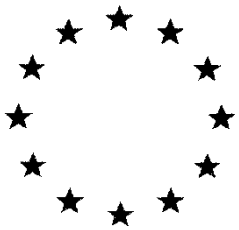
European Commission



VOLUME 3 – Annex B (AS)

- Flutolanil -

B.8 Environmental fate and behaviour

Rapporteur Member State: The Netherlands

June 2018

Renewal Assessment Report and Proposed decision of the Netherlands prepared in the context of the possible approval of flutolanil under Regulation (EC) 1107/2009

Version history page

Date	Version history
June 2018	Initial RAR

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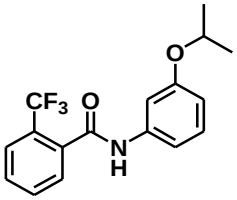
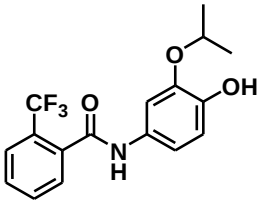
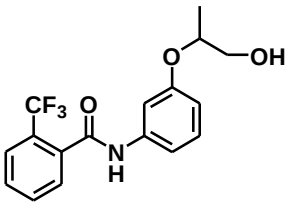
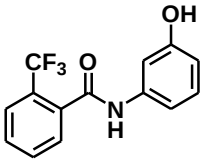
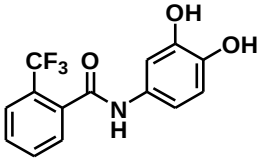
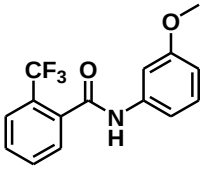
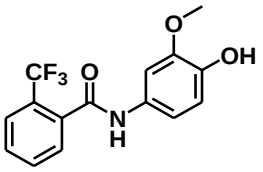
B.8 Environmental fate and behaviour

A renewal note ("**RMS remarks renewal")** is presented directly below each study.

Table B.8-1 Summary of Environmental Fate of flutonalil and its metabolites

Code	Chemical name	Structure	Key Information

Code	Chemical name	Structure	Key Information
Flutolanil SN 84364 NNF-136 S-837	α,α,α-trifluoro-3'-isopropoxy-*o*toluanilide		Parent substance
M-2 HFT	α,α,α-trifluoro-4'-hydroxy-3'-isopropoxy-*o*toluanilide		minor metabolite
M-3 HIP	α,α,α-trifluoro-3'-(2-hydroxy-1-methylethoxy)-*o*toluanilide		minor metabolite
M-4 DIP	α,α,α-trifluoro-3'-hydroxy-*o*-toluanilide		Major metabolite in water
M-5 HDP	α,α,α-trifluoro-3', 4'-dihydroxy-*o*-toluanilide		minor metabolite
M-6 MDP	α,α,α-trifluoro-3'-methoxy-*o*-toluanilide		minor metabolite
M-7	α,α,α-trifluoro-4'-hydroxy-3'-methoxy-*o*-toluanilide		minor metabolite

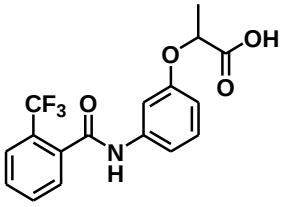
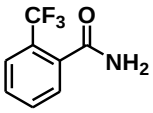
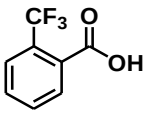
Code	Chemical name	Structure	Key Information
M-11	2-[3-(α,α,α-trifluoro-*o*-toluoylamino) phenoxy]propionic acid		Major metabolite in water
M-101	2-(trifluoromethyl) benzamide		minor metabolite
M-102	2-(trifluoromethyl) benzoic acid		minor metabolite

Table B.8-2 Flutolanil and its metabolites considered in this assessment

Component	Soil (max %)			Water (max %)		Sediment (max %)	Air
	Aerobic	Anaerobic	Photolysis	Photolysis	Surface		
Flutolanil SN 84364 NNF-136 S-837	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
M-1	2.3						
M-2 HFT	0.4	-	-	-	-	-	-
M-3 HIP	1.7	-	-	-	-	-	-
M-4 DIP	3.0	3.5	0.4	-	5.2*	1.6	-
M-5 HDP	0.2	-	-	-	-	-	-
M-6 MDP	3.7	-	-	-	-	-	-
M-7	0.9	2.3	-	-	-	-	-
M-11	4.9	4.6	0.3	-	6.9*	1.4	-
M-101	0.4	-	-	2.6	-	-	-
M-102	1.5	-	-	1.3	-	-	-

n.a. not applicable

- not detected

* in the risk assessment (3-CP), the system max observed (%) was used in the modelling (M4: 6.8%, M11 8.3%)

B.8.1 Route and rate of degradation in soil

Studies cited in section B.8.1.1 were included to address the route of degradation of flutolanil in soil. Section B.8.1.2 is used for the rate of degradation in soil.

B.8.1.1 Route of degradation in soil

B.8.1.1.1 Aerobic degradation, laboratory studies

Previous evaluation	Submitted for first approval, DAR 2005
RMS remark	Acceptable

Report:	**CA 7.1.1.1/01. Morgenroth, U. (1993)**
Title:	^{14}C-Flutolanil: Degradation in four soils incubated under aerobic conditions
Document No:	R-3018
Guidelines:	BBA Guideline Part No. 4-1, Dec. 1986, Dutch Guideline for the Registration of Pesticides, June 1991, Parts G.1 and G.1.1
Testing laboratory:	RCC UMWELTCHEMIE AG, ltingen, Switzerland
GLP:	Yes

Executive summary

The route and rate of degradation of [aniline-U-^{14}C]-flutolanil was studied in four soils: a standard German soil Speyer 2.2 (loamy sand), and three additional agricultural soils collected from Breda, Netherlands (sandy loam), Westmaas, Netherlands (loam) and St. Maartensbrug Netherlands (sand), for 105 days under aerobic conditions. Soil samples were maintained in the dark at 20°C and a soil moisture content of 100% field moisture capacity. The test soil was treated with radiolabelled [aniline-U-^{14}C]-flutolanil at a rate of 6.0 mg/kg dry soil (equivalent to 9 kg /ha).

Samples (in duplicate) were taken for extraction and analysis immediately after treatment (Day 0) and after 7, 14, 28, 56, 78 and 105 days of incubation. Soil samples were sequentially extracted with acetonitrile and acetonitrile/water (4/1, *v/v*). Extracts, trap solutions and post extraction solids (PES) were subjected to radioanalysis. The extracts were analysed by TLC. Total recovery was determined as the sum of radioactivity in extracts, trap solution and post extraction solids.

After incubation for 105 days, a low mineralisation of the test substance was observed in all four soils. $^{14}CO_2$ accounted for 9.9%, 2.9%, 5.9% and 3.4% for soils Speyer 2.2, Breda, Westmaas and St. Maartensbrug, respectively. The extracted radioactivity ranged from 99.1%, 99. 2%, 98.9 % and 99.9 % for soils Speyer 2.2, Breda, Westmaas and St. Maartensbrug, respectively, on day 0 to corresponding values of 59.7%, 83.8%, 64.1% and 84.3% on day 105. The amounts of non-extractable radioactivity increased from 0.7%, 0.5%, 1.1% and 0.6 % for soils Speyer 2.2, Breda, Westmaas and St. Maartensbrug, respectively on day 0 to corresponding amounts of 24.0%, 14.2%, 27.9% and 9.4% on day 105. This bound radioactivity on day 105 was mainly associated to the immobile organic fractions in soil humic acids and humin fraction.

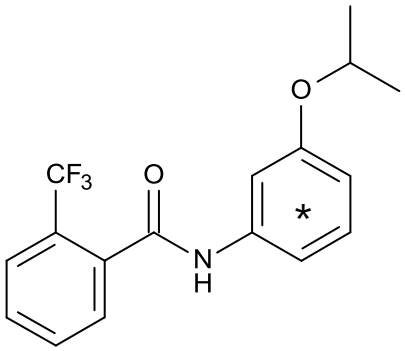
The degradation rate of the test article was faster in soils Speyer 2.2 and Westmaas. Nevertheless, the 50% decline was not reached experimentally in any of the soils.

Soil	**$DegT_{50}$ (days)**	**$DegT_{90}$ (days)**	**r^2**
Speyer 2.2	119.0	395.5	0.9926
Breda	383.4	1273.6	0.9779
Westmaas	152.0	504.8	0.9985
St. Maartensbrug	411.8	1367.9	0.9259

I. MATERIALS AND METHODS

A. MATERIALS

1. Test material: [aniline -U-^{14}C]-flutolanil



* Denotes position of [^{14}C]-radiolabel

Chemical name (CAS): α,α,α-trifluoro-3'-isopropoxy-*o*-toluanilide

CA registry number: 66332-96-5

Lot or batch number: CP-1412

Specific activity: 73.5 µCi/mg (equivalent to 23.8 mCi/mmole or 879 MBq/mmol)

Radiochemical purity: 99.7%

Stability of test compound: Shown to be stable under the conditions of the test

Application vehicle: Acetone

2. Soil A standard German soil Speyer 2.2 (loamy sand), and three additional agricultural soils collected from Breda, Netherlands (sandy loam), Westmaas, Netherlands (loam) and St. Maartensbrug Netherlands (sand) were used in the study. The soils were collected fresh, then stored under aerobic conditions

Parameter	Results			
Soil I. D.	Soil A Speyer 2.2	Soil B Breda	Soil C Westmaas	Soil D St. Maartensbrug
Geographic Location	Speyer 2.2, Germany	Breda Netherlands	Westmaas Netherlands	St. Maartensbrug Netherlands
Texture Class	loamy sand	sandy loam	loam	sand
pH (1M KCl)	6.0	7.1	7.2	7.4
Organic carbon (%)	2.29	2.4	1.0	0.6
Cation exchange capacity (meq/100 g)	9.7	14.8	17.9	3.3
DIN classification Sand (>63-2000 µm) % Silt (2-63 µm) % Clay (< 2 µm) %	 82.3 13.0 5.1	 73.7 14.0 12.3	 33.5 47.5 19.0	 94.5 2.0 3.5
Maximum water holding capacity (%)	37.4	39.8	43.6	34.9
Field capacity (%)	29.5	31.2	31.0	15.5
Biomas (mgC/100 g soil) Start End	 46.9 24.2	 11.1 10.8	 25.0 30.9	 12.5 6.4

B. STUDY DESIGN AND METHODS

1. In-life dates:

08 June 1993 – 04 November 1993

2. Experimental design

Parameter		Description
Duration of test		105 Days
Soil condition		Soil sieved to 2 mm.
Target application rate		9 kg a.i./ha (assuming 1.5 g/cm^3 bulk density and depth of 10 cm).
Nominal concentration in test system		6.0 mg a.i./g dry soil
Number of replications		Two replicates
Test apparatus		100 g dry weight equivalent of soil in glass metabolism flasks
Test material application	Identity of solvent	Acetone
	Volume of application solution	610 µL per 100 g soil dry weight
	Application method	By Hamilton syringe to the soil surface and the soil then mixed thoroughly.
Traps for CO_2 and organic volatiles		An ethylene glycol trap followed by a 2 M sodium hydroxide trap
Is there any indication of the test material absorbing to the walls of the test apparatus?		No
Experimental conditions	Temperature	20 ± 2°C
	Moisture content	100% of the field capacity.
	Lighting	Dark

Sampling

Parameter	Description
Sampling intervals	Two replicates 0, 7, 14, 28, 56, 78 and 105 DAT
Soil sampling procedures	Complete treated samples were removed at each sampling time and extracted as detailed below.
Collection of CO_2 and volatile organics	An ethylene glycol trap followed by a 2 M sodium hydroxide trap. Traps were exchanged at each sampling interval (except day 0) and additionally, on days 21, 42 and 70.

Analytical procedures

The soil from each flask was extracted as follows:

1. Acetonitrile repeated two further times. From day 14 the soil residues were also extracted with a single volume of acetonitrile /water (4/1 *v/v*).
2. From day 14 the soil residues were also soxhlet extracted with acetonitrile overnight.

Extracts were quantified by LSC. Further characterisation of the non-extractable radioactivity in the 105 day samples was performed by organic matter fractionation of the soil residue.

The acetonitrile water extracts from each sampling were combined and concentrated. The soxhlet extracts were also concentrated and both sets of extracts analysed by two different TLC systems. The identity of metabolites was confirmed by co-chromatography with reference standards.

Following extraction, soil samples were air-dried and homogenised, and the remaining unextracted radioactivity quantified by combustion.

The volume of each trapping solution was measured and the radioactivity present was determined by LSC.

Degradation kinetics

DT_{50} value for the degradation of flutolanil were estimated by a simple first order kinetic model.

II. RESULTS AND DISCUSSION

The total recoveries and distribution of radioactivity are shown in detail in Table B.8.1.1.1-2 to Table B.8.1.1.1-6. The recoveries, extractable and non-extractable residue and trap contents at the beginning and end of the study are summarised below.

Table B.8.1.1.1-1 Mass Balance

Total radioactivity	Sum of activity in soil extracts, soil residue on combustion and that trapped as $^{14}CO_2$ and volatile organics in traps.
Recovery at 0 DAT	Speyer 2.2: 99.8% AR Breda: 99.7% AR Westmaas: 100.0% AR St. Maartensbrug: 100.5% AR
Overall recovery (all samples)	Speyer 2.2: 93.6 to 101.6%, mean 98.5% AR Breda: 98.9 to 102.5%, mean 100.8% AR Westmaas: 96.5 to 101.7%, mean 99.5% AR St. Maartensbrug: 95.6 to 101.3%, mean 98.8% AR

Bound and Extractable Residues

For the 105 DAT timepoint, soil samples post extraction were subjected to soil organic matter fractionation into humic acids, fulvic acids and humin fractions. The results indicated that the majority of the non-extractable radioactivity was associated with the humic acids and humin fraction: 17.1%, 11.5%, 21.2% and 6.3% of the applied radioactivity for soils A to D, respectively.

Extractable residues	Extractable residues gradually decreased throughout the study	
	Total extractable residues at 0 DAT	99% AR
	Total extractable residues at end of study (105 DAT)	60 to 84 % AR
Bound residues	Bound residues gradually increased throughout the study.	
	Bound residues at end of study (105 DAT)	9.4 to 27.9% AR

Volatilisation

$^{14}CO_2$	There was some mineralisation throughout the incubation.	
	$^{14}CO_2$ evolved at end of study (105 DAT)	2.9 to 9.9% AR
Other volatiles	No other volatiles were observed	

Transformation of Parent Material

[^{14}C]-Flutolanil was gradually metabolised in aerobic soil. At the first sampling interval, day 0, flutolanil represented 99% AR in all for soils. By day 28, it had declined to between 80.7 and 93.6% AR and at day105, the end of incubation, levels of flutolanil further decreased to between 54.9 and 81.6% AR.

Unidentified metabolites were also detected but never accounted for >4.8% AR.

Table B.8.1.1.1-2 Recovery and degradation of the applied radioactivity in Soil A (Speyer 2.2) treated with flutolanil (as % applied radioactivity)

	Incubation time (days)						
	0	**7**	**14**	**28**	**56**	**78**	**105**
Extractables	99.1	95.3	90.9	82.6	73.3	62.3	59.7
Non-extracted	0.7	6.0	9.4	13.3	19.5	26.6	24.0
Volatiles	n.p.	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
$^{14}CO_2$	n.p.	0.2	1.3	3.0	4.0	8.5	9.9
TOTAL	99.8	101.5	101.6	98.9	96.8	97.4	93.6
Mean ± sd	98.5 ± 2.6						
Flutolanil	99.1	94.3	89.5	80.7	70.2	58.9	54.9
Unidentified	n.d.	1.0	1.4	1.9	3.1	3.4	4.8

n.p.: Not performed n.d.: Not detected

Table B.8.1.1.1-3 Recovery and degradation of the applied radioactivity in Soil B (Breda) treated with flutolanil (as % applied radioactivity)

	Incubation time (days)						
	0	**7**	**14**	**28**	**56**	**78**	**105**

Extractables	99.2	98.6	99.1	94.8	90.8	89.9	83.8
Non-extracted	0.5	2.5	3.1	3.5	7.8	9.4	14.2
Volatiles	n.p.	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
$^{14}CO_2$	n.p.	0.2	0.2	0.5	2.4	1.7	2.9
TOTAL	99.7	101.3	102.5	98.9	101.0	101.0	100.9
Mean ± sd	100.8 ± 1.1						
Flutolanil	99.2	98.6	99.1	93.6	89.5	88.9	81.6
Unidentified	n.d.	n.d.	n.d.	1.2	1.3	1.0	2.2

n.p.: Not performed n.d: Not detected

Table B.8.1.1.1-4 Recovery and degradation of the applied radioactivity in Soil C (Westmaas) treated with flutolanil (as % applied radioactivity)

	Incubation time (days)						
	0	**7**	**14**	**28**	**56**	**78**	**105**
Extractables	98.9	93.7	94.3	88.5	78.7	69.8	64.1
Non-extracted	1.1	6.5	5.9	10.1	19.7	22.5	27.9
Volatiles	n.p.	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
$^{14}CO_2$	n.p.	0.2	0.4	1.0	3.3	4.2	5.9
TOTAL	100.0	100.4	100.6	99.6	101.7	96.5	97.9
Mean ± sd	99.5 ± 1.6						
Flutolanil	98.9	93.7	93.0	86.4	76.5	69.7	60.3
Unidentified	n.d.	n.d.	1.3	2.1	2.2	0.1	3.8

n.p.: Not performed n.d.: Not detected

Table B.8.1.1.1-5 Recovery and degradation of the applied radioactivity in Soil D (St. Maartensbrug) treated with flutolanil (as % applied radioactivity)

	Incubation time (days)						
	0	**7**	**14**	**28**	**56**	**78**	**105**
Extractables	99.9	97.7	96.3	89.8	90.6	88.8	84.3
Non-extracted	0.6	1.9	2.3	4.5	5.7	9.6	9.4
Volatiles	n.p.	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
$^{14}CO_2$	n.p.	0.5	0.4	1.3	2.1	2.9	3.4
TOTAL	100.5	100.1	99.0	95.6	98.3	101.3	97.1
Mean ± sd	98.8 ± 1.9						
Flutolanil	99.9	97.7	95.4	87.9	89.0	87.3	81.6
Unidentified	n.d.	n.d.	0.9	1.9	1.6	1.5	2.7

n.p.: Not performed n.d.: Not detected

Table B.8.1.1.1-6 Humic substance fractionation (as % applied radioactivity)

Humic substance fraction	Soil A (Speyer 2.2)		Soil B (Breda)		Soil C (Westmaas)		Soil D (St. Maartensbrug)	
	% of un extractable	% of AR	% of un extractable	% of AR	% of un extractable	% of AR	% of un extractable	% of AR
Fulvic acid	6.9	28.6	2.7	19.1	6.7	24.1	3.1	33.1
Humic acid	12.4	51.5	4.5	48.9	4.2	15.2	4.8	50.3
Humin	4.8	19.8	6.9	32.1	17.0	60.8	1.6	16.6
Total	24.0	99.9	14.2	100.1	27.9	100.1	9.4	100.0

Table B.8.1.1.1-7 DT_{50} for flutolanil in aerobic soil

Soil	$DegT_{50}$ (days)	$DegT_{90}$ (days)	r^2
Speyer 2.2	119.0	395.5	0.9926
Breda	383.4	1273.6	0.9779
Westmaas	152.0	504.8	0.9985
St. Maartensbrug	411.8	1367.9	0.9259

III. CONCLUSIONS

The degradation of flutolanil in the soils used was described by a first-order kinetic reaction. The degradation rates were faster in soils A (Speyer 2.2) and C (Westmaas). Nevertheless, the DT_{50} values were not reached experimentally in any of the soils after 105 days of incubation. Low mineralisation of the test substance was observed in all four soils. $^{14}CO_2$ accounted for 9.9%, 2.9%, 5.9% and 3.4% of the applied radioactivity for soils A to D, respectively. The non-extractable radioactivity on day 105 was mainly associated to the immobile organic soil fractions, i.e. the humic acids and humin fraction.

RMS remarks renewal

- Experimental results could be used to determine the half-life of the substance. DegT50 values were calculated probably after log-transformation of the results, not according to FOCUS degradation kinetics. Such analyses are needed to determine whether the kinetic parameters are within acceptable ranges or whether biphasic kinetics describe the behaviour more accurately. The stated r^2 result for St. Maartenbrug soil indicates a poor fit.
- It is noted that the application dose is a factor 5 higher than the proposed dose rate in bulb flowers (9 kg a.s./ha versus 2.76 kg a.s./ha in the GAP).
- The incubation was at 20 °C and field moisture capacity. Field moisture capacity is not further defined, but moisture contents are stated in section 2.2.2 of the underlying report. If these moisture contents are below pF2 default values, a correction for low moisture is necessary after acceptable kinetic results have been derived.

- For a kinetic analysis of the data from this study, please refer to study CA 7.1.2.1.1/02. Hardy, I., Agostini, F. & Jastrzebski, N. 2016a, which overrules the above kinetic analysis.

Previous evaluation	Submitted for first approval, DAR 2005
RMS remark	Acceptable

Report:	**CA 7.1.1.1/02. Swanson, M. (1996)**
Title:	Aerobic soil metabolism of ^{14}C-Flutolanil
Document No:	A55786/W70 (E-3026)
Guidelines:	EPA Pesticides Assessment Guidelines Subdivision N, Section 162-1
Testing laboratory:	Battelle Columbus Operations., Ohio, USA
GLP:	Yes

Executive Summary

The route and rate of degradation of [aniline-U-^{14}C] was studied in a sandy loam soil, for 365 days under aerobic conditions. Soil samples were maintained in the dark at 25°C and a soil moisture content of 75% 1/3 bar field moisture capacity. The test soil was treated with radiolabelled [phenyl-U-^{14}C]-flutolanil at a rate of 1.0 mg/kg dry soil (equivalent to 2240 g /ha).

Samples were taken for extraction and analysis immediately after treatment (Day 0) and after 14, 30, 63, 77, 92, 116, 148, 212, 274 and 365 days of incubation. Soil samples were sequentially extracted with methanol/water (4/1, *v/v*) then 2 N sodium hydroxide-methanol (3:1; *v/v*). Extracts, trap solutions and post extraction solids (PES) were subjected to radioanalysis. The methanol/water extracts were analysed by HPLC and TLC. The radioactivity in 2 N sodium hydroxide-methanol was partitioned against dichloromethane (DCM), and the DCM fraction was analysed by HPLC and TLC. Total recovery was determined as the sum of radioactivity in extracts, trap solution and post extraction solids.

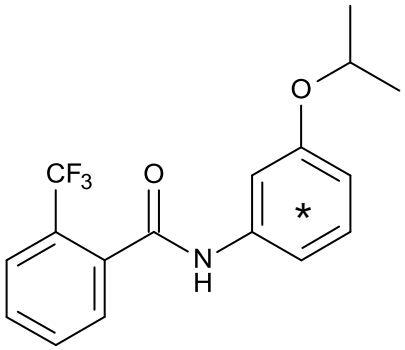
Material balance was 98.7 ± 1.2% (range = 96.7 to 101.8 of applied radioactivity, % AR). Extractable [^{14}C]-residues decreased from a maximum of 98% AR at Day 0 to a minimum of 46.8% AR at Day 365. Non extractable [^{14}C]-residues gradually increased throughout the study, to reach 26.7% AR by 365 days. Organic matter fractionation of residual radioactivity remaining in the soil post extraction for selected Day 120 showed the majority of the radioactivity was associated with the fulvic acids. At study termination, evolved $^{14}CO_2$ reached a maximum of 27.5% AR. Significant levels of organic volatiles were not observed.

Parent compound gradually decreased in soil and accounted for 26.5% AR at 365 days. Although the half-life, estimated by assuming first-order kinetics, was 210 days, a more representative DT_{50} of 106 days was estimated using a biphasic exponential model. The biphasic exponential model gave a better fit to the data than did the first-order model, as shown by correlation coefficients and residuals. Several known minor metabolites were detected M-4, M-6 and M-11 which never accounted for < 3.7% AR throughout the incubation period. Three unknown metabolites were also detected but never accounted for < 0.2% AR.

I. MATERIALS AND METHODS

A. MATERIALS

1. Test material: [aniline -U-^{14}C]-flutolanil



* Denotes position of [^{14}C]-radiolabel

Chemical name (CAS) α,α,α-trifluoro-3'-isopropoxy-*o*-toluanilide

CA registry number: 66332-96-5

Lot or batch number: CP-1412

Specific activity: 73.5 µCi/mg (equivalent to 23.8 mCi/mmole or 163170 dpm/ µg)

Radiochemical purity: 99.8%

Stability of test compound: Shown to be stable under the conditions of the test

Application vehicle: Acetonitrile

2. Soil A sandy loam soil, was collected fresh from the top 20 cm horizon of a permanent turf area. No pesticides or fertilizers had been applied to the sampling area over the previous 15 years. The soil was sieved to 2mm then stored at 1 – 9 °C until use.

Parameter	Results
Soil I. D.	Millington Loam Bottom Soil
Geographic Location	Wonder Lake, Illinois
Texture Class (USDA)	sandy loam
pH (method not stated, not GLP)	7.4
Organic matter (%)	5.57
Organic carbon (%)	3.24
Cation exchange capacity (meq/100 g)	15.46
USDA classification Sand (>20 µm) % Silt (2 - 20 µm) % Clay (< 2 µm) %	 64.2 25.4 10.4
Water holding capacity (%) 1/3 bar Water holding capacity (%) 15 bar	21.63 14.19
Bulk density (g/cm^3)	1.26
Biomass (µg C/100 g soil) Start	 516.90

B. STUDY DESIGN AND METHODS

1. In-life dates:

29 April 1993 – 26 September 1994

2. Experimental design

Parameter		Description
Duration of test		365 Days
Soil condition		Soil sieved to 2 mm.
Target application rate		2.24 kg a.i./ha (assuming 1.3 g/cm^3 bulk density and depth of 15 cm).
Nominal concentration in test system		1.12 µg a.i./g dry soil
Number of replications		Two replicates 0, 14, 30, 63, 77, 92, 148, 274 and 365 DAT and a single flask at 116 and 212 DAT.
Test apparatus		100g dry weight equivalent of soil in 250 mL Erlenmeyer flasks.
Test material application	Identity of solvent	Acetonitrile
	Volume of application solution	398 µL per 100 g soil dry weight
	Application method	By pipette to the soil surface and the soil then mixed thoroughly.
Traps for CO_2 and organic volatiles		An ethylene glycol trap followed by a 0.1 M H_2S0_4, followed by two ethanolamine traps.
Is there any indication of the test material absorbing to the walls of the test apparatus?		No
Experimental conditions	Temperature	25 ± 1°C
	Moisture content	75% of the 1/3 bar field moisture capacity
	Lighting	Dark

Sampling

Parameter	Description
Sampling intervals	Two replicates 0, 14, 30, 63, 77, 92, 148, 274 and 365 DAT and a single flask at 116 and 212 DAT.
Soil sampling procedures	Complete treated samples were removed at each sampling time and extracted as detailed below.
Collection of CO_2 and volatile organics	An ethylene glycol trap followed by a 0.1 M H_2S0_4, followed by two ethanolamine traps was employed for the first four months of incubation. Only two ethanolamine traps for the remaining part of the study

Analytical procedures

The soil from each flask was extracted as follows:

1. Methanol/water (4:1; *v/v*), repeated three further times. The extraction was performed on a shaker at approximately 200 stroke/minute for *ca.* 30 minutes. Then centrifuged at 5000 rpm.
2. 2 N sodium hydroxide-methanol (3:1; *v/v*), repeated twice more. The extraction was performed on a shaking incubator maintained at 40°C ± 2°C, for 3 hours.

Extracts were quantified by LSC. The sodium hydroxide extract was partitioned 3x with dichloromethane. The dichloromethane extract and the residue aqueous extract post partition were quantified by LSC. Further characterisation of the non-extractable radioactivity in the 148 and 274 day samples was performed by organic matter fractionation of the residue aqueous extract post partition.

The methanol/water and dichloromethane extracts post partition were analysed by reverse phase HPLC and TLC. The identity of metabolites was confirmed by co-chromatography with reference standards.

Following extraction, soil samples were air-dried and homogenised, and the remaining unextracted radioactivity quantified by combustion.

The volume of each trapping solution was measured and the radioactivity present was determined by LSC. The radioactivity in the ethanolamine traps was characterised to be $^{14}CO_2$ by $BaCO_3$ precipitation, which indicated the mineralisation of flutolanil.

Degradation kinetics

DT_{50} value for the degradation of flutolanil were estimated on the basis of pseudo-first order reaction and a two-compartment model.

II. RESULTS AND DISCUSSION

The recoveries, extractable and non-extractable residue and trap contents at the beginning and end of the study are summarised below.

Table B.8.1.1.1-8 Mass Balance

Total radioactivity	Sum of activity in soil extracts, soil residue on combustion and that trapped as $^{14}CO_2$ and volatile organics in traps.
Recovery at 0 DAT	98.1% AR
Overall recovery (all samples)	Range 96.7 to 101.8%, mean 98.7% AR

Bound and Extractable Residues

For the 148 and 274 DAT timepoint, soil samples post extraction were subjected to soil organic matter fractionation into humic acids, fulvic acids and humin fractions. The results indicated that the majority of the non-extractable radioactivity was associated with the fulvic acids amounting to 9.8% and 11.7 %.

Extractable residues	Extractable residues gradually decreased throughout the study	
	Total extractable residues at 0 DAT	98.0% AR
	Total extractable residues at end of study (365 DAT)	46.8% AR
Bound residues	Bound residues gradually increased throughout the study.	
	Bound residues at end of study (365 DAT)	26.7% AR

Volatilisation

$^{14}CO_2$	There was considerable mineralisation throughout the incubation.	
	$^{14}CO_2$ evolved at end of study (356 DAT)	27.5% AR
Other volatiles	No other volatiles were observed	

Transformation of Parent Material

[^{14}C]-flutolanil was gradually metabolised in aerobic soil. At the first sampling interval, day 0, flutolanil represented 97.8% AR. By day 77, it had declined to 56.1% AR and at day 365, the end of incubation, levels of flutolanil further decreased to 26.5% AR.

Several known minor metabolites were detected M-4, M-6 and M-11 which never accounted for < 3.7% AR throughout the incubation period. Three unknown metabolites were also detected but never accounted for < 0.2% AR.

