabolism

Absorption, distribution, excretion and metabolism in mammals

Rate and extent of absorption:	Rapid (84%-93%) rats, based on urinary excretion
Distribution:	Widely distributed.
Potential for accumulation:	Low potential for accumulation
Rate and extent of excretion:	Nearly completely, excreted within 48 hours, mainly via urine (approx. 80%)
Toxicologically significant compounds:	Parent compound and chlorpyrifos oxon
Metabolism in animals:	Moderately-extensively. Steps: oxidation and hydrolysis

Acute toxicity

Rat LD ₅₀ oral:	66-195 mg/kg bw (T-R25)
Rat LD ₅₀ dermal:	1250-2000 mg/kg bw (Xn-R21)
Rat LC ₅₀ inhalation:	> 1.0 mg/l (whole-body)
Skin irritation:	Non-irritant
Eye irritation:	Non-irritant
Skin sensitization (test method used and result):	Non-sensitiser (M&K and Buehler tests)

Short term toxicity

Target / critical effect:	Nervous system / Inhibition of Acetyl-cholinesterase
Lowest relevant oral NOAEL / NOEL:	1 mg/kg bw/day; 90-day rats, mice and dogs (JMPR criteria)
Lowest relevant dermal NOAEL / NOEL:	> 5mg/kg bw/day; 21-days rats
Lowest relevant inhalation NOAEL / NOEL:	>0.296x10 ⁻³ mg/l (nose-only)

Genotoxicity

No genotoxic potential

Long term toxicity and carcinogenicity

Target / critical effect:	Nervous system/ Acetyl cholinesterase inhibition
Lowest relevant NOAEL:	1 mg/kg bw/day: 2-years rats, mice, dogs (JMPR criteria)
Carcinogenicity:	No carcinogenic potential

Reproductive toxicity

Target / critical effect - Reproduction:	Decreased bw and survival of pups at parental toxic doses.
Lowest relevant reproductive NOAEL / NOEL:	1 mg/kg bw/day , rats
Target / critical effect - Developmental toxicity:	Increase embryofetotoxicity (increased post-implantation loss at maternal toxic doses)
Lowest relevant developmental NOAEL / NOEL:	2.5 mg/kg bw/day, rats

Delayed neurotoxicity

No evidence of delayed neurotoxicity (13-weeks, hens) NOAEL= 10 mg/kg bw/day (13-weeks, rats)

Other toxicological studies

Acute oral toxicity of chlorpyrifos oxon: DL₅₀= 100-300 mg/kg bw/day (male and female, respectively)

Acute oral study in humans: LOAEL = 2 mg/kg bw/day based on RBC acetyl cholinesterase inhibition.(Kisicki, 1999). NOAEL=1.0 mg/kg bw/day

Subacute oral study in humans (males): LOAEL= 0.5 mg/kg bw/day based on clinical symptoms.

6.week-dietary study in dogs: peripheral tissue AchE inhibition NOAEL = 1 mg/kg bw/day; brain AchE inhibition NOAEL = 2 mg/kg bw/day; RBC AchE inhibition NOAEL < 0.5 mg/kg bw/day.

Medical data

No neurotoxic effects in manufacturing plant personnel reported. Evidence of polyneuropathy from acute poisonings.
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Summary

	Value	Study	Safety factor
ADI:	0.01 mg/kg bw/day	2-years rats, mice and dogs	100
AOEL systemic:	0.01 mg/kg bw/day	90-day rats, mice and dogs	100
AOEL inhalation:	Not required		
AOEL dermal:	Not required		
ARfD (acute reference dose):	0.1 mg/kg bw/day	Acute and delayed neurotoxicity studies in rats	100

Dermal absorption

1% based on human study

2 Fate and behaviour in the environment

2.1 Fate and behaviour in soil

Route of degradation

Aerobic:

Mineralization after 100 days:

Up to 82%AR in 120 days (5 to 50% in other studies)

Non-extractable residues after 100 days:

4% AR (up to 25% in other studies)

Major metabolites above 10 % of applied active substance: name and/or code % of applied rate (range and maximum)

3,5,6-trichloro-2-pyridinol (TCP or pyridinol)
30%-38% AR at 14-360 d (2 EU, 5 US soils, 25°C)
(up to 100% in other studies)

Supplemental studies

Anaerobic:

Similar to aerobic but with accumulation of TCP (more than 90% AR after 270 days)

Soil photolysis:

Rapid degradation to TCP (DT₅₀= 30 hours natural sunlight) which is further degraded (DT₅₀=17.7 days)

Remarks:

None

Rate of degradation

Laboratory studies

DT_{50lab} (20 °C, aerobic):

Chlorpyrifos

DT_{50lab} (25°C, aerobic):11-141 days, n=11
(additional studies suggest a range of 3.8 to 146 days)

DT_{50lab} (20°C, aerobic):43-111 days (EU soils n= 4). Mean DT50 of 74 days.

TCP

DT_{50lab} (20°C, aerobic): 10-67 days (EU soils n= 4)

DT_{90lab} (20 °C, aerobic):

Chlorpyrifos

DT_{90lab} (20°C, aerobic): 141-360 days (EU soils

DT_{50lab} (10 °C, aerobic):

n= 4) <u>TCP</u> DT _{90lab} (20°C, aerobic):35-221 days (EU soils n= 4)
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DT_{50lab} (20 °C, anaerobic):

<u>Chlorpyrifos</u> DT _{50lab} (10°C, aerobic,): 80 days (EU soil) DT _{90lab} (10°C, aerobic,): 265 days (EU soil) <u>TCP</u> DT _{50lab} (10°C, aerobic,): 129 days (EU soil) DT _{90lab} (10°C, aerobic,): 426 days (EU soil)
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Field studies (country or region)DT_{50f} & DT_{90f} from soil dissipation studies:

<u>Chlorpyrifos</u> DT _{50lab} (20°C, anaerobic): 39 days, n=1 (aerobic DT50 under similar conditions 11 days) <u>TCP</u> No data submitted

DT _{50f} : Europe: Germany: DT _{50f} =13-22d; DT _{90f} =148-248d (n=2; 1 st order r ² =0.91-0.88) Germany: DT _{50f} =10-19d; DT _{90f} =97-112d (n=2; 1,5 order; root 1 st order ;r ² =0.94-0.72) UK: DT _{50f} = 23-65d(n=2 Square root 1.5; square root 2.0) DT _{50f} = 8; DT _{90f} =26d (n=1 1 st order; r ² =0.96) France (N): DT _{50f} =11d; DT _{90f} =37d (n=1 1 st order; r ² =0.852) Greece: DT _{50f} = 34d; DT _{90f} =113d (n=1 1 st order; r ² =0.91) Spain: DT _{50f} = 2d; DT _{90f} =8d (n=1 1 st order; r ² =0.97)

North America range 1-77 (one single case of 77 days (n>10) (Reported range in literature 1.3-120 days).

TCP (following chlorpyrifos application)

France (N):DT _{50f} =8 DT _{90f} =8d (n=1;1 st order; r ² =0.889) Spain : DT _{50f} =96 DT _{90f} =319d (n=1 1 st order; r ² =0.99)

Soil accumulation studies:

No potential for accumulation (DT _{90f} < 1 y)

Soil residue studies:

No relevant

Remarks:

e.g. effect of soil pH on degradation rate

DT_{50 f} proposed by the rapporteur of 14 days.

Adsorption/desorptionK_f / K_{oc}:K_d:

pH dependence:

ChlorpyrifosK_{oc}

2785-31000; n=14 mean = 8151.31

K_d

22.76-295 mean = 299.84

Ph dependence

No

TCPK_{oc} 77-242, n=4 ;mean=148.5K_d 0.53-1.95; n=4 mean=3.77K_{oc} 67.2-315 n=5; mean =174K_d= 1.21-13.6 n=5 mean= 4.55

No pH dependence

TMPK_{oc} 565-1308 n=5 mean=888K_d 7.70-39.4 n=5 mean=20.1**Mobility****Laboratory studies:**

Column leaching:

Aged residue leaching:

0.7% AR in leachate (no characterised)

5% AR in leachate, distributed as follows: 1.7%AR
CO₂, 1.9%AR non-extractable residues, 9%
unknown polar metabolite.Neither chlorpyrifos nor TCP were detected in
leachate**Field studies:**

Lysimeter/Field leaching studies:

Studies included in a published review (original
studies not submitted) showed no leaching
potential of chlorpyrifos or metabolite TCP**Remarks:**

None

2.2 Fate and behaviour in water

Abiotic degradation

Hydrolytic degradation:

pH 4.7-5 25°C: 63-73 days

pH 6.9-7 25°C: 16-35 days

pH 8.1 25°C: 23 days

Major metabolites:

TCP and O-ethyl-O-(3,5,6-trichloro-2-pyridyl) phosphorothioic acid ("phosphorothioate") both >10% AR

Photolytic degradation:

From quantum yield of 0.0063, photolysis half-life values as a function of latitude and season were determined (DT₅₀: 15 d (mid-summer 20°N), 30 d (mid-summer 40°N) or 29200 d (mid-winter 60°N))

Major metabolites:

unknown

Biological degradation

Readily biodegradable:

No

Water/sediment study:

3-6 days (1-15 days in other studies)

DT₅₀ water:

9-21 days

DT₉₀ water:

22-51 days

DT₅₀ whole system:

72-168 days

DT₉₀ whole system:

Distribution in water / sediment systems (active substance)

Water layer 40-60% AR after 6 hours, 13-29% after 7 days.

After 100 days, chlorpyrifos residue was 3-26% in sediments

Distribution in water / sediment systems (metabolites)

TCP represented up to 10% of the AR from day 7 to the end of the study with same variations, mainly associated to the sediment.

Accumulation in water and/or sediment:

No

Degradation in the saturated zone No data submitted

Remarks:

None

2.3 Fate and behaviour in air

Volatility

Vapour pressure:

3.35 10⁻³ Pa at 25° C (99.8 %)1.43 10⁻³ Pa at 20°C (99.8%)

Henry's law constant:

0.478 Pa x m³ x mol⁻¹

Photolytic degradation

Direct photolysis in air:

1-2.6 days

Photochemical oxidative degradation in air

Atkinson calculation DT₅₀. 1.4 hoursDT₅₀:

Atmospheric Oxidation Program DT50 1.4 hours (chlorpyrifos), and 60.5 days (TCP)

Volatilisation:

from plant surfaces: 79-81% in 24 hours

from soil: 22-26 % in 24 hours

Remarks:

None

Monitoring data

Soil

Several studies suggest no accumulation of soil residues due to continuous use

Surface Water

Valencia (Spain)

	Mean µg/L	Media µg/L	50 th percentile µg/L	90 th percentile µg/L
Clot	0.012	0.0085	0.0100	0.0284
Irrig channels	0.1347	0.0085	0.0169	0.1597
All data	0.0643	0.0085	0.0128	0.0852

Italy:

Chlorpyrifos (90th percentile exposure)

Regional/catchment scale:

Surface water <0.05 µg/L

Sediment <0.01 mg/kg

Field scale:

Surface water (8 m from treated crop)

2000 0.120µg/L

2001 0.275µg/L

All data (2000–2001) 0.135µg/L

	Italy: Chlorpyrifos <u>Regional scale:</u> Surface water <0.05 µg/L Sediment <0.01 mg/kg <u>Catchment scale:</u> Surface water <0.05 µg/L Sediment 0.02 mg/kg
	Review of monitoring and occurrence of chlorpyrifos in groundwater and surface water in Europe. Wright, K. & Horth, H. (2002): The surface water 90th percentile concentration will clearly be significantly less than 0.5 µg/L.
Ground water	Several studies have been submitted. Chlorpyrifos has only been occasionally detected. Only in one study the concentration was higher than 0.1 µg/L (n=139)
Air	No data submitted

3 Ecotoxicology

Terrestrial Vertebrates

Acute toxicity to mammals:

Acute toxicity to birds:

Dietary toxicity to birds:

Reproductive toxicity to birds:

Short term oral toxicity to mammals:

Mouse (females) LD50= 64 mg/kg b.w.
Active substance: <i>Passer domesticus</i> 122 mg as/kg <i>Coturnix coturnix</i> LD50 = 13.3 mg/kg bw 95th percentile of the Species Sensitivity Distribution, 6.9 mg as/kg bw
Formulated: <i>Phasianus colchicus</i> LD50 =8.41 mg/kg b. w.
Mallard duck LC50= 203 ppm (a value of 180 was obtained in another study not fully validable)
Mallard duck NOEC = 25 ppm
Rat 2 generations NOAEL = 1 mg/kg bw/day

Aquatic Organisms

Acute toxicity fish:

Long term toxicity fish:

Bioaccumulation fish:

Acute toxicity invertebrate:

Chronic toxicity invertebrate:

Acute toxicity algae:

Microcosm or mesocosm tests

Test substance	Time-scale	Endpoint	Toxicity (mg/l)
technical	acute	96h LC50 (10 species) (5 species)	0.0013-520 0.00054-203
technical	chronic	35d NOEC ELS	0.00014
Metabolite TCP	chronic	31d NOEC	0.0808
No data	No data	No data	No data
formulated technical	acute	48h EC50	0.000014a.i. 0.0001
Technical	chronic	35 days NOEC M.bahia	0.0046
formulated		21 days NOEC D.magna	0.000056
Technical	Acute	72h EC50	1.2
formulated	chronic	NOEC NOEC	0.1-0.001 0.027-0.063
Several studies. Predicted No Effects Concentration or EAC of 0.1 µg /l.			

