SECTION IIIA 7	FATE AND BEHAVIOUR IN THE ENVIRONMENT	Official use only
IIIA 7.2.3.1/05	**Adsorption and desorption in accordance with new test guideline EC C18 or the corresponding OECD 106 and, where relevant, adsorption and desorption of metabolites and degradation products**	
	Evaluation by Competent Authorities	
	EVALUATION BY RAPPORTEUR MEMBER STATE	
Date	Not relevant	
Materials and Methods	[redacted]	

SECTION IIIA 7	FATE AND BEHAVIOUR IN THE ENVIRONMENT	Official use only
IIIA 7.2.3.1/05	**Adsorption and desorption in accordance with new test guideline EC C18 or the corresponding OECD 106 and, where relevant, adsorption and desorption of metabolites and degradation products**	
Results and discussion	[redacted]	
Conclusion	[redacted]	
Reliability	[redacted]	
Acceptability	[redacted]	
Remarks	--	

[redacted]

[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]

[redacted]

[redacted]	[redacted]	[redacted]				
[redacted]						
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]						
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

98/8 Doc IIIA section No.	**7.2.3.2**	**Mobility in at least three soil types and where relevant mobility of metabolites and degradation products**
91/414 Annex IIA point addressed	**7.1.3**	**Column leaching studies**

		Official use only
Reference point in dossier	**7.2.3.2/01**	
Title:	PP563 and PP321 : Leaching of PP563 and PP321 and their Degradation Products in Soil Columns	
Project/Report number:	RJ0408B	
Author(s):	Stevens, J.E.B. and Bewick, D.W.	
Date of report:	1985	
Published:	No	
Testing facility:	Jealott's Hill Research Station, Bracknell, Berkshire, UK	
Test substance:	^{14}C-cyclopropane Cyhalothrin (PP563), radiochemical purity [redacted]	X1
Study dates	May 1983 to March 1985	
GLP:	Yes	
Reliability indicator	1	

	Official use only
Materials and methods: The mobility of ^{14}C-cyclopropane labelled Cyhalothrin and its degradation products have been investigated, in two soil types, by column leaching experiments following ageing for 30 days under aerobic conditions at 20°C and 40% maximum water holding capacity. Radiolabelled Cyhalothrin was applied to the soils at a nominal application rate of 100 g ai/ha and aged for 30 days. The preparations of Cyhalothrin, and its degradation products in soil, were quantified after incubation. Aged soil samples were then transferred to the top of soil columns and leached with a total of 1350 ml of 0.01M $CaCl_2$, over a 9 week period.	X2 X3 X4 X5
Findings: The radioactive residues in leachate samples from the "18 Acres" sandy loam soil were below the limit of analytical determination [<0.000023 µg/ml (Cyhalothrin equivalents)] throughout the study. In "Frensham" loamy sand soil columns, a "lighter" soil, maximum leachate concentrations were still very small, amounting to only 0.000030 µg/ml, after 14 days leaching. The distribution of the radioactive residues within the soil columns was similar for both soil types and showed that below 5 cm there were no detectable residues [<0.00047 µg/g (Cyhalothrin equivalents), corresponding to <0.65% of the applied radiocarbon, in each column segment]. Therefore 'aged' residues of Cyhalothrin, containing both the parent enantiomer mix (and hence *lambda*-Cyhalothrin) and the acid moiety were not mobile in soil.	X6

	Evaluation by Competent Authorities
	Use separate "evaluation boxes" to provide transparency as to the comments and views submitted
	EVALUATION BY RAPPORTEUR MEMBER STATE
Date	Not relevant
Materials and Methods	[redacted]
Results and discussion	[redacted]

	[redacted]
Conclusion	[redacted]
Reliability	[redacted]
Acceptability	[redacted]
Remarks	[redacted]

98/8 Doc IIIA section No.	**7.3.1**	**Phototransformation in air (estimation method), including identification of breakdown products**
91/414 Annex IIA point addressed	**7.2.2**	**Rate and route of degradation in air**

		Official use only
Reference point in dossier	**7.3.1/01**	
Title:	*Lambda*-Cyhalothrin : Calculation of Half-Life by Reaction with Atmospheric Hydroxyl Radicals	
Project/Report number:	RIC0461	
Author(s):	Hayes S E	
Date of report:	September 1998	
Published:	No	
Testing facility:	Zenecca	
Test substance:	Not applicable, model simulation	
Study dates	Not applicable, model simulation	
GLP:	No	
Reliability indicator	1	

	Official use only
SUMMARY : HYDROXYL RADICALS Hydrogen Abstraction = 1.0012 x 10^{-12} cm^3/molecule-sec Reaction with N, S and -OH = 0.0000 x 10^{-12} cm^3/molecule-sec Addition to Triple Bonds = 0.0000 x 10^{-12} cm^3/molecule-sec Addition to Olefinic Bonds = 13.8692 x 10^{-12} cm^3/molecule-sec **Addition to Aromatic Rings = 16.5939 x 10^{-12} cm^3/molecule-sec Addition to Fused Rings = 0.0000 x 10^{-12} cm^3/molecule-sec OVERALL OH Rate Constant = 31.4643 x 10^{-12} cm^3/molecule-sec HALF-LIFE = 0.340 Days (12-hr day; 1.5E6 OH/cm^3) HALF-LIFE = 4.079 Hrs ..... ** Designates Estimation(s) Using ASSUMED Value(s) **SUMMARY : OZONE REACTION** OVERALL OZONE Rate Constant = 0.162662 x 10^{-17} cm^3/molecule-sec HALF-LIFE = 7.045 Days (at 7x 10^{11} mol/cm^3)	X1 X2

	Evaluation by Competent Authorities
	Use separate "evaluation boxes" to provide transparency as to the comments and views submitted
	EVALUATION BY RAPPORTEUR MEMBER STATE
Date	Not relevant
Materials and Methods	[redacted]
Results and discussion	[redacted]
Conclusion	[redacted]
Reliability	[redacted]
Acceptability	[redacted]
Remarks	--

98/8 Doc IIIA section No.	7.3.2	Fate and behaviour in air, further studies

		Official use only
Reference point in dossier	**7.3.2/01**	
Title:	Fluorochloridone, Pirimicarb, *Lambda*-Cyhalothrin, Prosulfocarb, Fluazifop-p-Butyl: Volatility from French Bean Leaves and Speyer 2.1 Soil	
Project/Report number:	RJ1046B	
Author(s):	Heath, J, and Ahmed, A.	
Date of report:	1992	
Published:	No	
Testing facility:	Jealott's Hill Research Station, Bracknell, Berkshire, UK	
Test substance:	^{14}C-cyclopropane and ^{14}C-methine *lambda*-Cyhalothrin, radiochemical purity [redacted]	X1
Study dates	April 1991 to December 1991	
GLP:	Yes	
Reliability indicator	1	

	Official use only
Materials and methods: ^{14}C-labelled *lambda*-Cyhalothrin, formulated as an emulsifiable concentrate was applied directly to the surface of a standard sandy soil (Speyer 2.1) and air passed over the soil surface at a rate of 1 metre/second. The treated soil was maintained at 60% moisture holding capacity, and the air temperature and relative humidity monitored during the 24 hour period of the experiment.	X2
^{14}C-labelled *lambda*-Cyhalothrin, formulated as an emulsifiable concentrate was applied directly to the surface of a number of leaves on a french bean plant and air passed over the treated leaves at a rate of 2 metres/second. The air temperature and relative humidity were constantly monitored during the 24 hour period of the experiment.	X3 X4 X5
Findings: The percentage of the applied radioactivity recovered is given below. These results clearly establish that *lambda*-Cyhalothrin does not volatilise from soil surfaces and there is no substantial evaporation (ie <20% in 24 hours under a continuous air speed of 2 metre/second) from leaf surfaces.	