Table B.8.1.1.1-9 Recovery of the applied radioactivity in soil treated with flutolanil (as % applied radioactivity)

Sample	**Incubation time (days)**										
	0	**14**	**30**	**63**	**77**	**92**	**116[a]**	**148**	**212[a]**	**274**	**365**
Methanol/water	96.2	85.4	72.8	61.2	57.6	55.3	50.6	41.8	40.0	30.5	25.2
	98.1	81.6	73.6	62.7	59.8	56.4		43.7		34.2	24.6
Mean	**97.2**	**83.5**	**73.2**	**62.0**	**58.7**	**55.9**	**-**	**42.8**	**-**	**32.4**	**24.9**
NaOH /methanol	0.8	6.3	10.4	14.1	15.1	15.5	18.5	18.3	19.0	20.5	21.9
	0.8	7.2	10.4	13.9	16.2	15.6		18.4		20.2	21.8
Mean	**0.8**	**6.8**	**10.4**	**14.0**	**15.7**	**15.6**	**-**	**18.4**	**-**	**20.4**	**21.9**
Non-extracted	0.1	5.0	9.4	13.7	15.2	15.1	15.9	20.8	21.1	24.6	26.0
	0.1	5.4	9.2	13.4	10.8	15.4		20.0		23.7	27.3
Mean	**0.1**	**5.2**	**9.3**	**13.6**	**13.0**	**15.3**	**-**	**20.4**	**-**	**24.2**	**26.7**
Volatiles	n.p.	1.8	5.3	9.6	11.0	11.1	13.4	19.3	17.4	24.3	26.9
	n.p.	2.5	5.1	9.7	10.3	11.0		17.8		21.9	28.1
Mean	**n.p.**	**2.2**	**5.2**	**9.6**	**10.7**	**11.1**	**-**	**18.6**	**-**	**23.1**	**27.5**
TOTAL	97.1	98.5	97.9	98.6	98.9	97.0	98.9	100.2	97.5	99.9	100.0
	99.0	96.7	98.3	99.7	97.1	98.4		99.9		100.0	101.8
Mean	**98.1**	**97.6**	**98.1**	**99.1**	**98.0**	**97.7**		**100.1**		**100.0**	**100.9**
Mean ± sd	98.7 ± 1.2%										

[a] result form an individual flask n.p.: Not performed

Table B.8.1.1.1-10 Distribution of radioactivity from the sodium hydroxide/methanol extracts (as % applied radioactivity)

Sample	**Incubation time (days)**										
	0	**14**	**30**	**63**	**77**	**92**	**116[a]**	**148**	**212[a]**	**274**	**365**

DCM fraction	0.7	3.1	4.0	5.1	5.5	5.5	6.0	5.8	7.0	5.9	5.8
Aqueous fraction	0.1	3.8	6.6	8.8	9.2	10.2	10.7	12.4	12.1	14.3	16.6
Total	0.8	6.9	10.5	13.8	14.7	15.7	16.7	18.2	19.1	20.2	22.4
Partition recovery	93.8	101.4	101.0	98.6	93.8	100.6	90.3	98.9	100.5	99.0	102.3

[a] result form an individual flask

Table B.8.1.1.1-11 Humic substance fractionation (as % applied radioactivity)

Humic substance fraction	Day 148	Day 274
Fulvic acid	9.8	11.6
Humic acid	1.9	2.3
Humin	0.2	0.1
Total	11.9	14.0

Table B.8.1.1.1-12 Degradation and formation of metabolites in soil treated with flutolanil (as % applied radioactivity (from HPLC)

Sample	Incubation time (days)										
	0	**14**	**30**	**63**	**77**	**92**	**116[a]**	**148**	**212[a]**	**274**	**365**
Flutolanil	96.8	85.0	70.5	59.6	54.7	52.5	52.0	39.6	42.2	31.7	27.1
	98.8	81.8	72.3	61.7	57.5	56.0		41.8		36.6	26.0
Mean	**97.8**	**83.4**	**71.4**	**60.6**	**56.1**	**54.3**	**-**	**40.7**	**-**	**34.1**	**26.5**
M-4	n.d.	2.3	1.9	1.2	1.5	1.7	0.4	1.2	0.4	0.4	0.6
	n.d.	2.0	2.1	1.4	1.5	0.9		1.2		n.d.	0.4
Mean	**n.d.**	**2.2**	**2.0**	**1.3**	**1.5**	**1.3**	**-**	**1.2**	**-**	**0.2**	**0.5**
M-6	n.d.	n.d.	3.3	2.9	3.4	2.4	3.2	3.9	3.2	3.2	2.5
	n.d.	0.9	2.4	3.0	2.9	3.1		3.6		2.8	1.9
Mean	**n.d.**	**0.5**	**2.9**	**2.9**	**3.2**	**2.7**	**-**	**3.7**	**-**	**3.0**	**2.2**
Unknown 3	n.d.	n.d.	n.d.	0.1	0.1	<0.1	n.d	0.1	0.1	n.d.	0.1
	n.d.	n.d.	n.d.	0.1	0.1	0.1		0.1		<0.1	0.1
Mean	**n.d.**	**n.d.**	**n.d.**	**0.1**	**0.1**	**<0.1**	**-**	**0.1**	**-**	**<0.1**	**0.1**
M-11	n.d.	1.0	1.0	2.1	3.1	4.2	1.0	2.5	1.0	0.6	0.4
	n.d.	n.d.	0.9	1.6	3.4	1.6		2.6		0.5	1.4
Mean	**n.d.**	**0.5**	**1.0**	**1.9**	**3.2**	**2.9**	**-**	**2.5**	**-**	**0.6**	**0.9**
Unknown 1	n.d.	n.d.	n.d.	0.2	0.1	n.d.	n.d	0.2	n.d	n.d.	0.1
	n.d.	n.d.	n.d.	n.d	n.d.	0.1		0.2		n.d.	0.2
Mean	**n.d.**	**n.d.**	**n.d.**	0.1	**<0.1**	**<0.1**	**-**	**0.2**	**-**	**n.d.**	**0.2**
Unknown 2	n.d.	n.d.	n.d.	0.2	0.1	<0.1	n.d	n.d.	0.2	0.3	0.2
	n.d.	n.d.	n.d.	0.1	n.d.	0.1		n.d.		0.1	0.3
Mean	**n.d.**	**n.d.**	**n.d.**	**0.1**	**<0.1**	**0.1**	**-**	**n.d.**	**-**	**0.2**	**0.2**

[a] result form an individual flask n.d.: Not detected

Table B.8.1.1.1-13 DT_{50} for flutolanil in aerobic soil

Kinetic model	DT_{50} (days)	r^2
SFO	210	0.915
Biphasic Exponential Model	106	0.996

III. CONCLUSIONS

Flutolanil was metabolised in sandy loam soil under aerobic conditions at 25 ± 1°C. After 12 months of incubation under darkness, approximately 26.5 % remained undegraded as analysed by HPLC. Although the half-life, estimated by assuming first-order kinetics, was 210 days, a more representative DT_{50} of 106 days was estimated using a biphasic exponential model. The biphasic exponential model gave a better fit to the data than did the first-order model, as shown by correlation coefficients and residuals.

Soil-bound residues and $^{14}CO_2$ were the major products (greater than 10 % of applied radioactivity), accounting for 26.7% and 27.5% (replicate means) of the applied dose, respectively, by Day 365. M-4, M-6, and M-11 were seen as minor degradates at less than 5 % of applied radioactivity.

RMS remarks renewal

- Experimental results can be used to determine the half-life of the substance.
- DegT50 values according to SFO were calculated, but not according to FOCUS degradation kinetics. Such analyses are needed to determine whether the kinetic parameters are within acceptable ranges. The stated r^2 result indicates a poor fit.
- Biphasic degradation was examined, but again not according to FOCUS degradation kinetics
- Correction for low moisture and temperature is necessary after acceptable fits have been derived
- Incubation lasted for more than 120 days. Microbial activity may have decreased. Fitting procedures might have excluded the data after 120 days of incubation.
- For a kinetic analysis of the data from this study, please refer to study CA 7.1.2.1.1/02. Hardy, I., Agostini, F. & Jastrzebski, N. 2016a, which overrules the above kinetic analysis

Previous evaluation	Submitted for the purpose of renewal
RMS remark	Acceptable

Report:	**CA 7.1.1.1/03. Takahashi, Y. (2015)**
Title:	Aerobic soil metabolism of Flutolanil
Document No:	LRSC-M15-111A (E-3055)
Guidelines:	OECD 307, EPA OPPTS 835.4100
Testing laboratory:	Nihon Nohyaku Co., Ltd, Japan
GLP:	Yes

Executive Summary

The route and rate of degradation of [phenyl-U-^{14}C] and [aniline-U-^{14}C]-flutolanil was studied in a LUFA loamy sand soil (F2.2), for 120 days under aerobic conditions. Soil samples were maintained in the dark at 20°C and a soil moisture content of 40-60% of maximum water holding capacity. The test soil was treated with radiolabelled [phenyl-U-^{14}C] and [aniline ring-U-^{14}C]-flutolanil at a rate of 2.1 mg/kg dry soil.

Samples were taken for extraction and analysis immediately after treatment (Day 0) and after 15, 30, 60, 91 and 120 days of incubation for [phenyl-U-^{14}C] flutolanil. Aniline labelled samples were taken for

extraction and analysis at 0, 30, 60 and 120 days. Soil samples were sequentially extracted with acetonitrile/water (4/1, *v/v*) containing 0.1% (*w/v*) ascorbic acid, acetonitrile/0.1 M hydrochloric acid (4/1, *v/v*) containing 0.1% (*w/v*) ascorbic acid and then acetonitrile/1 M hydrochloric acid (4/1, *v/v*) containing 0.1% (*w/v*) ascorbic acid. Extracts, trap solutions and post extraction solids (PES) were subjected to radioanalysis. Aliquots of soil extracts were evaporated in vacuo, the resulting aqueous residue was added to an appropriate aliquot of sodium chloride and extracted with ethyl acetate. Concentrated and reconstituted ethyl acetate extracts were analysed for flutolanil and degradates by normal-phase 2D-TLC, with confirmation of identity by reversed-phase HPLC.

Recovery of radioactivity from individual samples was in the range 93.2-98.4% Initial extractability of individual samples (range for both labels) was 93.7-98.0% AR, this declined to 89.3-90.3% AR at the end of incubation. Mineralisation to [^{14}C]-carbon dioxide was a minor route of degradation, with 0.8-1.5% AR formed at the end of incubation (range for individual samples of both labels). The radioactivity in the day 120 ethanolamine traps was confirmed to be $^{14}CO_2$ by $BaCO_3$ precipitation. Organic volatile radioactivity was not detectable throughout incubation. Bound residue in individual samples (range for both labels) increased to 3.0-4.2% AR at study end.

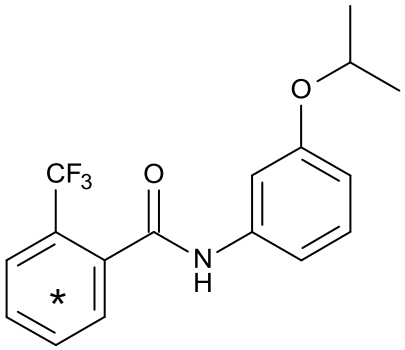
Flutolanil decreased from 96.8-98.1% AR at day 0 to 80.8-82.3% AR at day 120 in soil treated with phenyl-label, and from 93.8-97.4% AR at day 0 to 81.7-81.8% AR at day 120 in soil treated with aniline-label. Metabolites identified in soil extracts were M-2, M-3, M-4, M-6, M-11, M-101 and M-102. No individual metabolite was found at >5% AR. The maximum level of any metabolite found in any sample was 4.9% AR (M11 in replicate 2 of day 91 sample (phenyl-label) and replicate 1 of day 120 sample (aniline-label); corresponding replicate means were 4.4 and 4.5%AR, respectively.

For a kinetic analysis of the data from this study, please refer to study CA 7.1.2.1.1/02.

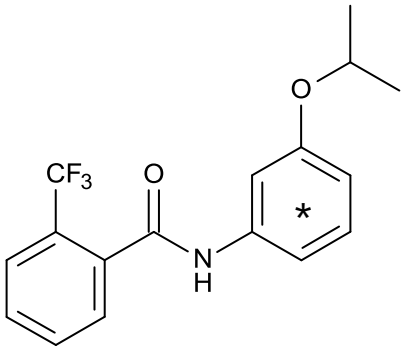
MATERIALS AND METHODS

MATERIALS

1. Test material: Label 1: [phenyl-U-^{14}C]-flutolanil



* Denotes position of [^{14}C]-radiolabel
Label 2: [aniline-U-^{14}C]-flutolanil



* Denotes position of [^{14}C]-radiolabel

Chemical name (CAS)	α,α,α-trifluoro-3'-isopropoxy-*o*-toluanilide
Label 1:	
Lot or batch number:	0AE0002S-R
Specific activity:	2.37 GBq/mmol
Radiochemical purity:	98.2%
Label 2:	
Lot or batch number:	CP-3778
Specific activity:	10.0 GBq/mmol
Radiochemical purity:	99.6%

2. Soil A loamy sand soil, which was supplied by Lufa Speyer was collected fresh, then stored under refrigeration for <3 weeks prior to the start of the test.

Parameter	Results
Soil I. D.	F2.2
Geographic Location	Germany/ Rheinland-Pfalz/Hanhofen "Groβer Striet", Nr. 585
Texture Class (USDA)	Loamy sand
pH (0.01M $CaCl_2$)	5.5
Organic carbon (%)	1.61
Cation exchange capacity (meq/100 g)	10.0
USDA classification Sand (>20 µm) % Silt (2 - 20 µm) % Clay (< 2 µm) %	 75.8 16.3 7.9
Maximum water holding capacity (%)	43.3
Bulk density (g/cm^3)	1.236
Biomass (mg C/100 g soil)[(A)] Start 60 days Completion of incubation	 165 (↔1.0% of oc content) 205 (↔1.3% of oc content) 178 (↔1.1% of oc content)

(A) Determined using the fumigation/extraction method

STUDY DESIGN AND METHODS

1. In-life dates:

23 October 2014 – 01 July 2015

2. Experimental design

Parameter		Description
Duration of test		120 days
Soil condition		Soil sieved to 2 mm.
Target application rate		2100 g a.i./ha (assuming 1.0 g/cm^3 bulk density and depth of 10 cm)
Nominal concentration in test system		2.1 µg a.i./g dry soil
Number of replications		Two replicates per time point for each radiolabel.
Pre-incubation		All test systems were incubated for about two weeks prior to test substance application.
Test apparatus		50g dry weight equivalent of soil in round glass flasks with glass cover (internal diameter: 7.5 cm, height: 12 cm; soil depth ~ 2 cm), continuous aeration with moist air, including traps for CO_2 and organic volatiles (see below).
Test material application	Identity of solvent	Acetonitrile
	Volume of application solution	250 µL per 50 g soil dry weight
	Application method	The solution of the radioactive test material isotopically diluted with non-radiolabelled flutolanil (lot number 1AE0012P, 99.6% pure) was applied to the soil surface and the soil was then mixed thoroughly.
Traps for CO_2 and organic volatiles		An ethylene glycol trap followed by a 20% ethanolamine trap.
Experimental conditions	Temperature	20 ± 2°C (actual maximum and minimum temperature were 19.3ºC and 20.6ºC)
	Moisture content	Soil moisture was maintained from 40 to 60% of MWHC. Water content in soil was generally checked by weighing

Parameter		Description
		each test system every about 30 days and was adjusted to 60% of MWHC by adding distilled water. Actual measured soil moisture was in the range of 17.4 to 25.9% (↔ 40.2-59.8% of MWHC).
	Lighting	Dark

Sampling

Parameter		Description
Sampling intervals	Phenyl ring	0, 15, 30, 60, 91 and 120 DAT
	Aniline ring	0, 30, 60 and 120 DAT
	Untreated soils for biomass	Day 0, 60 and at end of incubation
Soil sampling procedures		Complete treated samples were removed at each sampling time and extracted as detailed below.
Collection of CO_2 and volatile organics		Traps were renewed approximately every 30 days during the study

Analytical procedures

The soil from each flask was extracted twice with acetonitrile/water (4:1; v/v) containing 0.1% (w/v) ascorbic acid (extract 1) followed by two extractions with acetonitrile/ 0.1 M hydrochloric acid (4:1; v/v) containing 0.1% (w/v) ascorbic acid (extract 2). Radioactivity in each extract was quantified by LSC. Aliquots of soil extracts 1 and 2 and 3 were evaporated in vacuo, the resulting aqueous residue was added to an appropriate aliquot of sodium chloride and extracted with ethyl acetate twice. Ethyl acetate extracts were combined, following radio-analysis evaporated to dryness in vacuo, and following radio-analysis reconstituted in acetonitrile followed by chromatography analysis for identification and quantitation of flutolanil and degradates by normal-phase 2D-TLC. The identity of metabolites was confirmed by co-chromatography with non-radiolabelled reference standards. The residual aqueous phase obtained after ethyl acetate extraction was subjected to radioanalysis. Following extraction, soil samples were air-dried and the remaining unextracted radioactivity quantified by combustion analysis. Radioactivity in trapping solutions and in acetonitrile extracts of polyurethane foam plugs was determined by LSC.

RESULTS

The extraction method used was validated by fortifying the following samples with radioactive-labeled test substance followed by radio-analysis: samples of extracts 1, 2 and 3 of untreated soil; ethyl acetate extract of extracts 1, 2 and 3 of untreated soil; aqueous residues following ethyl acetate extraction of extracts 1, 2 and 3 of untreated soil. The recovery of radioactivity was in the range of 95-100%, with RSD ≤2.2%.

Microbial activity of the test soil was determined at the start, halfway and at the end of the test. Biomass was always ≥1% of the organic carbon content.

Recovery of radioactivity from individual samples was in the range 93.2-98.4% Initial extractability of individual samples (range for both labels) was 93.7-98.0% AR, this declined to 89.3-90.3% AR at the end of incubation. Mineralisation to [^{14}C]-carbon dioxide was a minor route of degradation, with 0.8-1.5% AR formed at the end of incubation (range for individual samples of both labels). The radioactivity in the day 120 ethanolamine traps was confirmed to be $^{14}CO_2$ by $BaCO_3$ precipitation. Organic volatile radioactivity was not detectable throughout incubation. Bound residue in individual samples (range for both labels) increased to 3.0-4.2% AR at study end.

Flutolanil decreased from 96.8-98.1% AR at day 0 to 80.8-82.3% AR at day 120 in soil treated with phenyl-label, and from 93.8-97.4% AR at day 0 to 81.7-81.8% AR at day 120 in soil treated with aniline-label. Metabolites identified in soil extracts were M-2, M-3, M-4, M-6, M-11, M-101 and M-102. No individual metabolite was found at >5% AR. The maximum level of any metabolite found in any sample was 4.9% AR (M11 in replicate 2 of day 91 sample (phenyl-label) and replicate 1 of day 120 sample (aniline-label); corresponding replicate means were 4.4 and 4.5% AR, respectively.

Table B.8.1.1.1-14 Recovery of the applied radioactivity in soil treated with [phenyl-U-^{14}C]-flutolanil (as % applied radioactivity)

Fractions		Radioactivity distribution (% toward applied radioactivity) Incubation time (days)					
		0	15	30	60	91	120
Extractable	**1**	**98.1**	**95.4**	**96.1**	**91.7**	**93.9**	**89.3**
	2	**96.8**	**95.1**	**97.0**	**92.1**	**95.4**	**90.1**
	Mean	**97.4**	**95.2**	**96.6**	**91.9**	**94.7**	**89.7**
Soil extract-1	1	96.4	90.6	91.2	83.8	86.7	79.7
	2	95.1	90.4	91.9	84.7	87.4	81.6
	Mean	95.7	90.5	91.5	84.3	87.0	80.6
Soil extract-2	1	1.6	4.3	4.3	6.8	6.4	7.9
	2	1.6	4.1	4.6	6.3	6.9	7.2
	Mean	1.6	4.2	4.5	6.5	6.6	7.5
Soil extract-3	1	<0.1	0.5	0.6	1.1	0.9	1.7
	2	<0.1	0.5	0.5	1.1	1.1	1.4
	Mean	<0.1	0.5	0.6	1.1	1.0	1.5
Post extraction solid	**1**	**0.2**	**1.4**	**1.2**	**3.0**	**2.1**	**4.1**
	2	**0.1**	**1.4**	**1.3**	**2.1**	**1.8**	**3.2**
	Mean	**0.2**	**1.4**	**1.2**	**2.6**	**1.9**	**3.7**
Volatiles	**1**	**N.A.** [A]	**<0.1**	**<0.1**	**0.6**	**0.2**	**1.6**
	2	**N.A.**	**<0.1**	**0.1**	**0.5**	**0.1**	**0.8**
	Mean	**N.A.**	**<0.1**	**<0.1**	**0.6**	**0.1**	**1.2**
Ethylene glycol trap media	1	N.A.	N.D. [B]	N.D.	N.D.	N.D.	N.D.
	2	N.A.	N.D.	N.D.	N.D.	N.D.	N.D.
	Mean	N.A.	N.D.	N.D.	N.D.	N.D.	N.D.
Ethanolamine trap media	1	N.A.	<0.1	<0.1	0.6	0.2	1.6
	2	N.A.	<0.1	0.1	0.5	0.1	0.8
	Mean	N.A.	<0.1	<0.1	0.6	0.1	1.2
Total recovery	**1**	**98.2**	**96.8**	**97.4**	**95.4**	**96.2**	**94.9**
	2	**96.9**	**96.6**	**98.4**	**94.7**	**97.3**	**94.2**
	Mean	**97.6**	**96.7**	**97.9**	**95.0**	**96.7**	**94.6**

[A]: Not applicable, [B]: Not detected

Table B.8.1.1.1-15 Recovery of the applied radioactivity in soil treated with [aniline-U-^{14}C]-flutolanil (as % applied radioactivity)

Fractions		Radioactivity distribution (% toward applied radioactivity)			
		Incubation time (days)			
		0	30	60	120
Extractable	**1**	**97.4**	**91.6**	**87.4**	**89.5**
	2	**93.8**	**93.0**	**91.4**	**89.7**
	Mean	**95.6**	**92.3**	**89.4**	**89.6**
Soil extract-1	1	95.9	86.4	79.2	80.7
	2	92.1	87.2	82.9	79.5
	Mean	94.0	86.8	81.1	80.1
Soil extract-2	1	1.5	4.4	7.0	6.8
	2	1.6	5.0	7.2	7.8
	Mean	1.5	4.7	7.1	7.3
Soil extract-3	1	<0.1	0.8	1.3	1.9
	2	<0.1	0.8	1.2	2.4
	Mean	<0.1	0.8	1.3	2.1
Post extraction solid	**1**	**0.1**	**1.5**	**4.9**	**3.0**
	2	**0.1**	**1.5**	**2.9**	**4.2**
	Mean	**0.1**	**1.5**	**3.9**	**3.6**
Volatiles	**1**	**N.A.** [A]	**0.2**	**0.8**	**1.0**
	2	**N.A.**	**0.4**	**0.6**	**1.5**
	Mean	**N.A.**	**0.3**	**0.7**	**1.2**
Ethylene glycol trap media	1	N.A.	N.D. [B]	N.D.	N.D.
	2	N.A.	N.D.	N.D.	N.D.
	Mean	N.A.	N.D.	N.D.	N.D.
Ethanolamine trap media	1	N.A.	0.2	0.8	1.0
	2	N.A.	0.4	0.6	1.5
	Mean	N.A.	0.3	0.7	1.2
Total recovery	**1**	**97.5**	**93.3**	**93.2**	**93.5**
	2	**93.9**	**94.9**	**94.9**	**95.4**
	Mean	**95.7**	**94.1**	**94.0**	**94.4**

[A]: Not applicable, [B]: Not detected

Table B.8.1.1.1-16 Bound residue fractionation in day 120 samples

Humic substance fraction	[phenyl-U-^{14}C]Flutolanil(A)	[aniline-U-^{14}C]Flutolanil(A)
Fulvic acid	1.7 (45.3)(B)	1.4 (37.8)
Humic acid	1.1 (30.6)	1.3 (35.0)
Humin	0.9 (24.0)	1.0 (27.2)
Total	3.7 (100.0)	3.6 (100.0)

(A) Values represent replicate means

(B) Values in parenthesis are the percentage toward total radioactivity in post extraction solid.

Table B.8.1.1.1-17 Degradation and formation of metabolites in soil treated with [phenyl-U-^{14}C]-flutolanil (as % applied radioactivity)

Degradates		Radioactivity distribution (% toward applied radioactivity) Incubation time (days)					
		0	15	30	60	91	120
Extractable	**1**	**98.1**	**95.4**	**96.1**	**91.7**	**93.9**	**89.3**
	2	**96.8**	**95.1**	**97.0**	**92.1**	**95.4**	**90.1**
	Mean	**97.4**	**95.2**	**96.6**	**91.9**	**94.7**	**89.7**
flutolanil	1	98.1	91.5	91.2	84.1	86.8	80.8
	2	96.8	90.9	91.9	85.1	85.5	82.3
	Mean	97.4	91.2	91.5	84.6	86.1	81.5
M-2	1	N.D.[A]	0.4	N.D.	N.D.	N.D.	N.D.
	2	N.D.	0.3	N.D.	N.D.	N.D.	N.D.
	Mean	N.D.	0.3	N.D.	N.D.	N.D.	N.D.
M-3	1	N.D.	N.D.	N.D.	N.D.	0.1	N.D.
	2	N.D.	N.D.	N.D.	N.D.	0.2	N.D.
	Mean	N.D.	N.D.	N.D.	N.D.	0.1	N.D.
M-4	1	N.D.	1.1	1.1	2.0	0.8	3.0
	2	N.D.	1.1	1.1	1.3	1.1	1.9
	Mean	N.D.	1.1	1.1	1.6	0.9	2.5
M-6	1	N.D.	N.D.	0.2	0.3	0.2	0.4
	2	N.D.	N.D.	0.2	0.2	0.7	0.2
	Mean	N.D.	N.D.	0.2	0.2	0.5	0.3
M-11	1	N.D.	1.5	2.2	4.4	3.9	2.8
	2	N.D.	1.8	2.5	4.2	4.9	3.8
	Mean	N.D.	1.7	2.4	4.3	4.4	3.3
M-101	1	N.D.	0.3	0.2	0.2	0.2	0.1
	2	N.D.	0.2	<0.1	0.1	0.4	0.3
	Mean	N.D.	0.3	0.1	0.2	0.3	0.2
M-102	1	N.D.	0.5	0.8	0.3	1.1	0.3
	2	N.D.	0.5	0.9	0.4	1.5	0.3
	Mean	N.D.	0.5	0.8	0.4	1.3	0.3
Sum of others	1	N.D.	0.1	0.5	0.5	0.7	1.8
	2	N.D.	0.2	0.4	0.8	1.1	1.3
	Mean	N.D.	0.2	0.4	0.6	0.9	1.6
Post extraction solid	**1**	**0.2**	**1.4**	**1.2**	**3.0**	**2.1**	**4.1**
	2	**0.1**	**1.4**	**1.3**	**2.1**	**1.8**	**3.2**
	Mean	**0.2**	**1.4**	**1.2**	**2.6**	**1.9**	**3.7**
Volatiles	**1**	**N.A.[B]**	**<0.1**	**<0.1**	**0.6**	**0.2**	**1.6**
	2	**N.A.**	**<0.1**	**0.1**	**0.5**	**0.1**	**0.8**
	Mean	**N.A.**	**<0.1**	**<0.1**	**0.6**	**0.1**	**1.2**
Total recovery	**1**	**98.2**	**96.8**	**97.4**	**95.4**	**96.2**	**94.9**
	2	**96.9**	**96.6**	**98.4**	**94.7**	**97.3**	**94.2**
	Mean	**97.6**	**96.7**	**97.9**	**95.0**	**96.7**	**94.6**

[A]: Not detected, [B]: Not applicable

Table B.8.1.1.1-18 Degradation and formation of metabolites in soil treated with [aniline-U-^{14}C]-flutolanil (as % applied radioactivity)

Degradates		Radioactivity distribution (% toward applied radioactivity) Incubation time (days) 0	30	60	120
Extractable	**1**	**97.4**	**91.6**	**87.4**	**89.5**
	2	**93.8**	**93.0**	**91.4**	**89.7**
	Mean	**95.6**	**92.3**	**89.4**	**89.6**
flutolanil	1	97.4	88.1	81.4	81.8
	2	93.8	87.5	84.7	81.7
	Mean	95.6	87.8	83.0	81.7
M-2	1	N.D.[A]	0.3	N.D.	N.D.
	2	N.D.	N.D.	N.D.	N.D.
	Mean	N.D.	0.1	N.D.	N.D.
M-3	1	N.D.	N.D.	N.D.	N.D.
	2	N.D.	N.D.	<0.1	N.D.
	Mean	N.D.	N.D.	<0.1	N.D.
M-4	1	N.D.	0.9	1.7	1.3
	2	N.D.	1.1	1.4	2.2
	Mean	N.D.	1.0	1.6	1.8
M-6	1	N.D.	<0.1	0.3	0.3
	2	N.D.	0.2	0.4	0.4
	Mean	N.D.	0.1	0.4	0.3
M-11	1	N.D.	1.9	3.5	4.9
	2	N.D.	2.6	4.2	4.0
	Mean	N.D.	2.3	3.8	4.5
Sum of others	1	N.D.	0.3	0.5	1.1
	2	N.D.	1.5	0.6	1.4
	Mean	N.D.	0.9	0.5	1.3
Post extraction solid	**1**	**0.1**	**1.5**	**4.9**	**3.0**
	2	**0.1**	**1.5**	**2.9**	**4.2**
	Mean	**0.1**	**1.5**	**3.9**	**3.6**
Volatiles	**1**	**N.A.[B]**	**0.2**	**0.8**	**1.0**
	2	**N.A.**	**0.4**	**0.6**	**1.5**
	Mean	**N.A.**	**0.3**	**0.7**	**1.2**
Total recovery	**1**	**97.5**	**93.3**	**93.2**	**93.5**
	2	**93.9**	**94.9**	**94.9**	**95.4**
	Mean	**95.7**	**94.1**	**94.0**	**94.4**

[A]: Not detected, [B]: Not applicable

CONCLUSIONS

Aerobic degradation of [^{14}C]-flutolanil (phenyl-label and aniline-label) in LUFA F2.2 soil: [^{14}C]-carbon dioxide max 0.8-1.5% AR at the end of incubation (day 120); bound residue max 3.0-4.2% AR at study end; flutolanil decreased from 93.8-98.1% AR at day 0 to 80.8-82.3% AR at day 120 (range for both replicates and radio-labels); no metabolite found at >5% AR.

Comments by RMS

- The study is acceptable. The relatively large sampling intervals are considered to be justified by the low rate of degradation of flutolanil (about 20% degradation within 120 days). For a kinetic analysis of the data from this study, please refer to study CA 7.1.2.1.1/02. Hardy, I., Agostini, F. & Jastrzebski, N. 2016a.

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Previous evaluation	Submitted for the purpose of renewal
RMS remark	Not acceptable

Report:	**CA 7.1.1.1/04. Yoshizane, T. (2013)**
Title:	Aerobic soil metabolism study of [Phenyl-U-^{14}C] Flutolanil
Document No:	LRSC-M13-008A (E-3050)
Guidelines:	Not reported
Testing laboratory:	Nihon Noyaku Co., Ltd, Japan
GLP:	No

Executive Summary

The route and rate of degradation of [phenyl-U-^{14}C]-flutolanil was studied in six Japanese soils for 55 days under aerobic conditions. Soil samples were maintained in the dark at 25°C and a soil moisture content of 40-60% maximum water holding capacity. The test soil was treated with radiolabelled [phenyl-U-^{14}C] at a rate of 1 mg/kg dry soil.

Samples were taken for extraction and analysis after 13, 27 and 55 days of incubation. Soil samples were sequentially extracted with acetonitrile/water (1/1, *v/v*) containing 0.1% (*w/v*) ascorbic acid and acetonitrile/0.1 M hydrochloric acid (4/1, *v/v*) containing 0.1% (*w/v*) ascorbic acid. Extracts, trap solutions and post extraction solids (PES) were subjected to radioanalysis. Soil extracts were combined, concentrated, and the resulting aqueous residue was added to an appropriate aliquot of sodium chloride and extracted with ethyl acetate. Concentrated and reconstituted ethyl acetate extracts were analysed for flutolanil and degradates by normal-phase 2D-TLC.