Bioconcentration factor (BCF)

1374

Clearance time (CT50)

2-3 days

Honeybees

Acute oral toxicity:

0.25 µg/bee

Acute contact toxicity:

0.059 µg/bee

Other arthropod species

Test species	Stage	Test Substance	Dose (kg as/ha)	Endpoint	Effect
<i>Aleochara bilineata</i>	adults	Dursban	960g ai/ha	parasitisms	100%
<i>Typhlodromus pyri</i>	protonymphs	EC formulation	576g ai/ha	Beneficial capacity	100%
<i>Aphidius rhopalosiphi</i>		EC formulation	576g ai/ha	Beneficial capacity	100%
<i>Poecilus cupreus</i>		EC formulation	576g ai/ha	Beneficial capacity	100%

Species tested / Stage	Dose (g as/ha)	Initial effects	Persistence	Notes
Laboratory tests				
<i>Typhlodromus pyri</i> protonymphs	Dose-response	LC ₅₀ 1986 ppm	-	Dip test
<i>Aphidius colemani</i> Adults	Dose-response	LC ₅₀ ca. 1 ppm Equivalent to 0.2 g as/ha	-	Glass plate
<i>Coccinella septempunctata</i> Larvae	Dose-response	LC ₅₀ 33.4 ppm Equivalent to 66.8 g as/ha	-	Glass plate
<i>Poecilus cupreus</i>	Dose-response	LC ₅₀ 224 ppm	-	Topical application
Extended laboratory				
<i>Typhlodromus pyri</i> Protonymphs	317 48	M = 0%, R = 0% M = 6%, R = 0%	-	Bean leaves
<i>Aphidius rhopalosiphi</i> Adults	317 48	M = 100% M = 100%	M = 0%, 7 days M = 2.9%, 7 days No effect on parasitism	Bean leaves
<i>Chrysoperla carnea</i> Larvae	317 48	M = 100% M = 89%	M = 21%, 7 days M = 1%, 7 days	Bean leaves

Species tested / Stage	Dose (g as/ha)	Initial effects	Persistence	Notes
			No effects on fecundity	
Chrysoperla carnea Larvae	1000 g as/hL	M = 100%	M = 0%, 14 days	Field aged residues in apple laboratory bioassay. 10x field conc. tested
Extended laboratory / semi-field				
<i>Aphidius colemani</i> (pupae within mummified aphids)	120 480	M = 17% M = 55%	-	Field aged residues in winter wheat laboratory bioassay
<i>Aphidius colemani</i> Adults	120 480	100% 100%	M = 0%, 8 days M = 10%, 14 days	Field aged residues in winter wheat laboratory bioassay
<i>Coccinella septempunctata</i>	120 480	M = 28% M = 98%	M = 13%, 2 days	Field aged residues in winter wheat laboratory bioassay
<i>Bembidion lampros</i> Adults On LUFA soil	0.12 0.48	M = 100% M = 100%	M = 15%, 5 days M = 70%, 9 days	Field aged soil in winter wheat laboratory bioassay
<i>Bembidion lampros</i> Adults On field soil	120 480	M = 100% M = 100%	M = 5%, 5 days M = 100%, 9 days	Field aged soil in winter wheat laboratory bioassay
<i>Pardosa</i> spp. Adults	120 480	M = 10% M = 55%	- M = 15%, 2 days	Field aged soil in winter wheat laboratory bioassay
Field studies				
Orchard test in France 1991 (J63).				
One summer application at 960 g as/ha, conducted to GLP. Initial reduction in				

Species tested / Stage	Dose (g as/ha)	Initial effects	Persistence	Notes
<p>abundance observed for <i>Heterotoma planicornis</i>, Heteroptera, hymenoptera, <i>Chilochorus bispustulatus</i>, Coccinellidae, <i>Forficula</i>, spiders and Diptera. Recovery observed for most taxa 11 to 25 days after treatment.</p> <p>Grassland test in UK 1992 (J78). One spring application 720 g as/ha, conducted to GLP. After application Staphylinidae and Carabidae species were initially reduced in numbers but showed signs of recovery within the first year. Collembola were strongly affected after application with numbers depressed throughout the year. Linyphiidae were initially affected after a spring applications, but rapidly recovered in the summer. Lycosidae were unaffected. By the spring of the following year all affected taxa had recovered.</p> <p>Vines field test in France 1996 non-GLP (Spinosad MJ27) A single late season application of chlorpyrifos at 336 g as/ha in vines caused a temporary reduction in mite numbers of 36% up to 9 days after application. By 38 days the population had recovered to levels similar to that of the control.</p>				

Earthworms

Acute toxicity:

14days LC50 =129 mg/kg Metabolite TCP 14 days LC50 =9.8 mg/kg Formulated product: 138 mg as/kg
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Reproductive toxicity:

56 days NOEC = 9.5 kg chlorpyrifos/ha (12.7 mg as/kg) Metabolite TCP 56-day NOEC 4.60 mg/kg dry soil

Soil micro-organisms

Nitrogen mineralization:

No significant effects at 4.8 kg a.i./ha
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Carbon mineralization:

No significant effects at 4.8 kg a.i./ha
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APPENDIX IIIA**CHLORPYRIFOS**

List of studies for which the main submitter has claimed data protection and which during the re-evaluation process were considered as essential for the evaluation with a view to Annex I inclusion.

B.1 Identity, B.2 Physical and chemical properties, B.3 Data on application and further information, B.4 Proposals for classification and labelling, B.5 Methods of analysis

Annex point/ reference number	Author(s)	Year	Title Source (where different from company) Company, Report No. GLP or GEP status (where relevant) Published or not	Reports⁷ on previous use in granting national authorizations
I/A, 2	Richardson, N.	1995	Chlorpyrifos (Technical): Determination of Physico-Chemical Properties DowElanco, Letcobe Regis, UK – A051; Report No.: GHE-P-4053 GLP. Unpublished	
I/A, 2	Richardson, N.	1995	Chlorpyrifos (Pure): Determination of Physico-Chemical Properties (A081) DowElanco, Letcobe Regis, UK – A081; Report No.: GHE-P-4458 GLP. Unpublished	
I/A, 2.1.1	Knowles, S.; Iosson, I.	1994	Chlorpyrifos: Generation of NMR and DSC DowElanco, Letcobe Regis, UK – A049; Report No.: GHE-P-3861; 93003/DC GLP. Unpublished	
I/A/2.1.1;2.7	Boothroyd, S.J.	1993	Determination of the Physico-chemical Properties of Chlorpyrifos (Pure), Batch AGR 267300 GHE-P-3312 (A45) GLP. Unpublished	
I/A/2.1.2	Huntley, K.	2000	Determination of Boiling Point for chlorpyrifos NAFST320 (A166) GLP. Unpublished	

⁷ Entries are based on information received from the Notifier(s) and in certain cases Member States. Neither the Commission nor the Member States are responsible for the completeness or validity of this information received.

Annex point/ reference number	Author(s)	Year	Title Source (where different from company) Company, Report No. GLP or GEP status (where relevant) Published or not	Reports⁷ on previous use in granting national authorizations
IIA/2.2; 2.13	Boothroyd, S.J.	1994	Determination of the Physico-chemical Properties of Chlorpyrifos (tech) Batch AGR 273801. GHE-P-3394 (A46) GLP. Unpublished	
IIA/2.3.1	Griffin, K.A.	2002	Vapour Pressure of chlorpyrifos by Knudsen-Effusion weight loss method DECO GL-AL MD-20001-003701 (A194) GLP. Unpublished	
IIA/2.3.2	Watson, P.A.	2002	Chlorpyrifos: Calculation of Henry's Law Constant (H) GHE-P-9747 (A196) Unpublished	
IIA/2.5	Boothroyd, S., Ghosh, D., Knowless, S.	1994	Chlorpyrifos (pure): Generation of Spectral Data (UV-VIS, IR, NMR, MS) GHE-P-3808 (A47) GLP. Unpublished	
IIA,2.5	Knowles, S.; Drossopoulos, M.	1998	Spectral characterisation of chlorpyrifos oxon (AGR203674) (A128) GHE-P-7359; Study No. P98-067 GLP. Unpublished	
IIA,2.5	Knowles, S.; Drossopoulos, M.	1998	Spectral characterisation of sulfotepp (TSN101227) (A129) GHE-P-7360; Study No. P98-068 GLP. Unpublished	
IIA, 2.5	Knowles, S.; Drossopoulos, M.	1998	Spectral characterisation of 2-pyridinol (AGO143197) GHE-P-7361; Study No. P98-069 GLP. Unpublished	
IIA/2.6	Busse, J.	2002	Determination of the Water Solubility of chlorpyrifos FOR01019 (A196) GLP. Unpublished	
IIA/2.7	Boothroyd, S.J.	1993	Determination of the Physico-chemical Properties of Chlorpyrifos (Pure), Batch AGR 267300 GHE-P-3312 (A45) GLP. Unpublished	
IIA/2.9.3; 7.2.1.2/02	Jackson, R.	1994	Calculation of the photochemical quantum yield for chlorpyrifos. GHE-P-3917 (K68) Not GLP. Unpublished	

Annex point/ reference number	Author(s)	Year	Title Source (where different from company) Company, Report No. GLP or GEP status (where relevant) Published or not	Reports⁷ on previous use in granting national authorizations
IIA/2.10	Day, S.R. , Rudel, H..	1993	The Persistence of Chlorpyrifos in Air and its Evaporation Behaviour from Soil and Leaf Surfaces following application of Dursban 480 (EF 1042) - Germany 1992. GHE-P-2966 (K60) GLP. Unpublished	
IIA/2.11	Huntley, K.	2000	Determination of Flammability of chlorpyrifos NAFST307 (A167) GLP. Unpublished	
IIA, 4.1	Nelson, R.M.	1996	Analytical method and validation for the determination of impurities in DURSBAN R, DURSBAN XP, DURSBAN FM, DURSBAN FE and LORSBAN F insecticidal chemicals by liquid chromatography (O080) DECO ML-AL 97-002210 GLP. Unpublished	
IIA,4.2.1/0 1	Portwood, D.E. and Williams, M.	1997	Independent validation of DowElanco method ACR 90.5 for the determination of residues of chlorpyrifos in apples by Gas Chromatography (ODR45A) GHE-P-5704 GLP. Unpublished	
IIA/4.2.1/0 2	Olberding, E., Arnold, B.H. and Lindsey, A.E.	2002	Determination of residues of chlorpyrifos in Agricultural Commodities by Gas Chromatography with Negative-Ion Chemical Ionization Mass spectrometry; GRM 02.03 GH-C 5424 (ODR070) Unpublished	
IIA/4.2.1/0 3	Clark, S. and Clark, K.	2002	Independent Laboratory Validation of Dow Agrosiences LLC Method GRM 02.03 - Determination of residues of chlorpyrifos in Agricultural Commodities by Gas Chromatography with Negative-Ion Chemical Ionization Mass spectrometry GH-C 5419 (ODR070A) GLP. Unpublished	
IIA, 4.2.2	Robb, C.K., Goodwin, P.A. and Ostrander, J.A.	1993	Determination of Chlorpyrifos in Soil by Gas Chromatography (ODR61) GRM 92.10.S1 Not GLP. Unpublished	

Annex point/ reference number	Author(s)	Year	Title Source (where different from company) Company, Report No. GLP or GEP status (where relevant) Published or not	Reports⁷ on previous use in granting national authorizations
IIA, 4.2.2	Dixon-White, H.E.	1994	Residue Analytical Method for the analysis of 3, 5, 6-trichloro-2-pyridinol in Soil – GRM92.12.R2, Determination of 3, 5, 6-trichloro-2-pyridinol in soil by gas chromatography/Mass Spectrometry (O13A) GH-C 2838 Not GLP. Unpublished	
IIA,4.2.3	Olberding, E.I.	1996	Determination of residues of Tricolpyr, 3, 5, 6-triclooro-2-pyridinol and 2-methoxy-3, 5, 6-trichloropyridine in water by capillary gas chromatography with mass selective detection (O34) Not GLP. Unpublished	
IIA, 4.2.4	Rawle, N.W.	1998	Determination of Chlorpyrifos in air (ODR13D) ERC 983.11 Not GLP. Unpublished	

B.6 Toxicology and metabolism

Annex point/ reference number	Author(s)	Year	Title Source (where different from company) Company, Report No. GLP or GEP status (where relevant) Published or not	Reports⁸ on previous use in granting national authorizations
IIA, 5.1	Mendrala, A.L. and Brzak, K.A.	1998	Chlorpyrifos: Part A – Concentration- time course of chlorpyrifos and chlorpyrifos-oxon in blood DECO HET T2.02-191-000-003A (G060) GLP. Unpublished	
IIA,5.2	Stebbins, KE	1996	DURSBAN F Insecticidal Chemical: Acute Oral toxicity study in Fischer rats B021 GLP No published	
IIA, 5.2	Stebbins, KE	1996	DURSBAN F Insecticidal Chemical: Acute Dermal toxicity study in New Zealand White rabbits B022 GLP No published	
IIA, 5.2	Stebbins, KE.	1996	DURSBAN F Insecticidal Chemical: Primary dermal irritation study in New Zealand White rabbits B023 GLP No published	
IIA,5.2	Stebbins, KE	1996	DURSBAN F Insecticidal Chemical: Primary eye irritation study in New Zealand White rabbits B024 GLP No published	
IIA, 5.2	Stebbins, KE	1996	DURSBAN F Insecticidal Chemical: Dermal sensitization study in Hartley Albino Guinea Pigs B025 GLP No Published	

⁸ Entries are based on information received from the Notifier(s) and in certain cases Member States. Neither the Commission nor the Member States are responsible for the completeness or validity of this information received.