Hours After Treatment	Soil	Leaves
0	100%	100%
1	104%	98%
3	101%	101%
5	101%	90%
7	Not Sampled	91%
24	102%	88%

	Evaluation by Competent Authorities
	Use separate "evaluation boxes" to provide transparency as to the comments and views submitted
	EVALUATION BY RAPPORTEUR MEMBER STATE
Date	Not relevant
Materials and Methods	[redacted]
Results and discussion	--
Conclusion	[redacted]
Reliability	[redacted]
Acceptability	[redacted]
Remarks	[redacted]

		Official use only
Reference point in dossier	**7.3.2/02**	
Title:	*Lambda*-Cyhalothrin - Volatilization from Soil and Leaf Surfaces Following Application as a WG Formulation	
Project/Report number:	RJ1346B	
Author(s):	Mound, E.L. and Skidmore, M.W.	
Date of report:	1992	
Published:	No	
Testing facility:	Jealott's Hill Research Station, Bracknell, Berkshire, UK	
Test substance:	^{14}C-phenyl *lambda*-Cyhalothrin, radiochemical purity [redacted]	X1
Study dates	July – October 1992	
GLP:	Yes	
Reliability indicator	1	

Materials and methods (Official use only)

^{14}C-phenyl labelled *lambda*-Cyhalothrin was applied to Speyer 2.1 soil and Dwarf French Bean (*Phaseolus vulgaris*) leaves at application rates equivalent to 150.2 and 117.4 g ai/ha respectively. The active ingredient was formulated as a wettable grain (WG) using Syngenta formulation number YF8048 and was [redacted] pure at the time of application. X2 X3 The leaves were from plants at the flowering/first fruit stage at the time of application. The test systems were maintained in air flows of > 1 m/s for 24 hours at a temperature of approximately 20°C. The soil was maintained at 60% of its moisture holding capacity (MHC) throughout the experiment. At 0, 1, 3, 6, 20 and 24 hours after treatment, replicate samples were removed from the air flow. The radioactivity remaining on the soil/leaf surface was quantified. X4 The mean radioactivity recovered at each time point was expressed as a percentage of that recovered in the zero-time samples. X5

Findings:

The results of the study are shown in the following table. The results obtained from this study demonstrate that *lambda*-Cyhalothrin, formulated as a wettable grain, is not significantly volatilized from either soil or leaf surfaces. The atmosphere is, therefore, not considered to be a significant compartment in the fate of *lambda*-Cyhalothrin.

Volatilization of *Lambda*-Cyhalothrin from Soil and Leaf Surfaces

Experiment	Sampling Time, Hours					
	0	**1**	**3**	**6**	**20**	**24**
Soil Surface	100.0	101.1	93.6	91.9	93.8	96.2
Leaf Surface	100.0	95.4	90.3	92.4	91.6	88.6

	Evaluation by Competent Authorities
	Use separate "evaluation boxes" to provide transparency as to the comments and views submitted
	EVALUATION BY RAPPORTEUR MEMBER STATE
Date	Not relevant
Materials and Methods	[redacted]
Results and discussion	--
Conclusion	[redacted]
Reliability	[redacted]
Acceptability	[redacted]
Remarks	--

Competent Authority Report

According to Directive 98/8/EC

lambda-Cyhalothrin

CAS 91465-08-6

Active substance in Biocidal Products, Product Type 18 (Insecticide)

Notifier: Syngenta European Center

DOCUMENT III-A

Section 7.4-7.5: Ecotoxicology

Rapporteur Member State: Sweden

Final CAR, September 2010

KEMI
Kemikalieinspektionen
Swedish Chemicals Agency

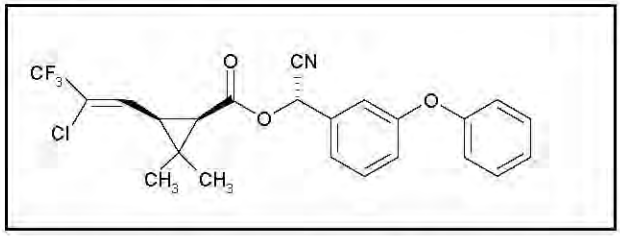
INFORMATION FROM THE RMS:

Format

Lambda-cyhalothrin has previously been evaluated as a plant protection product and was included in the Annex I of the Council Directive of 15 July 1991 concerning placing of plant protection products on the market (91/414/EEC) in 2002. Syngenta has used the possibility to utilise the PPP dossier for the BP dossier preparation in agreement with the EU document "Guidance Document on How to utilize PPP Dossiers/Monographs and Existing Substances (ESR) Dossiers/Risk Assessments for the Preparation of BP dossiers/ CAs' reports" thus study summaries in this dossier does not follow the standard BPD format. The study summaries are from Tier I sections 5 and 6 for Annex II of 91/414/EEC dossier. For studies which were not part of the original PPP-dossier and for studies which were submitted to supplement the original BP-dossier (e.g., at the stage of completeness check) more complete study summaries were provided.

Stereoisomers

Lambda-cyhalothrin (code PP321), α-cyano-3-phenoxybenzyl 3-(2-chloro-3,3,3-trifluoropropenyl)-2,2-dimethylcyclopropanecarboxylate, is a 1:1 mixture of the (Z)-(1R,3R),S-ester and the (Z)-(1S,3S),R-ester:



The molecule "cis, trans-ZE-cyhalothrin" (PP564) contains three asymmetric carbon atoms and a centre for geometrical isomerism about the double bond (either an E or Z configuration). Therefore 2^4 structures (eight enantiomeric pairs) are possible. Eight of these isomers have a cis-configuration about the 1,3-bond of the cyclopropane ring and the other eight a trans-configuration:

isomers with a cis-configuration about the 1,3-bond of the cyclopropane ring	A'	E(1R,3R,αR) and E(1S,3S,αS) enantiomer pair
	A	Z(1R,3R,αR) and Z(1S,3S,αS) enantiomer pair
	B'	E(1R,3R,αS) and E(1S,3S,αR) enantiomer pair
	B	Z(1R,3R,αS) and Z(1S,3S,αR) enantiomer pair
isomers with a trans-configuration about the 1,3-bond of the cyclopropane ring	C	Z(1R,3S,αR) and Z(1S,3R,αS) enantiomer pair
	C'	E(1R,3S,αR) and E(1S,3R,αS) enantiomer pair
	D	Z(1R,3S,αS) and Z(1S,3R,αR) enantiomer pair
	D'	E(1R,3S,αS) and E(1S,3R,αR) enantiomer pair

Lambda-cyhalothrin (PP321) consists of the enantiomeric pair cis B ("cis B diastereoisomer"). Cyhalothrin (PP563) consists of the enantiomeric pairs cis A and cis B.