Recovery of radioactivity from individual samples was in the range 94.1-100.9%. Extractability decreased from 92.6-98.1% AR on day 13 to 78.5-89.6% AR on day 55. Mineralisation to [^{14}C]-carbon dioxide was a minor route of degradation, with 1.3-3.8% AR formed at the end of incubation (day 55). Organic volatile radioactivity was not detectable throughout incubation. Bound residue increased to 5.3-12.5% AR on day 55.

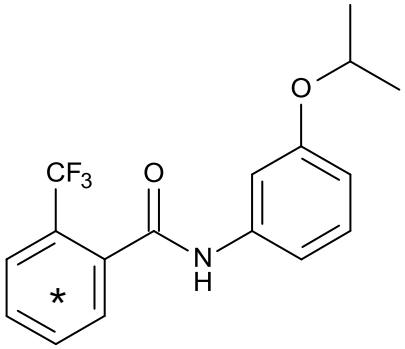
Flutolanil levels decreased from 86.8-91.9% AR at day 13 to 72.7-84.0% AR at day 55. Metabolites identified in soil extracts were M-4, M-6, M-101 and M-102 but none exceeded 5% AR. Five unknown fractions were found in each soil, none exceeded 5% AR except unknown-1 and unknown-3 in Kochi-1 soil (max 8.7 and 5.2% AR, respectively, on day 27).

The following deviations from OECD 307 were noted: major soil properties (pH, % organic carbon, texture, CEC) were not reported; the soil history was not reported; the soil sampling date, the period of storage and the conditions of storage prior to use of the soil in the test were not reported; soil microbial activity was not determined; one of the soils (Ibaraki) was a volcanic soil; single flasks per sampling point; no day 0 sample taken; only 3 sampling times instead of at least 6 including day 0; insufficient duration of incubation (55 instead of 120 days). Considering that the study was not conducted under GLP, and had major deviations from OECD 307, the study is not acceptable.

MATERIALS AND METHODS

A. MATERIALS

1. Test material: [phenyl-U-^{14}C]-flutolanil



* Denotes position of [^{14}C]-radiolabel

Lot or batch number: 0AE0002S-R
Specific activity: 2.37 GBq/mmol
Radiochemical purity: >95% (confirmed by TLC prior to application)

2. Soil Six Japanese soils which were collected from three sites in Japan.

Parameter	**Results**					
Soil I. D.	Kochi-1	Kochi-2	Chiba-1	Chiba-2	Ibaraki-1	Ibaraki-2
Sampling Location	JPPA, Kochi	JPPA, Kochi	JPPA, Chiba	JPPA, Chiba	JPPA, Ibaraki	JPPA, Ibaraki
Sampling date	November-March	November-March	November-May	November-May	November-March	November-March
Soil type	Non-volcanic	Non-volcanic	Non-volcanic	Non-volcanic	Volcanic	Volcanic
Maximum water holding capacity (% w/w)	47.3	33.9	88.3	75.1	61.8	75.1

B. STUDY DESIGN AND METHODS

1. In-life dates:

04 June 2012 – 31 October 2012

2. Experimental design

Parameter	**Description**
Duration of test	55 days
Soil condition	Soil sieved to 4.75 mm.
Target application rate	1000 g a.i./ha (assuming 1.0 g/cm^3 bulk density and depth of 10 cm)
Nominal concentration in test system	1 mg/kg dry soil
Number of replications	Single flask per time point
Pre-incubation	All test systems were incubated for one week in the dark at 25°C prior to test substance application.
Test apparatus	30g dry weight equivalent of soil in brown glass vessels (soil depth ~ 2 cm)

Parameter		Description
Test material application	Identity of solvent	Acetonitrile
	Volume of application solution	250 µL per 30 g soil dry weight
	Application method	The solution of the radioactive test material isotopically diluted with non-radiolabelled flutolanil (lot number 8AE0010P, 99.5% pure) was applied to the soil surface and the soil was then mixed thoroughly.
Traps for CO_2 and organic volatiles		20% ethanolamine solution (1 trap) followed by "urethane" (presumably meant to be polyurethane) (1 trap).
Experimental conditions	Temperature	25 ± 2°C
	Moisture content	Target: 60% maximum water holding capacity. The report stated: "Throughout the incubation period, water content of the test soil was kept in the range between 40 and 60% by adding distilled water when necessary."
	Lighting	Dark

Sampling

Parameter	Description
Sampling intervals	13, 27 and 55 DAT
Soil sampling procedures	Complete treated samples were removed at each sampling time and extracted as detailed below.
Collection of CO_2 and volatile organics	13, 27 and 55 DAT

Analytical procedures

The soil from each flask was extracted twice with acetonitrile/water (4:1; v/v) containing 0.1% (w/v) ascorbic acid (extract 1) followed by two extractions with acetonitrile/ 0.1 M hydrochloric acid (4:1; v/v) containing 0.1% (w/v) ascorbic acid (extract 2). Radioactivity in each extract was quantified by LSC. Soil extracts 1 and 2 were combined, evaporated *in vacuo*, and the resulting aqueous residue was added to an appropriate aliquot of sodium chloride and extracted with ethyl acetate twice. Ethyl acetate extracts were combined, following radio-analysis evaporated to dryness *in vacuo*, and following radio-analysis reconstituted in acetonitrile followed by chromatography analysis for identification and quantitation of flutolanil and degradates by normal-phase 2D-TLC. The identity of metabolites was confirmed by co-chromatography with non-radiolabelled reference standards. The residual aqueous phase obtained after ethyl acetate extraction was subjected to radioanalysis. Following extraction, soil samples were air-dried and the remaining unextracted radioactivity quantified by combustion analysis. Radioactivity in trapping solutions and in acetonitrile extracts of polyurethane foam plugs was determined by LSC.

RESULTS AND DISCUSSION

Recovery of radioactivity from individual samples was in the range 94.1-100.9%. Extractability decreased from 92.6-98.1% AR on day 13 to 78.5-89.6% AR on day 55. Mineralisation to [^{14}C]-carbon dioxide was a minor route of degradation, with 1.3-3.8% AR formed at the end of incubation (day 55). Organic volatile radioactivity was not detectable throughout incubation. Bound residue increased to 5.3-12.5% AR on day 55.

Flutolanil levels decreased from 86.8-91.9% AR at day 13 to 72.7-84.0% AR at day 55. Metabolites identified in soil extracts were M-4, M-6, M-101 and M-102 but none exceeded 5% AR. Five unknown fractions were found in each soil, none exceeded 5% AR except unknown-1 and unknown-3 in Kochi-1 soil (max 8.7 and 5.2% AR, respectively, on day 27).

Table B.8.1.1.1-19 Recovery of the applied radioactivity in Kochi soil (as % AR)

Soil No	**Kochi-1**			**Kochi-2**		
Incubation time (days)	**13**	**27**	**55**	**13**	**27**	**55**
Extractables	98.1	95.9	85.5	96.8	93.4	87.0
Non-extracted	1.3	4.4	7.8	1.5	3.8	5.6
$^{14}CO_2$	0.2	0.6	1.3	0.2	0.8	1.5
Other volatiles	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
TOTAL	99.6	100.9	94.7	98.6	97.9	94.1

n.d. = not detected (LOD not reported)

Table B.8.1.1.1-20 Recovery of the applied radioactivity in Chiba soil (as % AR)

Soil No	**Chiba-1**			**Chiba-2**		
Incubation time (days)	**13**	**27**	**55**	**13**	**27**	**55**
Extractables	94.3	93.3	89.0	94.0	95.0	89.6
Non-extracted	2.6	5.1	6.3	2.8	4.1	5.3
$^{14}CO_2$	0.5	1.4	1.6	0.7	0.9	1.3
Other volatiles	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
TOTAL	97.4	99.8	96.8	97.6	100.0	96.2

n.d. = not detected (LOD not reported)

Table B.8.1.1.1-21 Recovery of the applied radioactivity in Ibaraki soil (as % AR)

Soil No	**Ibarakia-1**			**Ibaraki-2**		
Incubation time (days)	**13**	**27**	**55**	**13**	**27**	**55**
Extractables	93.3	90.6	78.5	92.6	91.6	79.8
Non-extracted	2.8	5.9	11.9	3.1	5.8	12.5
$^{14}CO_2$	0.4	1.7	3.8	0.7	0.9	3.3
Other volatiles	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
TOTAL	96.5	98.2	94.2	96.4	97.9	95.6

n.d. = not detected (LOD not reported)

Table B.8.1.1.1-22 Degradation and formation of metabolites in Kochi soil (as % AR)

Soil No	**Kochi-1**			**Kochi-2**		
Incubation time (days)	**13**	**27**	**55**	**13**	**27**	**55**
Parent	89.0	72.4	72.8	91.9	84.0	80.9
M-2	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
M-4	n.d.	n.d.	0.2	0.8	n.d.	0.1
M-6	n.d.	n.d.	0.5	n.d.	0.5	0.8
M-101	1.2	0.8	1.5	0.8	0.2	0.4
M-102	0.3	0.7	0.5	0.2	0.2	0.3
Unknown -1	3.2	8.7	3.6	1.0	2.3	1.0
Unknown -2	0.9	4.1	3.6	0.7	1.2	1.0
Unknown -3	2.3	5.2	1.1	0.4	1.7	1.1
Unknown -4	n.d.	1.4	0.5	n.d.	0.6	0.3
Unknown -5	n.d.	1.1	n.d.	n.d.	0.3	n.d.
Origin	1.1	1.4	1.2	0.9	2.3	1.0

n.d. = not detected (LOD not reported)

Table B.8.1.1.1-23 Degradation and formation of metabolites in Chiba soil (as % AR)

Soil No	**Chiba-1**			**Chiba-2**		
Incubation time (days)	**13**	**27**	**55**	**13**	**27**	**55**
Parent	88.6	88.2	82.8	89.2	88.2	84.0
M-2	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
M-4	2.8	1.7	0.9	1.5	n.d.	n.d.
M-6	0.8	0.6	0.7	0.8	0.8	0.7
M-101	1.1	0.2	n.d.	0.8	0.2	n.d.
M-102	n.d.	n.d.	0.1	n.d.	0.3	0.4
Unknown -1	n.d.	0.4	0.9	0.7	1.1	0.9
Unknown -2	n.d.	0.3	1.0	0.7	1.1	0.9
Unknown -3	n.d.	n.d.	0.2	n.d.	0.4	0.7
Unknown -4	n.d.	0.3	0.3	n.d.	0.7	0.4
Unknown -5	n.d.	0.7	1.6	n.d.	0.8	0.8
Origin	0.9	0.9	0.4	0.5	1.5	0.9

n.d. = not detected (LOD not reported)

Table B.8.1.1.1-24 Degradation and formation of metabolites in Ibaraki soil (as % applied radioactivity)

Soil No	**Ibaraki-1**			**Ibaraki-2**		
Incubation time (days)	**13**	**27**	**55**	**13**	**27**	**55**
Parent	88.2	85.2	72.7	86.8	85.1	73.4
M-2	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
M-4	3.1	4.0	3.2	3.6	2.9	3.3
M-6	0.5	0.6	1.2	0.4	0.8	1.1
M-101	1.0	0.2	n.d.	0.9	0.2	n.d.
M-102	0.3	n.d.	0.1	0.7	0.9	0.2
Unknown -1	n.d.	n.d.	0.1	n.d.	0.2	0.2
Unknown -2	n.d.	n.d.	0.1	n.d.	0.2	0.2
Unknown -3	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Unknown -4	n.d.	n.d.	0.1	n.d.	n.d.	0.1
Unknown -5	n.d.	0.4	0.7	n.d.	1.0	0.9
Origin	0.1	0.1	0.3	0.1	0.4	0.4

n.d.: Not detected

RMS remarks renewal

- The study is not acceptable (not conducted under GLP, major deviations from OECD 307 (soil properties not reported)).
- The study was performed in 2012, but not conducted under GLP.
- The following deviations from OECD 307 were noted: major soil properties (pH, % organic carbon, texture, CEC) were not reported; the soil history was not reported; the soil sampling date, the period of storage and the conditions of storage prior to use of the soil in the test were not reported; soil microbial activity was not determined; one of the soils (Ibaraki) was a volcanic soil; single flasks per sampling point; no day 0 sample taken; only 3 sampling times instead of at least 6 including day 0; insufficient duration of incubation (55 instead of 120 days).
- Considering that the study was not conducted under GLP, and had major deviations from OECD 307, the study is not acceptable. DT_{50} values for the degradation of flutolanil were estimated on the basis of pseudo-first order reaction but not included in the summary (invalid study, insufficient time points, no day 0 value).

Previous evaluation	Submitted for first approval, DAR 2005
RMS remark	Acceptable

Report:	**CA 7.1.1.1/05. Aizawa, H. (1982)**
Title:	Decomposition Test of Flutolanil in Soil
Document No:	56-076-(3) (E-3002)
Guidelines:	None reported

Testing laboratory:	Mitsubishi-Kasei Institute of Toxicological and Environmental Sciences, Japan
GLP:	No

Executive Summary

The route and rate of degradation of [aniline-U-^{14}C]-flutolanil was studied in three Japanese soils under upland and flooded conditions for 180 days.

Soils under upland condition were incubated at 60% of the maximum water capacity. The flooded soils were maintained at a water layer depth of 0.5 cm. The soils were treated with ^{14}C-flutolanil at 1.75 mg a.i./kg (dry weight), then incubated in the dark at 30°C. Incubated vessel was connected to traps to collect volatile degradation products. Samples were taken for extraction and analysis at 0, 10, 30, 90 and 180 days of incubation time. The total radioactivity in soil sample was determined by combustion. The soil samples were extracted with solvent and extracts were analysed by thin layer chromatography (TLC).

Material balance was in the range of 95.3 to 101%, mean 98.9% AR. Extractable [^{14}C]-residues decreased from a maximum of >98% AR at Day 0 to a minimum of 70-80% AR at Day 180 in the upland soil. Extractable [^{14}C]-residues decreased from a maximum of >99% AR at Day 0 to around 70% AR at Day 180 in the flooded soil. Non extractable [^{14}C]-residues slowly increased throughout the study, to reach a maximum of 28.7% AR by 180 days. At study termination, evolved $^{14}CO_2$ reached a maximum of 7.7% AR. Significant levels of organic volatiles were not observed.

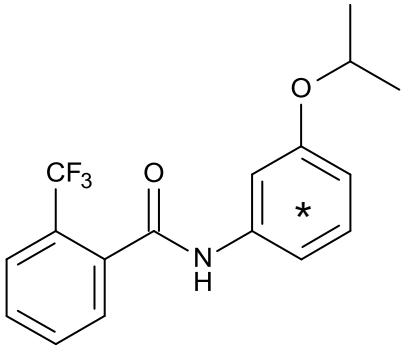
The major component identified was parent compound, flutolanil. Other minor components were α,α,α-trifluoro-4'-hydroxy-3'-isopropoxy-o-toluanilide (M-2/HFT), α,α,α-trifluoro-3'-(2-hydroxy-1-methylethoxy)-o-toluanilide (M-3/HIP), α,α,α-trifluoro-3'-hydroxy-o-toluanilide (M-4/DIP), α,α,α-trifluoro-3'-methoxy-o-toluanilide (M-6/MDP) and α,α,α-trifluoro-4'-hydroxy-3'-methoxy-o-toluanilide (M-7/HMD). Sum of unidentified components did not exceed 6.4% of the applied dose.

Disappearance of flutolanil was faster under flooded condition than under upland condition which was associated with the higher formation rates of both bound residue and carbon dioxide under the former condition.

I. MATERIALS AND METHODS

A. MATERIALS

1. Test material: [aniline-U-^{14}C]-flutolanil



* Denotes position of [^{14}C]-radiolabel

Chemical name (CAS) α,α,α-trifluoro-3'-isopropoxy-*o*-toluanilide

CAS registry number: 66332-96-5

Lot or batch number: 0AE0002S-R

Specific activity: 11 mCi/mmol

Radiochemical purity: 99%

Stability of test compound: Shown to be stable under the conditions of the test

Application vehicle: Acetonitrile

2. Soil Three Japanese soils which were from three sites in Japan a Clay loam (volcanic ash soil), Loam alluvial soil and a Sandy loam alluvial soil sieved to 2 mm.

Parameter	**Results**		
Sampling Location	Tochigi	Saitama	Okayama
Soil Texture	Clay loam volcanic ash soil	Loam alluvial soil	Sandy loam alluvial soil
Organic carbon (%)	16.4	4.9	3.1
Sand (>20 µm) % Silt (2 - 20 µm) % Clay (< 2 µm) %	52.9 25.3 21.8	52.2 35.9 13.9	60.3 32.8 6.9
Cation exchange capacity (meq/100 g)	28.7	15.0	10.0
pH (H_2O)	6.3	5.1	6.0
pH (KCl)	5.4	4.8	5.3
Water content (%)	38.4	12.3	5.1
Maximum water holding capacity (%)	115.0	90.3	55.6

B. STUDY DESIGN AND METHODS

1. In-life dates:

April 1981 – March 1982

2. Experimental design

Parameter		Description
Duration of test		180 Days
Soil condition		Soil sieved to 2 mm.
Target application rate		1.3 kg a.i./ha (assuming 1.5 g/cm^3 bulk density and depth of 5 cm)
Nominal concentration in test system		1.75 mg/kg dry soil
Number of replications		Single flask
Test apparatus		20 g dry weight equivalent of soil in Erlenmeyer flask
Test material application	Identity of solvent	Acetone
	Volume of application solution	100 µL per 20 g soil dry weight
	Application method	To the soil surface with a microsyringe, soil then mixed thoroughly.
Traps for CO_2 and organic volatiles		Commercially available CO_2 trapping agent and urethane foam plug.
Is there any indication of the test material absorbing to the walls of the test apparatus?		No
Experimental conditions	Temperature	30°C
	Moisture content	60% maximum water holding capacity for the flasks under upland conditions. For flooded soils, water was maintained at a depth of 0.5 cm.
	Lighting	Dark

Sampling

Parameter	Description
Sampling intervals	0, 10, 30, 90 and180 DAT
Soil sampling procedures	Complete treated samples were removed at each sampling time and extracted as detailed below.
Collection of CO_2 and volatile organics	0, 10, 30, 90 and180 DAT

Analytical procedures

The soil from each flask was extracted as follows:

For the flooded samples, the water phase was removed from the soil by centrifugation and weighed. The corresponding water was extracted twice with ethyl acetate then acidified with hydrochloric acid and re-extracted twice with ethyl acetate. The soil from the upland flasks and the flooded flasks after removal of the water were extracted as follows:

1. Acetonitrile/water (3:1 *w/w*) repeated four times. The extraction was performed on a shaker for *ca.* 5 minutes.
2. Acetone.
3. Chloroform/methanol (3:1; *w/w*) repeated three times.

The soil residue post extraction was extracted with 2N sodium hydroxide and the resulting solution partitioned with organic solvent.

All of the soil extracts from above were combined concentrated re-dissolved in water and partitioned with organic solvent. Extracts were quantified by LSC. Extracts were analysed by normal-phase TLC. The identity of metabolites was confirmed by co-chromatography with reference standards.

Following extraction, soil samples were air-dried and homogenised, and the remaining unextracted radioactivity quantified by combustion.

The trapped $^{14}CO_2$ was released from the trapping agent by reaction with hydrochloric acid and trapped in sodium hydroxide solution and the $^{14}CO_2$ present was determined by LSC. The urethane trap was extracted with methanol/water (4:1 *w/w*) and the aliquot analysed by LSC.

Degradation kinetics

Half-life values for the degradation of flutolanil were estimated on the basis of a first order reaction.

II. RESULTS AND DISCUSSION

The recoveries, extractable and non-extractable residue and trap contents at the beginning and end of the study are summarised below.

Mass Balance

Total radioactivity	Sum of activity in soil extracts, soil residue on combustion and that trapped as $^{14}CO_2$ and volatile organics in the urethane traps.
Recovery at 0 DAT	99.6 to 101% AR
Overall recovery (all samples)	Range 95.3 to 101%, mean 98.9% AR

Bound Extractable Residues

Extractable residues	Extractable residues decreased throughout the study.	
	Total extractable residues at 0 DAT	>98% AR upland soil >99% AR flooded soil
	Total extractable residues at end of study (180 DAT)	70 – 80% AR upland soil *ca* 60% AR flooded soil
Bound residues	Bound residues gradually increased during the study.	
	Bound residues at end of study (180 DAT)	28.7% AR (maximum)

The amount of radioactivity bound to soil increased with time. However, the increase appears to reach its maximum after 180 days.

Volatilisation

$^{14}CO_2$	There was a gradual increase in mineralisation throughout the incubation.	
	$^{14}CO_2$ evolved at end of study (180 DAT)	7.7% AR (maximum)
Other volatiles	No other volatiles were observed	

Transformation of Parent Material

In the soil extracts the major component identified was parent compound, flutolanil. Other minor components were M-2, M-3, M-4, M-6 and M-7. Sum of unidentified components did not exceed 6.4% of the applied dose.

Disappearance of flutolanil was faster under flooded condition than under upland condition which was associated with the higher formation rates of both bound residue and carbon dioxide under the former condition.

Table B.8.1.1.1-25 Recovery of the applied radioactivity in Tochigi soil under flooded conditions (as % applied radioactivity)

Soil No	**Tochigi**				
Incubation time (days)	**0**	**10**	**30**	**90**	**180**
Water - organo soluble	<0.1	1.1	0.9	0.2	0.1
Water - water soluble	<0.1	<0.1	<0.1	<0.1	<0.1
Extracts - organo soluble	100.2	78.2	58.1	37.5	33.0
Extracts - water soluble	<0.1	<0.1	<0.1	<0.1	<0.1
NaOH Extract - organo soluble	0.4	14.3	27.6	30.5	35.2
NaOH Extract - water soluble	<0.1	0.7	0.7	1.1	1.3
Unextractable	<0.1	5.9	12.4	26.3	28.7
Volatiles $^{14}CO_2$	<0.1	0.1	0.1	3.8	7.7
Volatiles	<0.1	<0.1	<0.1	<0.1	<0.1
TOTAL	100.6	100.4	100.1	99.5	96.0
Mean ± sd	99.0 ± 2.0%				

Table B.8.1.1.1-26 Recovery of the applied radioactivity in Saitama soil under flooded conditions (as % applied radioactivity)

Soil No	**Saitama**				
Incubation time (days)	**0**	**10**	**30**	**90**	**180**
Water - organo soluble	0.1	2.5	0.6	0.1	<0.1
Water - water soluble	<0.1	<0.1	<0.1	<0.1	<0.1
Extracts - organo soluble	99.1	88.4	78.8	64.6	62.7
Extracts - water soluble	<0.1	<0.1	<0.1	<0.1	0.1
NaOH Extract - organo soluble	0.2	5.6	14.1	17.3	9.0
NaOH Extract - water soluble	<0.1	0.1	1.1	1.7	0.5
Unextractable	0.3	4.0	4.2	14.2	21.4
Volatiles $^{14}CO_2$	<0.1	<0.1	0.1	1.2	2.9
Volatiles	<0.1	<0.1	<0.1	<0.1	<0.1
TOTAL	99.6	100.7	99.0	99.1	96.6
Mean ± sd	98.9 ± 1.5%				

Table B.8.1.1.1-27 Recovery of the applied radioactivity in Okayama soil under flooded conditions (as % applied radioactivity)

Soil No	**Okayama**				
Incubation time (days)	**0**	**10**	**30**	**90**	**180**
Water - organo soluble	<0.1	2.5	1.5	0.6	0.3
Water - water soluble	<0.1	<0.1	<0.1	<0.1	<0.1
Extracts - organo soluble	99.6	86.8	67.3	56.1	54.0
Extracts - water soluble	<0.1	<0.1	0.2	0.2	0.1
NaOH Extract - organo soluble	0.2	6.0	22.4	21.5	16.2
NaOH Extract - water soluble	<0.1	0.2	2.4	0.3	1.1
Unextractable	0.5	4.3	5.7	19.8	20.5
Volatiles $^{14}CO_2$	<0.1	<0.1	0.4	1.8	3.2
Volatiles	<0.1	<0.1	<0.1	<0.1	<0.1
TOTAL	100.3	99.9	100.0	100.4	95.3
Mean ± sd	98.9 ± 2.2%				

Table B.8.1.1.1-28 Recovery of the applied radioactivity in Tochigi soil under upland conditions (as % applied radioactivity)

Soil No	**Tochigi**				
Incubation time (days)	**0**	**10**	**30**	**90**	**180**
Extracts - organo soluble	100.1	83.6	70.9	56.8	47.7
Extracts - water soluble	<0.1	<0.1	0.3	2.2	<0.1
NaOH Extract - organo soluble	0.5	12.5	16.5	21.2	22.2
NaOH Extract - water soluble	0.2	2.5	0.6	3.4	2.4
Unextractable	0.2	0.6	8.7	12.3	18.5
Volatiles $^{14}CO_2$	<0.1	0.3	1.9	4.2	5.9
Volatiles	<0.1	<0.1	<0.1	<0.1	<0.1
TOTAL	101.0	99.5	98.8	100.0	96.6
Mean ± sd	98.7 ± 1.6%				

Table B.8.1.1.1-29 Recovery of the applied radioactivity in Saitama soil under upland conditions (as % applied radioactivity)

Soil No	**Saitama**				
Incubation time (days)	**0**	**10**	**30**	**90**	**180**
Extracts - organo soluble	98.7	92.1	85.0	76.7	74.4
Extracts - water soluble	<0.1	<0.1	0.2	0.1	0.1
NaOH Extract - organo soluble	0.8	4.5	8.7	10.8	11.9
NaOH Extract - water soluble	<0.1	0.8	0.3	0.8	0.4
Unextractable	0.9	2.3	4.7	11.5	12.3
Volatiles $^{14}CO_2$	<0.1	<0.1	0.4	0.2	0.4
Volatiles	<0.1	<0.1	<0.1	<0.1	<0.1
TOTAL	100.4	99.8	99.2	100.0	99.5
Mean ± sd	99.6 ± 0.46%				

Table B.8.1.1.1-30 Recovery of the applied radioactivity in Okayama soil under upland conditions (as % applied radioactivity)

Soil No	**Okayama**				
Incubation time (days)	**0**	**10**	**30**	**90**	**180**
Extracts - organo soluble	99.3	94.2	84.3	77.3	68.9
Extracts - water soluble	<0.1	0.1	0.2	0.2	0.6
NaOH Extract - organo soluble	0.2	4.8	9.2	8.0	12.8
NaOH Extract - water soluble	<0.1	0.6	0.7	1.9	1.8
Unextractable	0.4	0.2	5.3	8.3	9.2
Volatiles $^{14}CO_2$	<0.1	0.1	0.3	2.2	3.0
Volatiles	<0.1	<0.1	<0.1	<0.1	<0.1
TOTAL	99.9	100.0	100.0	97.8	96.3
Mean ± sd	98.5 ± 1.7%				

Table B.8.1.1.1-31 Degradation and formation of metabolites in Tochigi soil under flooded conditions (as % applied radioactivity)

Soil No	**Tochigi**				
Incubation time (days)	**0**	**10**	**30**	**90**	**180**
Flutolanil	99.3	91.7	85.1	67.0	56.7
M-4 (Referred to as DIP in report)	0.1	0.4	0.6	0.4	0.7
M-3 (Referred to as HIP in report)	-	0.2	0.1	0.1	0.1
M-2 (Referred to as HFT in report)	-	-	0.1	0.1	0.1
Unknown	-	-	<0.1	-	0.1
others	0.8	1.1	0.7	0.5	0.4

- Not detected

Table B.8.1.1.1-32 Degradation and formation of metabolites in Saitama soil under flooded conditions (as % applied radioactivity)

Soil No	**Saitama**				
Incubation time (days)	**0**	**10**	**30**	**90**	**180**
Flutolanil	98.1	94.4	91.5	80.7	70.3
M-4 (Referred to as DIP in report)	0.2	0.7	1.0	0.7	0.7
M-3 (Referred to as HIP in report)	-	0.2	0.1	<0.1	0.1
M-2 (Referred to as HFT in report)	-	-	0.1	0.2	<0.1
Unknown	-	<0.1	0.1	0.1	<0.1
others	0.8	1.3	0.8	0.3	0.3

- Not detected

Table B.8.1.1.1-33 Degradation and formation of metabolites in Okayama soil under flooded conditions (as % applied radioactivity)

Soil No	**Okayama**				
Incubation time (days)	**0**	**10**	**30**	**90**	**180**
Flutolanil	98.7	93.2	87.5	75.0	66.2
M-4 (Referred to as DIP in report)	0.2	0.5	1.7	1.3	1.6
M-3 (Referred to as HIP in report)	-	0.1	0.2	<0.1	-
M-2 (Referred to as HFT in report)	-	<0.1	0.2	0.4	0.1
Unknown	-	-	0.1	<0.1	0.1
others	0.7	1.3	1.6	1.4	2.5

- Not detected

Table B.8.1.1.1-34 Degradation and formation of metabolites in Tochigi soil under upland conditions (as % applied radioactivity)

Soil No	**Tochigi**				
Incubation time (days)	**0**	**10**	**30**	**90**	**180**
Flutolanil	99.3	93.9	85	74.7	67
M-4 (Referred to as DIP in report)	0.1	1.5	1.7	2.2	1.5
M-3 (Referred to as HIP in report)	-	0.1	<0.1	<0.1	<0.1
M-2 (Referred to as HFT in report)	-	<0.1	0.1	<0.1	-
M-6 (Referred to as MDP in report)	-	-	0.1	0.1	0.1
M-7 (Referred to as HMD in report)	-	-	0.3	0.1	-
Unknown	-	<0.1	<0.1	0.1	<0.1
others	0.7	0.5	0.3	0.6	0.3

- Not detected

Table B.8.1.1.1-35 Degradation and formation of metabolites in Saitama soil under upland conditions (as % applied radioactivity)

Soil No	**Saitama**				
Incubation time (days)	**0**	**10**	**30**	**90**	**180**

Flutolanil	97.6	94.4	91.1	85.3	81.2
M-4 (Referred to as DIP in report)	0.2	1.0	1.1	1.5	1.2
M-3 (Referred to as HIP in report)	-	0.1	-	0.1	0.1
M-2 (Referred to as HFT in report)	-	<0.1	0.1	0.2	<0.1
M-6 (Referred to as MDP in report)	-	-	0.1	<0.1	0.2
M-7 (Referred to as HMD in report)	-	-	-	0.1	0.9
Unknown	-	-	>0.1	0.1	0.6
others	0.9	1.2	0.1	0.3	2.1

- Not detected

Table B.8.1.1.1-36 Degradation and formation of metabolites in Okayama soil under upland conditions (as % applied radioactivity)

Soil No	**Saitama**				
Incubation time (days)	**0**	**10**	**30**	**90**	**180**
Flutolanil	98.3	96.2	90.4	80.8	78.8
M-4 (Referred to as DIP in report)	0.2	1.5	2.1	2.8	2.1
M-3 (Referred to as HIP in report)	-	<0.1	<0.1	-	-
M-2 (Referred to as HFT in report)	-	0.1	0.1	0.1	0.1
M-6 (Referred to as MDP in report)	-	-	<0.1	0.2	0.4
M-7 (Referred to as HMD in report)	-	-	0.1	0.3	0.1
Unknown	-	0.1	0.1	0.2	0.1
others	0.8	1.0	0.7	1.0	0.3

- Not detected

Table B.8.1.1.1-37 Half-life values for flutolanil in aerobic soil

	Aerobic flooded condition		Upland condition	
	Half-life, days	Correlation coefficient	Half-life, days	Correlation coefficient
Tochigi	160	99.99	190	98.24
Saitama	300	96.80	320	99.46
Okayama	210	99.90	300	99.97

III. CONCLUSIONS

The disappearance of flutolanil was faster under flooded conditions than under upland conditions which was associated with the higher formation rates of both bound residue and carbon dioxide under the former condition. Only minor degradation components were detected M-2, M-3, M-4, M-6 and M-7 never greater than 5% of applied radioactivity.