Annex point/ reference number	Author(s)	Year	Title Source (where different from company) Company, Report No. GLP or GEP status (where relevant) Published or not	Reports⁸ on previous use in granting national authorizations
IIA, 5.2.6	Dreher, D.M.	1994	Chlorpyrifos Technical: Magnusson and Kligman Maximisation study in the guinea pig GHE-T-997 (B032) GLP. Unpublished	
IIA, 5.2.6/01	Stebbins, K.E.	1996	Dursban F Insecticidal Chemical: Dermal sensitization potential in Hartley albino guinea pigs DECO HET K0044793-102E (B025) GLP, Unpublished	
IIA, 5.4.3/01	Linscombe, V. A., Mensik, D.C., Clem, B.A.	1992	Evaluation of Chlorpyrifos in an In Vitro Chromosomal Aberration Assay Utilising rat Lymphocytes. TXT: K-044793-092 (E09) GLP. Unpublished	
IIA, 5.6.1	Breslin, W.J., Liberacki, A.B., Dittenberger, D.A., Brzak, K.A., Quast, J.F.	1991	Chlorpyrifos: Two-Generation Dietary Reproduction Study in Sprague-Dawley rats. HET K-044793-088 (F09) GLP. Unpublished	
IIA, 5.7	Dittenber, D.A	1997	Chlorpyrifos: Evaluation of single oral doses on cholinesterase and neurotoxic esterase inhibition in F344 rats DECO HET K-044793-105 (B026) GLP. Unpublished	
IIA, 5.8.1.1	Cieszlak, F.S.	1999	Chlorpyrifos oxon: Acute oral toxicity in Fischer 344 rats DECO HET K-045925-004 (C006) GLP. Unpublished	
IIA, 5.8.2.1	Hoberman, A.M.	1998	Developmental neurotoxicity of Chlorpyrifos administered orally via gavage to CrI;CDBR/Plus presumed pregnant rats DECO HET K-044793-109 (F010) GLP. Unpublished	
IIA,5.8.2.1	Mattsson, JL; Spencer, PJ; Brzak, KA; Maurissen, JP and Zablllotny, CL	1998	Effects of chlorpyrifos administered via gavage to CD rats during gestation and lactation on plasma, erythrocyte, heart and brain cholinesterase and analytical determination of chlorpyrifos and metabolites F011 GLP No published	

Annex point/ reference number	Author(s)	Year	Title Source (where different from company) Company, Report No. GLP or GEP status (where relevant) Published or not	Reports⁸ on previous use in granting national authorizations
IIA, 5.8.2.1.1	Wilmer, J.W., Berdasco, N.M., Crissman, J.W., Maurissen, J.P	1992	Acute neurotoxicity study in Fischer 344 Rats K-044793-093B (B20) GLP. Unpublished	
IIA, 5.8.2.1.2	Shankar, M R et. al.	1993	Chlorpyrifos: 13-week Neurotoxicity Study in Fischer 344 rats K-044793-094 (D21) GLP. Unpublished	
IIA, 5.8.2.2	Maurissen, JP; Shankar, MR and Mattson, JL.	1996	Chlorpyrifos: Cognitive study in Adult Long-Evans rats G053 GLP No published	
IIA, 5.8.2.3	Kisicki, JC; Seip, CW; Combs, ML.	1999	Rising dose toxicology study to determine the no- observable effect-levels (NOEL) for erythrocyte acetylcholinesterase (AchE) inhibition and cholinergic signs and symptoms of chlorpyrifos at three dose levels G079 GLP No published	
IIA, 5.8.5	Burns, C.J., Cartmill, J.B., Powers, B.S. and Lee, M.K.	1996	Update of the morbidity experience of employees potentially exposed to chlorpyrifos EPI-3635 (G054)	

B.7 Residue data.

Annex point/ reference number	Author(s)	Year	Title Source (where different from company) Company, Report No. GLP or GEP status (where relevant) Published or not	Reports on previous use in granting national authorizations
IIA, 6.0	Gardner, R.C. and Schotts, B.A.	1993	Frozen storage stability of trichlopyr, 3,5,6-trichloro-2-pyridinol and 3,5,6- trichloro-2-methoxypyridine (N100) (TCP/TMP) Report No. GH-C 2965 – 87125 GLP. Unpublished	
IIA, 6.1	Baloch, R. (Dow AgroSciences) and Caley, C. (IRI)	1996	Report Metabolism of Chlorpyrifos- methyl in Tomatoes Report No. GHE-P-6064 (L04) GLP. Unpublished	
IIA, 6.1	Baloch, R. (Dow AgroSciences) and Caley, C. (IRI)	1996	Report Metabolism of Chlorpyrifos- methyl in Lettuce Report No. GHE-P-6065 (L05) GLP. Unpublished	
IIA, 6.1	Magnussen, J.D.	2002	Chlorpyrifos citrus nature of residue study Interim report (L015) 010095 GH-C 5404 Not GLP. Unpublished	
IIA, 6.1	Graper, L.K.	2002	Nature of residue study with ¹⁴ C-labeled chlorpyrifos-methyl applied to tomatoes – Interim Report (L06) 010029 GH-C 5412 Not GLP. Unpublished	
IIA, 6.1	Graper, L.K.	2002	Nature of the Residue Study with ¹⁴ C- Labeled Chlorpyrifos Applied to Cabbage GH-C 5482 (L017) GLP. Unpublished	
IIA/6.3/95	Khoshab, A., Hastings, M., Berryman, T.	1994	Residues of Chlorpyrifos and its Pyridinol Metabolite in grapes at Intervals Following a Single Application of Dursban 2 (EF 121) or Dorsban 480 (EF 1042), Southern France-1993. GHE-P-3637 (NH14) GLP. Unpublished.	
IIA/6.3/96	Khoshab, A., Hastings, M., Berryman, T.	1994	Residues of Chlorpyrifos and its Pyridinol Metabolite in grapes at Harvest Following a Single Application of Dursban 2 (EF 121) or Dorsban 480 (EF 1042), Northern France-1993. GHE-P-3636 (NH15) GLP. Unpublished.	

Annex point/ reference number	Author(s)	Year	Title Source (where different from company) Company, Report No. GLP or GEP status (where relevant) Published or not	Reports on previous use in granting national authorizations
IIA/6.3	Khosab, A., Press, A., Bolton, A.	1995	Residues of chlorpyrifos and its pyridinol metabolite in wine grapes at intervals following a single application of DURSBAN 2 (EF-121) or DURSBAN 480 (EF-1042), Northern France-1994 NH16	
IIA/6.3	Portwood, D., Williams, M.	1996	Residues of chlorpyrifos in Wine Grapes at harvest following three applications of DURSBAN 480 (EF-1042) or DURSBAN WG (EF-1315), Italy NH21	
IIA/6.3	Portwood, D., Williams, M.	1.996 (n)	Dow Residues of chlorpyrifos in Wine Grapes at harvest following three applications of DURSBAN 480 (EF-1042) or DURSBAN WG (EF-1315), Italy NH20	Yes
IIA/6.3	Portwood, D., Williams, M.	1996	Residues of chlorpyrifos in Wine Grapes at harvest following one application of DURSBAN 480 (EF-1042) or DURSBAN WG (EF-1315), Greece NH19	
IIA/6.3	Portwood, D., Williams, M.	1996	Residues of chlorpyrifos in Wine Grapes at intervals following one application of DURSBAN 480 (EF-1042) or DURSBAN WG (EF-1315), Southern and Northern France NH18	
IIA, 6.3	Khoshab, A., Hastings, M.	1994	Determination of Chlorpyrifos Residues in Grapes Report No. ERC 94.1 Not GLP. Unpublished	
IIA, 6.3	Khosab, A., Press, A., Bolton, A.	1995	Residues of Chlorpyrifos and its pyridinol metabolite in wine grapes at harvest following a single application of Dursban 2 (EF 121) or Dursban 480 (EF 1042), Southern France – 1994 Report No. GHE-P-4082 GLP. Unpublished	
IIA, 6.3	Gale, D.	2000	Residues of Chlorpyrifos in Wine Grapes at intervals following multiple applications of DURSBAN 75 WG (EF-1315), Northern France – 1999 (NH024) R99-051 GHE-P-8761 GLP. Unpublished	

Annex point/ reference number	Author(s)	Year	Title Source (where different from company) Company, Report No. GLP or GEP status (where relevant) Published or not	Reports on previous use in granting national authorizations
IIA, 6.3	Gale, D.	2000	Residues of Chlorpyrifos in Wine Grapes at intervals following multiple applications of DURSBAN 75 WG or DURSBAN 480 (EF-1315 or EF-1042), Northern France – 1999 (NH025) R99-052 GHE-P-8762 GLP. Unpublished	
IIA, 6.3	Gale, D.	2000	Residues of Chlorpyrifos in Wine Grapes at harvest following multiple applications of DURSBAN 480 (EF-1042), Germany – 1999 (NH026) R99-054 GHE-P-8764 GLP. Unpublished	
IIA, 6.3	Gale, D.	2000	Residues of Chlorpyrifos in Wine Grapes at intervals following multiple applications of DURSBAN 75 WG (EF-1315), Germany – 1999 (NH027) R99-055 GHE-P-8765 GLP. Unpublished	
IIA, 6.3	Gale, D.	2000	Residues of Chlorpyrifos in Wine Grapes at harvest following multiple applications of either DURSBAN 480 or DURSBAN 75 WG (EF-1042 or EF-1315), Southern France – 1999 (NH028) R99-056 GHE-P-8766 GLP. Unpublished	
IIA, 6.3	Gale, D.	2000	Residues of Chlorpyrifos in Grapes at intervals following multiple applications of DURSBAN 480 (EF-1042), Spain – 1999 (NH029) R99-057 GHE-P-8767 GLP. Unpublished	
IIA, 6.3	Gale, D.	2000	Residues of Chlorpyrifos in Grapes at harvest following multiple applications of DURSBAN 480 (EF-1042), Italy – 1999 (NH030) R99-058 GHE-P-8768 GLP. Unpublished	

Annex point/ reference number	Author(s)	Year	Title Source (where different from company) Company, Report No. GLP or GEP status (where relevant) Published or not	Reports on previous use in granting national authorizations
IIA, 6.3	Gale, D.	2000	Residues of Chlorpyrifos in Wine Grapes at intervals following multiple applications of DURSBAN 480 (EF-1042), Northern France – 1999 (NH031) R99-053 GHE-P-8763 GLP. Unpublished	
IIA, 6.3	Old, J. and Clements, B.	2002	Residues of chlorpyrifos in grapes at harvest under field conditions following four applications of DURSBAN 480 (EF-1551, GF-160, EF-1042), Northern Europe – 2000 (NH033) 19728 GHE-P-9077 GLP. Unpublished	
IIA, 6.3	Old, J. and Clements, B.	2002	Residues of chlorpyrifos in grapes at intervals under open field conditions following two applications of DURSBAN 480 (EF-1551 or EF-1042), Southern Europe – 2000 (NH034) 19731 GHE-P-9080 GLP. Unpublished	
IIA, 6.3	Old, J. and Clements, B.	2002	Residues of chlorpyrifos in grape vines at harvest under field conditions following two applications of DURSBAN 480 (EF-1527, GF-160, EF-1551 and EF-1042), Southern Europe – 2000 (NH035) 19730 GHE-P-9079 GLP. Unpublished	
IIA, 6.3	Old, J. and Clements, B.	2002	Residues of chlorpyrifos in grape vines at intervals under field conditions following four applications of DURSBAN 480 (EF-1551), Northern Europe – 2000 (NH036) 19729 GHE-P-9078 GLP. Unpublished	
IIA, 6.7	Sarff, P. and Smith, J.K.	2002	Processing: Effects on nature of residue for ¹⁴ C-chlorpyrifos (L016) 010125 GH-C 5436 GLP. Unpublished	

Annex point/ reference number	Author(s)	Year	Title Source (where different from company) Company, Report No. GLP or GEP status (where relevant) Published or not	Reports on previous use in granting national authorizations
IIA, 6.7.2.4	Gale, D.	1999	Residues of chlorpyrifos in wine grapes at intervals and processed fractions following multiple applications of Dursban WG (EF-1315), Northern France-1996 GHE-P-7467 (NH023) GLP. Unpublished	

B.8 Environmental fate and behaviour.