Some of the studies in environmental fate and behaviour and ecotoxicology were conducted on Cyhalothrin, however, in all areas data were also available for *Lambda*-cyhalothrin. The information provided in studies carried out on Cyhalothrin is used as supportive information.

The tested metabolites and transformation products were identified in different test systems investigating the degradation of *lambda*-cyhalothrin. For more information, see section 7.1 – 7.2 (Environmental fate).

98/8 Doc IIIA section No.	**7.4**	**Effects on aquatic organisms**

98/8 Doc IIIA section No.	**7.4.1**	**Aquatic toxicity, initial tests *(headline)***

98/8 Doc IIIA section No.	**7.4.1.1/01**	**Acute toxicity to fish**
91/414 Annex Point addressed	**II 8.2.1/01**	**Acute toxicity to fish**

		Official use only
Reference point (location) in dossier	**7.4.1.1/01**	
Title:	*Lambda*-Cyhalothrin: Acute toxicity to golden orfe (*Leuciscus idus*)	
Project/Report number:	BL/6142/B	
Author(s):	[redacted]	
Date of report:	1997	
Published:	Not published.	
Testing facility:	[redacted]	
Test substance:	Technical *lambda*-Cyhalothrin, purity [redacted]	
Study dates	29 September – 03 October 1997	
GLP:	Yes	
Deficiencies:	None	
Reliability indicator	1.	

	Official use only
Materials and methods: *Lambda*-Cyhalothrin technical, Purity: [redacted] w/w *lambda*-Cyhalothrin. Groups of 20 golden orfe (*Leuciscus idus*) were exposed to nominal concentrations of 0.03, 0.06, 0.12, 0.24, 0.48 and 0.96 µg/L of *lambda*-Cyhalothrin technical in a freshwater flow-through test system for 96 hours at 12±1°C. In addition fish were maintained in dilution water and 0.1 mL dimethylformamide/L flow-through systems for control and solvent control purposes respectively. Concentrations of *lambda*-Cyhalothrin were determined by chemical analysis at 0, 48, and 96 hours. Mortality and symptoms of toxicity were recorded at 24, 48, 72 and 96 hours. **Findings:** The mean measured concentrations of *lambda*-Cyhalothrin technical ranged from 43 to 58% of the nominal values. The low and variable measured concentrations were considered to be	X1

due to the adsorption of *lambda*-Cyhalothrin technical onto surfaces that the stock and test solutions came into contact with. This is typical for a chemical with adsorptive properties. Consequently the mean measured concentrations were used in the calculation and reporting of all results and have been presented with observations of fish mortality in the table below. The general symptoms of toxicity observed in this study were quiescence, sounding, erratic and ceased swimming, spiralling, surfacing, loss of balance, rapid, laboured and irregular respiration, light discolouration and gulping air.	

Effects on golden orfe exposed to *lambda*-Cyhalothrin for 96 hours under flow-through conditions

Nominal *lambda*-Cyhalothrin concentration (µg/L)	Mean measured a.s. concentration (µg/L)	Cumulative percentage mortality observed			
		24 hour	48 hour	72 hour	96 hour
Dilution Water Control	<0.002	0	0	0	0
Solvent Control	<0.002	0	0	0	0
0.03	0.017	0	0	0	0
0.06	0.026	0	0	0	0
0.12	0.056	0	0	0	0
0.24	0.11	0	100	100	100
0.48	0.28	100	100	100	100
0.96	0.48	100	100	100	100

The LC_{50} values were calculated by the binomial method. LC_{50} values with 95% confidence intervals, based on mean measured a.s. concentrations are presented below. The 96h LC_{50} of *lambda*-Cyhalothrin to golden orfe (*Leuciscus idus*) was 0.078 µg/L, based on mean measured concentrations. The no observed effect concentration (NOEC) based on mortality and symptoms of toxicity was 0.056 µg/L.	X2

***Lambda*-Cyhalothrin golden orfe LC_{50} values (95% confidence intervals)**

Time (hours)	LC_{50} (µg a.s./L)
24	0.18 (0.11 – 0.28)
48	0.078 (0.056 – 0.11)
72	0.078 (0.056 – 0.11)
96	0.078 (0.056 – 0.11)

	Evaluation by Competent Authorities
	EVALUATION BY RAPPORTEUR MEMBER STATE
Date	Not relevant
Materials and Methods	[redacted]
Results and discussion	[redacted]
Conclusion	[redacted]
Reliability	[redacted]
Acceptability	[redacted]
Remarks	

98/8 Doc IIIA section No.	7.4.1.1/02	Acute toxicity to fish
91/414 Annex Point addressed	II 8.2.1/02	Acute toxicity to fish

		Official use only
Reference point (location) in dossier	**7.4.1.1/02**	
Title:	*Lambda*-Cyhalothrin: Acute toxicity to channel catfish (*Ictalurus punctatus*)	
Project/Report number:	BL/6147/B	
Author(s):	[redacted]	
Date of report:	1997	
Published:	Not published.	
Testing facility:	[redacted]	
Test substance:	Technical *lambda*-Cyhalothrin, purity [redacted]	
Study dates	20 – 24 October 1997	
GLP:	Yes	X1
Deficiencies:	None	
Reliability indicator	1.	

	Official use only
Materials and methods: *Lambda*-Cyhalothrin technical, Purity: [redacted] w/w *lambda*-Cyhalothrin. Groups of 20 channel catfish (*Ictalurus punctatus*) were exposed to nominal concentrations of 0.080, 0.16, 0.32, 0.64, 1.28 and 2.56 µg/L of *lambda*-Cyhalothrin technical in a freshwater flow-through test system for 96 hours at 17±1°C. In addition fish were maintained in dilution water and 0.1 mL dimethylformamide/L flow-through systems for control and solvent control purposes respectively. Concentrations of *lambda*-Cyhalothrin were determined by chemical analysis at 0, 48, and 96 hours. Mortality and symptoms of toxicity were recorded at 24, 48, 72 and 96 hours. **Findings:** The mean measured concentrations of *lambda*-Cyhalothrin technical ranged from 25 to 57% of the nominal values. The low measured concentrations were considered to be due to the adsorption of *lambda*-Cyhalothrin technical onto surfaces that the stock and test solutions came into contact with. This is typical for a chemical with adsorptive properties. Consequently the mean measured concentrations were used in the calculation and reporting of all results and have been presented with observations of fish mortality in the table below. The general symptoms of toxicity observed in this study were weakness/quiescence, surfacing, sounding, twitching, spiralling, loss of balance, discolouration, tetanous, breathing difficulties and erratic swimming.	X2 X3

Effects on channel catfish exposed to *lambda*-Cyhalothrin for 96 hours under flow-through conditions