Flutolanil gradually degraded in aerobic flooded soil with half-life values of 160 to 300 days at 30°C and half-life values of 190 to 320 days at 30°C in upland soils.

RMS remarks renewal

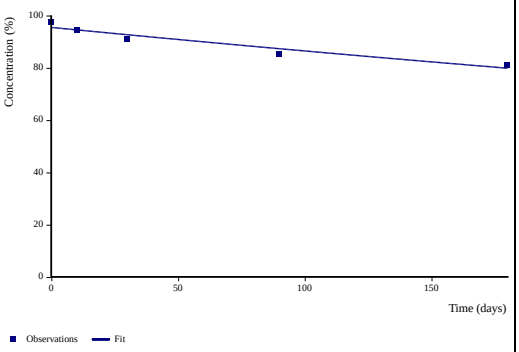
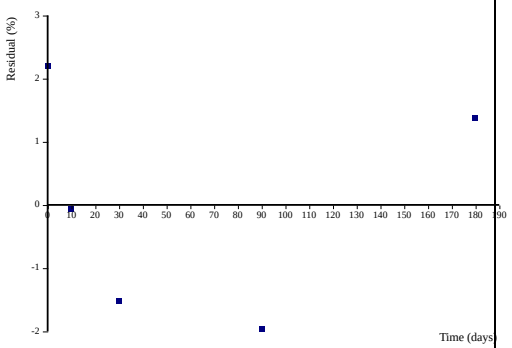
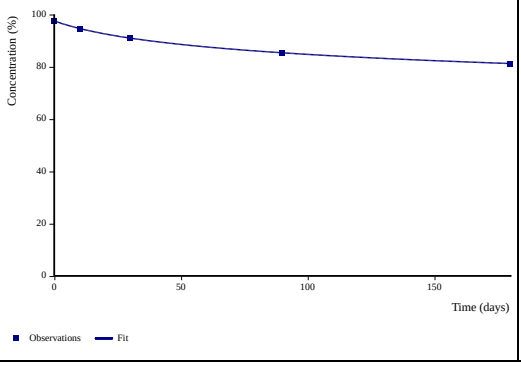
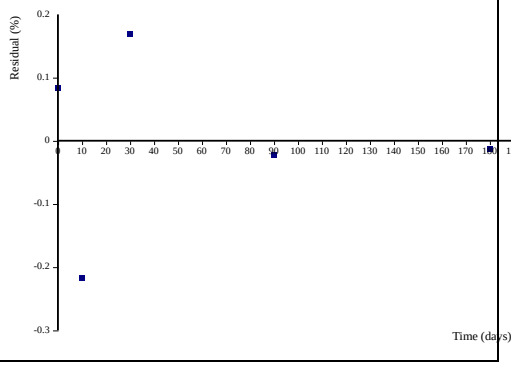
- Volcanic ash soil is not representative of European conditions and results of Tochigi should not be used.
- The differences in results between flooded and upland conditions may have been caused by upland conditions being too dry.
- Microbial biomass is not recorded.
- Degradaton kinetics would need to be re-analysed, using currently approved methods (FOCUS DegKin). However, the number of analysis points in time is rather low, just meeting the minimumfor old studies. For biphasic kinetics the degrees of freedom is two and one for FOMC and DFOP respectively.
- Since no information is available on the oxygen availability in the flooded soils, these soils can not be used to determine the DT50. The upland soils are available for recalculation, although the quality of these trials is disputable. Overall, RMS considers the Saitama and Okayama alluvial soils, incubated under 'upland' conditions, sufficient to take into consideration.
- RMS performed a kinetic analysis (according to FOCUS kinetics, v1.1) on the data. NB This analysis is based on the raw data and does not include moisture and temperature normalisation (soils were incubated at 30°C). See Volume 1 for results after normalisation (DT50 exceeding 1000 days for both soils).

RMS kinetic recalculation

Table B.8.1.1.1-38 Graphical summary of soil Saitama

Study reference - Soil	Saitama		
Model	SFO	FOMC	DFOP
Visual Fit	Good	Good	Good
Residuals (visual)	Moderate	Good	Good
χ^2 error (%)	1.43	0.131	0.234
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 9.91E-004 σ: 1.64E-004 p (k): 0.004537	α: 0.08438 σ: 0.004728 95th %ile CI does not contain 0 β: 23.25 σ: 3.089 95th %ile CI does not contain 0	k: 0.03053 σ: 0.009933 p (k_1): 0.1001 k2: 4.91E-004 σ: 1.37E-004 p (k_2): 0.08634 g: 0.09042

			σ: 0.02035
Trigger DT_{50} (days)	700	>10000 DT50 of **1000** days selected	1220
DT_{90} (days)	2320	>10000	4490
FOCUS decision step (Trigger)	SFO acceptable, but not more appropriate than FOMC	FOMC better than SFO Default DT50 of 1000 days selected	DFOP better than SFO, but worse than FOMC
Modelling DT_{50} (days)	**700**		1410
FOCUS decision step (Modelling)	SFO acceptable	FOMC not applicable (>10% initial AR remaining at end of study)	DFOP better than SFO but k_1 and k_2 not robust; SFO selected for modelling

Model	Visual Fit	Residuals plot
SFO		
FOMC		

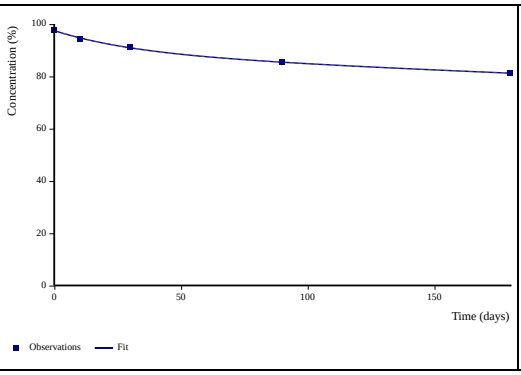
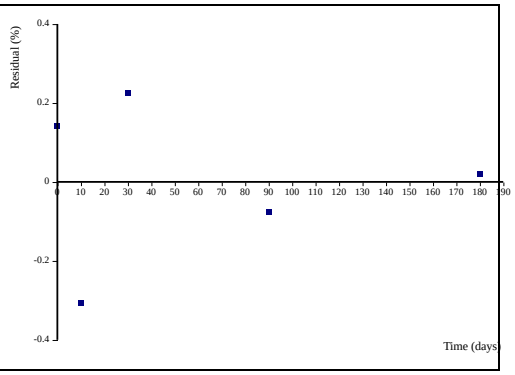
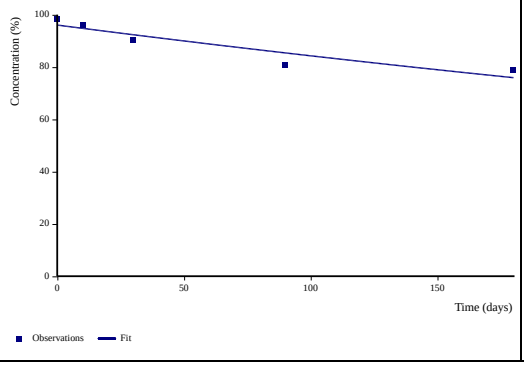
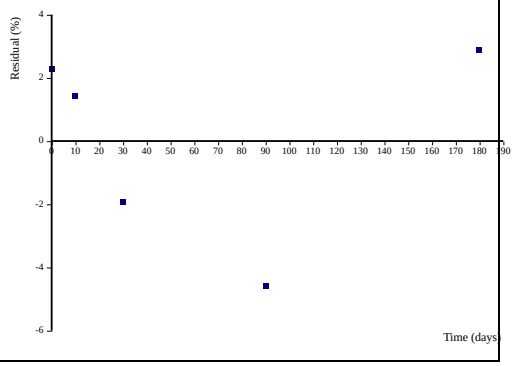
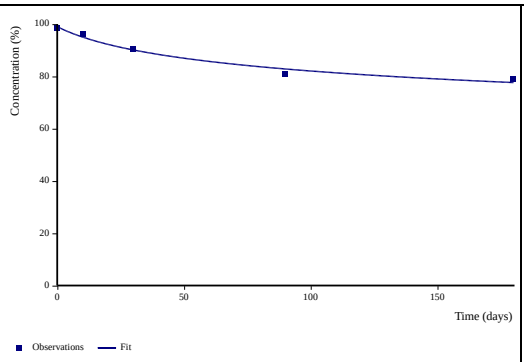
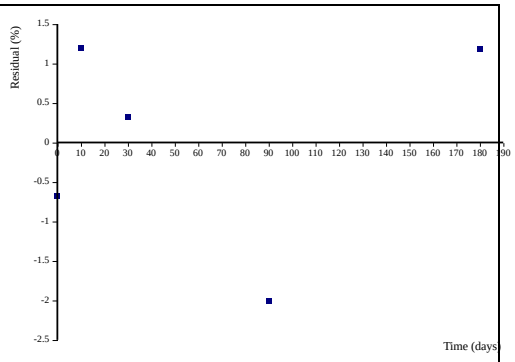
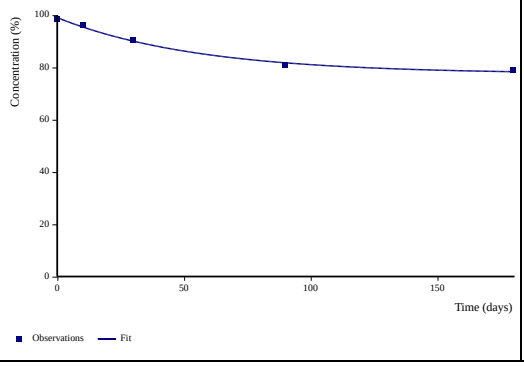
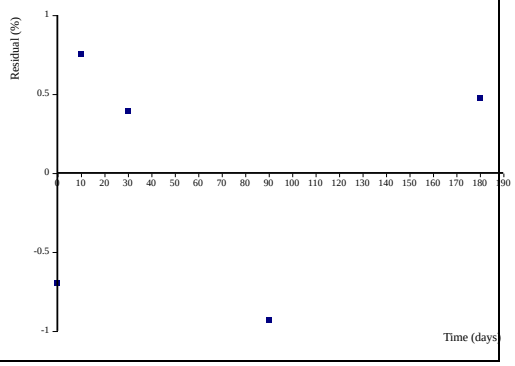
DFOP		

Table B.8.1.1.1-39 Graphical summary of soil Okayama

Study reference - Soil	Okayama		
Model	SFO	FOMC	DFOP
Visual Fit	Good	Good	Good
Residuals (visual)	Moderate	Good	Good
χ^2 error (%)	2.55	1.23	0.87
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.001305 σ 02.297 p (k): 0.01114	α: 0.1099 σ:0.04368 95th %ile CI contains 0 90th %ile CI contains 0 β: 22.13 σ: 20.93 95th %ile CI contains 0 90th %ile CI contains 0	k_1: 0.01804 σ: 0.01885 p (k1): 0.257 k_2: 1.92E-16 σ: 0.001294 p (k2): 0.5 g = 0.2173 σ = 0.217
Trigger DT_{50} (days)	**531**	>10000	>10000
DT_{90} (days)	**1770**	>10000	>10000
FOCUS decision step (Trigger)	SFO acceptable; compare with FOMC	FOMC better than SFO, but α parameter not robust; compare with DFOP	DFOP better than SFO but k_1 and k_2 not robust; SFO selected as best fit
Modelling DT_{50} (days)	**531**		

FOCUS decision step (Modelling)	SFO visually acceptable; SFO DT_{50} selected		DFOP better than SFO but k_1 and k_2 not robust; SFO selected for modelling

Model	Visual Fit	Residuals plot
SFO		
FOMC		
DFOP		

RMS notes that for both soils the SFO fit is acceptable in terms of statistics, although biphasic kinetics improved the visual fit. However, independent of the kinetic model, the resulting DT50 at 20 °C would be 1000 days for both soils.

Previous evaluation	Submitted for first approval, DAR 2005
RMS remark	Not acceptable for determining aged sorption

Report:	**CA 7.1.1.1/06. Daly, D., (1991b)**
Title:	Soil/Sediment Adsorption-Desorption of Soil Incorporated 14C-Flutolanil Following Aerobic Aging
Document No:	37793 (E-3014)
Guidelines:	EPA Pesticides Assessment Guidelines Subdivision N, Section 163-1-C N-

	163-1-C
Testing laboratory:	ABC Laboratories, Inc., Missouri, USA
GLP:	Yes

Material and methods

Since flutolanil has been shown to have relatively long half-life (>105 days) it was requested by EPA that an aged batch adsorption/desorption study should be performed on the extractable residues from soil after aging for one half-life. The objective of the study was to characterize the adsorption/ desorption properties of aged residues of ^{14}C-flutolanil on four different soil types and one sediment. The principle of the method was to age flutolanil on sandy loam soil, exhaustively extract the soil and then conduct a adsorption/desorption study on the extractable residues. Characteristics of the soil used for aging are presented in the table below.

Table B.8.1.1.1-40 Characteristics of soil used for aerobic aging of 14C-flutolanil

Property/parameter	Test soil
Origin	Nebraska, USA
Soil type	Sandy loam
Organic matter (%)	1.6
Textural analysis (%) - sand - silt - clay	 56 26 18
pH	6.8
Cation exchange capacity (meq/100 g soil)	11.6
Total microbial count (colonies/g)	4-8 x 10^6

600 g of sandy loam soil was weighed into a glass jar to serve as test soil and 200 g of soil was weighed into a separate jar to serve as control. Test soil was dosed with ^{14}C-flutolanil at a rate of 9 mg/kg. Test and control soils were moistened to 75 % of field capacity, connected to water saturated air supply and traps for ^{14}C-volatiles and incubated at 25 ^{o}C for 8 months. Ten gram soil samples were taken on day 0 and at 2, 4, 6 and 8 months after dosing. Trapping solutions were collected monthly.

Soil samples were extracted with methanol:water and sodium hydroxide:methanol and partitioned with methylene chloride. The extracts were analyzed by LSC and post-extracted soil samples were combusted. Trapping solutions were analyzed by LSC.

Results

Distribution of radioactivity during the test is presented in the table below. After 8 months flutolanil still accounted for 84 % of the extracted radioactivity. The pattern of dissipation consisted of degradation to volatile residues and trace levels of extractable metabolites and of formation of bound residues. Flutolanil became more tightly bound to soil with time. These results are compatible with those obtained in aerobic degradation studies. It was therefore considered inappropriate to continue the experiment as the net result would be to repeat the immediate adsorption/desorption study already performed on flutolanil.

Table B.8.1.1.1-41 Distribution of radioactivity on aerobically aged sandy soil

Months after application	Percent of initial measured dose				
	Total ^{14}C-accountability	Total volatiles	Non-extractable residues	Extractable residues	
				Total	Characterized as flutolanil
0	100	0	0.140	99.9	91.7
2	101.4	1.23	5.66	94.5	83.8
4	95.5	2.59	6.19	86.7	82.6
6	96.6	3.37	5.43	87.8	77.8
8	96.8	4.12	4.36	88.3	74.2

RMS remarks original DAR

The study on adsorption/desorption following aerobic aging was found unnecessary since flutolanil was the only significant component present in the aged extractable residue. The RMS considers this conclusion reasonable and acceptable.

RMS remarks renewal

Previous evaluation remains applicable. As sufficient aerobic soil degradation studies according to OECD 307 are available, the study was not used to supplement the route and rate of degradation in soil data set.

B.8.1.1.2 Anaerobic degradation, laboratory studies

Previous evaluation	Submitted for the purpose of renewal
RMS remark	Not acceptable (including route of degradation) for 2 soils; Acceptable for 2 remaining soils (rate of degradation only)

Report:	**CA 7.1.1.2/01. Mallipudi, N. & Cooke, L. (2013)**
Title:	Anaerobic Soil Metabolism of [^{14}C] Flutolanil
Document No:	SR20130114A (E-3049)
Guidelines:	EPA, OCSPP 835.4200, OECD 307
Testing laboratory:	Eurofins Product Safety Labs, New Jersey, USA
GLP:	Yes

Executive Summary

The route and rate of degradation of [aniline-U-^{14}C]-flutolanil was studied in a loamy sand 1 soil under aerobic / anaerobic conditions for 363 days. During the 30-day aerobic phase soil samples were maintained in the dark at 20°C and a soil moisture content of 40% maximum water holding capacity. Soils were flooded and maintained under an atmosphere of N_2 gas throughout the anaerobic phase. The study also investigated the rate of degradation of [aniline-U-^{14}C]-flutolanil in a sandy clay loam, loamy sand 2 and clay loam over 120 days of flooded anaerobic incubation after 30 days of aerobic incubation.

The test soil was treated with radiolabelled flutolanil at a rate of 1.12 mg/kg dry soil. Samples were taken for extraction and analysis immediately after treatment (Day 0) and after 15 and 30 days of aerobic incubation, and then after 14, 30, 60, 90, 120 days (all soils) and 180 and 333 days (loamy sand 1) of anaerobic incubation post flooding.

For anaerobic samples the water phase was analysed separately. For the aerobic and anaerobic phase samples, soil samples were extracted three times using acetonitrile : 1N HCl /water (4:1; *v/v*). An additional extraction was performed for all of the aerobic and anaerobic soil samples from the sandy clay loam, loamy sand 2 and clay loam, and for the day 30 through day 333 anaerobic samples from the loamy sand 1, using 1N sodium hydroxide / methanol (3:1, *v/v*). The 30 day anaerobic samples from the loamy sand 1 were also extracted with methanol / water (4:1, *v/v*). Water samples (after extraction with dichloromethane or after lyophilisation) and soil extracts were analysed by HPLC (reversed phase for quantification, 2nd HPLC system for confirmation of identity).

Recovery of radioactivity from individual samples was in the range 98-103%, except for the 180 and 333 day anaerobic samples of the loamy sand 1 soil (70-81% AR). The reason for these low mass balances could not be identified. Soil extractable radioactivity was 96-100% AR during the aerobic phase, decreased on day 120 of anaerobic incubation to 56-60% AR (loamy sand 1 and sandy clay loam) and 84-86% AR (loamy sand 2 and clay loam), and to 39% AR in loamy sand 1 on day 333 of anaerobic incubation. Mineralisation to [^{14}C]-carbon dioxide and formation of organic volatile radioactivity was a minor route of degradation, with at the most 1.2% AR formed during incubation. Soil bound residue in the 4 soils increased to 0.8-4.6% AR on day 120 of anaerobic incubation, and to 11% AR in the sandy loam 1 soil after 333 days of anaerobic incubation.

Flutolanil levels in the total system of the loamy sand 1 soil decreased from 95% AR at the start to 89% AR at the end of aerobic incubation (30DAT), and to 73% AR and 37% AR on day 120 and day 333, respectively, of anaerobic incubation. Flutolanil levels in the total system of the remaining three soil decreased from 98-99% AR at the start to 89-96% AR at the end of aerobic incubation (30DAT), and to 85-91% AR on day 120 of anaerobic incubation.

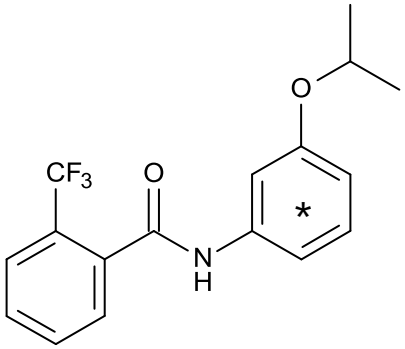
Metabolites identified in water and soil extracts of loamy sand 1 were M-2, M-4 and M-6, which never exceeded 1.2, 4.3 and 0.9% AR, respectively in the total system. No individual unidentified component exceeded 1.2% AR and 3.0% AR in the soil extracts and water phase, respectively.

The results for rate and route of anaerobic degradation in the loamy sand 1 are not acceptable since there were no anaerobic conditions in the flooded loamy sand 1 soil. The results for the clay loam soil are not acceptable since the microbial biomass during the 30-day aerobic incubation was insufficient. The results for the rate of degradation of flutolanil in the remaining two soils (sandy clay loam and loamy sand 2; no measurable degradation) are acceptable.

MATERIALS AND METHODS

A. MATERIALS

1. Test material: [aniline -U -^{14}C]-flutolanil



* Denotes position of [^{14}C]-radiolabel

Lot or batch number: CP 3778

Specific activity: 10.0 MBq/mg

Radiochemical purity: 98.9%

2. Soil Four fresh agricultural soils were used in the study. The soils were collected fresh from field sites with a known history.

Parameter	**Results**			
Texture Class (USDA)	Loamy sand 1(C)	Sandy clay loam(D)	Loamy sand 2	Clay loam
pH (soil water 1 : 1)	6.2	6.9	5.9	5.8
Organic matter (%)	0.79	1.1	0.67	4.0
Organic carbon (%)(A)	0.46	0.64	0.39	2.32
Cation exchange capacity (meq/100 g)	5.9	9.5	3.7	20.0
USDA classification Sand (>50 µm) % Silt (2 - 50 µm) % Clay (< 2 µm) %	 81 14 5	 63 26 11	 87 8 5	 27 44 29
Water holding capacity 1/3 bar (%) 15 bar (%)	 6.6 -	 12.1 -	 6.0 2.2	 30.0 15.0
Bulk density (g/cm^3)	1.29	1.37	1.4	1.10
Biomass (µg C/ g soil)(B) Start End of aerobic phase	 60.1 (1.3) 21.4 (0.5)	 31.5 (0.5) 101.0 (1.6)	 107.7 (2.8) 86.7 (2.2)	 26.0 (0.1) 90.5 (0.4)

(A) % organic carbon = % organic matter/1.724.
(B) Between brackets the microbial biomass expressed as % of soil organic carbon content.
(C) The reported soil textural class according to USDA based on the hydrometer method was sandy loam, but based on the reported particle size distribution included in the above table the soil textural class according to USDA is loamy sand.
(C) The reported soil textural class according to USDA based on the hydrometer method was loam, but based on the reported particle size distribution included in the above table the soil textural class according to USDA is sandy clay loam.

Dissolved oxygen, redox potential in water and soil and pH were measured after flooding the soil. In the loamy sand 1 soil, dissolved oxygen was in the range 4.01-5.87 mg/L mg/L, pH in the range 5.16-6.53, and redox potential in soil in the range 270-425 mV except in replicate 1 on day 333 (-5 mV). In

the sandy clay loam soil, dissolved oxygen was in the range 0.06-0.20 mg/L, pH in the range 8.19-8.73, and redox potential in soil -42/-43 mV on day 30 and ≤-186 mV from day 60 onwards. In the loamy sand 2 soil, dissolved oxygen was in the range 0.05-0.15 mg/L, pH in the range 7.92-8.22, and redox potential in soil -86/-108 mV on day 30 and ≤-147 mV from day 60 onwards. In the clay loam soil, dissolved oxygen was in the range 0.11-0.34 mg/L, pH in the range 6.80-7.45, and redox potential in soil -44/-53 mV on day 30 and ≤-257 mV from day 60 onwards.

STUDY DESIGN AND METHODS

1. In-life dates:

31 March 2011 – 24 January 2013

2. Experimental design

A full rate and route of metabolism study was performed in the loamy sand 1 soil (30 days of aerobic incubation, followed by flooding and 333 days of anaerobic incubation). In the remaining three soils the rate of degradation of flutolanil was studied (30 days of aerobic incubation, followed by flooding and 120 days of anaerobic incubation).

Parameter		**Description**
Duration of test		Aerobic phase 30 days Anaerobic phase 333 days (loamy sand 1) or 120 days (other three soils) Total duration 363 days (loamy sand 1) or 150 days (other three soils)
Target application rate		2.24 kg a.i./ha (assuming 1.3 g/cm^3 bulk density and depth of 0-15 cm). Concentration 1.12 mg/kg
Number of replications		Two replicates per time point
Test apparatus		Closed 250 mL Erlenmeyer glass flasks with 50g dry weight equivalent of soil.
Test material application	Identity of solvent	Acetonitrile (final concentration in test system 1%)
	Application method	To the soil surface by syringe and the soil was then mixed.
Traps for CO_2 and organic volatiles		At samplings the headspace was flushed through a series of traps: ethylene glycol trap followed by 0.1N sulphuric acid trap followed by 1N sodium hydroxide trap.
Experimental conditions	Temperature	20 ± 2°C
	Moisture content	Soil moisture content was adjusted to 40% of the maximum water holding capacity before application of the test substance. After the 30 days aerobic incubation, the soil was flooded with water and maintained under atmosphere N_2 gas during the anaerobic phase.
	Lighting	Dark

Sampling

Parameter		**Description**
Sampling intervals	Normal dose	Aerobic phase: 0.1, 15 and 30 DAT Anaerobic phase: 44, 60, 90, 120, 150, 210 and 363 DAT (14, 30, 60, 90, 120, 180 and 333 days anaerobic)
	Untreated soils for biomass	Day 0 and at end of aerobic incubation
Soil sampling procedures		Complete treated samples were removed at each

Parameter	Description
	sampling time and extracted as detailed below.
Collection of CO_2 and volatile organics	Headspace flushed through a series of volatile traps at each timepoint.

Analytical procedures
For the anaerobic phase samples, the water phase was either decanted directly into a graduated cylinder or first transferred into a centrifuge bottle and centrifuged before decanting into a graduated cylinder. A portion or all of the water phase was either extracted with dichloromethane and the extract reduced to dryness, or lyophilized or reduced to dryness under nitrogen gas. The sample was reconstituted in mobile phase and analysed by HPLC for chromatographic characterization.

For the aerobic and anaerobic phase samples, soil samples were extracted three times using acetonitrile : 1N HCl /water (4:1; *v/v*). An additional extraction was performed for all of the aerobic and anaerobic soil samples from the sandy clay loam, loamy sand 2 and clay loam, and for the day 30 through day 333 anaerobic samples from the loamy sand 1, using 1N sodium hydroxide / methanol (3:1, *v/v*). The 30 day anaerobic samples from the loamy sand 1 were also extracted with methanol / water (4:1, *v/v*).

Radioactivity in soil extracts was quantified by LSC and analysed by HPLC (two different systems). The identity of metabolites was confirmed by co-chromatography with reference standards.
Radioactivity in extracted soil was quantified by combustion analysis. Trap solutions were collected at each time point. The volume of each trapping solution was measured and the radioactivity present was determined by LSC.

The anaerobic half-life (DT_{50}) of flutolanil was determined from the results of HPLC analyses using simple first order (SFO) kinetics.

RESULTS AND DISCUSSION
Recovery of radioactivity from individual samples was in the range 98-103%, except for the 180 and 333 day anaerobic samples of the loamy sand 1 soil (70-81% AR). The report stated: "*The most plausible reasons for low recovery could be possible error in dosing or leak in volatile traps.*". See comments by RMS. In the summary below, % AR values represent replicate means.

Soil extractable radioactivity was 96-100% AR during the aerobic phase, decreased on day 120 of anaerobic incubation to 56-60% AR (loamy sand 1 and sandy clay loam) and 84-86% AR (loamy sand 2 and clay loam), and to 39% AR in loamy sand 1 on day 333 of anaerobic incubation. Mineralisation to [^{14}C]-carbon dioxide and formation of organic volatile radioactivity was a minor route of degradation, with at the most 1.2% AR formed during incubation. Soil bound residue in the 4 soils increased to 0.8-4.6% AR on day 120 of anaerobic incubation, and to 11% AR in the sandy loam 1 soil after 333 days of anaerobic incubation.

Flutolanil levels in the total system of the loamy sand 1 soil decreased from 95% AR at the start to 89% AR at the end of aerobic incubation (30DAT), and to 73% AR and 37% AR on day 120 and day 333, respectively, of anaerobic incubation. Flutolanil levels in the total system of the remaining three soil decreased from 98-99% AR at the start to 89-96% AR at the end of aerobic incubation (30DAT), and to 85-91% AR on day 120 of anaerobic incubation.

Metabolites identified in water and soil extracts of loamy sand 1 were M-2, M-4 and M-6, but never exceeded 1.2, 4.3 and 0.9% AR, respectively in the total system. No individual unidentified component exceeded 1.2% AR and 3.0% AR in the soil extracts and water phase, respectively.

Table B.8.1.1.2-1 Recovery of the applied radioactivity in loamy sand 1 soil treated with [aniline-U-^{14}C]-flutolanil (as % AR)

DAT[a]	Replicate #	Percent of Total Applied Radioactive Residues (% TRR)					
		Water Phase	Soil Phase			CO_2 / Volatiles	Mass Balance[e]
			Total Soil Extractable Residues[b]	Non-Extractable Residues[c]	Total[d]		
Soil Under Aerobic Condition							
0.1	1	NA[f]	99.2	0.1	99.3	NA	99.3
0.1	2	NA	99.2	0.1	99.3	NA	99.3
0.1	**Mean[g]**	**NA**	**99.2**	**0.1**	**99.3**	**NA**	**99.3**
15	1	NA	96.1	0.5	96.6	0.4	97.0
15	2	NA	96.2	0.8	97.0	0.4	97.4
15	**Mean**	**NA**	**96.2**	**0.6**	**96.8**	**0.4**	**97.2**
30	1	NA	95.4	1.2	96.5	0.9	97.4
30	2	NA	96.2	1.2	97.4	0.9	98.2
30	**Mean**	**NA**	**95.8**	**1.2**	**97.0**	**0.9**	**97.8**
Soil Under Anaerobic Condition							
14	1	31.2	63.1	0.7	63.8	1.0	96.0
14	2	29.8	64.6	1.2	65.8	1.0	96.6
14	**Mean**	**30.5**	**63.8**	**1.0**	**64.8**	**1.0**	**96.3**
30	1	33.1	58.3	1.0	59.3	1.3	93.7
30	2	33.9	59.2	1.1	60.3	1.3	95.6
30	**Mean**	**33.5**	**58.8**	**1.1**	**59.8**	**1.3**	**94.6**
60	1	33.7	58.0	2.6	60.6	1.0	95.2
60	2	33.3	57.2	1.8	59.0	1.0	93.3
60	**Mean**	**33.5**	**57.6**	**2.2**	**59.8**	**1.0**	**94.2**
90	1	31.5	54.5	3.6	58.0	0.9	90.5
90	2	31.4	54.3	2.8	57.2	0.9	89.5
90	**Mean**	**31.4**	**54.4**	**3.2**	**57.6**	**0.9**	**90.0**
120	1	29.6	54.7	5.6	60.3	0.9	90.8
120	2	27.7	56.5	3.6	60.1	0.9	88.8
120	**Mean**	**28.6**	**55.6**	**4.6**	**60.2**	**0.9**	**89.8**
180	1	23.3	47.6	8.8	56.4	0.8	80.5
180	2	19.0	46.1	9.1	55.2	0.8	75.0
180	**Mean**	**21.1**	**46.9**	**8.9**	**55.8**	**0.8**	**77.8**
333	**1[h]**	**19.6**	**38.7**	**10.8**	**49.5**	**1.1**	**70.2**

[a] DAT: Days After Initiation of aerobic or anaerobic soil conditions
[b] Total extractable residues include Acetonitrile:1N HCl, 1N NaOH:Methanol, and/or Methanol:Water extracts of soil, as applicable. Refer to Appendix B for extraction solvents used.
[c] Non-Extractable Residues: Unextractable from the soil with acetonitrile:HCl mixture
[d] Total: Extractable + Non-Extractable Residues
[e] Mass Balance: Extractable + Non-Extractable + CO_2/Volatile residues
[f] NA: Not Applicable as aerobic soil would not be flooded with water.
[g] Mean: Average of two replicates
[h] Only one soil replicate was analyzed.