Annex point/ reference number	Author(s)	Year	Title Source (where different from company) Company, Report No. GLP or GEP status (where relevant) Published or not	Reports on previous use in granting national authorizations
IIA/7.0	Gale, D.L., Draper, R.	1993	The stability of chlorpyrifos in fortified soil stored under frozen conditions (S001) Report No. GHE-P-2826 GLP. Unpublished	
IIA, 7.1.1	Reeves, G.L.	1994	The Aerobic Soil Degradation of [¹⁴ C]-Chlorpyrifos-methyl. (Reldan K13) Report No. GHE-P-3638 GLP. Unpublished.	
IIA, 7.1.1	de Vette, H.Q.M. and Schoonmade, J.A	2001	Study on the route and rate of aerobic degradation of [¹⁴ C]-TCP (3,5,6-trichloropyridinol) in four European soils (TCP/TMP K18) 2302/01 GH-C 5182 GLP. Unpublished.	
IIA, 7.1.1	de Vette, H.Q.M. and Schoonmade, J.A	2001	Study on the route and rate of aerobic degradation of [¹⁴ C]-chlorpyrifos in four European soils (K115) 2301/01 GH-C 5204 GLP. Unpublished.	
IIA, 7.1.1	Brull, L.p., Donath-van Scholl, I., de Vette, H.Q.M. and Heim L.G.	2002	Investigation into the identity of an unknown metabolite formed during an aerobic soil degradation study using 3,5,6-trichloro-2-pyridinol (TCP/TMP K18A) 2302/02 GLP. Unpublished.	
IIA, /7.1.1.1.2/ 01	Havens, P.L., Kieatiwong, S., Shepler, K.	1992	The photochemical degradation of chlorpyrifos on soil by natural sunlight. GH-C 2867 (K59) GLP. Unpublished	
IIA, /7.1.1.2.2/ 01 IIIA, /9.1.1.2/0 1	Khoshab, A. , Nicholson, A., Draper, R.	1993	The Dissipation of Chlorpyrifos and Fate of its Major Metabolite, 3,5,6-Trichloropyridin-2-ol, in Two Soil Types following application of Dursban Fluessig (EF 747) to Bare Soil, Germany - 1991 GHE-P-3170 (K61) GLP. Unpublished	

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IIA, /7.1.1.2.2/ 02 IIIA, /9.1.1.2/0 2	Khoshab, A. , Nicholson, A., Berryman, T.	1994	The Dissipation of Chlorpyrifos and Fate of its Major Metabolite, 3,5,6-Trichloropyridinol, in Soil Following Application of Dursban Fluessig (EF 747) to Bare Soil, Germany - 1992. GHE-P-3336 (K63) GLP. Unpublished	
IIA, 7.1.1.2.2	Teasdale, R.	1997	The Dissipation of triclopyr 2-butoxyethyl ester, Triclopyr acid and its Pyridinol Metabolite in Soil following a single application of GARLON 4 (M-4717), Southern France – 1995 (Garlon K54) Report No. GHE-P-6568 - R94-064 GLP. Unpublished.	
IIA, 7.1.1.2.2	Teasdale, R.	1998	The Dissipation of triclopyr 2-butoxyethyl ester, Triclopyr and its 3,5,6 Trichloropyridin-2-ol Metabolite in Soil at Intervals following a single application of GARLON 4 (M-4717), UK – 1994 (Garlon K53) Report No. GHE-P-6567 - R94-096 GLP. Unpublished.	
IIA, 7.1.1.2.2	Teasdale, R.	1998	The Dissipation of triclopyr and its pyridinol Metabolite in Soil at Intervals following a single application of GARLON 4 (M-4717), Germany – 1994 (Garlon K55) Report No. GHE-P-6719 - R94-154 GLP. Unpublished.	
IIA, 7.1.1.2.2	Teasdale, R.	1999	The Dissipation of triclopyr and any major Metabolite in Soil at Intervals following Application of GARLON 4 (M-4717), Germany - 1993 (K56) Report No. GHE-P-6720 - R93-102 GLP. Unpublished.	
IIA, 7.1.1.2.2	Old, J.		Dissipation of chlorpyrifos and its major metabolite (3,5,6-trichloro-2-pyridinol) in soil following a single application of DURSBAN 4, UK - 2000 (K119) 397514 GLP. Unpublished	
IIA, 7.1.1.2.2	Old, J.		Dissipation of chlorpyrifos and its major metabolite (3,5,6-trichloro-2-pyridinol) in soil following a single application of DURSBAN 4, France - 2000 (K120) 397535 GLP. Unpublished	

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IIA, 7.1.1.2.2	Old, J.		Dissipation of chlorpyrifos and its major metabolite (3,5,6-trichloro-2-pyridinol) in soil following a single application of DURSBAN 4, Greece - 2000 (K121) 300006 GLP. Unpublished	
IIA, 7.1.1.2.2	Old, J.		Dissipation of chlorpyrifos and its major metabolite (3,5,6-trichloro-2-pyridinol) in soil following a single application of DURSBAN 4, UK - 2000 (K122) 397540 GLP. Unpublished	
IIA, 7.1.2	Damon, A. and Sarff, P.	2001	Adsorption and desorption of ¹⁴ C-3,5,6-trichloro-2-pyridinol to five European soils (TCP/TMP K20) GH-C 5251 46261 GLP. Unpublished.	
IIA, 7.1.2	Damon, A. and Heim, L.	2001	Adsorption and desorption of ¹⁴ C-3,5,6-trichloro-2-methoxypyridine to five European soils (TCP/TMP K101) 46260 GH-C 5326 GLP. Unpublished.	
IIA, 7.1.2	Damon, A. and Heim, L.	2004	Adsorption and desorption of ¹⁴ C-chlorpyrifos to five European soils (K116) 46259 GH-C 5325 GLP. Unpublished.	
IIA, /7.1.2/04	Racke, K.D., Lubinski, R.N.	1992	Sorption of 3,5,6-Trichloro-2-Pyridinol in four Soils. GH-C 2821 (K64) GLP. Unpublished	
IIA 7.1.3 AIII, 9.2.1	Reeves, G.	2002	Modelling the leaching of chlorpyrifos and its major soil metabolite (3,5,6-trichloro-2-pyridinol) to groundwater in the EU using PELMO in the FOCUS scenarios (K124) GHE-P-9753 GLP. Unpublished.	
All 7.1.3 AIII, 9.2.3	Pepper, T., Arnold, D. and Reeves, G.	2002	Parameters affecting the deposition of chlorpyrifos spray drift on edge of field water bodies (K125) XACER GHE-P-9790 GLP. Unpublished.	

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IIA, /7.1.3.1/0 1 IIIA, /9.1.2.1/0 5	Reeves, G.L.	1994	Determination of the Seepage Behaviour of Chlorpyrifos by Soil Column Studies GHE-P-3830 (K66) GLP. Unpublished	
IIA, /7.1.3.2/0 1; 7.1.1.1.1/ 01; IIIA, /9.1.2.1/0 6	Reeves, G.L.	1994	The Leaching Characteristics of Aged [14C]-Chlorpyrifos Soil Residues. GHE-P-3758 (K65) GLP. Unpublished	
IIA,/7.2.1	Kennard, L.M.	1996	Aerobic aquatic degradation of chlorpyrifos in a flow-through system (K081) Report No. GH-C 4072 GLP. Unpublished	
IIA, /7.2.1.2/0 2	Jackson, R.	1994	Calculation of the photochemical quantum yield for chlorpyrifos GHE-P-3917 (K68) Not GLP. Unpublished	
IIA, /7.2.1.3.2/ 01	Reeves, G.L., Mackie, J.A.	1993	The Aerobic Degradation of (14C)-Chlorpyrifos in Natural Waters and Associated Sediments. GHE-P-3196 (K62) GLP. Unpublished	
IIA, /7.2.1.3.2/ 03 IIIA, /9.2.2/01	Giddings, J.M.	1993	Chlorpyrifos (Lorsban 4E): Outdoor aquatic microcosm test for environmental fate and ecological effects. J75 (92-6-4288) GLP. Unpublished	
IIA, /7.2.1.3.2/ 04 IIIA, /9.2.2/02	Giddings, J.M.	1993	Chlorpyrifos (Lorsban 4E): Outdoor aquatic microcosm test for environmental fate and ecological effects of combinations of spray and slurry treatments. J76 (92-11-4486) GLP. Unpublished	
IIA, /7.2.2/01	Day, S.R., Rudel, H..	1993	The Persistence of Chlorpyrifos in Air and its Evaporation Behaviour from Soil and Leaf Surfaces following application of Dursban 480 (EF 1042) - Germany 1992. GHE-P-2966 (K60) GLP. Unpublished	

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AII, 7.2.2	Simon, K.	2001	Estimation of Photochemical Oxidative Degradation of chlorpyrifos and 3,5,6-trichloropyridinol (TCP/TMP K21) GH-C 5268 Not GLP. Unpublished.	
AII, 7.4	Hernández, F., Sancho, J.V., Roig, A., López, F.J., Morell, I., Pozo, O., Marin, J.M., Tuñón, J., and Lara, A. Reeves, G	2002	Monitoring chlorpyrifos surface water concentrations following use in citrus orchards, Spain – 2000/2001 (K118) 00378 GHE-P-9667 GLP. Unpublished.	
AII, 7.4	Yon, D., Wright, K. and Horth, H.	2002	Review of monitoring and occurrence of chlorpyrifos in groundwater and surface water in Europe (K123) CO 5054 GHE-P-9755 Not GLP. Unpublished.	
IIA, 7.4	Capri, E.	2002	Monitoring the chlorpyrifos and chlorpyrifos methyl surface water exposure at field, catchment and regional scale in Trentino (N. Italy, 2001-2002)- final report. (K126) GHE-P-9821 GLP. Unpublished.	
IIA, 7.4	Capri, E.	2002	Monitoring the chlorpyrifos and chlorpyrifos methyl surface water exposure at field, catchment and regional scale in Sicily (S. Italy, 2001-2002) – final report. (K127) GHE-P-9822 GLP. Unpublished.	

B.9 Ecotoxicology

Annex point/ reference number	Author(s)	Year	Title Source (where different from company), Report No. GLP or GEP status (where relevant) Published or not	Reports on previous use in granting national authorizations
IIA, 8.1	Campbell, S., Hoxter, K.A. and Jaber, M.		3,5,6-trichloro-2-pyridinol : Acute oral toxicity study with the Northern bobwhite (J9) Wildlife Int., Maryland, USA - Study Id. 103-347 Report No. DECO-ES-2330 GLP. Unpublished	
IIA, 8.1/8.6 IIIA, 10.1/10.3	Kendall, R.J., Best, L.B., Coats, J.R., Dixon, K.R., Giesy, J.P., Hooper, M.J., Kenaga, E.E., McMurry, S.T. and Solomon, K.R.	1998	Terrestrial Ecological Risk Assessment of chlorpyrifos use in corn agrosystems (J100) Inst. Environ. And Human Health, USA, Iowa State Univ, USA, Michigan Sate Univ., USA, Univ. of Guelph, Canada - Report No. GH-C 4697 Not GLP. Unpublished	
IIA, 8.1/8.3 IIIA, 10.1/10.3/ 10.5.2	McQuillen, H.L., Brewer, L.W. and Stafford, J.M.	1998	Determination of chlorpyrifos in insects. Soil invertebrates and seed after a single application of LORSBAN 4E Insecticide in citrus (J089) Ecotox. And Biosys. Assoc. Inc. Snow Camp, NC, USA - Study Id. 079717 – Report No. GH-C 4699 GLP. Unpublished	
IIA, 8.1/8.3 IIIA, 10.1/10.3/ 10.5.2	McQuillen, H.L., Brewer, L.W., Tank, S.L. and Stafford, J.M.	1998	Determination of chlorpyrifos in insects. Soil invertebrates and seed after a single application of LORSBAN 4E Insecticide in alfalfa (J090) Ecotox. And Biosys. Assoc. Inc. Snow Camp, NC, USA - Study Id. 079716 - Report No. GH-C 4700 – J090 GLP. Unpublished	
IIA, 8.1/8.6 IIIA, 10.1/10.3	Fontaine, D.D.	1995	Statistical review of the effects of chlorpyrifos insecticidal treatments upon avian abundance, avian casualties and vertebrate casualties in turf in Florida (K072)[See also J091] Report No. DECO-ES-2992 – K072 Not GLP. Unpublished	

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IIA, 8.1/8.6 IIIA, 10.1/10.3	Fontaine, D.D.	1995	Statistical review of the effects of chlorpyrifos insecticidal treatments upon avian abundance, avian casualties and vertebrate casualties in Californian Citrus groves (K073) [See also J093] Report No. DECO-ES-2991 – K073 Not GLP. Unpublished	
IIA, 8.1/8.6 IIIA, 10.1/10.3	Fontaine, D.D.	1995	Statistical review of the effects of chlorpyrifos insecticidal treatments upon avian abundance, avian casualties and vertebrate casualties in Iowa Cornfields (K074) [See also J092] Report No. DECO-ES-2886 Not GLP. Unpublished	
IIA, 8.1/8.6 IIIA, 10.1/10.3	Worley, K.B., Frey, L.T., Palmer, D.A. and Krueger, H.O.	1994	DURSBAN Insecticide: Evaluation of its effects upon avian and mammalian species on and around golf courses in fall in Florida (J091) [See also K072] Wildlife Int. Ltd., Easton, Maryland, and MVTL Labs Inc., New Ulm, MN, USA - Study Id. 103-364 - Report No. DECO-ES-2596 GLP. Unpublished	
IIA, 8.1/8.6 IIIA, 10.1/ 10.3	Frey, L.T., Krueger, H.O. and Palmer, D.A.	1994	LORSBAN Insecticide: Evaluation of its effects upon avian and mammalian species on and around corn fields in Iowa (J092) [See also K074] Wildlife Int. Ltd., Easton, Maryland, and MVTL Labs Inc., New Ulm, MN, USA - Study Id. 103-366 - Report No. ES-2524 GLP. Unpublished	
IIA, 8.1	Ormand, J. R. and Bell, C.D.	1990	3,5,6-trichloro-2-pyridinol : Stability in prepared game bird starter ration (J13) Study Id. ES-2294 Report No. ES-DR-0037-0423-12 GLP. Unpublished	
IIA, 8.1	Gallagher, S.P., Beavers, J.B. and Jaber, M.J.	1996	Chlorpyrifos technical : Acute toxicity study with the house sparrow (J083) Wildlife International Ltd, Maryland, USA Study Id. 103-418A. Report No. DECO-ES-3133 – J083 GLP. Unpublished	