Nominal *lambda*-Cyhalothrin concentration (µg/L)	Mean measured a.s. concentration (µg/L)	Cumulative percentage mortality observed			
		24 hour	48 hour	72 hour	96 hour
Dilution Water Control	<0.002	0	0	0	0
Solvent Control	<0.002	0	0	0	0
0.08	0.020	0	0	0	0
0.16	0.058	0	0	0	0
0.32	0.090	0	0	0	10
0.64	0.25	0	0	80	85
1.28	0.73	30	100	100	100
2.56	1.0	75	100	100	100

The LC_{50} values were calculated by the binomial method. LC_{50} values with 95% confidence intervals, based on mean measured a.s. concentrations are presented below. The 96h LC_{50} of *lambda*-Cyhalothrin to channel catfish (*Ictalurus punctatus*) was 0.16 µg/L, based on mean measured concentrations. The no observed effect concentration (NOEC) based on mortality and symptoms of toxicity was 0.058 µg/L.	X4

***Lambda*-Cyhalothrin channel catfish LC_{50} values (95% confidence intervals)**

Time (hours)	LC_{50} (µg a.s./L)
24	0.82 (0.67 – 1.1)
48	0.43 (0.25 – 0.73)
72	0.18(0.15 – 0.23)
96	0.16 (0.13 – 0.20)

	Evaluation by Competent Authorities
	EVALUATION BY RAPPORTEUR MEMBER STATE
Date	Not relevant
Materials and Methods	[redacted]
Results and discussion	[redacted]
Conclusion	[redacted]

Reliability	[redacted]
Acceptability	[redacted]
Remarks	[redacted]

98/8 Doc IIIA section No.	7.4.1.1/03	Acute toxicity to fish
91/414 Annex Point addressed	II 8.2.1/03	Acute toxicity to fish

		Official use only
Reference point (location) in dossier	**7.4.1.1/03**	
Title:	*Lambda*-Cyhalothrin: Acute toxicity to three-spined stickleback (*Gasterosteus aculeatus*)	
Project/Report number:	BL/6146/B	
Author(s):	[redacted]	
Date of report:	1997	
Published:	Not published.	
Testing facility:	[redacted]	
Test substance:	Technical *lambda*-Cyhalothrin, purity [redacted]	
Study dates	16 – 20 September 1997	
GLP:	Yes	X1
Deficiencies:	None.	
Reliability indicator	1.	

	Official use only
Materials and methods: *Lambda*-Cyhalothrin technical, Purity: [redacted] w/w *lambda*-Cyhalothrin.	X2
Groups of 20 three-spined stickleback (*Gasterosteus aculeatus*) were exposed to nominal concentrations of 0.1, 0.2, 0.4, 0.8, 1.6 and 3.2 µg/L of *lambda*-Cyhalothrin technical in a freshwater flow-through test system for 96 hours at 12±1°C. In addition fish were maintained in dilution water and 0.1 mL dimethylformamide/L flow-through systems for control and solvent control purposes respectively. Concentrations of *lambda*-Cyhalothrin were determined by chemical analysis at 0, 48, and 96 hours. Mortality and symptoms of toxicity were recorded at 24, 48, 72 and 96 hours.	X3
Findings: The mean measured concentrations of *lambda*-Cyhalothrin technical ranged from 68 to 138% of the nominal values. The measured concentrations were variable and poorly reproducible throughout the course of the study. This was considered to be due to the adsorption of *lambda*-Cyhalothrin technical onto surfaces that the stock and test solutions came into contact with. This is typical for a chemical with adsorptive properties. Consequently the mean measured concentrations were used in the calculation and reporting of all results and have been presented with observations of fish mortality in the table below. The general symptoms of toxicity observed in this study were quiescence, spiralling, surfacing, loss of balance, sounding, discolouration, tetanous, laboured breathing and erratic swimming.	X4

Effects on three-spined stickleback exposed to *lambda*-Cyhalothrin for 96 hours under

flow-through conditions

Nominal *lambda*-Cyhalothrin concentration (µg/L)	Mean measured a.s. concentration (µg/L)	Cumulative percentage mortality observed			
		24 hour	48 hour	72 hour	96 hour
Dilution Water Control	<0.003	0	0	0	0
Solvent Control	<0.003	0	0	0	0
0.1	0.068	0	0	0	0
0.2	0.16	0	0	0	0
0.4	0.68	0	35	40	50
0.8	0.79	100	100	100	100
1.6	1.5	100	100	100	100
3.2	2.5	100	100	100	100

The LC_{50} values were calculated by the binomial method. LC_{50} values with 95% confidence intervals, based on mean measured a.s. concentrations are presented below. The 96h LC_{50} of *lambda*-Cyhalothrin to three-spined stickleback (*Gasterosteus aculeatus*) was 0.4 µg/L, based on mean measured concentrations. The no observed effect concentration (NOEC) based on mortality and symptoms of toxicity was 0.068 µg/L.	X5

***Lambda*-Cyhalothrin three-spined stickleback LC_{50} values (95% confidence intervals)**

Time (hours)	LC_{50} (µg a.s./L)
24	0.73 (0.68 – 0.79)
48	0.44 (0.36 – 0.56)
72	0.43 (0.35 – 0.54)
96	0.40 (0.33 – 0.50)

	Evaluation by Competent Authorities
	EVALUATION BY RAPPORTEUR MEMBER STATE
Date	Not relevant
Materials and Methods	[redacted]
Results and discussion	[redacted]

[redacted]

Conclusion [redacted]

Reliability [redacted]

Acceptability [redacted]

Remarks [redacted]

98/8 Doc IIIA section No.	7.4.1.1/04	Acute toxicity to fish
91/414 Annex Point addressed	II 8.2.1/04	Acute toxicity to fish

		Official use only
Reference point (location) in dossier	**7.4.1.1/04**	
Title:	Determination acute toxicity to mirror carp (*Cyprinus carpio*) of a 5%EC formulation	
Project/Report number:	BL/B2784	
Author(s):	[redacted]	
Date of report:	1985	
Published:	Not published.	
Testing facility:	[redacted]	
Test substance:	*lambda*-Cyhalothrin, 5% EC formulation, 50.7 g/L	
Study dates	30 September to 11 November 1985	
GLP:	Yes	
Deficiencies:	None.	
Reliability indicator	1.	

	Official use only
Materials and methods: 5% EC formulation of *lambda*-Cyhalothrin (JF9509), Purity: certificate of analysis stated that the *lambda*-Cyhalothrin (PP321) concentration of the formulation was 50.7 g/l with a density of 0.907 at 20°C.	X1
Groups of 10 mirror carp (*Cyprinus carpio*) were exposed to nominal concentrations of 5.6, 10, 18, 32, 56 and 100 µg/L of a 5% EC formulation of *lambda*-Cyhalothrin in a freshwater flow-through test system for 96 hours at 21±2°C. Fish were maintained in a dilution water flow-through system as a control. Concentrations of *lambda*-Cyhalothrin were determined by chemical analysis at 2, 24, 48, 72 and 96 hours. Mortality and symptoms of toxicity were recorded at 24, 48, 72 and 96 hours as well as at other times throughout the study.	X2
Findings: The mean measured concentrations of the 5% EC *lambda*-Cyhalothrin formulation ranged from 57.1 to 100 % of the nominal values. The mean measured concentrations were used in the calculation and reporting of all results and are presented in the table below with observations of fish mortality. There were no mortalities in the dilution water control or in the nominal formulation concentration of 5.6 µg/L during the 96 hour exposure. The general symptoms of toxicity observed in this study were rapid and irregular respiration, coughing, spiralling, twitching, loss of balance and darkening of colour.	X3