Table B.8.1.1.2-2 Recovery of the applied radioactivity in sandy clay loam soil treated with [aniline-U-^{14}C]-flutolanil (as % AR)

DAT[a]	Replicate	Percent of Total Applied Radioactive Residues (% TRR)					
		Water Phase	Soil Phase			CO_2 / Volatiles	Mass Balance[e]
			Total Soil Extractable Residues[b]	Non-Extractable Residues[c]	Total[d]		
Soil Under Aerobic Condition							
0.1	1	NA[f]	99.5	0.0	99.6	NA	99.6
0.1	2	NA	98.0	0.0	98.1	NA	98.1
0.1	**Mean[g]**	**NA**	**98.8**	**0.0**	**98.8**	**NA**	**98.8**
30	1	NA	95.9	3.0	98.9	0.9	99.8
30	2	NA	101.3	0.9	102.2	0.9	103.1
30	**Mean**	**NA**	**98.6**	**2.0**	**100.6**	**0.9**	**101.4**
Soil Under Anaerobic Condition							
30	1	34.5	63.9	0.9	64.8	0.7	100.1
30	2	33.5	64.0	1.4	65.4	0.7	99.6
30	**Mean**	**34.0**	**64.0**	**1.2**	**65.1**	**0.7**	**99.9**
60	1	34.0	63.8	1.3	65.1	0.7	99.8
60	2	34.3	62.5	1.0	63.5	0.7	98.4
60	**Mean**	**34.1**	**63.1**	**1.1**	**64.3**	**0.7**	**99.1**
90	1	33.7	62.0	1.0	63.0	0.3	97.0
90	2	33.8	61.2	1.1	62.3	0.3	96.4
90	**Mean**	**33.7**	**61.6**	**1.1**	**62.6**	**0.3**	**96.7**
120	1	33.6	59.8	2.8	62.6	1.2	97.4
120	2	34.5	60.4	1.5	61.9	1.2	97.6
120	**Mean**	**34.0**	**60.1**	**2.1**	**62.3**	**1.2**	**97.5**

[a] DAT: Days After Initiation of aerobic or anaerobic soil conditions
[b] Total extractable residues include Acetonitrile:1N HCl and 1N NaOH:Methanol extracts of soil.
[c] Non-Extractable Residues: Unextractable from the soil with Acetonitrile: 1N HCl mixture
[d] Total: Extractable + Non-Extractable Residues
[e] Mass Balance: Extractable + Non-Extractable + CO_2/Volatile residues
[f] NA: Not Applicable as aerobic soil would not be flooded with water.
[g] Mean: Average of two replicates

Table B.8.1.1.2-3 Recovery of the applied radioactivity in loamy sand 2 soil treated with [aniline-U-^{14}C]-flutolanil (as % AR)

DAT[a]	Replicate	Percent of Total Applied Radioactive Residues (% TRR)					
		Water Phase	Soil Phase			CO_2 / Volatiles	Mass Balance[e]
			Total Soil Extractable Residues[b]	Non-Extractable Residues[c]	Total[d]		
Soil Under Aerobic Condition							
0.1	1	NA[f]	98.2	0.0	98.3	NA	98.3
0.1	2	NA	99.0	0.1	99.0	NA	99.0
0.1	**Mean[g]**	**NA**	**98.6**	**0.0**	**98.6**	**NA**	**98.6**
30	1	NA	101.1	0.5	101.6	0.3	101.9
30	2	NA	99.5	0.4	100.0	0.3	100.2
30	**Mean**	**NA**	**100.3**	**0.5**	**100.8**	**0.3**	**101.1**
Soil Under Anaerobic Condition							
30	1	15.5	77.2	0.6	77.8	0.3	93.6
30	2	16.5	80.9	0.8	81.7	0.3	98.5
30	**Mean**	**16.0**	**79.1**	**0.7**	**79.7**	**0.3**	**96.1**
60	1	15.0	81.2	0.5	81.8	0.4	97.2
60	2	14.9	79.6	0.6	80.2	0.4	95.5
60	**Mean**	**14.9**	**80.4**	**0.6**	**81.0**	**0.4**	**96.3**
90	1	13.5	84.4	0.7	85.1	0.5	99.1
90	2	13.3	83.3	0.7	84.0	0.5	97.8
90	**Mean**	**13.4**	**83.8**	**0.7**	**84.5**	**0.5**	**98.4**
120	1	13.3	82.2	1.0	83.1	0.6	97.0
120	2	14.4	85.6	0.8	86.4	0.6	101.4
120	**Mean**	**13.9**	**83.9**	**0.9**	**84.8**	**0.6**	**99.2**

[a] DAT: Days After Initiation of aerobic or anaerobic soil conditions
[b] Total extractable residues include Acetonitrile:1N HCl and 1N NaOH:Methanol extracts of soil.
[c] Non-Extractable Residues: Unextractable from the soil with Acetonitrile: 1N HCl mixture
[d] Total: Extractable + Non-Extractable Residues
[e] Mass Balance: Extractable + Non-Extractable + CO_2/Volatile residues
[f] NA: Not Applicable as aerobic soil would not be flooded with water.
[g] Mean: Average of two replicates

Table B.8.1.1.2-4 Recovery of the applied radioactivity in clay loam soil treated with [aniline-U-^{14}C]-flutolanil (as % AR)

DAT[a]	Replicate	Percent of Total Applied Radioactive Residues (% TRR)					
		Water Phase	Soil Phase			CO_2 / Volatiles	Mass Balance[e]
			Total Soil Extractable Residues[b]	Non-Extractable Residues[c]	Total[d]		
Soil Under Aerobic Condition							
0.1	1	NA[f]	98.7	0.3	99.0	NA	99.0
0.1	2	NA	99.4	0.5	99.9	NA	99.9
0.1	**Mean[g]**	**NA**	**99.0**	**0.4**	**99.4**	**NA**	**99.4**
30	1	NA	100.9	0.9	101.9	0.1	102.0
30	2	NA	98.2	0.8	99.0	0.1	99.1
30	**Mean**	**NA**	**99.6**	**0.9**	**100.4**	**0.1**	**100.5**
Soil Under Anaerobic Condition							
30	1	9.0	89.2	0.6	89.8	0.2	99.0
30	2	8.8	89.4	0.6	90.0	0.2	99.0
30	**Mean**	**8.9**	**89.3**	**0.6**	**89.9**	**0.2**	**99.0**
60	1	7.6	81.8	0.7	82.5	0.3	90.4
60	2	7.8	81.6	0.8	82.4	0.3	90.5
60	**Mean**	**7.7**	**81.7**	**0.8**	**82.5**	**0.3**	**90.5**
90	1	7.4	88.7	1.0	89.6	0.3	97.3
90	2	7.7	86.3	0.8	87.1	0.3	95.1
90	**Mean**	**7.5**	**87.5**	**0.9**	**88.4**	**0.3**	**96.2**
120	1	7.3	88.2	0.8	89.0	0.3	96.6
120	2	7.5	83.5	0.8	84.2	0.3	92.1
120	**Mean**	**7.4**	**85.8**	**0.8**	**86.6**	**0.3**	**94.3**

[a] DAT: Days After Initiation of aerobic or anaerobic soil conditions
[b] Total extractable residues include Acetonitrile:1N HCl and 1N NaOH:Methanol extracts of soil.
[c] Non-Extractable Residues: Unextractable from the soil with Acetonitrile: 1N HCl mixture
[d] Total: Extractable + Non-Extractable Residues
[e] Mass Balance: Extractable + Non-Extractable + CO_2/Volatile residues
[f] NA: Not Applicable as aerobic soil would not be flooded with water.
[g] Mean: Average of two replicates

Table B.8.1.1.2-5 Identification of extractable radioactivity in soil of loamy sand 1 soil treated with [aniline-U-^{14}C]-flutolanil (as % AR)

DAT [a]	REP #	Soil Extractable Residues (% of TRR)[b]	HPLC Radioactive Components (% of TRR)[c]						Total[e]
			Flutolanil	M-2	M-4	M-6	Unknown (RT ~34 min)	Others (x)[d]	
Soil Under Aerobic Condition									
0.1	1	99.2	95.3	0.0	0.3	0.1	0.0	0.6 (2)	96.3
0.1	2	99.2	95.4	0.1	0.1	0.1	0.2	3.4 (13)	99.3
0.1	**Mean**	**99.2**	**95.4**	**0.1**	**0.2**	**0.1**	**0.1**	**2.0**	**97.8**
15	1	96.1	91.7	0.4	0.6	0.1	1.0	1.7 (8)	95.5
15	2	96.2	91.8	0.2	0.8	0.1	1.2	2.2 (10)	96.3
15	**Mean**	**96.2**	**91.8**	**0.3**	**0.7**	**0.1**	**1.1**	**2.0**	**95.9**
30	1	95.4	90.1	0.1	0.6	0.2	2.0	2.3 (7)	95.3
30	2	95.6	87.5	0.4	0.8	0.5	1.8	4.7 (15)	95.7
30	**Mean**	**95.5**	**88.8**	**0.3**	**0.7**	**0.4**	**1.9**	**3.5**	**95.5**
Soil Under Anaerobic Condition									
14	1	63.1	61.6	0.1	0.0	0.0	0.3	0.9 (6)	62.9
14	2	64.6	59.5	0.3	0.6	0.2	0.7	3.3 (14)	64.6
14	**Mean**	**63.8**	**60.6**	**0.2**	**0.3**	**0.1**	**0.5**	**2.1**	**63.8**
30	1	56.7	55.6	0.0	0.2	0.1	0.2	0.5 (2)	56.6
30	2	57.9	55.6	0.0	0.2	0.3	0.4	1.2 (4)	57.7
30	**Mean**	**57.3**	**55.6**	**0.0**	**0.2**	**0.2**	**0.3**	**0.9**	**57.2**
60	1	56.5	53.6	0.3	0.3	0.3	0.5	1.3 (5)	56.3
60	2	55.6	50.8	0.1	0.5	0.7	0.6	2.6 (11)	55.3
60	**Mean**	**56.1**	**52.2**	**0.2**	**0.4**	**0.5**	**0.6**	**2.0**	**55.8**
90	1	51.2	49.8	0.0	0.4	0.3	0.3	0.4 (2)	51.2
90	2	51.2	45.7	0.2	0.7	0.7	0.6	3.1 (11)	51.0
90	**Mean**	**51.2**	**47.8**	**0.1**	**0.6**	**0.5**	**0.5**	**1.8**	**51.1**
120	1	52.6	49.7	0.1	0.7	0.4	1.1	0.8 (5)	52.8
120	2	53.9	51.9	0.0	0.8	0.1	0.6	0.5 (3)	53.9
120	**Mean**	**53.3**	**50.8**	**0.1**	**0.8**	**0.3**	**0.9**	**0.7**	**53.4**
180	1	43.9	39.1	0.5	0.5	0.4	0.7	2.5 (6)	43.7
180	2	42.0	38.1	0.2	0.3	0.8	0.4	2.1 (8)	41.9
180	**Mean**	**43.0**	**38.6**	**0.4**	**0.4**	**0.6**	**0.6**	**2.3**	**42.8**
333	**1**	**34.2**	**26.0**	**0.8**	**2.1**	**0.6**	**1.2**	**2.7** (13)	**33.4**

[a] DAT: Days After Initiation of aerobic or anaerobic soil conditions
[b] Acetonitrile:HCl extractable residue; Data from Appendix B
[c] TRR: Total Applied Radioactive Residues. Results of the HPLC analysis of the acetonitrile:HCl extracts of the soil. Data are from HPLC radiochromatogram chromplots included in Appendix C.
[d] Others (x): (x) Represents number of other unknowns.
[e] Total: Includes Flutolanil + Metabolites (M-2, M-4, and M-6) + Unknown at ~34 min + Others

Table B.8.1.1.2-6 Identification of extractable radioactivity in water phase of loamy sand 1 soil treated with [aniline-U-^{14}C]-flutolanil (as % AR)

DAT[a]	REP#	Water Phase (% TRR)[b]	HPLC Radioactive Components (%TRR)[c]						Total[e]
			Flutolanil	M-2	M-4	M-6	Unknown (RT ~34 min)	Others (x)[d]	
Soil Under Anaerobic Condition									
14	1	31.2	29.4	0.0	0.3	0.1	1.1	0.2 (2)	31.1
14	2	29.8	28.5	0	0.1	0.1	0.6	0.2 (2)	29.5
14	**Mean**	**30.5**	**29.0**	**0.0**	**0.2**	**0.1**	**0.9**	**0.2**	**30.3**
30	1	33.1	30.6	0.0	0.4	0.2	1.2	0.3 (2)	32.7
30	2	33.9	30.9	0.0	0.4	0.1	1.9	0.2 (2)	33.5
30	**Mean**	**33.5**	**30.8**	**0.0**	**0.4**	**0.2**	**1.6**	**0.3**	**33.1**
60	1	33.7	30.1	0	0.3	0.2	2.4	0.3 (2)	33.3
60	2	33.3	30.2	0.1	0.4	0.3	1.6	0.3 (2)	32.9
60	**Mean**	**33.5**	**30.2**	**0.1**	**0.4**	**0.3**	**2.0**	**0.3**	**33.1**
90[f]	1	31.5	26.0	0.1	0.6	0.4	1.9	2.3 (7)	31.3
90	2	31.4	26.3	0.2	0.7	0.4	1.9	1.8 (6)	31.3
90	**Mean**	**31.4**	**26.2**	**0.2**	**0.7**	**0.4**	**1.9**	**2.1**	**31.3**
120[f]	1	28.7	23.3	0.1	1.3	0.4	2.8	0.7(4)	28.6
120	2	26.8	21.7	0.1	1.4	0.5	2.4	0.3 (3)	26.4
120	**Mean**	**27.8**	**22.5**	**0.1**	**1.4**	**0.5**	**2.6**	**0.5**	**27.5**
180[f]	1	23.3	16.4	0.4	0.7	1.2	1.3	3.2 (13)	23.2
180	2	19.0	13.9	0.5	0.5	0.3	1.3	2.1 (9)	18.6
180	**Mean**	**21.1**	**15.2**	**0.5**	**0.6**	**0.8**	**1.3**	**2.7**	**20.9**
333	**1**	**19.6**	**11.2**	**0.4**	**2.2**	**0.3**	**3.0**	**2.0** (9)	**19.1**

[a] DAT: Days After Initiation of anaerobic soil conditions
[b] Data from Appendix B
[c] TRR: Total Applied Radioactive Residues. Results of the HPLC analysis of the dichloromethane extract of the water phase. Data are from HPLC radiochromatogram chromplots included in Appendix C.
[d] Others (x): (x) Represents number of other unknowns.
[e] Total: Includes Flutolanil + Metabolites (M-2, M-4, and M-6) + Unknown at ~34 min + Others
[f] The water samples obtained from 90 to 180 DAT were not partitioned with dichloromethane, they were concentrated by freeze drying and reconstituted in a small amount of HPLC mobile phase for HPLC analysis.

Table B.8.1.1.2-7 Identification of extractable radioactivity in total system (soil + water phase) of loamy sand 1 soil treated with [aniline-U-^{14}C]-flutolanil (as % AR)

DAT[a]	Fraction[b]	% of TRR[b]	HPLC Radioactive Components (%TRR)[c]						Total[d]
			Flutolanil	M-2	M-4	M-6	Unknown (RT ~34 min	Others	
Soil Under Anaerobic Condition									
14	Water[e]	30.5	29.0	0.0	0.2	0.1	0.9	0.2	30.4
14	Soil[e]	63.8	60.6	0.2	0.3	0.1	0.5	2.1	63.8
14	**Sum[e]**	**94.3**	**89.6**	**0.2**	**0.5**	**0.2**	**1.4**	**2.3**	**94.2**
30	Water	33.5	30.8	0.0	0.4	0.2	1.6	0.3	33.3
30	Soil	57.3	55.6	0.0	0.2	0.2	0.3	0.9	57.2
30	**Sum**	**90.8**	**86.4**	**0.0**	**0.6**	**0.4**	**1.9**	**1.2**	**90.5**
60	Water	33.5	30.2	0.1	0.4	0.3	2.0	0.3	33.3
60	Soil	57.1	52.2	0.2	0.4	0.5	0.6	2	55.9
60	**Sum**	**90.6**	**82.4**	**0.3**	**0.8**	**0.8**	**2.6**	**2.3**	**89.2**
90	Water	31.4	26.2	0.2	0.7	0.4	1.9	2.1	31.5
90	Soil	51.2	47.8	0.1	0.6	0.5	0.5	1.8	51.3
90	**Sum**	**82.6**	**74.0**	**0.3**	**1.3**	**0.9**	**2.4**	**3.9**	**82.8**
120	Water	27.8	22.5	0.1	1.4	0.5	2.6	0.5	27.6
120	Soil	53.3	50.8	0.1	0.8	0.3	0.9	0.7	53.6
120	**Sum**	**81.1**	**73.3**	**0.2**	**2.2**	**0.8**	**3.5**	**1.2**	**81.2**
180	Water	21.1	15.2	0.5	0.6	0.8	1.3	2.7	21.1
180	Soil	43.0	38.6	0.4	0.4	0.6	0.6	2.3	42.9
180	**Sum**	**64.1**	**53.8**	**0.9**	**1.0**	**1.4**	**1.9**	**5.0**	**64.0**
333	Water	19.6	11.2	0.4	2.2	0.3	3.0	2.0	19.1
333	Soil	34.2	26.0	0.8	2.1	0.6	1.2	2.7	33.4
333	**Sum**	**53.8**	**37.2**	**1.2**	**4.3**	**0.9**	**4.2**	**4.7**	**52.5**

[a] DAT: Days After Initiation of anaerobic soil conditions
[b] Data from Tables 6 and 8
[c] TRR: Total Applied Radioactive Residues. Results of the HPLC analysis of the extracts of the water and soil phase. Data are from HPLC radiochromatogram chromplots included in Appendix C.
[d] Total: Includes Flutolanil + Metabolites (M-2, M-4, and M-6) + Unknown at ~34 min + Others
[e] Mean of two replicates. Refer to Table 6 and Table 8 for individual values.

Table B.8.1.1.2-8 Levels of flutolanil (% AR, replicate mean) in total system (soil + water phase) of sandy clay loam, loamy sand 2 and clay loam soil treated with [aniline-U-^{14}C]-flutolanil

soil condition	DAT	Flutolanil (% AR)		
		sandy clay loam	loamy sand 2	clay loam
aerobic	0.1	98.2	98.5	98.2
	30	88.8	96.3	96.2
anaerobic	60	88.4	91.5	94.1
	90	87.5	90.3	85.4
	120	88.9	92.2	92.6
	150	84.9	91.4	89.4

Table B.8.1.1.2-9 Reported SFO DT_{50} and DT_{90} values for flutolanil under anaerobic conditions

Soil Type	DT_{50} (days)	DT_{90} (days)	R^2
Loamy sand 1	248	822	0.9771
Sandy clay loam	2310	7675	0.485
Loamy sand 2	2310	7675	0.3823
Clay loam	1386	4605	0.303

Note: reported SFO DT50 values were determined with microsoft Excel using linear regression analysis by plotting the natural logarithm of replicate mean flutolanil % AR against DAT.

RMS remarks renewal

- The report stated that the soils were of known history, but the history of pesticide and fertilizer treatment of the test soils was not reported.
- The organic carbon content of the loamy sand 2 soil (0.39%) was slightly below the minimum recommended by OECD 307 (0.5%).
- The sampling dates of the test soils and the duration and conditions of storage of the test soils prior to use in the test were not reported. The soils were not pre-incubated under laboratory conditions. At the start of the test, the biomass of the sandy clay loam and the clay loam soil was <1% of soil organic carbon content (0.5% and 0.1%, respectively). The biomass of the sandy clay loam increased to 1.6% of organic carbon content during the 30-day aerobic incubation, and that of the clay loam increased also to 0.4% of organic carbon content, but remained below 1% of organic carbon content.
- Recovery of radioactivity from individual samples was in the range 98-103%, except for the 180 and 333 day anaerobic samples of the loamy sand 1 soil (70-81% AR). The report stated: "*The most plausible reasons for low recovery could be possible error in dosing or leak in volatile traps.*". A dosing error is considered not very likely since the flasks taken for analysis were sampled at random from all flasks that were treated and incubated. The tendency of decreasing mass balances was apparent throughout incubation and resulted in mass balances well below 90% after 180 and 333 days of anaerobic incubation. A loss of CO_2 or organic volatiles in the loamy sand 1 may not be very likely since these were trapped at very low levels (≤1.3% AR) up to day 120 when mass balances were acceptable; in addition, the formation of very low levels of CO_2 or organic volatiles was also found in the other three soils up to day 120 of anaerobic incubation, with acceptable mass balances. No aberrant pattern was observed for the day 180 and day 333 values for the other parameters (total extractables, non-extractables, levels of flutolanil in water and soil) compared to the values between day 14 and 120 of anaerobic incubation.
- After flooding of the loamy sand 1 soil, dissolved oxygen was in the range 4.01-5.87 mg/L and the redox potential in soil was in the range of 270-425 mV (except in replicate 1 on day 333 , -5 mV). These measurements show that anaerobic conditions have not been reached after flooding. The results for flooded soil loamy sand 1 are therefore not acceptable to derive endpoints for anaerobic degradation. Oxygen levels and soil redox potential after flooding of the other three soils were indicative of anaerobic conditions.
- No recovery data were presented for extraction of the water phase with dichloromethane followed by evaporation of the dichloromethane phase, and for lyophilisation of the water phase.
- The DT50 value of 248 days determined in the loamy sand 1 soil was derived from a visually and statistically acceptable fit (fit not shown in this summary, R^2 0.9771), but this DT50 value is not acceptable since there were no anaerobic conditions in the flooded loamy sand 1 soil. The DT50 values in the remaining three soils (range 1386-2310 days) are statistically not acceptable (R^2 in range 0.30-0.49). The data in Table B.8.1.1.2-9 indicate that degradation under anaerobic conditions, if any, is negligible. RMS performed a simple kinetic evaluation using the FOCUS Degradation Kinetics spreadsheet using only SFO on the data presented in Table B.8.1.1.2-10 and came to the following results (loamy sand 1 excluded).

Table B.8.1.1.2-10 RMS recalculated SFO DT50 values for the two acceptable soils.

Soil Type	DT_{50} (days)	DT_{90} (days)	Chi2
Sandy clay loam	958	3181	2.23
Loamy sand 2	1372	4556	1.49

These SFO DT50 values confirm that degradation under anaerobic conditions is slow.

- Overall evaluation: the results for rate and route of anaerobic degradation in the loamy sand 1 are not acceptable since there were no anaerobic conditions in the flooded loamy sand 1 soil. The results for the clay loam soil are not acceptable since the microbial biomass during the 30-day aerobic incubation was insufficient. The results for the rate of degradation of flutolanil in the remaining two soils indicate slow degradation.

Previous evaluation	Submitted for the purpose of renewal
RMS remark	Acceptable

Report:	**CA 7.1.1.2/02. Roohi, A. (2016)**
Title:	[^{14}C]-Flutolanil: Route and Rate of Degradation in Soil under Anaerobic Conditions at 20°C
Document No:	XG/15/007
Guidelines:	EPA, OCSPP 835.4200, OECD 307
Testing laboratory:	Battelle UK Ltd, Essex, UK
GLP:	Yes

Executive Summary

The route and rate of degradation of flutolanil have been investigated under aerobic / anaerobic conditions in a loamy sand soil (USDA textural class) at 20 ± 2°C in the dark.

[Phenyl-^{14}C]-flutolanil was applied at an application rate of 2.07 mg/kg. The treated samples were initially incubated under aerobic conditions, at pF2 soil moisture, for 30 days. Following the aerobic phase, nitrogen purged de-ionised water was added to the remaining samples to an approximate depth of 3 cm above the soil surface and anaerobic conditions were established and maintained for 119 days by a flow of nitrogen through the flasks.

At intervals of 0, 15 days and 30 days during the aerobic phase, and at 14, 29, 61, 90 and 119 days after flooding, duplicate flasks and their corresponding traps were removed from the incubation system. The water was decanted (where appropriate) and the soil was extracted:

- Extract 1: acetonitrile/water (4/1 *v/v*) containing 0.1% ascorbic acid
- Extract 2: acetonitrile/water (4/1 *v/v*) containing 0.1% ascorbic acid
- Extract 3: acetonitrile/0.1 N hydrochloric acid (4/1 *v/v*) containing 0.1% ascorbic acid
- Extract 4: acetonitrile/1 N hydrochloric acid (4/1 *v/v*) containing 0.1% ascorbic acid

Components present in the water and soil extracts were characterised and quantified by HPLC. The unextracted radioactivity in the soil was quantified by combustion/LSC.

Recovery of radioactivity from individual samples was in the range 100-105%. Soil extractable radioactivity was 99-104% AR during the aerobic phase, and was in the range 85-92% during anaerobic incubation. Radioactivity in the water phase was in the range 6.1-10% AR during the anaerobic phase. Mineralisation to [^{14}C]-carbon dioxide was a minor route of degradation, with at the most 1.2% AR formed during incubation. Organic volatile radioactivity was not detected. Soil bound residue increased to 4.9% AR on day 29 of anaerobic incubation, and then decreased to 1.9% AR after 119 days of anaerobic incubation.

During the initial 30 day aerobic phase, the level of flutolanil declined from 102% to 89% AR. During the subsequent 119 days incubation under anaerobic conditions there was no further observable decline, with flutolanil accounting for 94% AR at the final sampling at 119 days.

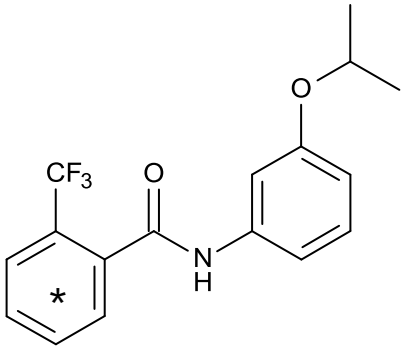
No metabolite was detected at a level of 5% or greater throughout the study. The main identified metabolite was M4 (maximum 3.5% AR at day 90 during the anaerobic phase). Metabolites M7 (max 2.3%, day 90 only) and M11 (max 1.1%, day 90) were also identified by co-elution with reference standards, but subsequent LC/MS analysis of these extracts could not confirm the presence of metabolite M7 or M11. Several other, unidentified metabolites were detected throughout the course of the study but in total these never reached 5% AR and no individual component exceeded 2.5% AR in any individual flask.

In conclusion, no significant degradation of flutolanil was detected in a loamy sand soil incubated under flooded, anaerobic conditions. No metabolite was detected at a level of 5% or greater throughout the study.

MATERIALS AND METHODS

A. MATERIALS

1. Test material: [phenyl-U-^{14}C]-flutolanil



* Denotes position of [^{14}C]-radiolabel

Lot or batch number: Original Quotient batch CFQ42127; repurified PTRL West 2747W

Specific activity: 118 mCi/mmol; 4.37 GBq/mmol; 13.36 MBq/mg

Radiochemical purity: >99%

2. Soil

A loamy sand from Hanhofen, Germany was used in the study. The soils was collected fresh, then stored under refrigeration for less than three months prior to use.

Parameter	**Result**
Soil Reference (Batch Reference No.)	Speyer 2.2 (15/029)
Geographic Location	Großer Striet, Nr. 585, Hanhofen, Rheinland-Pfalz, Germany (Supplied by LUFA Speyer)
Pesticide history	None in sampling year and previous 4 years
Texture Class (USDA)	Loamy sand
pH (soil : water 1 : 1) pH 1:2 in 0.01M $CaCl_2$ pH in 1N KCl	5.9 5.7 5.4
Organic carbon (%)	1.6
Cation exchange capacity (meq/100 g)	7.3
USDA classification Sand (>50 µm) % Silt (2 - 50 µm) % Clay (< 2 µm) %	 82 10 8
Water holding capacity: MWHC 1/3 bar (%) 0.1 bar (%)	 51.38 9.4 12.4
Bulk density (g/cm^3)	1.20
Biomass (µg C/ g soil)[(A)] Start End of aerobic phase	 166.4 (↔ 1.0% of organic carbon content) 180.4 (↔ 1.1% of organic carbon content)

(A) Determined by fumigation/extraction.

B. STUDY DESIGN AND METHODS

1. In-life dates:

29 June 2015 – 27 May 2016

2. Experimental design

Parameter		**Description**
Duration of test		30 days aerobic followed by 119 days anaerobic
Soil condition		Soil was sieved to 2 mm prior to use. The soil was pre-incubated at 20°C to acclimatize for an unspecified period.
Application rate		2.07 mg a.i./kg
Number of replications		Two replicates per sampling time.
Test apparatus		100 g soil (on dry weight basis) was dispensed into straight sided glass conical flasks with ground glass joints. The flasks were connected to a series of vessels to trap any liberated volatile material.
Test material application	Identity of solvent	Acetonitrile
	Volume of application solution	400 µL per flask
	Application method	Dropwise application to the soil surface followed by gentle mixing.

Traps for CO_2 and organic volatiles		One ethylene glycol trap followed by two 2M potassium hydroxide traps
Experimental conditions	Temperature	20 ± 2°C
	Moisture content	Soil moisture content was maintained at its pF2 value during the aerobic phase. The soil was flooded at the end of the aerobic phase (day 30) using nitrogen-purged de-ionized water to a depth of 3 cm above the soil surface and was maintained during the anaerobic phase under an atmosphere of N_2 gas.
	Lighting	Dark

Sampling

Parameter		**Description**
Sampling intervals	Normal dose	Aerobic phase: 0, 15 and 30 DAT Anaerobic phase: 14, 29, 61, 90 and 119 of anaerobic incubation (hence total study duration 149 days)
	Untreated soils for biomass	Day 0 and at end of aerobic incubation
Soil sampling procedures		Complete treated samples were removed at each sampling time and extracted as detailed below.
Collection of CO_2 and volatile organics		Volatile traps were collected at each time point.

Measurements of redox potential in the soil and water, and of oxygen concentration and pH of the water, were made during the anaerobic phase of the study. During this phase of the study all measurements showed a gradual change from aerobic to anaerobic conditions in both the soil and water phases. Redox measurements fell steadily from ca + 160 to -90 mV in the water and from ca + 150 to -150 mV in the soil over the 119 days following flooding of the soil and switching to an atmosphere of nitrogen. The oxygen readings in the water fell from ca 63% saturation at day 1 to ≤ 1% by day 49. The pH measurements of the water increased slowly but steadily from ca pH 6.9 to pH 8.1 over the duration of the study.

Analytical procedures

For the aerobic phase samples, soil samples were extracted as follows:

- Extract 1: acetonitrile/water (4/1 *v/v*) containing 0.1% ascorbic acid
- Extract 2: acetonitrile/water (4/1 *v/v*) containing 0.1% ascorbic acid
- Extract 3: acetonitrile/0.1 N hydrochloric acid (4/1 *v/v*) containing 0.1% ascorbic acid
- Extract 4: acetonitrile/1 N hydrochloric acid (4/1 *v/v*) containing 0.1% ascorbic acid

For the anaerobic phase samples, the water phase was decanted and the remaining soil sample was extracted with the same sequence of solvents as during the aerobic phase described above.
Concentration of the extracts prior to analysis was not required.