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IIA, 8.1/8.6 IIIA, 10.1/10.3	Gallagher, S.P., Palmer, D.A. and Krueger, H.O.	1994	LORSBAN Insecticide: Pilot year evaluation of its effects upon avian and mammalian species on and around corn citrus groves in California (J093) [See also K073] Wildlife Int. Ltd., Easton, Maryland, and MVT Labs Inc., New Ulm, MN, USA - Study Id. 103-365 Report No. DECO-ES-2525 GLP. Unpublished	
IIA, 8.1 IIIA, 10.1	Anderson, T.A., Richards, S.M., McMurray, S.T. and Hooper, M.J.	1998	Avian response to chlorpyrifos exposure in a corn agrosystems (J114) GH-C4698 Not GLP. Unpublished	
IIA, 8.1.1 IIIA, 10.1.1	Rodgers, M., Cameron, D.M., Gillham, A. & Healy, G.	1996	Dursban 5G: Acute oral toxicity (LD ₅₀) to Mallard duck (M110A) HLS Ltd, U.K. – Study Id. DWC 732/953108 Report No. GHE-T-619 – M110A GLP. Unpublished	
IIA, 8.1.1	Long, R.D., Hoxter, K.A. and Jaber, M.	1990	3,5,6-trichloro-2-pyridinol : Dietary LC ₅₀ study with the Mallard (J8) Wildlife Int., Maryland, USA - Study Id. 103-346 Report No. DECO-ES-2335 GLP. Unpublished	
IIA, 8.2 IIIA, 10.2	Giesy, J.P., Solomon, K.R., Coats, J.R., Dixon, K., Giddings, J. and Kenaga, E.E.	1998	Ecological risk Assessment of chlorpyrifos in North American Aquatic Environments : Reports of an Expert Panel (J094) Enrix Inc., Williamston, MI, USA - Report No. GH-C 4660 Not GLP. Unpublished	
IIA, 8.2.1	Gorzinski, S.J., Mayes, M.A., Ormand, J.R., Weinberg, J.T. and Richardson, C.H.	1991	3,5,6-trichloro-2-pyridinol : Acute toxicity to the Rainbow trout, <i>Oncorhynchus mykiss</i> Walbaum (J6) Study Id. ES-DR-0037-0423-8 Dow Report No. DECO-ES-2337 GLP. Unpublished	
IIA, 8.2.2	Gorzinski, S.J., Mayes, M.A., Ormand, J.R., Weinberg, J.T. and Richardson, C.H.	1991	3,5,6-trichloro-2-pyridinol : Acute 96-hour toxicity to the Bluegill, <i>Lepomis macrochirus</i> Rafinesque (J7) Study Id. ES-DR-0037-0423-7 Report No. DECO-ES-2336 GLP. Unpublished	

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IIA/8.2.2.1 /01	Mayes, M.A., Weinberg, J.T., Rick, D.L., Martin, M.D.	1993	Chlorpyrifos: A life-cycle toxicity test with the fathead Minnow, <i>Pimephales promelas</i> Rafinesque. DECO-ES-2557b (J73) GLP. Unpublished	
IIA, 8.2.2.2	Marino, T.A., Gilles, M.M., Rick, D.L. and Henry, K.S.		Evaluation of the toxicity of 3,5,6-Trichloro-2-pyridinol (TCP) to the early life stages of the rainbow trout, <i>Oncorhynchus mykiss</i> Walbaum (J17) 991173 DECO HET-K-038278-042 GLP. Unpublished	
IIA, 8.2.3	Hedlund, R.T.	1972	Determination of the bioconcentration potential of 3,5,6-trichloro-2-pyridinol (J3) Report No. GS-1282 Not GLP. Unpublished	
IIA, 8.2.3	Woodburn, K.B., Rick, D.L., Kirk, H.D. and Stahl D.C.	1995	Accumulation of chlorpyrifos residues in catfish, <i>Ictalurus punctatus</i> , from dietary exposure (J082) Report No. DECO-ES-2840 – J082 GLP. Unpublished	
IIA/8.2.3/01	Hansen, S.C., <i>et al.</i>	1992	A Bioconcentration test with the Eastern Oyster (<i>Crassostrea virginica</i>). ES-2526 (J65) GLP. Unpublished	
IIA/8.2.3/02	Hansen, S.C, Woodburn, K.B., Ball, T., Wilga, P.C.	1992	CHLORPYRIFOS: Distribution and metabolism in the Eastern Oyster. DECO-ES-2377 (J66) GLP. Unpublished	
IIA, 8.2.4	Brown, R.P., Landre, A.M., Miller, J.A., Hugo, J.M. and Kirk, A.D.	1997	Toxicity of sediment-associated chlorpyrifos with freshwater invertebrates <i>Hyalella azteca</i> (amphipod) and <i>Chironomus tentans</i> (midge) (J086) Report No. DECO-ES-3036 – J086 GLP. Unpublished	
IIA, 8.2.4	Brown, R., Hugo, J.M., Miller, J.A. and Harrington, C.K.	1997	Chlorpyrifos : Acute toxicity to the Amphipod (<i>Hyalella azteca</i>) (J087) Report No. 971095 GLP. Unpublished	
IIA, 8.2.4	Woodburn, K.D., Kirk, H.K. and Hugo, J.M.	1998	Chlorpyrifos: Acute toxicity to the daphnid, <i>Ceriodaphnia dubia</i> (J096) Report No. DECO ES-2957 Not GLP. Unpublished	

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IIA, 8.2.5	Gorzinski, S.J., Milazzo, D.P., Servinski, M.F. and Ormand, J.R.	1991	3,5,6-trichloro-2-pyridinol : Acute 48-hour toxicity to the water flea, <i>Daphnia magna</i> Strauss (J5) Study Id. ES-DR-0037-0423-5 Report No. DECO-ES-2339 GLP. Unpublished	
IIA/8.2.5/01	Sved, D, Drottar, K.R., Sweigert, J., Smith, G.J.	1993	A flow-through life cycle toxicity test with the saltwater mysid (<i>Mysidopsis bahia</i>). DECO-ES-2506 (J71) GLP. Unpublished	
IIA, 8.2.6	Kirk, H. D., Gilles, M.M., Hugo, J.M. and McFadden, L.G.	1999	Effect of 3,5,6-Trichloro-2-pyridinol (TCP) on the growth of the freshwater green alga, <i>Selenastrum capricornutum</i> , printz (J14) Study Id. 991194 Report No. DECO HET-K-038278-043 GLP. Unpublished	
IIA, 8.3 IIIA,10.5	Mead-Briggs, M., Vinall, S. and Longley, M.	1997	Determination of dose-response data for EC formulations of cypermethrin, as AMBUSH C, for chlorpyrifos, as DURSBAN 480 (EF-1042) and for NURELLE D 50/500 EC (EF-1393), a co-formulation of these two active ingredients, against four species of Beneficial Arthropods (M186) AEU, Univer. Of Southampton, UK – Study Id. DOW-96-4 Report No. GHE-P-6717 GLP. Unpublished	
IIA, 8.3.1 IIIA, 10.4.3	Bakker, F.	2002	Effects of RELDAN 22 and DURSBAN 75 WG on honeybees, <i>Apis mellifera</i> L, when applied at different times, determined in a cage test (J116) DA013AMS GLP. Unpublished	
IIA, 8.3.1 IIIA, 10.4.3	Bakker, F	2000	Effects of DURSBAN 75 WG on honeybees, <i>Apis mellifera</i> L, when applied to a flowering <i>Phacelia tanacetifolia</i> 1,3,5,7 and 14 days before exposure, determined in a cage test (M215) DA012AMS GHE-P-9188 GLP. Unpublished	
IIA/8.3.1.1 /01	Bell, G.	1994	DURSBAN F. Acute Toxicity to Honey Bees. GHE-P-3871 (J80) GLP. Unpublished	

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IIA, 8.3.2	Hertlein, M.B., Nolan, R.T., Tisdell, F.G. and Watson, P.A.	1999	Assessment of the potential insecticidal properties of 3,5,6-trichloro-2-pyridinol (TCP) (J15) Study Id. DAI0183 Report No. DAI0183 GLP. Unpublished	
IIA/8.3.2/1 4 IIIA/10.3.4 .1/11, 10.3.4.2, 10.5	Brown, K.C.	1993	The Effects of Dursban 4 on Predatory Epigeal Arthropods in Grassland. GHE-P-3831 (J78) GLP. Unpublished	
IIA/8.3.2/1 8; IIIA/10.3.4 .2/04, 10.5	Brown, K.C.	1991	The effects of Dursban 4 and Reldan 50 on beneficial arthropods in apple orchards. GHE-P 2653 (J63) GLP. Unpublished	
IIA, 8.3.2 IIIA, 10.5.1	Taruza, S.	2001	Extended laboratory test to determine the effects of fresh and aged residues of drift-rate concentrations of Dursban 4 EC (480 g/L chlorpyrifos) and Reldan 22 (225 g/L chlorpyrifos-methyl), on the predatory mite, Typhlodromus pyri (Acari, Phytoseiidae) (J111) DOW-01-37 GHE-P-9449 GLP. Unpublished	
IIA, 8.3.2 IIIA, 10.5.1	Vinall, S.	2001	Extended laboratory test to determine the effects of fresh and aged residues of drift-rate concentrations of Dursban 4 EC (480 g/L chlorpyrifos) and Reldan 22 (225 g/L chlorpyrifos-methyl), on the parasitic wasp, Aphidius rhopalosiphi (Hymenoptera, Braconidae) (J112) DOW-01-36 GHE-P-9455 GLP. Unpublished	
IIA, 8.3.2 IIIA, 10.5.1	Manley, B.	2001	Extended laboratory test to determine the effects of fresh and aged residues of drift-rate concentrations of Dursban 4 EC (480 g/L chlorpyrifos) and Reldan 22 (225 g/L chlorpyrifos-methyl), on the green lacewing, Chrysoperla carnea (Neuroptera, Chrysopidae) (J115) DOW-01-38 GHE-P-9725 GLP. Unpublished	

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IIA, 8.3.2 IIIA, 10.5.1	Miles, M.	2000	Extended laboratory bioassays to evaluate the duration of effect of RELDAN 40 EC (EF-1548 containing 400 g/L chlorpyrifos-methyl) and DURSBAN 75 WG (EF-1315 containing 750 g/kg chlorpyrifos-ethyl) on the lacewing (<i>Chrysoperla carnea</i>) in orchards (M214) GHE-P-6278 GLP. Unpublished	
IIA, 8.3.2 IIIA, 10.5.1	Mead-Briggs, M.	1997	Extended laboratory and semi-field study to evaluate the effects of DURSBAN 4 EC, RELDAN 50 EC and two reference products on the ladybird, <i>Coccinella septempunctata</i> , in wheat (M226) DOW-97-4 GHE-P-6926 GLP. Unpublished	
IIA, 8.3.2 IIIA, 10.5.1	Mead-Briggs, M.	1997	Extended laboratory and semi-field study to evaluate the effects of DURSBAN 4 EC, RELDAN 50 EC and two reference products on the lycosid spider, <i>Pardosa</i> spp. (M227) DOW-97-6 GHE-P-6927 GLP. Unpublished	
IIA, 8.3.2 IIIA, 10.5.1	Mead-Briggs, M.	1997	Extended laboratory and semi-field study to evaluate the effects of DURSBAN 4 EC, RELDAN 50 EC and two reference products on adult and pupal stages of aphid-specific parasitoids in wheat (M228) DOW-97-3 GHE-P-6928 GLP. Unpublished	
IIA, 8.3.2 IIIA, 10.5.1	Mead-Briggs, M	1997	Extended laboratory and semi-field study to evaluate the effects of DURSBAN 4 EC, RELDAN 50 EC and two reference products on the ground beetle, <i>Bembidion lampros</i> , in wheat (M229) DOW-97-5 GHE-P-6929 GLP. Unpublished	

Annex point/ reference number	Author(s)	Year	Title Source (where different from company) Company, Report No. GLP or GEP status (where relevant) Published or not	Reports on previous use in granting national authorizations
IIA/8.3.3.1 /01	Rodgers, M.H	1994	Chlorpyrifos (Dursban FE). Acute Toxicity to the Earthworm (<i>Eisenia foetida</i>) J79 GLP. Unpublished	
IIA/8.3.3.1 /02 IIIA/10.3.5 .1	Johnson, A.J.	1993	EF 1042 (DURSBAN 480) Acute Toxicity (LC50) to the Earthworm (<i>Eisenia foetida</i>). DWC 654/930785 (M99) GLP. Unpublished	
IIA, 8.4.1	Ward, T.J. & Boeri, R.L.	1999	3,5,6-Trichloro-2-pyridinol (TCP): Acute toxicity to the earthworm, <i>Eisenia foetida</i> . (J18) T.R. Wilbury Labs. Inc., Marblehead, MA, USA Study Id. 1860-DO Report No.: DECO HET-K-038278-041 GLP. Unpublished	
IIA, 8.4.2 IIIA, 10.6.1.2	Hayward, J.C.	2002	Effects of DURSBAN 480 EC on reproduction and growth of the earthworm <i>Eisenia fetida</i> (J113) CEMR-1719 GHE-T-1165 GLP. Unpublished	
IIA, 8.5	Mallet, M.J. and Hayward, J.C.	1999	Laboratory assessment of the effects of on soil microflora respiration and nitrogen transformation according to OECD Test Guidelines 216 and 217 (J16) Study Id. CEMs-1151 GLP. Unpublished	
IIA, 8.5	Barnes, S.P.	1999	Chlorpyrifos technical: Activated sludge – respiration inhibition test (J101) HLS, UK - Study Id. DOS 040/993978 - Report No. GHE-T-965 GLP. Unpublished	
IIIA, 10.2.2	van Wijngaarden, R.P.A. and Brock, T.C.M.	2001	Chlorpyrifos algal microcosm experiment (J110) F20507 GHE-T-1128 Not GLP. Unpublished	
IIIA/10.2.4	Giddings, J.M.	1993	Chlorpyrifos (Lorsban 4E): Outdoor aquatic microcosm test for environmental fate and ecological effects of combinations of spray and slurry treatments. J76 GLP. Unpublished	

Annex point/ reference number	Author(s)	Year	Title Source (where different from company) Company, Report No. GLP or GEP status (where relevant) Published or not	Reports on previous use in granting national authorizations
IIIA/10.2.4 /01	Giddings, J.M.	1993	Chlorpyrifos (Lorsban 4E): Outdoor aquatic microcosm test for environmental fate and ecological effects. J75 GLP. Unpublished	

APPENDIX IIIB**CHLORPYRIFOS**

List of studies which were submitted during the evaluation process and were not cited in the draft assessment report:

B.1 Identity, B.2 Physical and chemical properties, B.3 Data on application and further information, B.4 Proposals for classification and labelling, B.5 Methods of analysis.