Effects on mirror carp exposed to a 5% EC formulation of *lambda*-Cyhalothrin for 96 hours under flow-through conditions

Nominal concentration of formulation (µg/l)	Mean measured concentration of formulation (µg/l)	Cumulative percentage mortality observed			
		24 hour	48 hour	72 hour	96 hour
Untreated Control	0.11	0	0	0	0
5.6	3.2	0	0	0	0
10	6.1	0	20	40	40
18	13	20	80	80	80
32	32	100	100	100	100
56	49	70	70	70	70
100	85	90	90	90	90

The LC_{50} values were calculated by the binomial method. LC_{50} values with 95% confidence intervals, based on mean measured formulation concentrations are presented below. The 96h LC_{50} of *lambda*-Cyhalothrin 5% EC formulation (JF9509) to mirror carp (*Cyprinus carpio*) was 9 µg formulation/L (0.5 µg a.s./L, based on mean measured concentrations of *lambda*-Cyhalothrin). The no observed effect concentration (NOEC) based on mortality was 3.2 µg formulation/L (0.18 µg a.s./L, based on mean measured concentrations of *lambda*-Cyhalothrin).	X4 X5

***Lambda*-Cyhalothrin mirror carp LC_{50} values (95% confidence intervals)**

Time (hours)	LC_{50} nominal concentration of formulation (ug/L)	Equivalent *lambda*-Cyhalothrin concentration (ug/L)
24	18.2 (13 – 28)	1.0 (0.73 – 1.57)
48	10.5 (6 – 16)	0.59 (0.34 – 0.89)
72	9 (5 – 14)	0.5 (0.28 – 0.78)
96	9 (5 – 14)	0.5 (0.28 – 0.78)

	Evaluation by Competent Authorities
	EVALUATION BY RAPPORTEUR MEMBER STATE
Date	Not relevant
Materials and Methods	[redacted]
Results and discussion	[redacted]

	[redacted]
Conclusion	[redacted]
Reliability	[redacted]
Acceptability	[redacted]
Remarks	[redacted]

98/8 Doc IIIA section No.	7.4.1.1/05	Acute toxicity to fish
91/414 Annex Point addressed	II 8.2.1/05	Acute toxicity to fish

		Official use only
Reference point (location) in dossier	**7.4.1.1/05**	
Title:	*Lambda*-Cyhalothrin: Acute toxicity to zebra danio (*Brachydanio rerio*)	
Project/Report number:	BL/6144/B	
Author(s):	[redacted]	
Date of report:	1997	
Published:	Not published.	
Testing facility:	[redacted]	
Test substance:	Technical *lambda*-Cyhalothrin, purity [redacted]	
Study dates	22 - 26 September 1997	
GLP:	Yes	X1
Deficiencies:	None.	
Reliability indicator	1.	

	Official use only
Materials and methods: *Lambda*-Cyhalothrin technical, Purity: [redacted] w/w *lambda*-Cyhalothrin.	X2
Groups of 20 zebra danio (*Brachydanio rerio*) were exposed to nominal concentrations of 0.1, 0.2, 0.4, 0.8, 1.6 and 3.2 µg/L of *lambda*-Cyhalothrin technical in a freshwater flow-through test system for 96 hours at 25±1°C. In addition fish were maintained in dilution water and 0.1 mL dimethylformamide/L flow-through systems for control and solvent control purposes respectively. Concentrations of *lambda*-Cyhalothrin were determined by chemical analysis at 0, 48, and 96 hours. Mortality and symptoms of toxicity were recorded at 24, 48, 72 and 96 hours.	X3
Findings: The mean measured concentrations of *lambda*-Cyhalothrin technical ranged from 35 to 75% of the nominal values. The low measured concentrations were considered to be due to the adsorption of *lambda*-Cyhalothrin technical onto surfaces that the stock and test solutions came into contact with. This is typical for a chemical with adsorptive properties. Consequently the mean measured concentrations were used in the calculation and reporting of all results and have been presented with observations of fish mortality in the table below. The general symptoms of toxicity observed in this study were quiescence, sounding, erratic swimming, loss of balance, spiralling, laboured and rapid respiration, gulping air and dark discolouration.	X4

Effects on zebra danio exposed to *lambda*-Cyhalothrin for 96 hours under flow-through

conditions

Nominal *lambda*-Cyhalothrin concentration (µg/L)	Mean measured a.s. concentration (µg/L)	Cumulative percentage mortality observed			
		24 hour	48 hour	72 hour	96 hour
Dilution Water Control	<0.0082	0	0	0	0
Solvent Control	<0.0082	0	0	0	0
0.1	0.035	0	0	0	0
0.2	0.07	0	0	0	0
0.4	0.21	0	0	0	0
0.8	0.4	5	15	30	30
1.6	1.2	20	35	50	50
3.2	1.8	100	100	100	100

The LC_{50} values were calculated by the binomial method. LC_{50} values with 95% confidence intervals, based on mean measured a.s. concentrations are presented below. The 96h LC_{50} of *lambda*-Cyhalothrin to zebra danio (*Brachydanio rerio*) was 0.64 µg/L, based on mean measured concentrations. The no observed effect concentration (NOEC) based on mortality and symptoms of toxicity was 0.21 µg/L.	X5 X6

***Lambda*-Cyhalothrin *Zebra danio* LC_{50} values (95% confidence intervals)**

Time (hours)	LC_{50} (ug/L)
24	0.97 (0.74 – 1.4)
48	0.8 (0.62 – 1.1)
72	0.64 (0.48 – 0.9)
96	0.64 (0.48 – 0.9)

Evaluation by Competent Authorities	
	EVALUATION BY RAPPORTEUR MEMBER STATE
Date	Not relevant
Materials and Methods	[redacted]
Results and discussion	[redacted]

[redacted]

Conclusion	[redacted]
Reliability	[redacted]
Acceptability	[redacted]
Remarks	[redacted]

98/8 Doc IIIA section No.	**7.4.1.1/06**	**Acute toxicity to fish**
91/414 Annex Point addressed	**II 8.2.1/06**	**Acute toxicity to fish**

		Official use only
Reference point (location) in dossier	**7.4.1.1/06**	
Title:	*Lambda*-Cyhalothrin: Acute toxicity to fathead minnow (*Pimephales promelas*)	
Project/Report number:	BL/6246/B	
Author(s):	[redacted]	
Date of report:	1997	
Published:	Not published.	
Testing facility:	[redacted]	
Test substance:	Technical *lambda*-Cyhalothrin, purity [redacted]	
Study dates	01 - 05 September 1997	
GLP:	Yes	X1
Deficiencies:	None.	
Reliability indicator	1.	