The water sample and soil extracts were radioassayed using LSC and analysed by HPLC (co-chromatography with unlabelled compounds) to determine the levels of parent and significant degradates in each sample. Selected extracts were analysed by LC-MS to provide confirmation of structural identity of parent and metabolites.Following extraction, soil samples were air-dried and

homogenised, and the remaining unextracted radioactivity quantified by combustion. Radioactivity in trapping solutions was quantified by LSC.
HPLC column recovery was confirmed in a representative sample from the anaerobic phase (mean recovery 99.9%).

RESULTS AND DISCUSSION

Recovery of radioactivity from individual samples was in the range 100-105%. In the summary below, % AR values represent replicate means. Soil extractable radioactivity was 99-104% AR during the aerobic phase, and was in the range 85-92% during anaerobic incubation. Radioactivity in the water phase was in the range 6.1-10% AR during the anaerobic phase. Mineralisation to [^{14}C]-carbon dioxide was a minor route of degradation, with at the most 1.2% AR formed during incubation. Organic volatile radioactivity was not detected. Soil bound residue increased to 4.9% AR on day 29 of anaerobic incubation, and then decreased to 1.9% AR after 119 days of anaerobic incubation.

During the initial 30 day aerobic phase, the level of flutolanil declined from 102% to 89% AR. During the subsequent 119 days incubation under anaerobic conditions there was no further observable decline, with flutolanil accounting for 94% AR at the final sampling at 119 days.
No metabolite was detected at a level of 5% or greater throughout the study. The main identified metabolite was M4 (maximum 3.5% AR at day 90 during the anaerobic phase). Metabolites M7 (max 2.3%, day 90 only) and M11 (max 1.1%, day 90) were also identified by co-elution with reference standards, but subsequent LC/MS analysis of these extracts could not confirm the presence of metabolite M7 or M11. Several other, unidentified metabolites were detected throughout the course of the study but in total these never reached 5% AR and no individual component exceeded 2.5% AR in any individual flask.

The report presented anaerobic DT50 values of flutolanil determined using SFO and aerobic/anaerobic DT50 values using the hockey stick (HS) kinetic model. All DT50 values were >1000 days, but the rate constant for SFO and for the slow phase decline of HS were not statistically significant (both p=0.5). The conclusion with respect to rate of degradation under anaerobic conditions is that no degradation of flutolanil under anaerobic flooded conditions occurred.

Table B.8.1.1.2-11 Recovery of the applied radioactivity in loamy sand soil treated with [phenyl-U-^{14}C]-flutolanil (as % AR)

		% of Applied Radioactivity							
Incubation Time (days)	Flask No.	Water phase	Ambient Extracts 1-4	Total Water + Extracts	Ethylene Glycol Trap	KOH Traps 1+2	Total Volatiles	NER*	TOTAL
Aerobic Incubation									
0	1	n/a	104.30	104.30	n/a	n/a	n/a	0.52	104.81
0	2	n/a	103.24	103.24	n/a	n/a	n/a	0.54	103.78
Mean		**n/a**	**103.77**	**103.77**	**n/a**	**n/a**	**n/a**	**0.53**	**104.30**
15	3	n/a	98.90	98.90	0.00	0.38	0.38	1.73	101.01
15	4	n/a	98.09	98.09	0.00	0.34	0.34	1.78	100.21
Mean		**n/a**	**98.49**	**98.49**	**0.00**	**0.36**	**0.36**	**1.76**	**100.61**
30	5	n/a	98.87	98.87	0.00	0.92	0.92	3.14	102.92
30	6	n/a	99.24	99.24	0.00	0.99	0.99	3.62	103.84
Mean		**n/a**	**99.05**	**99.05**	**0.00**	**0.95**	**0.95**	**3.38**	**103.38**
Anaerobic Incubation									
14	7	4.59	92.01	96.60	0.00	1.30	1.30	3.51	101.41
14	8	7.51	90.26	97.77	0.00	0.89	0.89	3.49	102.16
Mean		**6.05**	**91.13**	**97.18**	**0.00**	**1.10**	**1.10**	**3.50**	**101.78**
29	9	8.13	88.58	96.71	0.00	1.06	1.06	5.50	103.27
29	10	10.75	87.13	97.88	0.01	0.67	0.68	4.39	102.95
Mean		**9.44**	**87.85**	**97.30**	**0.01**	**0.86**	**0.87**	**4.94**	**103.11**
61	11	9.64	85.26	94.90	0.00	1.09	1.09	3.84	99.84
61	12	10.38	84.84	95.22	0.01	1.24	1.25	3.73	100.20
Mean		**10.01**	**85.05**	**95.06**	**0.00**	**1.17**	**1.17**	**3.79**	**100.02**
90	14	7.91	92.25	100.16	0.00	0.80	0.81	3.21	104.18
90	15	8.31	90.96	99.27	0.00	1.13	1.14	2.71	103.12
Mean		**8.11**	**91.61**	**99.71**	**0.00**	**0.97**	**0.97**	**2.96**	**103.65**
119	18	6.80	91.92	98.72	0.00	1.10	1.10	1.41	101.23
119	19	7.93	91.30	99.24	0.00	1.19	1.20	2.43	102.86
Mean		**7.37**	**91.61**	**98.98**	**0.00**	**1.15**	**1.15**	**1.92**	**102.05**

* NER = Non-extractable residue

Table B.8.1.1.2-12 Identification of radioactivity in loamy sand soil treated with [phenyl-U-^{14}C]-Flutolanil (as % AR)

		% of Applied Radioactivity						
Incubation Time (days)	Flask No.	Total in Extracts	M7# RRT 0.66	M4 RRT 0.68-0.69	M11# RRT 0.73	Total "others" *	Flutolanil RRT 1.00	Sum of components
Aerobic Incubation								
0	1	102.80	-	-	-	0.00	102.80	102.80
0	2	101.70	-	-	-	0.00	101.70	101.70
Mean		**102.25**	-	-	-	**0.00**	**102.25**	**102.25**
15	3	96.44	-	1.32	0.00	0.00	95.12	96.44
15	4	95.49	-	1.25	0.26	0.00	93.99	95.49
Mean		**95.96**	-	**1.28**	**0.13**	**0.00**	**94.56**	**95.96**
30	5	89.73	-	1.31	-	0.13	88.29	89.73
30	6	90.00	-	1.26	-	0.00	88.73	90.00
Mean		**89.87**	-	**1.29**	-	**0.07**	**88.51**	**89.87**
Anaerobic Incubation								
14	7	93.92	-	1.74	0.01	0.38	91.78	93.92
14	8	95.20	-	1.51	0.35	0.73	92.62	95.21
Mean		**94.56**	-	**1.62**	**0.18**	**0.56**	**92.20**	**94.56**
29	9	95.22	-	1.59	0.32	0.78	92.53	95.21
29	10	96.46	-	1.36	0.00	0.61	94.50	96.47
Mean		**95.84**	-	**1.47**	**0.16**	**0.69**	**93.51**	**95.84**
61	11	90.22	-	1.41	0.33	1.04	87.44	90.22
61	12	90.51	-	1.52	0.26	1.70	87.02	90.51
Mean		**90.36**	-	**1.47**	**0.30**	**1.37**	**87.23**	**90.36**
90	14	100.16	3.31	4.98	0.15	4.77	86.95	100.15
90	15	99.27	1.27	2.10	2.04	4.39	89.44	99.25
Mean		**99.71**	**2.29**	**3.54**	**1.10**	**4.58**	**88.20**	**99.70**
119	18	98.72	-	1.87	0.22	2.75	93.88	98.72
119	19	99.24	-	2.36	0.23	2.98	93.67	99.24
Mean		**98.98**	-	**2.12**	**0.23**	**2.86**	**93.77**	**98.98**

* no individual component >2.5% in individual flask or >2% AR mean of duplicate flasks (for full tabulation of results see Appendix 10).
- not detected
Identified by HPLC co-chromatography vs reference standards only

CONCLUSIONS

No significant degradation of flutolanil was detected in a loamy sand soil incubated under flooded, anaerobic conditions. No metabolite was detected at a level of 5% or greater throughout the study.

RMS remarks renewal:

Study acceptable. No statistically sound DT50 endpoint could be derived but since no degradation was observed a DT50 value of >1000 days can be assumed.

B.8.1.1.3 Soil photolysis

Previous evaluation	Submitted for the purpose of renewal
RMS remark	Acceptable

Report:	**CA 7.1.1.3/01. Cooper, J and Moore, H (2016)**
Title:	[^{14}C]-Flutolanil: Soil Photolysis
Document No:	XG/15/008 (E-3057)
Guidelines:	OECD draft guideline: Phototransformation of chemicals on soil, US-EPA OPTS 835.2410
Testing laboratory:	Battelle UK Ltd, Essex, UK
GLP:	Yes

Executive Summary

The photolysis of [phenyl-U-^{14}C]-flutolanil on a sandy loam soil was investigated under aerobic conditions at 20 ± 1°C, with the soil moisture maintained at 75% of the pF2 value, and with continuous irradiation by artificial sunlight for 25 days (equivalent to 30.0 days natural summer sunlight at 30-50°N). The artificial sunlight was provided by a xenon arc lamp with filters to cut off any radiation below 290 nm.

The nominal treatment rate was 129.4 µg / 2g equivalent to 2100 g ha^{-1}. The soil in each photolysis vessel was treated with a 57 µL aliquot of [phenyl-U ^{14}C]-flutolanil solution in acetonitrile / water (1:1 *v/v*).

The test vessels were connected to traps for the collection of carbon dioxide and organic volatiles. Duplicate samples for both the irradiated and dark control regimes were taken at 0, 3, 7, 14, 20 and 25 days. The control samples were incubated under the same conditions but kept in the dark. The soil samples were subjected to two cycles of solvent extraction with acetonitrile: water + 0.1% ascorbic acid (4:1 + 0.1% *v/v*), followed by two extractions with acetonitrile: 0.1M hydrochloric acid (4:1 *v/v*). The components present were quantified by high performance liquid chromatography (HPLC).

Recovery of radioactivity from individual samples was in the range 102-112%. Soil extractable radioactivity from irradiated and dark samples was 110% at the start and ranged between 102-106% AR during the remainder of the study. Radioactivity in volatile traps was insignificant (0.09% AR and 0.20% AR at test end in irradiated and dark samples, respectively), and was predominantly found in the potassium hydroxide traps. Soil bound residue increased to 1.5% AR and 1.6% AR at test end in irradiated and dark samples, respectively.

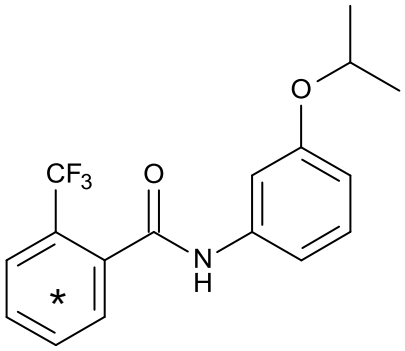
The level of flutolanil was 109% AR at the start and during the remainder of the study it was in the range 101-104% and 103-105% in irradiated and dark samples, respectively. No measurable degradation of flutolanil occurred under the conditions of the study in dark and irradiated samples.In irradiated samples the metabolites benzamide and M11 were found, never exceeding 1.9 and 0.14% AR, respectively. In dark samples, metabolites M4 and M11 were found, never exceeding 0.43 and 0.25% AR, respectively. Individual unknowns never exceeded 0.74% AR and 0.33% AR in irradiated

and dark samples, respectively. The identity of flutolanil was confirmed in selected extracts of irradiated and dark samples by LC-MS.

MATERIALS AND METHODS

A. MATERIALS

1. Test material: [phenyl-U-^{14}C]-flutolanil



* Denotes position of [^{14}C]-radiolabel

Lot or batch number: Original - CFQ42127 (Quotient BioResearch)
Re-purified - 2556W-001 (PTRL West)

Specific activity: 13.35 MBq/mg (360.8 µCi/mg, 4.37 GBq/mmol)

Radiochemical purity: ≥ 99.4%

2. Soil The sandy loam soil was collected from Mechtersheim, Rheinland-Pfalz, Germany. The soil was sampled from the top 20 cm of the soil profile and sieved to 2mm before use. There had been no pesticides and organic fertilizers applied in the sampling year and four previous years.

Parameter	**Results**
Name	Lufa Speyer 5M (15-058)
Geographic Location	"In der Speyerer Hohl", Nr. 977, Mechtersheim, Rheinland-Pfalz, Germany
Texture Class (USDA)	Sandy loam
pH (water) 1:1 soil: water pH (1 N KCl) pH (0.01M $CaCl_2$) 1:2 soil: $CaCl_2$	7.5 7.1 7.2
Organic carbon (%)	1.2
Cation exchange capacity (meq/100 g)	8.4
USDA classification Sand (>50 µm) % Silt (2 - 50 µm) % Clay (< 2 µm) %	 58 30 12
Maximum water holding capacity (%)	48.62
Moisture at pF2.0 (0.1bar, w/w %)	19.3
Moisture at pF2.5 (0.33 bar, w/w %)	13.6
Bulk density (g/cm^3)	1.11
Biomass (µg C/ g soil) at start[(A)]	180 (↔ 1.5% of organic carbon content)

(A) Determined by fumigation/extraction.

STUDY DESIGN AND METHODS

1. In-life dates:

13 October 2015 – 16 January 2016

2. Experimental design

Parameter		Description
Nature of light source		Xenon lamp from a Heraeus Sun Test (CPS+) equipped with filters to cut off any radiation below 290 nm. The intensity of irradiation was measured over the wavelength range from 300 nm to 400 nm, before and after the study, at the level of the soil surface and the average value was found to be 30.83 W/m^2. Based on the mean irradiance at 30-50°N of 67 W/m^2, the study duration of 593 hours (24.7 days) corresponds with 30.3 days of natural summer sunlight at 30-50°N (calculation according to draft OECD guideline for photodegradation of chemicals on soil surfaces (2002)).
Duration of the test		24.7 Days (593 actual hours) (equivalent to 30.3 days summer sunlight at 30-50°N)
Soil condition		Viable soil, passed through 2 mm sieve prior to use
Incubation		The soil (ca 2.0 g of oven dried equivalent) was adjusted to moisture content 75% of the pF2 value, placed into photolysis dishes of diameter 2.8 cm and treated using a pipette with 57 µL of application solution of 14C-flutolanil isotopically diluted with non-radiolabelled flutolanil (lot number 1AE0012P, 99.6% pure) in acetonitrile / water (1:1 *v/v*). The acetonitrile from the treatment was allowed to evaporate prior to the start of incubation. The photolysis dishes were then capped using quartz lids and positioned inside the photolysis unit. The units were connected to a flow-through air system to maintain aerobic conditions and to trap any released volatile components and exposed to continuous irradiation at 20 ± 1°C. Dark controls were treated and exposed in the same system, but kept in the dark. Moisture levels were checked daily and adjusted to initial levels, if necessary.
Test concentration	Nominal	129.4 µg/2g soil sample
	Measured	137.4 µg/2g soil sample
Number of replicates	Irradiated	2 per sampling time
	Darkness	2 per sampling time
Traps for CO_2 & organic volatiles		One ethylene glycol and two 2M KOH traps

Sampling

Parameter		Description
Sampling intervals	Irradiated	Duplicate samples: 3, 7, 14, 20 and 25 DAT
	Darkness	Duplicate samples: 0, 3, 7, 14, 20 and 25 DAT
Soil sampling procedures		Entire sample from one vessel
Collection of CO_2 and volatile organics		Complete trap system removed and aliquoted at time of sampling

Analytical procedures

Soils were extracted twice by shaking at room temperature for 30 minutes with acetonitrile/water (4:1 v/v) containing 0.1% ascorbic acid followed by two extractions with acetonitrile / 0.1M hydrochloric acid (4:1 v/v) containing 0.1% ascorbic acid. The radioactivity in each extract was determined by LSC. Extracts one and two were analysed directly by reverse phase HPLC. Metabolites in the extracts were identified by co-chromatography against reference standards. Extracts 3 and 4 did not contain sufficient radioactivity to be analysed.

Following extraction, soil samples were air-dried and homogenised, and the remaining unextracted radioactivity quantified by combustion. Trap solutions were collected at each time point. The volume of each trapping solution was measured and the radioactivity present was determined by LSC.
HPLC column recovery was confirmed in a time 0, extract 1, sample (recovery 112.9%).

DT_{50} and DT_{90} values for the degradation of flutolanil in the soil extracts was determined from the results of HPLC analyses according to the FOCUS guidance document on degradation kinetics using CAKE 2.0 software and based on individual replicate data. Time zero residues were set as recovered radioactivity * purity (99.4%). Best-fit kinetics (SFO and FOMC) were determined.

RESULTS AND DISCUSSION

Recovery of radioactivity from individual samples was in the range 102-112%. In the summary below, % AR values represent replicate means. Soil extractable radioactivity from irradiated and dark samples was 110% at the start and ranged between 102-106% AR during the remainder of the study. Radioactivity in volatile traps was insignificant (0.09% AR and 0.20% AR at test end in irradiated and dark samples, respectively), and was predominantly found in the potassium hydroxide traps. Soil bound residue increased to 1.5% AR and 1.6% AR at test end in irradiated and dark samples, respectively.

The level of flutolanil was 109% AR at the start and during the remainder of the study it was in the range 101-104% and 103-105% in irradiated and dark samples, respectively. In irradiated samples the metabolites benzamide and M11 were found, never exceeding 1.9 and 0.14% AR, respectively. In dark samples, metabolites M4 and M11 were found, never exceeding 0.43 and 0.25% AR, respectively. Individual unknowns never exceeded 0.74% AR and 0.33% AR in irradiated and dark samples, respectively. The identity of flutolanil was confirmed in selected extracts of irradiated and dark samples by LC-MS.

The report presented DT50 values of flutolanil determined using SFO and FOMC, and stated that in both cases (irradiated and dark) the FOMC model showed no improvement over SFO and so the SFO values were selected for reporting (>100000 hours in both cases). However, the rate constants for SFO were not statistically significant (both p=0.5). For the FOMC fit of irradiated samples no error values and confidence intervals for parameters α (parameter estimate 0.003) and β (parameter estimate 0.00E+0.000) could be determined because the covariance matrix could not be created. For the FOMC fit of dark samples 90% confidence intervals for parameters α and β included zero. Hence

all parameters are statistically not acceptable. At all samplings however, except t=0, flutolanil levels were in the range 101-104% and 103-105% in irradiated and dark samples, respectively, without any time related trend. The slightly higher value on day 0 (109% AR) is likely to be associated with the slightly higher mass balance at day 0 (109%) compared to the other samples (102-108%). This variation may be due to the error associated with the use of a small application volume (57 µL). The conclusion with respect to rate of degradation under irradiated and dark conditions is that no measurable degradation of flutolanil occurred under the conditions of the study in dark and irradiated samples.

Table B.8.1.1.3-1 Distribution of radioactivity in irradiated soil treated with [phenyl-U-^{14}C]-flutolanil

				Radioactivity as % of Applied			
Sample No.	Incubation Time [days]	Time [actual hours]	Time[2] [Equivalent days]	Soil Extracts	Volatile Traps	Unextracted	Total Material Balance
1[3]	0	0	0	110.11	0.00	0.04	110.16
2[3]	0	0	0	110.06	0.00	0.04	110.10
Mean				**110.09**	**0.00**	**0.04**	**110.13**
3	3	71	3.6	102.03	0.01	0.28	102.33
4	3	71	3.6	102.17	0.01	0.33	102.51
Mean				**102.10**	**0.01**	**0.31**	**102.42**
5	7	165	8.3	102.53	0.03	0.50	103.07
6	7	165	8.3	102.69	0.02	0.49	103.20
Mean				**102.61**	**0.02**	**0.50**	**103.13**
7	14	328	16.4	103.06	0.04	0.87	103.97
8	14	328	16.4	109.21	0.05	0.92	110.18
Mean				**106.13**	**0.04**	**0.90**	**107.07**
9	20	471	23.6	104.52	0.04	1.04	105.60
10	20	471	23.6	104.41	0.06	1.09	105.56
Mean				**104.46**	**0.05**	**1.06**	**105.58**
11	25	593	29.7	106.05	0.11	1.65	107.81
12	25	593	29.7	106.25	0.07	1.33	107.65
Mean				**106.15**	**0.09**	**1.49**	**107.73**

Table B.8.1.1.3-2 Distribution of radioactivity in dark controls of soil treated with [phenyl-U-^{14}C]- flutolanil

			Radioactivity as % of Applied			
Sample No.	Incubation Time [days]	Time [hours]	Soil Extracts	Volatile Traps	Unextracted	Total Material Balance
1[4]	0	0	110.11	0.00	0.04	110.16
2[4]	0	0	110.06	0.00	0.04	110.10
Mean			**110.09**	**0.00**	**0.04**	**110.13**
16	3	71	104.64	0.01	0.33	104.99
20	3	71	107.75	0.01	0.31	108.08
Mean			**106.20**	**0.01**	**0.32**	**106.53**
15	7	165	104.44	0.03	0.48	104.96
19	7	165	104.92	0.06	0.52	105.49
Mean			**104.68**	**0.04**	**0.50**	**105.23**
14	14	328	106.54	0.06	0.91	107.51
21	14	328	102.83	0.16	0.93	103.92
Mean			**104.69**	**0.11**	**0.92**	**105.72**
13	20	471	101.32	0.15	1.23	102.70
22	20	471	110.26	0.12	1.29	111.67
Mean			**105.79**	**0.13**	**1.26**	**107.18**
17	25	593	108.12	0.27	1.86	110.25
18	25	593	103.90	0.13	1.40	105.42
Mean			**106.01**	**0.20**	**1.63**	**107.83**

Table B.8.1.1.3-3 Degradation and formation of metabolites in irradiated soil treated with [phenyl-U-^{14}C]- flutolanil (sum of extracts 1 & 2)

				% of Applied Radioactivity				
Sample No.	Time [actual hours]	Time[7] [Equivalent days]	% of Applied Radioactivity	Benzamide RRT: 0.51-0.54	Metabolite M11 RRT: 0.73	Flutolanil	Unknowns*	TOTAL
1	0	0	109.46	0.00	0.00	109.46	0.00	109.46
2			109.36	0.00	0.00	109.36	0.00	109.36
Mean			**109.41**	**0.00**	**0.00**	**109.41**	**0.00**	**109.41**
3	71	3.55	100.38	0.00	0.00	100.38	0.00	100.38
4			101.25	0.00	0.00	101.25	0.00	101.25
Mean			**100.82**	**0.00**	**0.00**	**100.82**	**0.00**	**100.82**
5	165	8.25	101.55	0.31	0.00	101.24	0.00	101.55
6			101.64	0.00	0.00	101.64	0.00	101.64
Mean			**101.59**	**0.16**	**0.00**	**101.44**	**0.00**	**101.59**
7	328	16.40	101.94	0.52	0.00	101.42	0.00	101.94
8			108.20	0.44	0.28	107.48	0.00	108.20
Mean			**105.07**	**0.48**	**0.14**	**104.45**	**0.00**	**105.07**
9	471	23.55	103.33	0.80	0.00	102.46	0.08	103.33
10			103.19	0.85	0.00	101.43	0.91	103.19
Mean			**103.26**	**0.82**	**0.00**	**101.94**	**0.49**	**103.26**
11	593	29.65	104.65	2.03	0.00	101.87	0.74	104.64
12			105.00	1.75	0.00	102.77	0.48	105.00
Mean			**104.82**	**1.89**	**0.00**	**102.32**	**0.61**	**104.82**

* No individual > 0.74% AR

– Not detected

Table B.8.1.1.3-4 Degradation and formation of metabolites in dark controls of soil treated with [phenyl-U-^{14}C]- flutolanil (sum of extracts 1 & 2)

				% of Applied Radioactivity				
Sample No.	Time [actual hours]	Time[a] [Equivalent days]	% of Applied Radioactivity	Metabolite M4 RRT: 0.68	Metabolite M11 RRT: 0.73	Flutolanil	Unknowns*	TOTAL
1	0	0	109.46	0.00	0.00	109.46	0.00	109.46
2			109.36	0.00	0.00	109.36	0.00	109.36
Mean			**109.41**	**0.00**	**0.00**	**109.41**	**0.00**	**109.41**
16	71	3.55	103.73	0.00	0.00	103.73	0.00	103.73
20			106.93	0.00	0.00	106.93	0.00	106.93
Mean			**105.33**	**0.00**	**0.00**	**105.33**	**0.00**	**105.33**
15	165	8.25	103.48	0.00	0.00	103.48	0.00	103.48
19			103.94	0.00	0.00	103.94	0.00	103.94
Mean			**103.71**	**0.00**	**0.00**	**103.71**	**0.00**	**103.71**
14	328	16.40	105.49	0.33	0.50	104.42	0.24	105.49
21			101.80	0.00	0.00	101.54	0.26	101.80
Mean			**103.65**	**0.17**	**0.25**	**102.98**	**0.25**	**103.65**
13	471	23.55	100.21	0.00	0.00	100.21	0.00	100.21
22			109.16	0.00	0.00	109.16	0.00	109.16
Mean			**104.68**	**0.00**	**0.00**	**104.68**	**0.00**	**104.68**
17	593	29.65	106.94	0.41	0.00	106.53	0.00	106.94
18			102.72	0.45	0.51	101.35	0.41	102.72
Mean			**104.83**	**0.43**	**0.25**	**103.94**	**0.21**	**104.83**

* no individual > 0.33%AR

– Not detected

CONCLUSIONS

No measurable degradation of flutolanil occurred under the conditions of the study in dark and irradiated samples. No metabolites found in irradiated samples exceeding 2% AR.

RMS remarks renewal

Acceptable. No remarks.

Previous evaluation	Submitted for first approval, DAR 2005
RMS remark	Acceptable

Report:	**CA 7.1.1.3/02. Carpenter, M., (1991 amended 1994)**
Title:	Determination of the Photolysis Rate of Flutolanil on the Surface of Soil
Document No:	#38480 (E3022)
Guidelines:	EPA Pesticides Assessment Guidelines Subdivision N, Section 161-3 N,161-3
Testing laboratory:	Analytical Bio-Chemistry Laboratories, Missouri
GLP:	Yes

Executive Summary

The photolysis of [aniline-U-^{14}C]-flutolanil on a sandy loam soil was investigated under aerobic conditions at 25.6 ± 2°C, with the soil moisture maintained at 75% of the field capacity, and with irradiation by artificial sunlight for 30 days. The artificial sunlight was provided by a xenon arc lamp with filters to cut off any radiation below 290 nm.

The nominal treatment rate was 87.8 µg/g. Duplicate samples for both the irradiated and dark control regimes were taken at 1, 3, 7, 15, 21 and 30 days. The control samples were incubated under the same conditions but kept in the dark. The soil samples were subjected to three cycles of solvent extraction with methanol / water (4:1 *v/v*) combined and quantified by TLC.

The overall mean recovery of applied radioactivity was 93.8% (range 82.4% to 100.0%) in the irradiated samples and 98.4% (range 93.3% to 101%) in the dark control samples.

The extractability in both the irradiated and dark control remained constant from time zero until the end of the study. Extractability of 96.0% at time zero declined to 90.4% and 95.6% in the irradiated and dark control samples respectively.

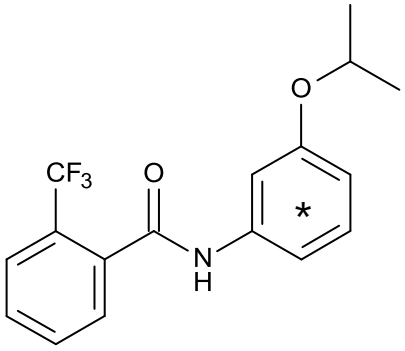
Flutolanil was not found to degrade over the duration of the study. Flutolanil did not form any major degradation products during the course of this study.

Exposure to sunlight did not influence the route of degradation of flutolanil under aerobic conditions at approximately 25°C in soil.

I. MATERIALS AND METHODS

A. MATERIALS

1. Test material: [aniline-U-^{14}C]-flutolanil



* Denotes position of [^{14}C]-radiolabel

Chemical name (IUPAC)	α,α,α-trifluoro-3'-isopropoxy-*o*-toluanilide
CA registry number:	66332-96-5
Lot or batch number:	#CP-993
Specific activity:	62.7 µCi/mg
Radiochemical purity:	> 97.0%
Stability of test compound:	Shown to be stable under the conditions of the test
Application vehicle:	DMF

2. Soil A sandy loam soil was air dried and sieved to 2mm before use.

Parameter	Results
Name	# 88 sandy loam
Texture Class	Sandy loam
pH	6.8
Organic matter (%)	1.6
Cation exchange capacity (meq/100 g)	11.6
% Sand % Silt % Clay	56 26 18
Field capacity (%)	17.37
Bulk density (g/cm^3)	1.51

B. STUDY DESIGN AND METHODS

1. In-life dates:

28 February 1990 – 30 March 1990

2. Experimental design

Parameter		Description
Nature of light source		Xenon lamp
Emission wavelength spectrum		Emission wavelength spectrum (300-800nm)
Filters used		UV filter
Relationship to natural sunlight		Similar spectral distribution
Duration of the test		30 Days
Soil condition		Viable soil air dried, passed through 2 mm sieve prior to use
Soil sample weight		*ca* 1.0 g of oven dried equivalent soil
Test concentration	Nominal	87.8 µg/g (22.4 mg/cm^2)
Control conditions		Darkness
Number of replicates	Irradiated	2
	Darkness	2
Test apparatus		Borosilicate glass photolysis vessels.
Traps for CO_2 & organic volatiles		n/a
Test material application	Acetonitrile	DMF
	Volume of test solution used/treatment	78 µL
	Evaporation of application solvent	No
Indication of test material adsorbing to walls of test apparatus		No
Experimental conditions	Temperature (°C)	25 ± 2°C (irradiated & dark control)
	Continuous irradiation	12 hour light and 12 hour dark cycle
	Moisture content	*ca* 75% of field moisture capacity

Sampling

Parameter		Description
Sampling intervals	Irradiated	Duplicate samples: 1, 3, 7, 15, 21 and 30 DAT

	Darkness	Duplicate samples: 1, 3, 7, 15, 21 and 30 DAT
Soil sampling procedures		Entire sample from one vessel
Collection of CO_2 and volatile organics		n/a

Analytical procedures

Soils were extracted with methanol/water (4:1; v/v). The radioactivity in the combined extracts was determined by LSC and an aliquots analysed directly by TLC.

Following extraction, soil samples were air-dried and homogenised, and the remaining unextracted radioactivity quantified by combustion.

II. RESULTS AND DISCUSSION

The recoveries, extractable and non-extractable residue at the beginning and end of the study are summarised below.

Mass Balance

Total radioactivity	Sum of activity in soil extracts, soil residue on combustion.
Recovery at 0 DAT	100% AR
Overall recovery (all samples)	Irradiated soil: Range 82.4 to 100.0%, mean 93.8% AR Dark control: Range 93.3 to 101.0%, mean 98.4% AR

Bound and Extractable Residues

Extractable residues	Extractable residues generally remained fairly stable with time.	
	Total extractable residues at 0 DAT	96.0%
	Total extractable residues at end of study (30 DAT)	Irradiated soil: 90.4% Dark control: 95.6%
Bound residues	Bound residues generally remained fairly stable with time.	
	Bound residues at end of study (30 DAT)	Irradiated soil: 9.6% Dark control: 4.4%

Transformation of Parent Material

In the irradiated and dark control experiment there was no significant breakdown of flutolanil. No major degradates were formed.