Annex point/ reference number	Author(s)	Year	Title Source (where different from company) Company, Report No. GLP or GEP status (where relevant) Published or not	Reports on previous use in granting national authorizations
IIA, 2.1.1	Knowles, S.; Iosson, I.	1994	Chlorpyrifos: Generation of NMR and DSC DowElanco, Letcobe Regis, UK – A049; Report No.: GHE-P-3861; 93003/DC A040 GLP. Unpublished	
IIA, 2	Richardson, N.	1995	Chlorpyrifos (Technical): Determination of Physico-Chemical Properties DowElanco, Letcobe Regis, UK – A051; Report No.: GHE-P-4053 GLP. Unpublished	
IIA, 2	Richardson, N.	1995	Chlorpyrifos (Pure): Determination of Physico-Chemical Properties (A081) DowElanco, Letcobe Regis, UK – A081; Report No.: GHE-P-4458 GLP. Unpublished	
IIA,2.5	Knowles, S.; Drossopoulos, M.	1998	Spectral characterisation of chlorpyrifos oxon (AGR203674) (A128) GHE-P-7359; Study No. P98-067 GLP. Unpublished	
IIA,2.5	Knowles, S.; Drossopoulos, M.	1998	Spectral characterisation of sulfotepp (TSN101227) (A129) GHE-P-7360; Study No. P98-068 GLP. Unpublished	
IIA, 2.5	Knowles, S.; Drossopoulos, M.	1998	Spectral characterisation of 2-pyridinol (AGO143197) GHE-P-7361; Study No. P98-069 GLP. Unpublished	

Annex point/ reference number	Author(s)	Year	Title Source (where different from company) Company, Report No. GLP or GEP status (where relevant) Published or not	Reports on previous use in granting national authorizations
IIA, 4.1	Nelson, R.M.	1996	Analytical method and validation for the determination of impurities in DURSBAN R, DURSBAN XP, DURSBAN FM, DURSBAN FE and LORSBAN F insecticidal chemicals by liquid chromatography (O080) DECO ML-AL 97-002210 GLP. Unpublished	
IIA,4.2.1	Portwood, D.E. and Williams, M.	1997	Independent validation of DowElanco method ACR 90.5 for the determination of residues of chlorpyrifos in apples by Gas Chromatography (ODR45A) GHE-P-5704 GLP. Unpublished	
IIA, 4.2.2	Robb, C.K., Goodwin, P.A. and Ostrander, J.A.	1993	Determination of Chlorpyrifos in Soil by Gas Chromatography (ODR61) GRM 92.10.S1 Not GLP. Unpublished	
IIA, 4.2.2	Dixon-White, H.E.	1994	Residue Analytical Method for the analysis of 3, 5, 6-trichloro-2-pyridinol in Soil – GRM92.12.R2, Determination of 3, 5, 6-trichloro-2-pyridinol in soil by gas chromatography/Mass Spectrometry (O13A) GH-C 2838 Not GLP. Unpublished	
IIA,4.2.3	Olberding, E.I.	1996	Determination of residues of Tricolpyr, 3, 5, 6-tricloro-2-pyridinol and 2-methoxy-3, 5, 6-trichloropyridine in water by capillary gas chromatography with mass selective detection (O34) Not GLP. Unpublished	
IIA, 4.2.4	Rawle, N.W.	1998	Determination of Chlorpyrifos in air (ODR13D) ERC 983.11 Not GLP. Unpublished	

B.6 Toxicology and metabolism

Annex point/ reference number	Author(s)	Year	Title Source (where different from company) Company, Report No. GLP or GEP status (where relevant) Published or not	Reports on previous use in granting national authorizations
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Annex point/ reference number	Author(s)	Year	Title Source (where different from company) Company, Report No. GLP or GEP status (where relevant) Published or not	Reports on previous use in granting national authorizations
IIA 5.5.1	Griffin, P; Mason, H; Heywood, K and Cocker, J.	1999	Oral and dermal absorption of chlorpyrifos: a human volunteer study. Occup. Environ. Med, 56, 10-13 PG019 No GLP Published	
IIA 5.1.1	Mendrala AL & Brzak KA	1998	Chlorpyrifos: Part A – Concentration-time course of chlorpyrifos and chlorpyrifos-oxon in blood G060 GLP No published	
IIA,5.2	Stebbins, KE	1996	DURSBAN F Insecticidal Chemical: Acute Oral toxicity study in Fischer rats B021 GLP No published	
IIA, 5.2	Stebbins, KE	1996	DURSBAN F Insecticidal Chemical: Acute Dermal toxicity study in New Zealand White rabbits B022 GLP No published	
IIA, 5.2	Stebbins, KE.	1996	DURSBAN F Insecticidal Chemical: Primary dermal irritation study in New Zealand White rabbits B023 GLP No published	
IIA,5.2	Stebbins, KE	1996	DURSBAN F Insecticidal Chemical: Primary eye irritation study in New Zealand White rabbits B024 GLP No published	

Annex point/ reference number	Author(s)	Year	Title Source (where different from company) Company, Report No. GLP or GEP status (where relevant) Published or not	Reports on previous use in granting national authorizations
IIA, 5.2	Stebbins, KE	1996	DURSBAN F Insecticidal Chemical: Dermal sensitization study in Hartley Albino Guinea Pigs B025 GLP No Published	
IIA, 5.7	Dittember, DA.	1997	Chorpyrifos: Evaluation of single oral doses on cholinesterase and neurotoxic esterase inhibition in F344 rats B026 GLP No Published	
IIA, 5.8.1	Cieszlak,FS	1999	Chlorpyrifos oxon: Acute oral toxicity in Fischer 344 rats C006 GLP No published	
IIA, 5.8.2.1	Hoberman, AM.	1998	Developmental neurotoxicity of Chlorpyrifos administered orally via gavage to Cri;CDBRVA/Plus presumed pregnant rats F010	
IIA,5.8.2.1	Mattsson, JL; Spencer, PJ; Brzak, KA; Maurissen, JP and Zablllotny, CL	1998	Effects of chlorpyrifos administered via gavage to CD rats during gestation and lactation on plasma, erythrocyte, heart and brain cholinesterase and analytical determination of chlorpyrifos and metabolites F011 GLP No published	
IIA, 5.8.2.2	Maurissen, JP; Shankar, MR and Mattson, JL.	1996	Chlorpyrifos: Cognitive study in Adult Long-Evans rats G053 GLP No published	
IIA, 5.8.2.3	Kisicki, JC; Seip, CW; Combs, ML.	1999	Rising dose toxicology study to determine the no- observable effect-levels (NOEL) for erythrocyte acetylcholinesterase (AchE) inhibition and cholinergic signs and symptoms of chlorpyrifos at three dose levels G079 GLP No published	

Annex point/ reference number	Author(s)	Year	Title Source (where different from company) Company, Report No. GLP or GEP status (where relevant) Published or not	Reports on previous use in granting national authorizations
IIA, 5.9.3	Shurdt, BA; Chen, WL; Nolan, RJ; Burns, CJ; McCormick, RA; Racke, KD.	1997	Critical assessment of report entitled "Review of Chlorpyrifos Poissoning data. G069 GLP Not published	
IIA, 5.9.3	Clegg, D.J & Gemert, M .	1999	Expert panel report studies on chlopryrifos and/or other organophosphates exposures. J. Tox. Environ Health Part B 2, 257-279 PG088 No GLP Published	
Ila 5.9.3	Clegg, D.J & Gemert,	1999	Determination of the reference dose of chlopryrifos: Proceedings of an expert panel. J. Tox. And Env. Health, Part B, 2, 211-255. T004 No GLP Published	
IIA 5.9.3	Schardein & Scialli.	1999	Legislation of toxicological safety factors: Food Quality Protection Act with chlorpyrifos as a test case. Report. Toxicol. 13 (1), 1-14 T005 No GLP Published	
IIA 5.9.3	Chen WL, Sheets, JJ; Nolan., R.J & Mattsson, J.L.	1999	Human red blood cell acetylcholinesterase inhibition as th eappropriate and coconservative surrogate endpoit for establishing chorpyrifos reference dose .Reg. Toxic and Pharma., 29 (1) 15-22 PG084 No GLP Published	

B.7 Residue data

Annex point/ reference number	Author(s)	Year	Title Source (where different from company) Company, Report No. GLP or GEP status (where relevant) Published or not	Reports on previous use in granting national authorizations
IIA, 6.0	Gardner, R.C. and Schotts, B.A.	1993	Frozen storage stability of trichlopyr, 3,5,6-trichloro-2-pyridinol and 3,5,6-trichloro-2-methoxypyridine (N100) (TCP/TMP) Report No. GH-C 2965 – 87125 GLP. Unpublished	
IIA, 6.1	Baloch, R. (Dow AgroSciences) and Caley, C. (IRI)	1996	Report Metabolism of Chlorpyrifos-methyl in Tomatoes Report No. GHE-P-6064 (L04) GLP. Unpublished	
IIA, 6.1	Baloch, R. (Dow AgroSciences) and Caley, C. (IRI)	1996	Report Metabolism of Chlorpyrifos-methyl in Lettuce Report No. GHE-P-6065 (L05) GLP. Unpublished	
IIA, 6.1	Bauridel, W.R.	1982	Compilation of three recent studies of the metabolic fate of ¹⁴ C-Chlorpyrifos-methyl in stored grain, lactating goats and laying hens (stored grain section) Report No. GH-C-1578 (L03) Not GLP. Unpublished	
IIA, 6.1	Magnussen, J.D.	2002	Chlorpyrifos citrus nature of residue study Interim report (L015) 010095 GH-C 5404 Not GLP. Unpublished	
IIA, 6.1	Graper, L.K.	2002	Nature of residue study with ¹⁴ C-labeled chlorpyrifos-methyl applied to tomatoes – Interim Report (L06) 010029 GH-C 5412 Not GLP. Unpublished	
IIA, 6.3	Khoshab, A., Hastings, M.	1994	Determination of Chlorpyrifos Residues in Grapes Report No. ERC 94.1 Not GLP. Unpublished	

Annex point/ reference number	Author(s)	Year	Title Source (where different from company) Company, Report No. GLP or GEP status (where relevant) Published or not	Reports on previous use in granting national authorizations
IIA, 6.3	Khosab, A., Press, A., Bolton, A.	1995	Residues of Chlorpyrifos and its pyridinol metabolite in wine grapes at harvest following a single application of Dursban 2 (EF 121) or Dursban 480 (EF 1042), Southern France – 1994 Report No. GHE-P-4082 GLP. Unpublished	
IIA, 6.3	Gale, D.	2000	Residues of Chlorpyrifos in Wine Grapes at intervals following multiple applications of DURSBAN 75 WG (EF-1315), Northern France – 1999 (NH024) R99-051 GHE-P-8761 GLP. Unpublished	
IIA, 6.3	Gale, D.	2000	Residues of Chlorpyrifos in Wine Grapes at intervals following multiple applications of DURSBAN 75 WG or DURSBAN 480 (EF-1315 or EF-1042), Northern France – 1999 (NH025) R99-052 GHE-P-8762 GLP. Unpublished	
IIA, 6.3	Gale, D.	2000	Residues of Chlorpyrifos in Wine Grapes at harvest following multiple applications of DURSBAN 480 (EF-1042), Germany – 1999 (NH026) R99-054 GHE-P-8764 GLP. Unpublished	
IIA, 6.3	Gale, D.	2000	Residues of Chlorpyrifos in Wine Grapes at intervals following multiple applications of DURSBAN 75 WG (EF-1315), Germany – 1999 (NH027) R99-055 GHE-P-8765 GLP. Unpublished	
IIA, 6.3	Gale, D.	2000	Residues of Chlorpyrifos in Wine Grapes at harvest following multiple applications of either DURSBAN 480 or DURSBAN 75 WG (EF-1042 or EF-1315), Southern France – 1999 (NH028) R99-056 GHE-P-8766 GLP. Unpublished	