	Official use only
Materials and methods: *Lambda*-Cyhalothrin technical, Purity: [redacted] w/w *lambda*-Cyhalothrin. Groups of 20 fathead minnow (*Pimephales promelas*) were exposed to nominal concentrations of 0.060, 0.125, 0.25, 0.50, 1.0 and 2.0 µg/L of *lambda*-Cyhalothrin technical in a freshwater flow-through test system for 96 hours at 25±1°C. In addition fish were maintained in dilution water and 0.1 mL dimethylformamide/L flow-through systems for control and solvent control purposes respectively. Concentrations of *lambda*-Cyhalothrin were determined by chemical analysis at 0, 48, and 96 hours. Mortality and symptoms of toxicity were recorded at 24, 48, 72 and 96 hours. **Findings:** The mean measured concentrations of *lambda*-Cyhalothrin technical ranged from 38 to 68% of the nominal values. The low measured concentrations were considered to be due to the adsorption of *lambda*-Cyhalothrin technical onto surfaces that the stock and test solutions came into contact with. This is typical for a chemical with adsorptive properties. Consequently the mean measured concentrations were used in the calculation and reporting of all results and have been presented with observations of fish mortality in the table below. The general symptoms of toxicity observed in this study were twitching, erratic swimming, spiralling, skittering, loss of balance, rapid and ceased respiration, gulping air, excitable and dark discolouration.	X2 X3

Effects on fathead minnow exposed to *lambda*-Cyhalothrin for 96 hours under flow-through conditions

Nominal *lambda*-Cyhalothrin concentration (ug/L)	Mean measured a.s. concentration (ug/L)	Cumulative percentage mortality observed			
		24 hour	48 hour	72 hour	96 hour
Untreated Control	<0.0029	0	0	0	0
Solvent Control	<0.0029	0	0	0	0
0.06	0.025	0	0	0	0
0.125	0.082	0	0	0	0
0.25	0.17	0	0	0	0
0.5	0.34	0	0	0	0
1	0.38	0	0	0	0
2	1.3	80	80*	100	100

* Remaining fish were removed and sacrificed to prevent further suffering

The LC_{50} values were calculated by the moving average angle and binomial methods. LC_{50} values with 95% confidence intervals, based on mean measured a.s. concentrations are presented below. The 96h LC_{50} of *lambda*-Cyhalothrin to fathead minnow (*Pimephales promelas*) was 0.7 µg/L, based on mean measured concentrations. The no observed effect concentration (NOEC) based on mortality and symptoms of toxicity was 0.34 µg/L.	X4 X5

***Lambda*-Cyhalothrin fathead minnow LC_{50} values (95% confidence intervals)**

Time (hours)	LC_{50} (µg a.s./L)
24	0.89 (0.73 – 1.1)
48	0.89 (0.73 – 1.1)
72	0.7 (0.38 – 1.3)
96	0.7 (0.38 – 1.3)

	Evaluation by Competent Authorities
	EVALUATION BY RAPPORTEUR MEMBER STATE
Date	Not relevant
Materials and Methods	[redacted]
Results and discussion	[redacted]

	[redacted]
Conclusion	[redacted]
Reliability	[redacted]
Acceptability	[redacted]
Remarks	[redacted]

98/8 Doc IIIA section No.	7.4.1.1/07	Acute toxicity to fish
91/414 Annex Point addressed	II 8.2.1/07	Acute toxicity to fish

		Official use only
Reference point (location) in dossier	**7.4.1.1/07**	
Title:	*Lambda*-Cyhalothrin: Acute toxicity to Japanese rice fish (*Oryzias latipes*)	
Project/Report number:	BL/6145/B	
Author(s):	[redacted]	
Date of report:	1997	
Published:	Not published.	
Testing facility:	[redacted]	
Test substance:	Technical *lambda*-Cyhalothrin, purity [redacted]	
Study dates	10 – 14 November 1997	
GLP:	Yes	X1
Deficiencies:	None.	
Reliability indicator	1.	

	Official use only
Materials and methods: *Lambda*-Cyhalothrin technical, Purity: [redacted] w/w *lambda*-Cyhalothrin.	X2
Groups of 10 Japanese rice fish (*Oryzias latipes*) were exposed to nominal concentrations of 0.3, 0.6, 1.2, 2.4, 4.8 and 9.6 µg/L of *lambda*-Cyhalothrin technical in a freshwater flow-through test system for 96 hours at 25±1°C. In addition fish were maintained in dilution water and 0.1 mL dimethylformamide/L flow-through systems for control and solvent control purposes respectively. Concentrations of *lambda*-Cyhalothrin were determined by chemical analysis at 0, 48, and 96 hours. Mortality and symptoms of toxicity were recorded at 24, 48, 72 and 96 hours.	X3 X4
Findings: The mean measured concentrations of *lambda*-Cyhalothrin technical ranged from 16 to 58% of the nominal values. The low measured concentrations were considered to be due to the adsorption of *lambda*-Cyhalothrin technical onto surfaces that the stock and test solutions came into contact with. This is typical for a chemical with adsorptive properties. Consequently the mean measured concentrations were used in the calculation and reporting of all results and have been presented with observations of fish mortality in the table below. The general symptoms of toxicity observed in this study were quiescence, sounding, weakness, loss of balance, dark discolouration, and rapid and laboured breathing.	X5 X6

Effects on Japanese rice fish exposed to *lambda*-Cyhalothrin for 96 hours under flow-

through conditions

Nominal *lambda*-Cyhalothrin concentration (ug/L)	Mean measured a.s. concentration (ug/L)	Cumulative percentage mortality observed			
		24 hour	48 hour	72 hour	96 hour
Dilution Water Control	<0.015	0	10	20	20
Solvent Control	<0.015	0	0	0	0
0.3	0.047	10	10	10	10
0.6	0.23	0	10	10	10
1.2	0.25	0	0	0	0
2.4	0.95	10	20	20	20
4.8	2.5	40	60	70	70
9.6	5.6	100	100	100	100

The LC_{50} values were calculated by the moving average angle method. LC_{50} values with 95% confidence intervals, based on mean measured a.s. concentrations are presented below.

The 96h LC_{50} of *lambda*-Cyhalothrin to Japanese rice fish (*Oryzias latipes*) was 1.4 µg/L, based on mean measured concentrations. The no observed effect concentration (NOEC) based on mortality and symptoms of toxicity was 0.25 µg/L.

***Lambda*-Cyhalothrin Japanese rice fish LC_{50} values (95% confidence intervals)**

Time (hours)	LC_{50} (ug a.s./L)
24	2.1 (1.5 – 3.3)
48	1.5 (1.0 – 2.6)
72	1.4 (0.93 – 2.3)
96	1.4 (0.93 – 2.3)

	Evaluation by Competent Authorities
	EVALUATION BY RAPPORTEUR MEMBER STATE
Date	Not relevant
Materials and Methods	[redacted]

Results and discussion	[redacted]
Conclusion	[redacted]
Reliability	[redacted]
Acceptability	[redacted]
Remarks	[redacted]

98/8 Doc IIIA section No.	7.4.1.1/08	Acute toxicity to fish
91/414 Annex Point addressed	II 8.2.1/08	Acute toxicity to fish

		Official use only
Reference point (location) in dossier	**7.4.1.1/08**	
Title:	*Lambda*-Cyhalothrin: Acute toxicity to guppy (*Poecilia reticulata*)	
Project/Report number:	BL/6143/B	
Author(s):	[redacted]	
Date of report:	1997	
Published:	Not published.	
Testing facility:	[redacted]	
Test substance:	Technical *lambda*-Cyhalothrin, purity [redacted]	
Study dates	22 - 24 September 1997	
GLP:	Yes	X1
Deficiencies:	None.	
Reliability indicator	1.	