Table B.8.1.1.3-5 Distribution and composition of radioactivity in irradiated soil treated with [aniline-U-^{14}C]-flutolanil (as % recovered in relation to time zero)

Sample	Incubation time (days)						
	0	**1**	**3**	**7**	**15**	**21**	**30**
Total extracted	96.0	94.0	94.9	94.4	92.1	91.2	90.4
Non-extracted	4.0	6.0	5.1	5.6	7.9	8.8	9.6
TOTAL	100	82.4	91.8	96.1	98.2	94.3	93.5
Mean	93.8 ± 5.5%						
Flutolanil	90.0	82.7	91.3	93.9	94.6	91.6	91.6

Table B.8.1.1.3-6 Distribution and composition of radioactivity in dark controls of soil treated with [aniline-U-^{14}C]- flutolanil (as % recovered radioactivity)

Sample	Incubation time (days)						
	0	**1**	**3**	**7**	**15**	**21**	**30**
Total extracted	96.0	91.6	95.8	95.8	94.5	94.5	95.6
Non-extracted	4.0	8.4	4.2	4.2	5.5	5.5	4.4
TOTAL	100.0	97.6	93.3	98.1	101.0	100.7	97.9
Mean	98.4 ± 2.8%						
Flutolanil	90.0	90.5	93.6	93.3	97.3	95.6	94.1

III. CONCLUSIONS

Flutolanil on a soil surface shows no detectable breakdown.

Exposure to sunlight did not influence the route of degradation of flutolanil under aerobic conditions at approximately 20 ± 1°C in soil.

RMS remarks renewal

- It cannot be concluded that sunlight did not change the route of degradation; no breakdown was observed.
- Water content of the soil was rather low. Correction for this is however not useful as no transformation was observed.
- Initial concentration is rather high.

B.8.1.1.4 Aerobic degradation, field studies

Please refer to section B.8.1.2.2

B.8.1.2 Rate of degradation in soil

B.8.1.2.1 Laboratory studies

B.8.1.2.1.1 Aerobic degradation

Previous evaluation	Submitted for first approval, DAR 2005
RMS remark	Acceptable

Report:	**CA 7.1.2.1.1/01.Völkl, S. (2001)**
Title:	Degradation of [^{14}C]-Flutolanil in one soil incubated under aerobic conditions at 10°C
Document No:	C017049 (E-3031)
Guidelines:	OECD 307, EPA Section 162-1 October 1982
Testing laboratory:	RCC Umweltchemie AG, Itingen, Switzerland
GLP:	Yes

Executive Summary

The rate of degradation of [aniline-U-^{14}C]-flutolanil was studied in a sandy loam soil for 365 days under aerobic conditions. Soil samples were maintained in the dark at 10°C and a soil moisture content of 40% maximum water holding capacity. The test soils were treated with radiolabelled flutolanil at a rate of 11.47 mg/kg dry soil (equivalent to 11.47 kg /ha).

Samples were taken for extraction and analysis immediately after treatment (Day 0) and after 14, 28, 58, 101, 140, 197, 280 and 365 days of incubation. Soil samples were extracted at room temperature with acetonitrile, followed by soxhlet extraction with acetonitrile from day 101. Soil extracts were analysed by reverse phase HPLC.

The mean recovery of radioactivity during the 365-day incubation period was 99.1% AR. The amount of total extractable radioactivity decreased from 97.8% AR immediately after treatment, to 48.1% by 365 days. The amount of non-extractable radioactivity was significant, reaching maximum values of 37.7 % AR.

Mineralization of flutolanil increased slowly with time, with $^{14}CO_2$ reaching a maximum level of 11.2% AR. Other volatile products were not observed.

[^{14}C]-flutolanil slowly decreased from 97.8% AR at Day 0 to 46.0% AR by day 365. The DT_{50} and DT_{90} of flutolanil, at 10°C estimated by single first-order kinetics is shown below.

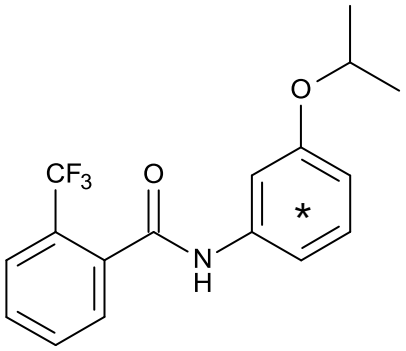
Soil	**Soil pH**	**Kinetic model**	**DT_{50} (days)**	**DT_{90} (days)**
Speyer 2.2	5.7	SFO	301	>1000

Five minor metabolites were detected which never exceeded 3.5% AR throughout the incubation period.

I. MATERIALS AND METHODS

A. MATERIALS

1. Test material: [aniline-U-^{14}C]-flutolanil



* Denotes position of [^{14}C]-radiolabel

Chemical name (IUPAC) α, α, α-trifluoro-3'-isopropoxy-*o*-toluene

CA registry number: 66332-96-5

Lot or batch number: GAR 1966/2

Specific activity: 1.257 MBq/mg

Radiochemical purity: 100.0%

Stability of test compound: Shown to be stable under the conditions of the test

Application vehicle: Acetone

2. Soil The Speyer 2.2 soil was supplied by LUFA, Speyer and collected from the top 20 cm. No pesticide or fertilizer applied in 4 years prior to test.

Parameter	**Speyer 2.2**
Geographic Location	LUFA, Speyer, Hanhofen, Rheinland-Pfalz Germany
Texture Class (USDA) [A]	Loamy sand
pH	5.7
Organic carbon (g/100 g soil, %)	2.17
Cation exchange capacity (meq/100 g)	11.0
Maximum water holding capacity (%)	50
40% MWHC (%)	20
USDA classification Sand (>50 µm) % Silt (2 - 50 µm) % Clay (< 2 µm) %	 77.1 15.4 7.5
International classification (ADAS) Sand (>20 µm) % Silt (2 - 20 µm) % Clay (< 2 µm) %	 75.9 16.8 7.5
Biomass (mg C/100 g soil) Start During the study Completion of incubation	 57.3 35.9 37.7

[A] USDA soil textures were assigned for the soil based on reported particle size distribution

B. STUDY DESIGN AND METHODS

1. In-life dates:

10 October 2000 – 31 October 2001

2. Experimental design

Parameter		Description
Duration of test		365 Days
Soil condition		Soil sieved to 2 mm and soil moisture adjusted to 40% MWHC.
Target application rate		11.47 kg a.i./ha
Nominal concentration in test system		11.47 mg/kg dry soil (1.147 mg a.i. per flask)
Number of replications		Two replicates.
Test apparatus		100 g dry weight equivalent of soil placed within 1 L glass metabolism flasks.
Test material application	Identity of solvent	Acetone
	Volume of application solution	540 µL per 100 g soil dry weight
	Application method	Dropwise to soil surface by Hamilton syringe and soil then mixed thoroughly.
Traps for CO_2 and organic volatiles		An ethylene glycol trap followed by 2N NaOH trap.
Is there any indication of the test material absorbing to the walls of the test apparatus?		No
Experimental conditions	Temperature	10 ± 2°C
	Moisture content	40% Maximum water holding capacity
	Lighting	Dark

Sampling

Parameter		Description
Sampling intervals	Aerobic, non-sterile	0, 14, 28, 58, 101, 140, 197, 280 and 365 DAT
	Untreated soils for biomass	Day 0, at about 200 days and at end of incubation
Soil sampling procedures		Complete treated samples were removed at each sampling time and extracted as detailed below.
Collection of CO_2 and volatile organics		0, 14, 28, 58, 101, 140, 197, 280 and 365 DAT and at about every 4 weeks during the incubation period.

Analytical procedures

The soil from each flask was extracted as follows:

1. Four times with acetonitrile. The extraction was performed on a shaker at approximately 200 - 250 strokes/minute for *ca.* 30 minutes.
2. Additionally soil samples were extracted by soxhlet with acetonitrile overnight from 58 DAT onwards.

The pooled extracts from day zero to day 28 were analysed directly all proceeding extracts were combined and concentrated. All extracts were analysed by reverse phase HPLC by co-

chromatography with reference standards, representative extracts were analysed by normal-phase TLC by co-chromatography with reference standards.

Following extraction, soil samples were air-dried and homogenised, and the remaining unextracted radioactivity quantified by combustion.

With the exception of the zero time samples, trap solutions were removed for analysis at each sampling time. The volume of each trapping solution was measured and the radioactivity present was determined by LSC.

Degradation kinetics

DT_{50} value for the degradation of flutolanil were estimated on the basis of non-linear first-order reaction.

II. RESULTS AND DISCUSSION

The recoveries, extractable and non-extractable residue and trap contents at the beginning and end of the study are summarised below.

Mass Balance

Total radioactivity	Sum of activity in soil extracts, soil residue on combustion and that trapped as $^{14}CO_2$ and volatile organics in the ethylene glycol and 2N sodium hydroxide traps.
Recovery at 0 DAT	100.4% AR
Overall recovery (all samples)	Range 97.0 to 100.9%, mean 99.1% AR

Bound and Extractable Residues

Extractable residues	Extractable residues generally declined with time.	
	Total extractable residues at 0 DAT	97.8% AR
	Total extractable residues at end of study (365 DAT)	48.1% AR
Bound residues	Bound residues increased to a maximum at the end of the study.	
	Maximum bound residues	37.7% AR at 365 DAT
	Bound residues at end of study (365 DAT)	37.7% AR at 365 DAT

Volatilisation

$^{14}CO_2$	Carbon dioxide evolution steadily increased throughout the incubation.	
	$^{14}CO_2$ evolved at end of study (365 DAT)	11.2% AR
Other volatiles	No other volatiles were observed (< 0.1% AR)	

Transformation of Parent Material

Levels of flutolanil in the soil declined continuously over a period of 365 days incubation. At the first sampling interval, day 0, flutolanil represented 97.8% AR. By day 101, levels declined to 78.2% AR and by day 365, the end of incubation, flutolanil represented 46.0% AR.

Five minor metabolites were detected which never exceeded 3.5% AR throughout the incubation period.

Table B.8.1.2.1-1 Recovery of the applied radioactivity (as % applied radioactivity)

Sample	Incubation time (days)								
	0	**14**	**28**	**58**	**101**	**140**	**197**	**280**	**365**
Acetonitrile extract	97.8	97.1	94.9	89.5	78.0	69.5	61.9	50.7	46.2
Soxhlet extract	n.p.	n.p.	n.p.	n.p.	2.5	3.0	2.5	2.3	1.9
Total extracted	97.8	97.1	94.8	89.5	80.4	72.5	64.3	52.9	48.1
Non-extracted	2.6	3.2	5.8	9.2	15.4	21.3	27.9	34.7	37.7
$^{14}CO_2$	n.p.	0.1	0.2	0.8	2.6	4.5	6.8	9.9	11.2
Other volatiles	n.p.	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TOTAL	100.4	100.4	100.9	99.5	98.5	98.3	99.1	97.5	97.0
Mean ± sd	99.1 ± 1.4%								

n.p.: Not performed

Table B.8.1.2.1-2 Degradation and formation of metabolites in soil treated with flutolanil (as % applied radioactivity)

Sample	Incubation time (days)								
	0	**14**	**28**	**58**	**101**	**140**	**197**	**280**	**365**
Flutolanil	97.8	97.1	94.8	88.1	78.2	70.7	60.3	51.2	46.0
M1	n.d.	n.d.	n.d.	0.2	0.3	0.4	2.3	0.6	0.9
M2	n.d.	n.d.	n.d.	0.1	n.d.	n.d.	n.d.	n.d.	n.d.
M3	n.d.	n.d.	n.d.	1.1	1.2	1.4	1.7	1.0	1.0
M4	n.d.	n.d.	n.d.	n.d.	1.6	n.d.	n.d.	n.d.	n.d.
M5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.2	0.2

n.d.: Not detected

Table B.8.1.2.1-3 DT_{50} and DT_{90} values for flutolanil in aerobic soil

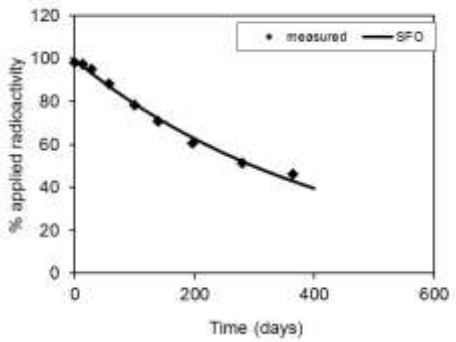
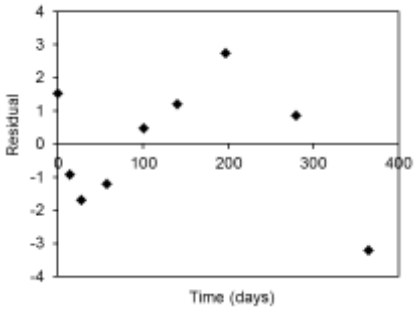
Soil	Soil pH	Kinetic model	k_1 [day^{-1}]	r^2	DT_{50} (days)	DT_{90} (days)
Speyer 2.2	5.7	SFO	0.0023	0.9914	301	>1000

III. CONCLUSIONS

[Aniline-U-^{14}C]-flutolanil slowly degraded in soil with a DT_{50} value of 301 days and DT_{90} value of >1000 days at 10°C. Five minor metabolites were detected which never exceeded 3.5% AR throughout the incubation period.

RMS remarks renewal

- The study is still acceptable
- Recalculation by RMS using FOCUS degradation Kinetics spreadsheet confirmed the above derived SFO DT50 value (M_0 99.31, *k* 0.0023/d, DT_{50} 300.4 days, chi^2 1.85), and a fair visual fit. In view of the distriction of the residuals biphasic fitting is not expected to improve the fit.

Model	Visual Fit	Residuals plot
SFO		

As sufficient data at 20°C is available the result is not used for further assessment.

Previous evaluation	Submitted for the purpose of renewal
RMS remark	Acceptable

Report:	**CA 7.1.2.1.1/02. Hardy, I., Agostini, F. & Jastrzebski, N. 2016a**
Title:	Flutolanil: Kinetic Modelling Analysis of Data from Aerobic Soil Metabolism Studies
Document No:	XG/15/023D
Guidelines:	FOCUS (2006) Guidance Document on Estimating Persistence and Degradation Kinetics from Environmental Fate Studies on Pesticides in EU Registration. The Final Report of the Work Group on Degradation Kinetics of FOCUS SANCO/10058/2005, version 2.0, June 2006. FOCUS (2014) Generic Guidance for Estimating Persistence and Degradation Kinetics from Environmental Fate Studies on Pesticides in EU Registration. Version 1.1, December, 2014.
Testing laboratory:	Battelle UK Ltd, Essex, UK
GLP:	No

Executive Summary

The degradation of flutolanil in soil has been investigated under laboratory conditions [Morgenroth, 1993, Swanson, 1996 and Takahashi, 2015]. The experimental data generated in these aerobic soil laboratory studies treated with flutolanil were re-evaluated according to the FOCUS guidance document on degradation kinetics (FOCUS, 2014) using the software CAKE (version 3.2). The aim of this re-evaluation was to derive DT_{50} values for use as modelling and persistence endpoints. Modelling

endpoints were normalised to a temperature of 20°C and a soil moisture content of pF 2, in compliance with the FOCUS kinetics guidance.

Kinetic modelling analysis following FOCUS (2014) guidance of the data from 6 aerobic soils treated with flutolanil provided acceptable model fits. For modelling and trigger endpoint determination, simple first order (SFO) was selected for all soils with the exception of Wonder lake soil, where the modelling DT_{50} was derived from the DFOP slow-phase k_2 degradation rate, and the trigger endpoints were also derived from DFOP.

The normalised modelling DT_{50} in 6 soils varied from 115 to 569 days, with a geometric mean DT_{50} of 295 days. The trigger DT50 and DT90 values of flutolanil were in the range 115-569 days and 383-1890 days, respectively.

MATERIALS AND METHODS

The degradation of flutolanil in soil has been investigated under laboratory conditions [Morgenroth, 1993, Swanson, 1996 and Takahashi, 2015]. The experimental data generated in these aerobic soil laboratory studies treated with flutolanil were re-evaluated according to the FOCUS guidance document on degradation kinetics (FOCUS, 2014) using the software CAKE (version 3.2). The aim of this re-evaluation was to derive DT_{50} values for use as modelling and persistence endpoints. Day 0 values were set to the total recovered amount of radioactivity (%) * radiochemical purity. The datasets evaluated for each label of F2.2 soil from Takahashi (2015) are provided in summary KCA 7.1.1.1-03, with the exception that the day 0 values were adjusted as described above (96.43% AR and 95.16% AR for phenyl-label, 97.11% AR and 83.52% AR for aniline-label).

Modelling endpoints were normalised to a temperature of 20°C and a soil moisture content of pF 2, in compliance with the FOCUS kinetics guidance, using the equation below:

$$DT_{50ref} = DT_{50act} * Q_{10}^{((T-T_{ref})/10)} * \left(\frac{MC_{act}}{MC_{ref}}\right)^{B}$$

Where:

DT_{50ref} is the normalised half-life at MC_{ref} and T_{ref}

DT_{50act} is the measured half-life at MC_{act} and T

Q_{10} is the temperature correction factor, 2.58 used in the present normalisation

T is the mean soil temperature during the study

T_{ref} is the reference temperature (20°C)

MC_{act} is the measured soil moisture content

MC_{ref} is the soil moisture content at the reference tension (pF2)

B is the moisture exponent, 0.7 as the FOCUS default

In the first instance, the data were directly fitted in CAKE [2016] un-weighted with the complete data set and unconstrained initial concentration (M0). Confidence in the resulting parameters has been assessed visually using a three-point scale (Poor = unacceptable fit; Acceptable = the fitted curve describes the trend of the data points, residuals may show some deviation from random distribution but it is not significant; Good = the fitted curve closely follows all the data points, residuals are

randomly distributed). Confidence in the resulting parameters has been assessed statistically from the confidence intervals for the α and β parameters of the first order multicompartment (FOMC) model or probability values for a t-test of the rate parameters for the single first order (SFO) and dual first order in parallel (DFOP) models. Parameter estimates with a significance level greater than 95% are acceptable and, if greater than 90%, may be accepted where the visual fit is acceptable or good. Where significance levels are less than 90%, the fits are not considered acceptable.The χ^2 error% parameter has been used to determine goodness of fit and where two models are an appropriate to fit the data, the choice of best fit has been based on the lowest value of this parameter, on the condition that the model parameters. Whether or not models are an appropriate to fit the data depends on the visual fit and the statistical reliability of the model parameters, such as p-value for the rate constants and confidence interval not including zero for the FOMC parameters α and β.

All datasets were evaluated against FOCUS Kinetics criteria based on visual assessment, minimum chi^2 error of <15%, t-test parameter significance ≥95% and 90th confidence interval of α and β parameters of FOMC should not include zero.

Table B.8.1.2.1-4 Summary of flutolanil processed residue data used in soils A-D (Morgenroth, 1993) used in the kinetic re-evaluation

Time (days)	Flutolanil (% applied radioactivity)			
	Soil A (Speyer 2.2)	Soil B (Breda)	Soil C (Westmaas)	Soil D (St Maartensbrug)
0	99.5	99.4	99.7	100.2
7	94.3	98.6	93.7	97.7
14	89.5	99.1	93.0	95.4
28	80.7	93.6	86.4	87.9
56	70.2	89.5	76.5	89.0
78	58.9	88.9	69.7	87.3
105	54.9	81.6	60.3	81.6

Table B.8.1.2.1-5 Summary of flutolanil processed residue data used in Wonder Lake soil (Swanson, 1996) used in the kinetic re-evaluation

Time (days)	Flutolanil (% applied radioactivity) Wonder Lake (sandy loam)
0	96.9
0	98.8
14	85.0
14	81.8
30	70.5
30	72.3
63	59.6
63	61.7
77	54.7
77	-
92	52.5
92	56.0
116	52.0
116	-
148	41.8
148	-
212	42.2
212	-
274	31.7
274	36.6
365	27.1
365	26.0

Note: the above Table was copied from the report. For day 148, besides the replicate value of 41.8% AR included in the above Table, a value of 36.6% AR was available for the other replicate, which was erroneously not included in the above Table. The modelling however included the replicate value of 36.6% AR.

RESULTS AND DISCUSSION

Kinetic fits with SFO, FOMC and DFOP models were assessed for each soil. The modelling DT_{50} of flutolanil in each soil was selected from one of the three kinetic model fits, based on criteria following FOCUS (2014) guidance, and normalised to 20°C and a moisture content of pF2. The normalised modelling DT_{50} in 6 soils varied from 115 to 569 days, with a geometric mean DT_{50} of 295 days.

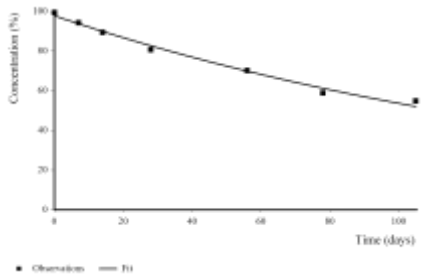
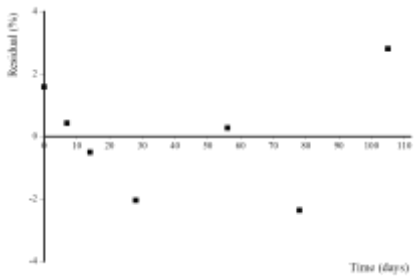
The persistence trigger DT_{50} of flutolanil in each soil was selected from the best fit model. The trigger DT50 and DT90 values of flutolanil were in the range 115-569 days and 383-1890 days, respectively.

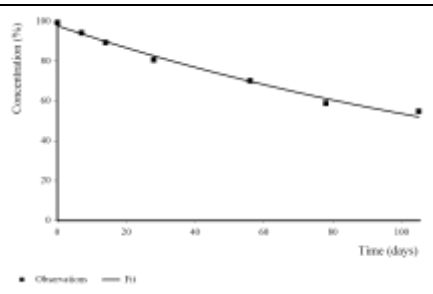
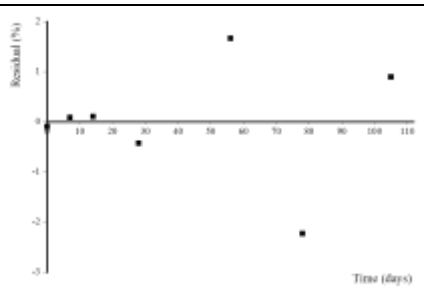
The kinetics as shown below is adapted by RMS (recalculation in some cases)

Table B.8.1.2.1-6 Graphical summary of soil A - Speyer 2.2

Study reference - Soil	Soil A – Speyer 2.2a		
Model	SFO	FOMC	DFOP
Visual Fit	Good	Good	Good
Residuals (visual)	Good	Good	Good

χ^2 error (%)	1.75	1.23	1.32
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.00601 σ: 0.006013 p (k) : 3.54 x 10^{-6}	α: 0.955 σ: 0.4244 95th %ile CI contains 0 90th %ile CI does not contain 0 β: 116.9 σ: 68.18 90th %ile CI contains 0	k1: 0.01239 σ: 0.02544 p (k_1): 0.32980 k2: 4.00 x 10^{-10} σ: 0.02292 p (k_2): 0.50000 g: 0.6249 σ: 0.624
Trigger DT_{50} (days)	**115**	125	130
DT_{90} (days)	**383**	1190	>10000
FOCUS decision step (Trigger)	SFO acceptable; compare with FOMC	FOMC better than SFO, but β parameter not robust and α parameter only marginally acceptable; compare with DFOP	DFOP better than SFO but k_1 and k_2 not robust; SFO selected as best fit
Modelling DT_{50} (days)	**115**		
FOCUS decision step (Modelling)	SFO acceptable; SFO DT_{50} selected		

Model	Visual Fit	Residuals plot
SFO		

FOMC		

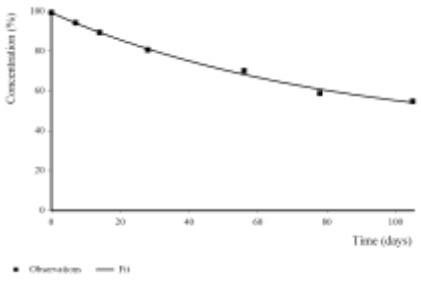
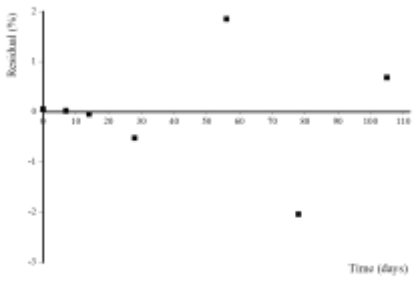
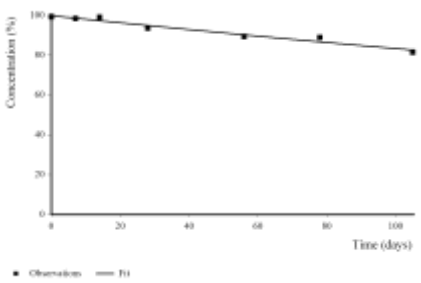
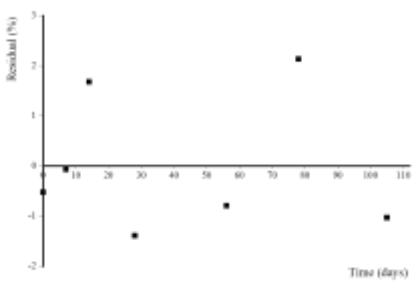
DFOP		

Table B.8.1.2.1-7 Graphical summary of soil B - Breda

Study reference - Soil	Soil B – Breda	
Model	SFO	FOMC
Visual Fit	Good	Good
Residuals (visual)	Good	Good
χ^2 error (%)	1.08	1.19
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.00181 σ: 0.001813 p (k): 6.84 x 10^{-5}	α: 1.664 σ: nd 90^{th} & 95^{th} %ile CI not calculated β: 870 σ: nd 90^{th} & 95^{th} %ile CI not calculated
Trigger DT_{50} (days)	**383**	450
DT_{90} (days)	**1270**	2600
FOCUS decision step (Trigger)	SFO acceptable; compare with FOMC	SFO better than FOMC; SFO selected as best fit
Modelling DT_{50} (days)	**383**	
FOCUS decision step (Modelling)	SFO acceptable; SFO DT_{50} selected	
Model	Visual Fit	Residuals plot
SFO		

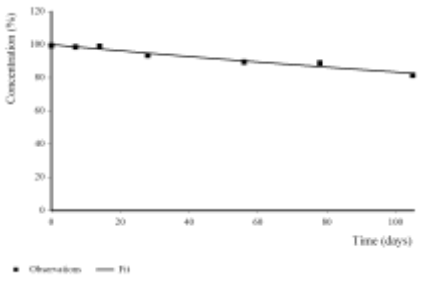
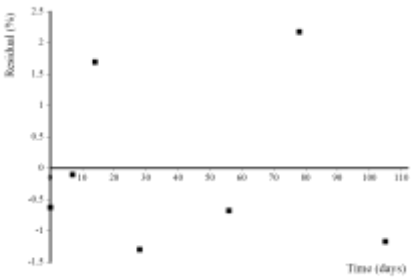
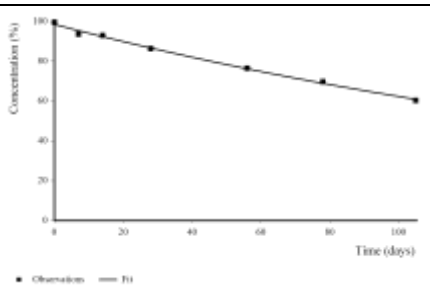
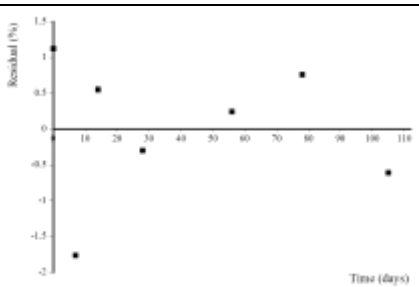
FOMC		

Table B.8.1.2.1-8 Graphical summary of soil C – Westmaas

Study reference - Soil	Soil C (Westmaas)	
Model	SFO	FOMC
Visual Fit	Good	Good
Residuals (visual)	Good	Good
χ^2 error (%)	0.873	0.943
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.00459 σ: 0.00459 p (k): 3.49 x 10^{-7}	α: 7.354 σ: 95.21 90th %ile CI contains 0 β: 1560 σ: 2040 90th %ile CI contains 0
Trigger DT_{50} (days)	**151**	154
DT_{90} (days)	**502**	573
FOCUS decision step (Trigger)	SFO acceptable; compare with FOMC	SFO better than FOMC; SFO selected as best fit
Modelling DT_{50} (days)	**151**	
FOCUS decision step (Modelling)	SFO acceptable; SFO DT_{50} selected	
Model	Visual Fit	Residuals plot
SFO		

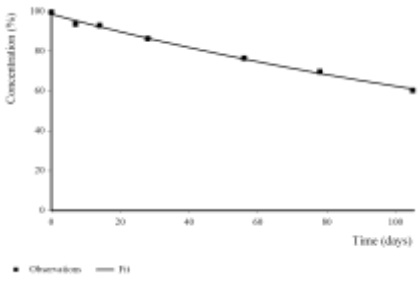
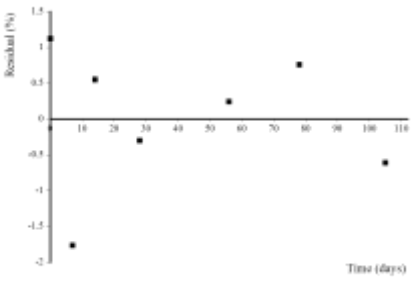
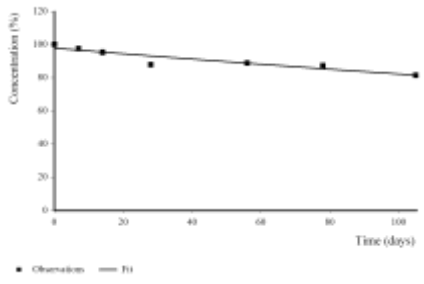
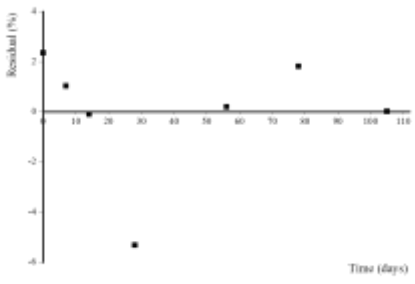
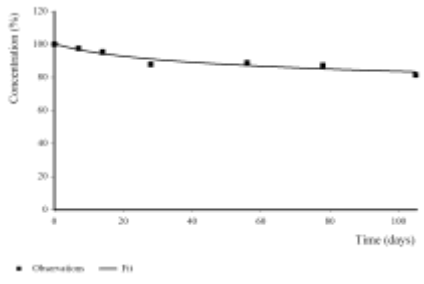
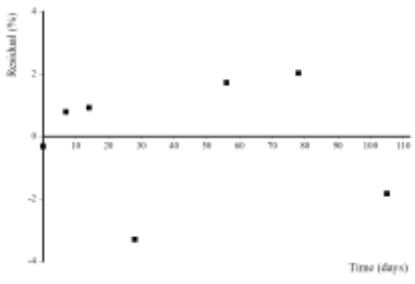
FOMC	 Concentration (%) Time (days) Observations Fit	 Residual (%) Time (days)