Annex point/ reference number	Author(s)	Year	Title Source (where different from company) Company, Report No. GLP or GEP status (where relevant) Published or not	Reports on previous use in granting national authorizations
IIA, 6.3	Gale, D.	2000	Residues of Chlorpyrifos in Grapes at intervals following multiple applications of DURSBAN 480 (EF-1042), Spain – 1999 (NH029) R99-057 GHE-P-8767 GLP. Unpublished	
IIA, 6.3	Gale, D.	2000	Residues of Chlorpyrifos in Grapes at harvest following multiple applications of DURSBAN 480 (EF-1042), Italy – 1999 (NH030) R99-058 GHE-P-8768 GLP. Unpublished	
IIA, 6.3	Gale, D.	2000	Residues of Chlorpyrifos in Wine Grapes at intervals following multiple applications of DURSBAN 480 (EF-1042), Northern France – 1999 (NH031) R99-053 GHE-P-8763 GLP. Unpublished	
IIA, 6.3	Old, J. and Clements, B.	2002	Residues of chlorpyrifos in grapes at harvest under field conditions following four applications of DURSBAN 480 (EF-1551, GF-160, EF-1042), Northern Europe – 2000 (NH033) 19728 GHE-P-9077 GLP. Unpublished	
IIA, 6.3	Old, J. and Clements, B.	2002	Residues of chlorpyrifos in grapes at intervals under open field conditions following two applications of DURSBAN 480 (EF-1551 or EF-1042), Southern Europe – 2000 (NH034) 19731 GHE-P-9080 GLP. Unpublished	
IIA, 6.3	Old, J. and Clements, B.	2002	Residues of chlorpyrifos in grape vines at harvest under field conditions following two applications of DURSBAN 480 (EF-1527, GF-160, EF-1551 and EF-1042), Southern Europe – 2000 (NH035) 19730 GHE-P-9079 GLP. Unpublished	

Annex point/ reference number	Author(s)	Year	Title Source (where different from company) Company, Report No. GLP or GEP status (where relevant) Published or not	Reports on previous use in granting national authorizations
IIA, 6.3	Old, J. and Clements, B.	2002	Residues of chlorpyrifos in grape vines at intervals under field conditions following four applications of DURS BAN 480 (EF-1551), Northern Europe – 2000 (NH036) 19729 GHE-P-9078 GLP. Unpublished	
IIA, 6.7	Sarff, P. and Smith, J.K.	2002	Processing: Effects on nature of residue for ¹⁴ C-chlorpyrifos (L016) 010125 GH-C 5436 GLP. Unpublished	

B.8 Environmental fate and behaviour

Annex point/ reference number	Author(s)	Year	Title Source (where different from company) Company, Report No. GLP or GEP status (where relevant) Published or not	Reports on previous use in granting national authorizations
IIA, 7.1.1	Reeves, G.L.	1994	The Aerobic Soil Degradation of [¹⁴ C]-Chlorpyrifos-methyl. (K13) Report No. GHE-P-3638 GLP. Unpublished.	
IIA, 7.1.1	de Vette, H.Q.M. and Schoonmade, J.A	2001	Study on the route and rate of aerobic degradation of [¹⁴ C]-TCP (3,5,6-trichloropyridinol) in four European soils (K18) 2302/01 GH-C 5182 GLP. Unpublished.	
IIA, 7.1.1	de Vette, H.Q.M. and Schoonmade, J.A	2001	Study on the route and rate of aerobic degradation of [¹⁴ C]-chlorpyrifos in four European soils (K115) 2301/01 GH-C 5204 GLP. Unpublished.	
IIA, 7.1.1	Brull, L.p., Donath-van Scholl, I., de Vette, H.Q.M. and Heim L.G.	2002	Investigation into the identity of an unknown metabolite formed during an aerobic soil degradation study using 3,5,6-trichloro-2-pyridinol (K18A) 2302/02 GLP. Unpublished.	

Annex point/ reference number	Author(s)	Year	Title Source (where different from company) Company, Report No. GLP or GEP status (where relevant) Published or not	Reports on previous use in granting national authorizations
IIA, 7.1.1.2.2	Teasdale, R.	1997	The Dissipation of triclopyr 2-butoxyethyl ester, Triclopyr acid and its Pyridinol Metabolite in Soil following a single application of GARLON 4 (M-4717), Southern France – 1995 (K54) Report No. GHE-P-6568 - R94-064 GLP. Unpublished.	
IIA, 7.1.1.2.2	Teasdale, R.	1998	The Dissipation of triclopyr 2-butoxyethyl ester, Triclopyr and its 3,5,6 Trichloropyridin-2-ol Metabolite in Soil at Intervals following a single application of GARLON 4 (M-4717), UK – 1994 (K53) Report No. GHE-P-6567 - R94-096 GLP. Unpublished.	
IIA, 7.1.1.2.2	Teasdale, R.	1998	The Dissipation of triclopyr and its pyridinol Metabolite in Soil at Intervals following a single application of GARLON 4 (M-4717), Germany – 1994 (K55) Report No. GHE-P-6719 - R94-154 GLP. Unpublished.	
IIA, 7.1.1.2.2	Teasdale, R.	1999	The Dissipation of triclopyr and any major Metabolite in Soil at Intervals following Application of GARLON 4 (M-4717), Germany - 1993 (K56) Report No. GHE-P-6720 - R93-102 GLP. Unpublished.	
IIA, 7.1.1.2.2	Old, J.		Dissipation of chlorpyrifos and its major metabolite (3,5,6-trichloro-2-pyridinol) in soil following a single application of DURSBAN 4, UK - 2000 (K119) 397514	
IIA, 7.1.1.2.2	Old, J.		Dissipation of chlorpyrifos and its major metabolite (3,5,6-trichloro-2-pyridinol) in soil following a single application of DURSBAN 4, France - 2000 (K120) 397535	
IIA, 7.1.1.2.2	Old, J.		Dissipation of chlorpyrifos and its major metabolite (3,5,6-trichloro-2-pyridinol) in soil following a single application of DURSBAN 4, Greece - 2000 (K121) 300006	
IIA, 7.1.1.2.2	Old, J.		Dissipation of chlorpyrifos and its major metabolite (3,5,6-trichloro-2-pyridinol) in soil following a single application of DURSBAN 4, UK - 2000 (K122) 397540	

Annex point/ reference number	Author(s)	Year	Title Source (where different from company) Company, Report No. GLP or GEP status (where relevant) Published or not	Reports on previous use in granting national authorizations
IIA, 7.1.2	Damon, A. and Sarff, P.	2001	Adsorption and desorption of ¹⁴ C-3,5,6-trichloro-2-pyridinol to five European soils (K20) GH-C 5251 46261 GLP. Unpublished.	
IIA, 7.1.2	Damon, A. and Heim, L.	2001	Adsorption and desorption of ¹⁴ C-3,5,6-trichloro-2-methoxypyridine to five European soils (K101) 46260 GH-C 5326 GLP. Unpublished.	
IIA, 7.1.2	Damon, A. and Heim, L.	2004	Adsorption and desorption of ¹⁴ C-chlorpyrifos to five European soils (K116) 46259 GH-C 5325 GLP. Unpublished.	
All, 7.2.2	Simon, K.	2001	Estimation of Photochemical Oxidative Degradation of chlorpyrifos and 3,5,6-trichloropyridinol (K21) GH-C 5268 Not GLP. Unpublished.	
All, 7.4	Hernández, F., Sancho, J.V., Roig, A., López, F.J., Morell, I., Pozo, O., Marin, J.M., Tuñón, J., and Lara, A. Reeves, G	2002	Monitoring chlorpyrifos surface water concentrations following use in citrus orchards, Spain – 2000/2001 (K118) 00378 GHE-P-9667 GLP. Unpublished.	
All, 7.4	Yon, D., Wright, K. and Horth, H.	2002	Review of monitoring and occurrence of chlorpyrifos in groundwater and surface water in Europe (K123) CO 5054 GHE-P-9755 Not GLP. Unpublished.	
All, 9.2.1	Reeves, G.	2002	Modelling the leaching of chlorpyrifos and its major soil metabolite (3,5,6-trichloro-2-pyridinol) to groundwater in the EU using PELMO in the FOCUS scenarios (K124) GHE-P-9753 GLP. Unpublished.	

Annex point/ reference number	Author(s)	Year	Title Source (where different from company) Company, Report No. GLP or GEP status (where relevant) Published or not	Reports on previous use in granting national authorizations
AIII, 9.2.3	Pepper, T., Arnold, D. and Reeves, G.	2002	Parameters affecting the deposition of chlorpyrifos spray drift on edge of field water bodies (K125) XACER GHE-P-9790 GLP. Unpublished.	
IIA, 7.4	Capri, E.	2002	Monitoring the chlorpyrifos and chlorpyrifos methyl surface water exposure at field, catchment and regional scale in Trentino (N. Italy, 2001-2002)- final report. (K126) GHE-P-9821 GLP. Unpublished.	
IIA, 7.4	Capri, E.	2002	Monitoring the chlorpyrifos and chlorpyrifos methyl surface water exposure at field, catchment and regional scale in Sicily (S. Italy, 2001-2002) – final report. (K127) GHE-P-9822 GLP. Unpublished.	

B.9 Ecotoxicology.

Annex point/ reference number	Author(s)	Year	Title Source (where different from company) Company, Report No. GLP or GEP status (where relevant) Published or not	Reports on previous use in granting national authorizations
IIA, 8.2.4	Brown, R.P., Landre, A.M., Miller, J.A., Hugo, J.M. and Kirk, A.D.	1997	Toxicity of sediment-associated chlorpyrifos with freshwater invertebrates <i>Hyalella azteca</i> (amphipod) and <i>Chironomus tentans</i> (midge) (J086) Report No. DECO-ES-3036 – J086 GLP. Unpublished	
IIA, 8.2.4	Brown, R., Hugo, J.M., Miller, J.A. and Harriugton, C.K.	1997	Chlorpyrifos : Acute toxicity to the Amphipod (<i>Hyalella azteca</i>) (J087) Report No. 971095 GLP. Unpublished	
IIA, 8.5	Barnes, S.P.	1999	Chlorpyrifos technical: Activated sludge – respiration inhibition test (J101) HLS, UK - Study Id. DOS 040/993978 - Report No. GHE-T-965 GLP. Unpublished	
IIA, 8.1/8.6 IIIA, 10.1/10.3	Fontaine, D.D.	1995	Statistical review of the effects of chlorpyrifos insecticidal treatments upon avain abundance, avian casualties and vertebrate casualties in turf in Florida (K072)[See also J091] Report No. DECO-ES-2992 – K072 Not GLP. Unpublished	
IIA, 8.1/8.6 IIIA, 10.1/10.3	Fontaine, D.D.	1995	Statistical review of the effects of chlorpyrifos insecticidal treatments upon avain abundance, avian casualties and vertebrate casualties in Californian Citrus groves (K073) [See also J093] Report No. DECO-ES-2991 – K073 Not GLP. Unpublished	
IIA, 8.1/8.6 IIIA, 10.1/10.3	Fontaine, D.D.	1995	Statistical review of the effects of chlorpyrifos insecticidal treatments upon avain abundance, avian casualties and vertebrate casualties in Iowa Cornfields (K074) [See also J092] Report No. DECO-ES-2886 Not GLP. Unpublished	
IIA, 8.1/8.6 IIIA, 10.1/ 10.3	Frey, L.T., Krueger, H.O. and Palmer, D.A.	1994	LORSBAN Insecticide: Evaluation of its effects upon avian and mammalian species on and around corn fields in Iowa (J092) [See also K074] Wildlife Int. Ltd., Easton, Maryland, and MVTI Labs Inc., New Ulm, MN, USA - Study Id. 103-366 - Report No. ES-2524 GLP. Unpublished	

Annex point/ reference number	Author(s)	Year	Title Source (where different from company) Company, Report No. GLP or GEP status (where relevant) Published or not	Reports on previous use in granting national authorizations
IIA, 8.1	Gallagher, S.P., Beavers, J.B. and Jaber, M.J.	1996	Chlorpyrifos technical : Acute toxicity study with the house sparrow (J083) Wildlife International Ltd, Maryland, USA Study Id. 103-418A. Report No. DECO-ES-3133 – J083 GLP. Unpublished	
IIA, 8.1/8.6 IIIA, 10.1/10.3	Gallagher, S.P., Palmer, D.A. and Krueger, H.O.	1994	LORSBAN Insecticide: Pilot year evaluation of its effects upon avian and mammalian species on and around corn citrus groves in California (J093) [See also K073] Wildlife Int. Ltd., Easton, Maryland, and MVT Labs Inc., New Ulm, MN, USA - Study Id. 103-365 Report No. DECO-ES-2525 GLP. Unpublished	
IIA, 8.2 IIIA, 10.2	Giesy, J.P., Solomon, K.R., Coats, J.R., Dixon, K., Giddings, J. and Kenaga, E.E.	1998	Ecological risk Assessment of chlorpyrifos in North American Aquatic Environments : Reports of an Expert Panel (J094) Entrix Inc., Williamston, MI, USA - Report No. GH-C 4660 Not GLP. Unpublished	
IIA, 8.1/8.6 IIIA, 10.1/10.3	Kendall, R.J., Best, L.B., Coats, J.R., Dixon, K.R., Giesy, J.P., Hooper, M.J., Kenaga, E.E., McMurry, S.T. and Solomon, K.R.	1998	Terrestrial Ecological Risk Assessment of chlorpyrifos use in corn agrosystems (J100) Inst. Environ. And Human Health, USA, Iowa State Univ, USA, Michigan Sate Univ., USA, Univ. of Guelph, Canada - Report No. GH-C 4697 Not GLP. Unpublished	
IIA, 8.1/8.3 IIIA, 10.1/10.3/ 10.5.2	McQuillen, H.L., Brewer, L.W. and Stafford, J.M.	1998	Determination of chlorpyrifos in insects. Soil invertebrates and seed after a single application of LORSBAN 4E Insecticide in citrus (J089) Ecotox. And Biosys. Assoc. Inc. Snow Camp, NC, USA - Study Id. 079717 – Report No. GH-C 4699 GLP. Unpublished	
IIA, 8.1/8.3 IIIA, 10.1/10.3/ 10.5.2	McQuillen, H.L., Brewer, L.W., Tank, S.L. and Stafford, J.M.	1998	Determination of chlorpyrifos in insects. Soil invertebrates and seed after a single application of LORSBAN 4E Insecticide in alfalfa (J090) Ecotox. And Biosys. Assoc. Inc. Snow Camp, NC, USA - Study Id. 079716 - Report No. GH-C 4700 – J090 GLP. Unpublished	