	Official use only
Materials and methods: *Lambda*-Cyhalothrin technical, Purity: [redacted] w/w *lambda*-Cyhalothrin.	X2
Groups of 10 guppy (*Poecilia reticulata*) were exposed to nominal concentrations of 0.2, 0.4, 0.8, 1.6, 3.2 and 6.4 µg/L of *lambda*-Cyhalothrin technical in a freshwater flow-through test system for 96 hours at 25±1°C. In addition fish were maintained in dilution water and 0.1 mL dimethylformamide/L flow-through systems for control and solvent control purposes respectively. Concentrations of *lambda*-Cyhalothrin were determined by chemical analysis at 0, 48, and 96 hours. Mortality and symptoms of toxicity were recorded at 24, 48, 72 and 96 hours.	X3
Findings: The mean measured concentrations of *lambda*-Cyhalothrin technical ranged from 40 to 80% of the nominal values. The low measured concentrations were considered to be due to the adsorption of *lambda*-Cyhalothrin technical onto surfaces that the stock and test solutions came into contact with. This is typical for a chemical with adsorptive properties. Consequently the mean measured concentrations were used in the calculation and reporting of all results and have been presented with observations of fish mortality in the table below. The general symptoms of toxicity observed in this study were quiescence, weakness, ceased and erratic swimming, swimming vertically, surfacing, sounding, loss of balance, dark discolouration, gulping air, slow and laboured respiration.	X4

Effects on guppy exposed to *lambda*-Cyhalothrin for 96 hours under flow-through conditions

Nominal *lambda*-Cyhalothrin concentration (µg/L)	Mean measured a.s. concentration (µg/L)	Cumulative percentage mortality observed			
		24 hour	48 hour	72 hour	96 hour
Dilution Water Control	<0.0082	0	0	0	0
Solvent Control	<0.0082	0	0	0	0
0.2	0.15	0	0	0	0
0.4	0.16	0	0	0	0
0.8	0.34	0	0	0	0
1.6	0.98	0	0	0	0
3.2	1.6	0	0	10	20
6.4	5.1	100	100	100	100

The LC_{50} values were calculated by the moving average angle and binomial methods. LC_{50} values with 95% confidence intervals, based on mean measured a.s. concentrations are presented below. The 96h LC_{50} of *lambda*-Cyhalothrin to guppy (*Poecilia reticulata*) was 2.3 µg/L, based on mean measured concentrations. The no observed effect concentration (NOEC) based on mortality and symptoms of toxicity was 0.34 µg/L.	X5

***Lambda*-Cyhalothrin guppy LC_{50} values (95% confidence intervals)**

Time (hours)	LC_{50} (ug a.s./L)
24	2.9 (1.6 – 5.1)
48	2.9 (1.6 – 5.1)
72	2.5 (1.9 – 3.4)
96	2.3 (1.8 – 3.1)

	Evaluation by Competent Authorities
	EVALUATION BY RAPPORTEUR MEMBER STATE
Date	Not relevant
Materials and Methods	[redacted]
Results and discussion	[redacted]

	[redacted]
Conclusion	[redacted]
Reliability	[redacted]
Acceptability	[redacted]
Remarks	[redacted]

98/8 Doc IIIA section No.	7.4.1.1/09	Acute toxicity to fish
91/414 Annex Point addressed	II 8.2.1/09	Acute toxicity to fish

		Official use only
Reference point (location) in dossier	**7.4.1.1/09**	
Title:	PP321: Determination of acute toxicity to rainbow trout (*Salmo gairdneri*).	
Project/Report number:	BL/B/2405	
Author(s):	[redacted]	
Date of report:	1984	
Published:	Not published.	
Testing facility:	[redacted]	
Test substance:	Technical *lambda*-Cyhalothrin, purity [redacted]	
Study dates	27 June - 01 July 1983	
GLP:	Yes	
Deficiencies:	None.	
Reliability indicator	1.	

	Official use only
Materials and methods: *Lambda*-Cyhalothrin technical (PP321 in the report), Purity: [redacted] w/w *lambda*-Cyhalothrin.	X1
Rainbow trout (*Onchorynchus mykiss* - formerly *Salmo gairdneri*), were exposed to a series of concentrations of *lambda*-Cyhalothrin in a flow-through system. Twenty fish were exposed at each test concentration (nominally, 0.056, 0.10, 0.18, 0.32, 0.56 and 1.0 µg/L, plus solvent and untreated controls) and assessed for mortality and symptoms of toxicity at 24, 48, 72 and 96 hours. Measured throughout the test, dissolved oxygen was in the range 10.2-11.2 mg/L, pH in the range 7.7-7.9 and temperature 11.8-12.7°C.	X2
Findings: There were no mortalities or symptoms of toxicity at measured concentrations of 0.11 and 0.03 µg/L or the controls. A single fish died at 0.07 µg/L, however this was not considered to be treatment-related and the 96 hour NOEC was considered to be 0.11 ug/L.	X3
The LC_{50} values were calculated by probit analysis. LC_{50} values with 95% confidence intervals, based on mean measured a.s. concentrations are presented below.	X4
The 96h LC_{50} of *lambda*-Cyhalothrin to rainbow trout (*Oncorhynchus mykiss*) was 0.24 µg/L, based on mean measured concentrations. The no observed effect concentration (NOEC) based on mortality and symptoms of toxicity was 0.11 µg/L.	X4

***Lambda*-Cyhalothrin rainbow trout LC_{50} values (95% confidence intervals)**

Time (hours)	LC_{50} (ug a.s./L)
24	0.52 (0.46 – 0.60)
48	0.40 (0.35 – 0.45)
72	0.27 (0.09 – 0.80)
96	0.24 (0.08 – 0.70)

	Evaluation by Competent Authorities
	EVALUATION BY RAPPORTEUR MEMBER STATE
Date	Not relevant
Materials and Methods	[redacted]
Results and discussion	[redacted]
Conclusion	[redacted]
Reliability	[redacted]
Acceptability	[redacted]
Remarks	[redacted]

98/8 Doc IIIA section No.	7.4.1.1/10	Acute toxicity to fish
91/414 Annex Point addressed	II 8.2.1/10	Acute toxicity to fish

		Official use only
Reference point (location) in dossier	**7.4.1.1/10**	
Title:	PP321: Determination of acute toxicity to bluegill sunfish (*Lepomis macrochirus*).	
Project/Report number:	BL/B/2406	
Author(s):	[redacted]	
Date of report:	1984	
Published:	Not published.	
Testing facility:	[redacted]	
Test substance:	Technical *lambda*-Cyhalothrin, purity [redacted]	
Study dates	20 - 24 June 1983	
GLP:	Yes	
Deficiencies:	None.	
Reliability indicator	1.	

	Official use only
Materials and methods: *Lambda*-Cyhalothrin technical (termed PP321 in the report), Purity: [redacted] w/w *lambda*-Cyhalothrin.	X1
Bluegill sunfish (*Lepomis macrochirus*), were exposed to a series of concentrations of *lambda*-Cyhalothrin in a flow through system. Test concentrations were nominally, 0.10, 0.18, 0.32, 0.56, 1.0 and 1.8 µg/L, plus solvent and untreated controls. Twenty fish were exposed at each test concentration and assessed for mortality and symptoms of toxicity at 24, 48, 72 and 96 hours. Measured throughout the test, dissolved oxygen was in the range 7.0-8.4 mg/L, pH in the range 7.4-8.6 and temperature 21.6-22.8°C	X2
Findings: There were no mortalities or symptoms of toxicity at measured concentrations of 0.1 and 0.6 µg/L or the controls. The 96 hour NOEC was therefore 0.10 µg/L.	X3

Effects on bluegill sunfish exposed to *lambda*-Cyhalothrin for 96 hours under flow-through conditions

Nominal *lambda*-Cyhalothrin concentration (µg/L)	Mean measured a.s. concentration (µg/L)	Cumulative percentage mortality observed			
		24 hour	48 hour	72 hour	96 hour
Dilution Water Control	-	0	0	0	0
Solvent Control	-	0	0	0	0
0.10	0.06	0	0	0	0
0.18	0.10	0	0	0	0
0.32	0.16	0	0	0	5
0.56	0.31	5	70	70	100
1.0	0.65	95	100	100	100
1.8	1.17	100	100	100	100

The LC_{50} values were calculated by probit analysis. LC_{50} values with 95% confidence intervals, based on mean measured a.s. concentrations are presented below. The 96h LC_{50} of *lambda*-Cyhalothrin to bluegill sunfish (*Lepomis macrochirus*) was 0.21 µg/L, based on mean measured concentrations. The no observed effect concentration (NOEC) based on mortality and symptoms of toxicity was 0.10 µg/L.	X4

***Lambda*-Cyhalothrin bluegill sunfish LC_{50} values (95% confidence intervals)**

Time (hours)	LC_{50} (ug a.s./L)
24	0.45 (0.38 – 0.52)
48	0.28 (0.23 – 0.32)
72	0.28 (0.23 – 0.32)
96	0.21 (0.18 – 0.25)

	Evaluation by Competent Authorities
	EVALUATION BY RAPPORTEUR MEMBER STATE
Date	Not relevant
Materials and Methods	[redacted]
Results and discussion	[redacted]

	[redacted]
Conclusion	[redacted]
Reliability	[redacted]
Acceptability	[redacted]
Remarks	[redacted]

98/8 Doc IIIA section No.	7.4.1.1/11	Acute toxicity to fish
91/414 Annex Point addressed	II 8.2.1/11	Acute toxicity to fish

		Official use only
Reference point (location) in dossier	**7.4.1.1/11**	
Title:	(Cyhalothrin): Toxicity to *Daphnia* and fish (carp) in the presence and absence of soil	
Project/Report number:	[redacted]/563/3	
Author(s):	[redacted]	
Date of report:	1984	
Published:	Not published.	
Testing facility:	[redacted]	
Test substance:	Technical *lambda*-Cyhalothrin, purity [redacted]	
Study dates	01 October 1983 – 16 April 1984	
GLP:	Yes	X1
Deficiencies:	None	X2
Reliability indicator	1	

	Official use only
Materials and methods: Cyhalothrin technical material, Purity: [redacted] w/w Cyhalothrin.	X3
Daphnia pulex and carp (*Cyprinus carpio*) were exposed to Cyhalothrin in static water systems, with or without soil. Toxicity in the following four test systems was determined with various Cyhalothrin application methods: 1. Water only, application to the water; 2. Water with undisturbed soil layer, application to the water phase; 3. Water with stirring to suspend the soil layer, application to the water phase with suspended material; 4. Water with undisturbed soil layer, application to the soil before adding the water.	
The test doses used provided the following nominal water concentrations in the carp tests, assuming all the Cyhalothrin applied was dissolved in the water phase in each system (details for the *D. pulex* tests are presented separately under point IIIA 7.4.1.2/04):	X4

Nominal Cyhalothrin concentrations applied in systems containing *C. carpio*, with and without soil

Nominal Concentrations in the Water[1] (µg a.s./L)			
System 1 water only	**System 2 water + undisturbed**	**System 3 water + suspended**	**System 4 water + undisturbed**

application to water	soil application to water	soil application to water	soil application to soil
Solvent control	Solvent control	Solvent control	Solvent control
2	14	20	280
4	20	40	400
8	28	80	560
16	40	160	800
32	56	-	1120

(1) Assuming all the Cyhalothrin applied was distributed evenly through the water phase.

Carp (*Cyprinus carpio*) approximately 6 months old and approximately 5 cm long were selected for the study. The systems comprised 5 litres of dechlorinated water with or without 400 g dry weight of paddy soil (5 mm sieved). The test systems containing the carp were aerated at a flow rate of 30 mL/min. Two replicate systems were prepared for each Cyhalothrin test concentration, plus a solvent control.

Five carp were introduced into the respective test systems at 0 hours. The exposure duration in all test systems was 72 hours. Carp mortalities were recorded after 24, 48 and 72 hours. Additionally, fish were examined for any abnormalities, such as abnormal myxeosis, haemorrhage or discolouration. The test systems were maintained at 25±1°C with a 16-hour photoperiod. X5 X6

Findings:
In all the test systems that included soil, toxicity to carp was reduced compared with the results from the water only system. The reduction in toxicity following application to the surface water was greater when the soil was suspended (System 3) than when it was undisturbed (System 2). This was probably due to the enhanced rate of adsorption of Cyhalothrin when the concentration of soil particles in the water column was increased. The greatest reduction in toxicity compared to the water only system was in System 4 in which the Cyhalothrin dose was applied into the soil before adding the water component. This indicates that Cyhalothrin was extensively adsorbed to the soil, and the fact that the carp LC_{50} values remained high over the 72 hour exposure period indicates that there was little desorption of Cyhalothrin from the soil into the water over this time.

The acute toxicity to Cyhalothrin over 72 hours based on nominal initial concentrations in the water phase was reduced when soil was included in the test system. The 72 h LC_{50} values for were increased by approximately 3 times with an undisturbed soil layer, 6-40 times where the soil was suspended in the water and 71-175 times when the Cyhalothrin was applied to the soil before adding the overlying water. These data indicate that, under environmentally realistic conditions in which soil or sediment is present, exposure will be substantially reduced, thereby reducing the apparent toxicity of the compound. The carp LC_{50} values and 95% confidence intervals, based on nominal initial water concentrations and obtained in the various test systems with and without soil after 24, 48 and 72 hours are shown below: X7 X8

Endpoints for *C. carpio* exposed to Cyhalothrin for 72 hours under static conditions, in the presence and absence of soil

Test system	Carp *(Cyprinus carpio)* LC_{50} µg/L (95% confidence interval)		
	24 hour	48 hour	72 hour
System 1 water only	9 (4-16)	9 (4-16)	9 (4-16)
System 2 water + undisturbed	32 (25-41)	32 (25-41)	32 (25-41)