Annex point/ reference number	Author(s)	Year	Title Source (where different from company) Company, Report No. GLP or GEP status (where relevant) Published or not	Reports on previous use in granting national authorizations
IIA, 8.3 IIIA,10.5	Mead-Briggs, M., Vinall, S. and Longley, M.	1997	Determination of dose-response data for EC formulations of cypermethrin, as AMBUSH C, for chlorpyrifos, as DURSBAN 480 (EF-1042) and for NURELLE D 50/500 EC (EF-1393), a co-formulation of these two active ingredients, against four species of Beneficial Arthropods (M186) AEU, Univer. Of Southampton, UK – Study Id. DOW-96-4 Report No. GHE-P-6717 GLP. Unpublished	
IIA, 8.1.1 IIIA, 10.1.1	Rodgers, M., Cameron, D.M., Gillham, A. & Healy, G.	1996	Dursban 5G: Acute oral toxicity (LD ₅₀) to Mallard duck (M110A) HLS Ltd, U.K. – Study Id. DWC 732/953108 Report No. GHE-T-619 – M110A GLP. Unpublished	
IIA, 8.2.4	Woodburn, K.D., Kirk, H.K. and Hugo, J.M.	1998	Chlorpyrifos: Acute toxicity to the daphnid, <i>Ceriodaphnia dubia</i> (J096) Report No. DECO ES-2957 Not GLP. Unpublished	
IIA, 8.1	Campbell, S., Hoxter, K.A. and Jaber, M.		3,5,6-trichloro-2-pyridinol : Acute oral toxicity study with the Northern bobwhite (J9) Wildlife Int., Maryland, USA - Study Id. 103-347 Report No. DECO-ES-2330 GLP. Unpublished	
IIA, 8.2.3	Woodburn, K.B.,Rick, D.L., Kirk, H.D. and Stahl D.C.	1995	Accumulation of chlorpyrifos residues in catfish, <i>Ictalurus punctatus</i> , from dietary exposure (J082) Report No. DECO-ES-2840 – J082 GLP. Unpublished	
IIA, 8.1/8.6 IIIA, 10.1/10.3	Worley, K.B., Frey, L.T., Palmer, D.A. and Krueger, H.O.	1994	DURSBAN Insecticide: Evaluation of its effects upon avian and mammalian species on and around golf courses in fall in Florida (J091) [See also K072] Wildlife Int. Ltd., Easton, Maryland, and MVT Labs Inc., New Ulm, MN, USA - Study Id. 103-364 - Report No. DECO-ES-2596 GLP. Unpublished	

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IIA, 8.2.1	Gorzinski, S.J., Mayes, M.A., Ormand, J.R., Weinberg, J.T. and Richardson, C.H.	1991	3,5,6-trichloro-2-pyridinol : Acute toxicity to the Rainbow trout, <i>Oncorhynchus mykiss</i> Walbaum (J6) Study Id. ES-DR-0037-0423-8 Dow Report No. DECO-ES-2337 GLP. Unpublished	
IIA, 8.2.2	Gorzinski, S.J., Mayes, M.A., Ormand, J.R., Weinberg, J.T. and Richardson, C.H.	1991	3,5,6-trichloro-2-pyridinol : Acute 96-hour toxicity to the Bluegill, <i>Lepomis macrochirus</i> Rafinesque (J7) Study Id. ES-DR-0037-0423-7 Report No. DECO-ES-2336 GLP. Unpublished	
IIA, 8.2.5	Gorzinski, S.J., Milazzo, D.P., Servinski, M.F. and Ormand, J.R.	1991	3,5,6-trichloro-2-pyridinol : Acute 48-hour toxicity to the water flea, <i>Daphnia magna</i> Strauss (J5) Study Id. ES-DR-0037-0423-5 Report No. DECO-ES-2339 GLP. Unpublished	
IIA, 8.2.3	Hedlund, R.T.	1972	Determination of the bioconcentration potential of 3,5,6-trichloro-2-pyridinol (J3) Report No. GS-1282 Not GLP. Unpublished	
IIA, 8.3.2	Hertlein, M.B., Nolan, R.T., Tisdell, F.G. and Watson, P.A.	1999	Assessment of the potential insecticidal properties of 3,5,6-trichloro-2-pyridinol (TCP) (J15) Study Id. DAI0183 Report No. DAI0183 GLP. Unpublished	
IIA, 8.2.6	Kirk, H. D., Gilles, M.M., Hugo, J.M. and McFadden, L.G.	1999	Effect of 3,5,6-Trichloro-2-pyridinol (TCP) on the growth of the freshwater green alga, <i>Selenastrum capricornutum</i> , printz (J14) Study Id. 991194 Report No. DECO HET-K-038278-043 GLP. Unpublished	
IIA, 8.1.1	Long, R.D., Hoxter, K.A. and Jaber, M.	1990	3,5,6-trichloro-2-pyridinol : Dietary LC ₅₀ study with the Mallard (J8) Wildlife Int., Maryland, USA - Study Id. 103-346 Report No. DECO-ES-2335 GLP. Unpublished	

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IIA, 8.5	Mallet, M.J. and Hayward, J.C.	1999	Laboratory assessment of the effects of on soil microflora respiration and nitrogen transformation according to OECD Test Guidelines 216 and 217 (J16) Study Id. CEMs-1151 GLP. Unpublished	
IIA, 8.1	Ormand, J. R. and Bell, C.D.	1990	3,5,6-trichloro-2-pyridinol : Stability in prepared game bird starter ration (J13) Study Id. ES-2294 Report No. ES-DR-0037-0423-12 GLP. Unpublished	
IIA, 8.4.1	Ward, T.J. & Boeri, R.L.	1999	3,5,6-Trichloro-2-pyridinol (TCP): Acute toxicity to the earthworm, Eisenia foetida. (J18) T.R. Wilbury Labs. Inc., Marblehead, MA, USA Study Id. 1860-DO Report No.: DECO HET-K-038278-041 GLP. Unpublished	
IIIA, 10.2.2	van Wijngaarden, R.P.A. and Brock, T.C.M.	2001	Chlorpyrifos algal microcosm experiment (J110) F20507 GHE-T-1128 Not GLP. Unpublished	
IIA, 8.3.2 IIIA, 10.5.1	Taruza, S.	2001	Extended laboratory test to determine the effects of fresh and aged residues of drift-rate concentrations of Dursban 4 EC (480 g/L chlorpyrifos) and Reldan 22 (225 g/L chlorpyrifos-methyl), on the predatory mite, Typhlodromus pyri (Acari, Phytoseiidae) (J111) DOW-01-37 GHE-P-9449 GLP. Unpublished	
IIA, 8.3.2 IIIA, 10.5.1	Vinall, S.	2001	Extended laboratory test to determine the effects of fresh and aged residues of drift-rate concentrations of Dursban 4 EC (480 g/L chlorpyrifos) and Reldan 22 (225 g/L chlorpyrifos-methyl), on the parasitic wasp, Aphidius rhopalosiphi (Hymenoptera, Braconidae) (J112) DOW-01-36 GHE-P-9455 GLP. Unpublished	

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IIA, 8.4.2 IIIA, 10.6.1.2	Hayward, J.C.	2002	Effects of DURSBAN 480 EC on reproduction and growth of the earthworm <i>Eisenia fetida</i> (J113) CEMR-1719 GHE-T-1165 GLP. Unpublished	
IIA, 8.1 IIIA, 10.1	Anderson, T.A., Richards, S.M., McMurray, S.T. and Hooper, M.J.	1998	Avian response to chlorpyrifos exposure in a corn agrosystems (J114) GH-C4698 Not GLP. Unpublished	
IIA, 8.3.2 IIIA, 10.5.1	Manley, B.	2001	Extended laboratory test to determine the effects of fresh and aged residues of drift-rate concentrations of Dursban 4 EC (480 g/L chlorpyrifos) and Reldan 22 (225 g/L chlorpyrifos-methyl), on the green lacewing, <i>Chrysoperla carnea</i> (Neuroptera, Chrysopidae) (J115) DOW-01-38 GHE-P-9725 GLP. Unpublished	
IIA, 8.3.1 IIIA, 10.4.3	Bakker, F.	2002	Effects of RELDAN 22 and DURSBAN 75 WG on honeybees, <i>Apis mellifera</i> L, when applied at different times, determined in a cage test (J116) DA013AMS GLP. Unpublished	
IIA, 8.2.2.2	Marino, T.A., Gilles, M.M., Rick, D.L. and Henry, K.S.		Evaluation of the toxicity of 3,5,6-Trichloro-2-pyridinol (TCP) to the early life stages of the rainbow trout, <i>Oncorhynchus mykiss</i> Walbaum (J17) 991173 DECO HET-K-038278-042 GLP. Unpublished	
IIA, 8.3.2 IIIA, 10.5.1	Miles, M.	2000	Extended laboratory bioassays to evaluate the duration of effect of RELDAN 40 EC (EF-1548 containing 400 g/L chlorpyrifos-methyl) and DURSBAN 75 WG (EF-1315 containing 750 g/kg chlorpyrifos-ethyl) on the lacewing (<i>Chrysoperla carnea</i>) in orchards (M214) GHE-P-6278 GLP. Unpublished	

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IIA, 8.3.1 IIIA, 10.4.3	Bakker, F	2000	Effects of DURSBAN 75 WG on honeybees, <i>Apis mellifera</i> L, when applied to a flowering <i>Phacelia tanacetifolia</i> 1,3,5,7 and 14 days before exposure, determined in a cage test (M215) DA012AMS GHE-P-9188 GLP. Unpublished	
IIA, 8.3.2 IIIA, 10.5.1	Mead-Briggs, M.	1997	Extended laboratory and semi-field study to evaluate the effects of DURSBAN 4 EC, RELDAN 50 EC and two reference products on the ladybird, <i>Coccinella septempunctata</i> , in wheat (M226) DOW-97-4 GHE-P-6926 GLP. Unpublished	
IIA, 8.3.2 IIIA, 10.5.1	Mead-Briggs, M.	1997	Extended laboratory and semi-field study to evaluate the effects of DURSBAN 4 EC, RELDAN 50 EC and two reference products on the lycosid spider, <i>Pardosa</i> spp. (M227) DOW-97-6 GHE-P-6927 GLP. Unpublished	
IIA, 8.3.2 IIIA, 10.5.1	Mead-Briggs, M.	1997	Extended laboratory and semi-field study to evaluate the effects of DURSBAN 4 EC, RELDAN 50 EC and two reference products on adult and pupal stages of aphid-specific parasitoids in wheat (M228) DOW-97-3 GHE-P-6928 GLP. Unpublished	
IIA, 8.3.2 IIIA, 10.5.1	Mead-Briggs, M	1997	Extended laboratory and semi-field study to evaluate the effects of DURSBAN 4 EC, RELDAN 50 EC and two reference products on the ground beetle, <i>Bembidion lampros</i> , in wheat (M229) DOW-97-5 GHE-P-6929 GLP. Unpublished	

APPENDIX IV

List of uses supported by available data

CHLORPYRIFOS

Crop and/or situation (a)	Member State or Country	Product name	F G or I (b)	Pests or Group of pests controlled (c)	Formulation		Application				Application rate per treatment			PHI (days) (l)	Remarks: (m)
					Type (d-f)	Conc. of as (i)	method kind (f-h)	growth stage & season (j)	number min max (k)	interval between applications (min)	kg as/ha min max	water l/ha min max	kg as/ha min max		
Grape vines	N. & S. Europe	Dursban 480 EC	F	Post-blossom pests	EC	480 g/L	Abmb, HL	Fruiting#	1	N/A	0.0408	600	0.245	21	# Timing of application to be consistent with minimal exposure to bees

- Remarks:**
- (a) For crops, the EU and Codex classifications (both) should be used; where relevant, the use situation should be described (e.g. fumigation of a structure)
 - (b) Outdoor or field use (F), glasshouse application (G) or indoor application (I)
 - (c) e.g. biting and suckling insects, soil born insects, foliar fungi, weeds
 - (d) e.g. wettable powder (WP), emulsifiable concentrate (EC), granule (GR)
 - (e) GCPF Codes - GIFAP Technical Monograph No 2, 1989
 - (f) All abbreviations used must be explained
 - (g) Method, e.g. high volume spraying, low volume spraying, spreading, dusting, drench
 - (h) Kind, e.g. overall, broadcast, aerial spraying, row, individual plant, between the plants - type of equipment used must be indicated
 - (i) g/kg or g/l
 - (j) Growth stage at last treatment (BBCH Monograph, Growth Stages of Plants, 1997, Blackwell, ISBN 3-8263-3152-4), including where relevant, information on season at time of application
 - (k) The minimum and maximum number of application possible under practical conditions of use must be provided
 - (l) PHI - minimum pre-harvest interval
 - (m) Remarks may include: Extent of use/economic importance/restrictions