Table B.8.1.2.1-9 Graphical summary of soil D – St Maartensbrug

Study reference - Soil	Soil D – St Maartensbrug		
Model	SFO	FOMC	DFOP
Visual Fit	Good	Good	Good
Residuals (visual)	Good	Good	Good
χ^2 error (%)	2.04	1.7	1.75
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.00173 σ: 0.001734 p (k): 0.00153	α: 0.08409 σ: 0.04463 90th %ile CI contains 0 β: 12.85 σ: 16.8 90th %ile CI contains 0	k1: 0.07613 σ1: 0.0761p (k_1): 0.27750 k2: 0.00107 σ2: 0.00107p (k_2): 0.15810
Trigger DT_{50} (days)	**400**	>10000	573
DT_{90} (days)	**1330**	>10000	2080
FOCUS decision step (Trigger)	SFO acceptable; compare with FOMC	FOMC better than SFO but statistically unreliable; compare with DFOP	DFOP better then SFO but k_1 and k_2 not robust; SFO selected as best fit
Modelling DT_{50} (days)	**400**		
FOCUS decision step (Modelling)	SFO acceptable; SFO DT_{50} selected		

Model	Visual Fit	Residuals plot
SFO		
FOMC		

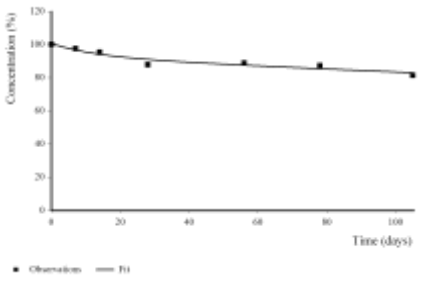
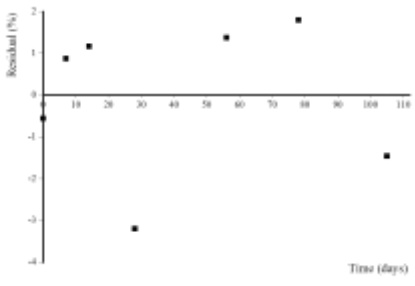
DFOP		

Table B.8.1.2.1-10 Graphical summary of Wonder Lake

Study reference - Soil	Wonder Lake		
Model	SFO	FOMC	DFOP
Visual Fit	Poor	Good	Good
Residuals (visual)	Poor	Good	Good
χ^2 error (%)	9.48	3.92	3.81
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.00418 σ: 0.004184 p (k): 6.80 x 10^{-9}	α: 0.542 σ: 0.06873 95th %ile CI does not contain 0 β: 43.11 σ: 11.22 95th %ile CI does not contain 0	k1: 0.02891 σ: 0.007598 p (k_1): 8.62 x 10^{-4} k2: 0.00225 σ: 0.000374 p (k_2): 1.19 x 10^{-5} g: 0.3683 σ: 0.36837
Trigger DT_{50} (days)	166	112	**116**
DT_{90} (days)	551	2980	**820**
FOCUS decision step (Trigger)	SFO not acceptable; compare with FOMC	FOMC better than SFO, compare with DFOP	DFOP better than FOMC; chosen as best fit
Modelling DT_{50} (days)			**308 (from k_2 DT_{50})**
FOCUS decision step (Modelling)	SFO not acceptable; fit FOMC and DFOP	FOMC acceptable; compare with DFOP	DFOP better than FOMC; DFOP k_2 selected as DT_{50}
Model	Visual Fit		Residuals plot

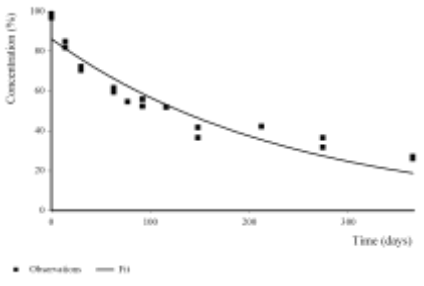
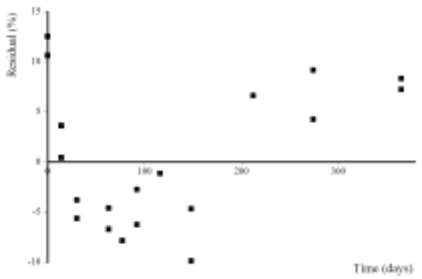
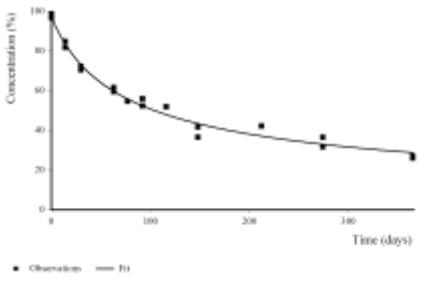
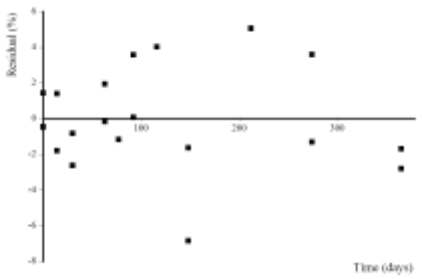
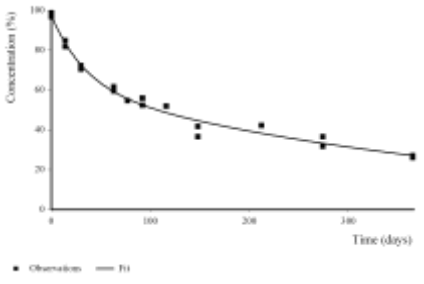
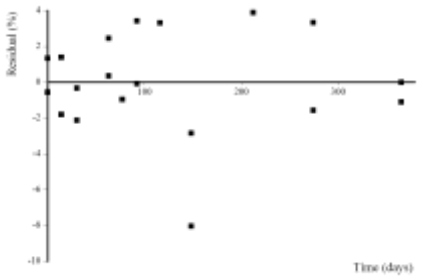
SFO		
FOMC		
DFOP		

Table B.8.1.2.1-11 Graphical summary of F2.2 (Phenyl-labelled)

Study reference - Soil	F2.2 (Phenyl-labelled)		
Model	SFO	FOMC	DFOP
Visual Fit	Good	Good	Good
Residuals (visual)	Good	Good	Good
χ^2 error (%)	1.51	1.43	1.62
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.00122 σ: 0.001222 p (k): 5.86 x 10^{-6}	α: 0.101 σ: 0.05607 90th %ile CI contains 0 β: 35.88 σ: 37.6 90th %ile CI contains 0	k1: 0.04406 σ: 0.08155 p (k_1): = 0.3019 k2: 8.24 x 10^{-4} σ: 0.000666 p (k_2): 0.1255 g: 0.05123 σ: 0.05123
Trigger DT_{50} (days)	**569**	>10000	778
DT_{90} (days)	**1890**	>10000	2730

FOCUS decision step (Trigger)	SFO acceptable; compare with FOMC	FOMC better than SFO but statistically unreliable; compare with DFOP	DFOP worse than SFO and k_1 and k_2 not robust; SFO selected as best fit
Modelling DT_{50} (days)	**569**		
FOCUS decision step (Modelling)	SFO acceptable; SFO DT_{50} selected		

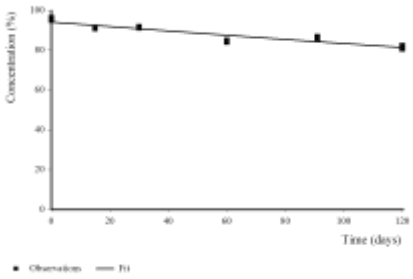
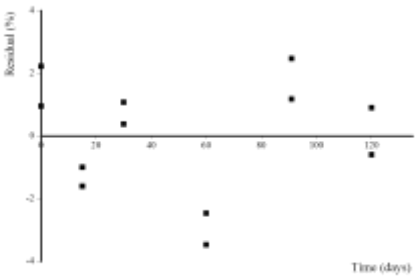
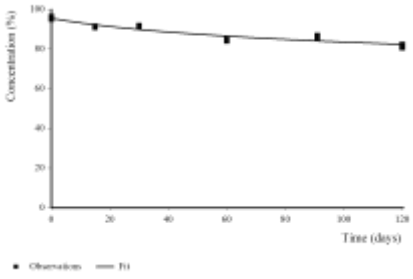
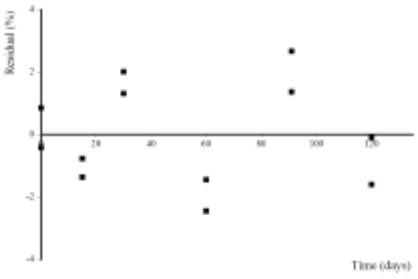
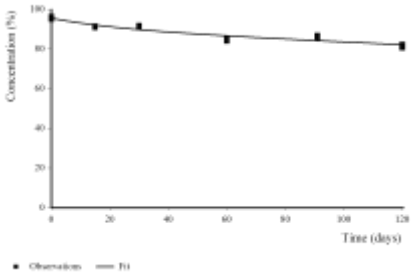
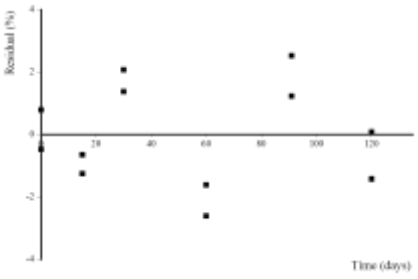
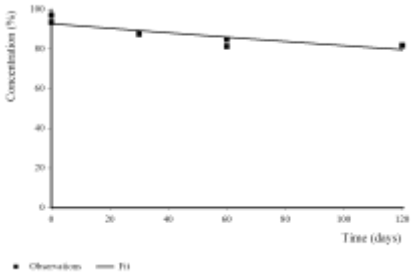
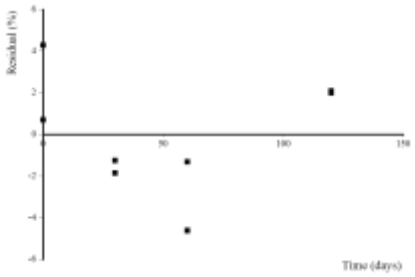
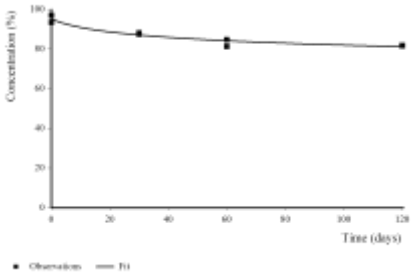
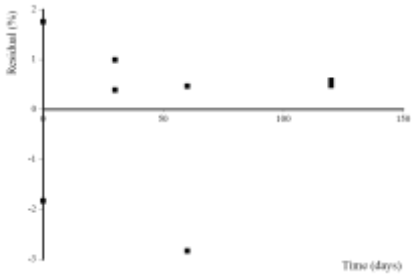
Model	Visual Fit	Residuals plot
SFO		
FOMC		
DFOP		

Table B.8.1.2.1-12 Graphical summary of F2.2 (Aniline-labelled)

Study reference - Soil	F2.2 (Aniline-labelled)		
Model	SFO	FOMC	DFOP
Visual Fit	Good	Good	Good
Residuals (visual)	Good	Good	Good
χ^2 error (%)	2.18	0.862	not determined

Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.00127 σ: 0.001276 p (k): 0.00219	α: 0.05754 σ: 0.02534 95th %ile CI contains 0 90th %ile CI does not contain 0 β: 7.868 σ: 9.21 90th %ile CI contains 0	k1: 0.02741 σ: 0.04535 p (k_1): 0.2891 k2: 7.64 x 10^{-13} σ: 0.001927 p (k_2): 0.5 g: 0.1518 σ: 0.1518
Trigger DT_{50} (days)	**547**	>10000	>10000
DT_{90} (days)	**1820**	>10000	>10000
FOCUS decision step (Trigger)	SFO acceptable; compare with FOMC	FOMC visually acceptable but statistically unreliable (β parameter not robust and α parameter only marginally acceptable); compare with DFOP	DFOP visually acceptable but statistically unreliable (k_1 and k_2 not robust); SFO selected as best fit
Modelling DT_{50} (days)	**547**		
FOCUS decision step (Modelling)	SFO acceptable; SFO DT_{50} selected		

Model	Visual Fit	Residuals plot
SFO		
FOMC		

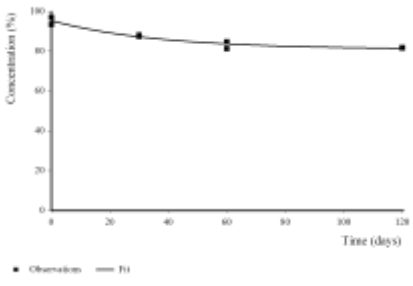
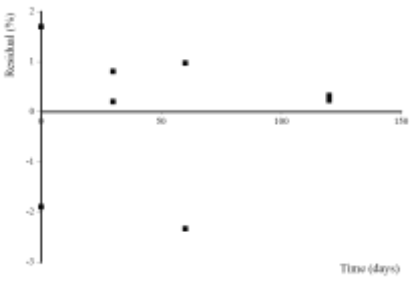
DFOP		

Table B.8.1.2.1-13 Graphical summary of F2.2 (two labels as replicates)

Study reference - Soil	F2.2 (two labels as replicates)		
Model	SFO	FOMC	DFOP
Visual Fit	Good	Good	Good
Residuals (visual)	Good	Good	Good
χ^2 error (%)	1.70	1.37	1.56
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.001237 σ: 0.0012370^{-4} p (k): 4.79×10^{-8}	α: 0.07658 σ: 0.02539 95th %ile CI does not contain 0 β: 18.53 σ: 13.59 90th %ile CI contains 0	k1: 0.02599 σ: 0.03437 p (k_1): 0.2302 k2: 2.67×10^{-4} σ: 0.001234 p (k_2): 0.4157 g: 0.1181 σ: 0.1181
Trigger DT_{50} (days)	**560**	>10000	2130
DT_{90} (days)	**1860**	>10000	7340
FOCUS decision step (Trigger)	SFO acceptable; compare with FOMC	FOMC better than SFO but statistically unreliable (β parameter not robust); compare with DFOP	DFOP k_1 and k_2 not robust; SFO selected as best fit
Modelling DT_{50} (days)	**560**		
FOCUS decision step (Modelling)	SFO acceptable; SFO DT_{50} selected		
Model	Visual Fit	Residuals plot	

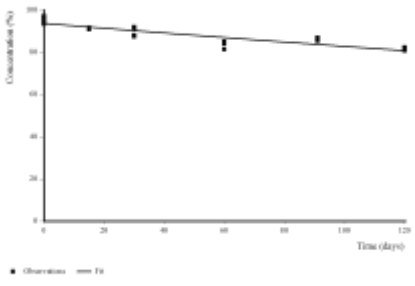
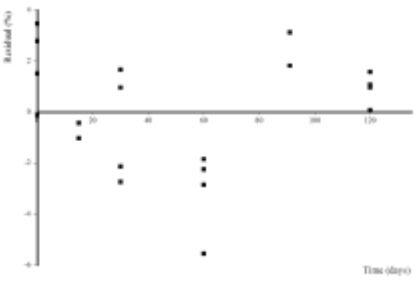
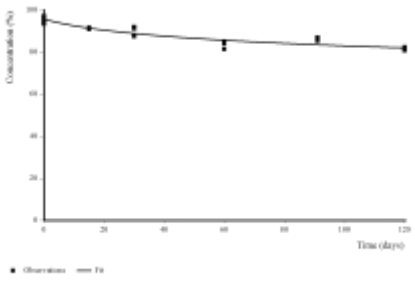
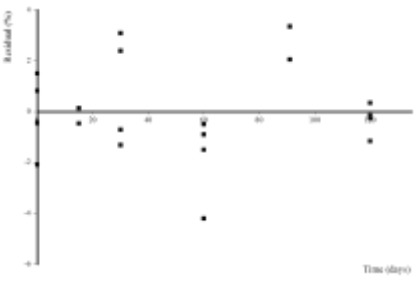
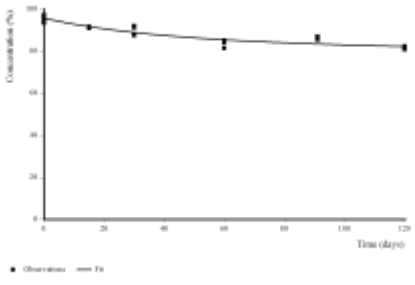
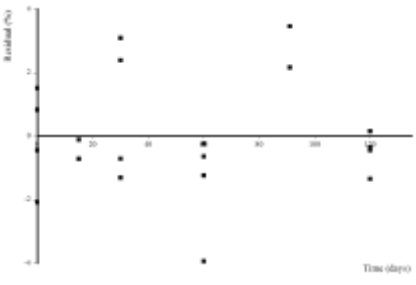
SFO		
FOMC		
DFOP		

Table B.8.1.2.1-14 Degradation parameters and modelling endpoints for flutolanil

Soil	Soil type	DT50 (d)	Actual temp (°C)	Moisture content study (% w/w)	Reference moisture content (% w/w)	Moisture correction factor	Normalized DT50 (d)
Soil A – Speyer 2.2	Loamy sand	115	20	29.5	29.5	1	115
Soil B – Breda	Sandy loam	383	20	31.2	31.2	1	383
Soil C – Westmaas	Loam	151	20	31.0	31.0	1	151
Soil D- St Maartensbrug	Sand	400	20	15.5	15.5	1	400
Wonder Lake	Sandy loam	308	25	16.2	19[a]	0.894	442
F2.2 (Phenyl)	Loamy sand	569	20	26	14	1	569[a]
F2.2 (Aniline)	Loamy sand	547	20	26	14	1	547[a]

Soil	Soil type	DT50 (d)	Actual temp (°C)	Moisture content study (% w/w)	Reference moisture content (% w/w)	Moisture correction factor	Normalized DT50 (d)
F2.2 (Aggregated Rep)	Loamy sand	560	20	26	14	1	560
Geometric mean							**295**

[a] *The applicant used a value of 21.63% w/w, which represented the water holding capacity of the test soil at 1/3 bar (pF 2.5), but the reference moisture is defined as pF 2.0 (field capacity). Since the field capacity of the sandy loam test soil was not provided, the default value for pF2 of a sandy loam soil (19% w/w) was used, obtained from Table 2.2 of Generic Guidance for Tier 1 FOCUS Ground Water Assessments version 2.1 (December 2012).*

Table B.8.1.2.1-15 Degradation parameters and persistence trigger endpoints for flutolanil

Soil	Best-fit model	χ^2	Model parameters	DT_{50} (days)	DT_{90} (days)
Soil A – Speyer 2.2	SFO	1.75	Mo = 97.91 k = 0.00601	115	383
Soil B – Breda	SFO	1.08	Mo = 99.93 k = 0.00181	383	1270
Soil C – Westmaas	SFO	0.873	Mo = 98.58 k = 0.00459	151	502
Soil D- St Maartensbrug	SFO	2.04	Mo = 97.85 k = 0.00173	400	1330
Wonder Lake	DFOP	3.81	Mo = 97.47 k1 = 0.02891 k2 = 0.00225 g =0.3683	116	1890
F2.2 (Phenyl)	SFO	1.51	Mo = 94.21 k = 0.00122	569	1890
F2.2 (Aniline)	SFO	2.18	Mo = 92.82 k = 0.00127	547	1820
F2.2 (Aggregated Rep)	SFO	1.70	Mo = 93.65 k = 0.00124	560	1860

CONCLUSIONS

Kinetic modelling analysis following FOCUS (2014) guidance of the data from 6 aerobic soils treated with flutolanil provided acceptable model fits. The normalised modelling DT_{50} in 6 soils varied from 115

to 569 days, with a geometric mean DT_{50} of 295 days. The trigger DT50 and DT90 values of flutolanil were in the range 115-569 days and 383-1890 days, respectively.

RMS remarks renewal

Changes to the summary have been made by RMS, especially with regards to the kinetics. More often than applicant, RMS suggests to use SFO since biphasic is statistically not acceptable. Please note that the Japanese soils of Aizawa, H. (1982) have been included by RMS in the overall endpoint selection (please refer to Volume 1; section 2.8.1) since they were not included in the kinetic report of Hardy et al.

B.8.1.2.1.2 Aerobic degradation of metabolites, breakdown and reaction products

As there were no major aerobic degradation metabolites at >10% or minor metabolites in soil >5% at 2 or more consecutive timepoints or >5% and increasing at the final timepoint no aerobic degradation studies were carried out.

B.8.1.2.1.3 Anaerobic degradation of the active substance

The rate of degradation of flutolanil in soil under anaerobic conditions is summarised under B.8.1.1.2. In both studies after anaerobic conditions were established by flooding the soil, only very limited degradation of flutolanil and its metabolites was observed.

B.8.1.2.1.4 Anaerobic degradation of metabolites, breakdown and reaction products

The rate of degradation of flutolanil in soil under anaerobic conditions is summarised under point B.8.1.1.2. In anaerobic studies conducted with flutolanil in soil no major anaerobic degradation metabolites at >10% or minor metabolites >5% at 2 or more consecutive timepoints or >5% and increasing at the final timepoint were seen.

No additional anaerobic studies on the metabolites have been conducted as after anaerobic conditions were established by flooding the soil, only very limited degradation of flutolanil and its metabolites was observed.

B.8.1.2.2 Field studies

B.8.1.2.2.1 Soil dissipation studies

Previous evaluation	Submitted for first approval, DAR 2005
RMS remark	Acceptable with remarks

Report:	**CA 7.1.2.2.1/01. Wicks, R. (1999)**
Title:	FLUTOLANIL: Field Soil Dissipation Study after Soil and Seed Potato Treatment in Northern Europe
Document No:	Document 202274 (E-3027)
Guidelines:	164-1
Testing laboratory:	Rhône-Poulenc Agriculture, Ongar, Essex
GLP:	Yes

Executive Summary

The dissipation behaviour of flutolanil under field conditions was determined in six trials at four sites across Northern Europe. Four sites with treated potato and two with direct soil spray applications. The four treated potato trials were carried out in northern Germany, southern Germany, the Netherlands and the UK. The two direct soil spray trials followed by incorporation were conducted in the Netherlands and the UK. All trials were started in spring 1997. Seed potatoes were treated at a nominal dose rate of 120 mg a.i. kg^{-1} which at a rate of 5 ton seed potatoes ha^{-1} is equivalent to 600 g a.i. ha^{-1}. At the two plots to be sprayed, seed potatoes were planted, flutolanil was sprayed at a nominal rate of 4500 g a.i. ha^{-1} and incorporated to about 10 cm. Soil/potato and soil samples from different depths to a maximum of 0.6 m below the surface were then collected at regular intervals and analysed for flutolanil.

The degradation results indicate that flutolanil residue decline was faster when sprayed onto the soil and incorporated compared to direct application to the surface of seed potatoes. This may be due in part to the high concentration of flutolanil on the surface of the seed potatoes (12 mg active ingredient per potato) in combination with the relatively long persistence of the residual skin of the potato tuber. However, normal cultivation procedures after potato harvest would disperse any remaining flutolanil residues which would rapidly degrade. Flutolanil was found to have low mobility under field conditions at the six trials in Europe despite precipitation plus irrigation usually in excess of historical average precipitation. Greater than 95% of the applied flutolanil remained in the surface to 20 cm soil layer in all four soil types. In fact, at the two soil spray sites (Ottersum, Netherlands and Manningtree, UK) there were only a few sporadic residues detected below 20 cm and these residues were close to the limit of quantification. For the treated potato trials, small amounts of flutolanil were found in the 20 to 35 cm soil layer at a few sampling intervals but this did not exceed 5% of applied dose. Manningtree has the lightest soil with the highest sand content (sandy loam) and lowest organic carbon (0.9 % average) of the four sites and represents the worst case soil with respect to leaching potential. Even in this worst case soil with respect to leaching potential almost all of the parent stayed in the surface to 20 cm layer. No residues were found below 35 cm except for one sporadic detection at Manningtree close to the limit of quantification. This field study demonstrates the low potential for unsaturated zone movement and negligible potential for flutolanil to appear in groundwater.

A re-evaluation of the degradation kinetics of the direct soil spray applications and the tuber treatment has been carried out in accordance to the FOCUS guidance document on degradation kinetics (2014), see kinetic reports CA 7.1.2.2.1-04, -05, and -06.

The estimated SFO DT_{50} of 116 and 67.6 days and DT_{90} of 386 and 225 days were selected as persistence endpoints for the spray applications at Ottersum and Manningtree sites respectively.

Trial	Location	Kinetic model	DT_{50} (days)	DT_{90} (days)	Min χ^2 error
Ottersum	The Netherlands	SFO	116	386	16.3
Manningtree	United Kingdom	SFO	67.6	225	12.7

The estimated SFO DT_{50} of 125 to 171 days and DT_{90} of 416 to 569 days were selected as persistence endpoints for tuber applications at the four sites.

Trial	Location	M0	DT_{50} (days)	DT_{90} (days)	Minimum Chi2 error (%)
Goch	Germany	9.786 (mg $tube^{-1}$)	125	416	5.08
Manningtree	United Kingdom	10.29 (mg $tube^{-1}$)	137	456	8.47
Niederkirchen	Germany	10.10 (mg $tube^{-1}$)	166	551	14.6
Ottersum	The Netherlands	10.89 (mg $tube^{-1}$)	171	569	10.7

I. MATERIALS AND METHODS

A. MATERIALS

1. Name (formulated products): EXP10066A and EXP10057C

Batch numbers: OP960686 and OP970313

Active ingredient: Flutolanil

Nominal active ingredient content: OP960686 470 g/L, OP970313 52.4 % w/w

B. STUDY DESIGN AND METHODS

Experimental design

In the two spray trials the formulation EXP10066A was applied once at an application rate equivalent to 4.5 kg a.s./ha to a bare soil pre emergence of potatoes followed by incorporation to about 10 cm. Prior to spraying at the spray trial plots, seed potatoes were planted to a depth of about 20 cm and any ridges were smoothed out. At the normal harvest date the potato crop was treated with a non-residual total herbicide and left undisturbed in the soil. A grass cover crop was then sown with minimal disturbance of the soil.

For the treated seed potato trials, plastic tubes about 30 cm diameter and 50 cm long open at both ends were inserted vertically in the ground in a cultivated area and filled with soil. Seed potatoes were selected for average size, similar weight and surface area. Measured amounts of dust formulation EXP10057C, were carefully applied by brush over the surface of each wetted tuber to give a consistent application rate per tuber. One treated seed potato was planted in each plastic mesh basket about a third full of soil and then covered with soil to the top of the basket. The basket was approximately 10 cm diameter and 10 cm high. A basket containing a treated potato was placed at the top of each of the large plastic tubes and surrounded by soil until it was just buried. There were three tubes prepared per sampling interval. The nominal dose rate for the treated seed potatoes was 120

mg a.i./ kg which at a rate of 5 ton seed potatoes ha^{-1} was equivalent to 600 g a.i. ha^{-1}. Crop maintenance was the same as the spray trial with a following grass cover crop.

Table B.8.1.2.2-1 Test Site Description

Location:	Goch, Northern Germany; Niederkirchen, Southern Germany; Ottersum, The Netherlands; Manningtree, United Kingdom
Pre-treatment history	Not treated with test item in preceding 3 years.
Crop history	Goch: Fallow 1994-95; Sunflowers 1995-96; Winter Wheat 1996-97 Niederkirchen: Grass 1994-95; Fallow 1995-96; Maize 1996-97 Ottersum: Maize 1994-95; Leek 1995-96; Spring Barley 1996-97 Manningtree: Fallow 1994-95; Fallow 1995-96; Fallow 1996-97
Pesticides used in preceding 3 years	Goch not treated with any chemicals in preceding 4 years. Niederkirchen Lentagran (pyridate 450g/kg) applied during 1996-1997. Ottersum Atrazine (500g/L) 1994-95, Stomp SC (pendimethalin 400g/L) 1995-96, Verijal D (Mecoprop 300g/L and Bifenox 250g/L) 1996-97. Manningtree not treated with any chemicals in preceding 4 years.
Distance of weather station from test site	Goch & Ottersum; Agroplan, Berliner Straße 75 Goch D-47574 Germany (From February to April 1999 inclusive, air temperature, soil temperature and rainfall were measured at the Agroplan trial site) Haus Riswick weather station: Landwirtschaftskammer Rheinland Elsenpaß 5, Hausriswick, D-47533 Kleve-kellen, Germany (From May 1997 to January 1999 inclusive, air temperature and rainfall, site about 7 km from the Agroplan trial site.) Liedener Ringstraße weather station: Deutscher Wetterdienst Aubenstelle Bocholt, Liedener ijngstraße, D-46395 Bocholt-Liedern, Germany (Evaporation was obtained from Liedener RingstraBe, Bocholt about 37 km from the Agroplan trial site) Niederkirchen; Station No. 02519, Neustadt, Einstrasse (Heidehof), Southern Germany Manningtree; Rhone-Poulenc Agriculture Ltd, Aldhams Farm, Lawford, Manningtree, Essex, UK

Prior to application soil cores for soil characterisation and biomass determination (0-60 cm) were taken. Details are provided below.

Table B.8.1.2.2-2 Soil Characterisation (0-30 cm depth)

Parameter	**Results**			
Location	Goch Northern Germany	Niederkirchen Southern Germany	Ottersum The Netherlands	Manningtree United Kingdom
Texture Class	Silt loam	Sandy loam	Sandy loam	Sandy loam
pH (water)	6.5	7.6	7.0	5.2
Organic carbon (%)	2.0	0.9	2.4	0.9
Cation exchange capacity (meq/100 g)	14.0	12.4	16.8	8.2
USDA classification				
Sand (50 - 2000 µm) % Silt (2 - 50 µm) % Clay (< 2 µm) %	31 60 9	61 23 16	72 18 9	67 26 8
ADAS classification				
Sand (63 - 2000 µm) % Silt (2 - 63 µm) % Clay (< 2 µm) %	15 76 9	55 29 16	68 23 9	60 33 8
Moisture water holding capacity (%)	58.2	44.7	55.6	33.6
Biomass (µg C/100 g soil) Start Completion of incubation	 114 201	 203 271	 142 122	 123 43

Table B.8.1.2.2-3 Soil Characterisation (30-60 cm depth)

Parameter	**Results**			
Location	Goch Northern Germany	Niederkirchen Southern Germany	Ottersum The Netherlands	Manningtree United Kingdom
Texture Class	Silt loam	Sandy loam	Sandy loam	Sandy loam/loamy sand
pH (water)	6.5	8.3	7.2	6.3
Organic carbon (%)	0.7	0.6	1.5	0.5
Cation exchange capacity (meq/100 g)	8.5	11.3	13.1	5.9
USDA classification				
Sand (50 - 2000 µm) % Silt (2 - 50 µm) % Clay (< 2 µm) %	30 61 9	59 23 18	70 20 10	80 15 5
ADAS classification				
Sand (63 - 2000 µm) % Silt (2 - 63 µm) % Clay (< 2 µm) %	14 77 9	53 30 18	65 25 10	76 18 5

Table B.8.1.2.2-4 Experimental design, plot set up and application details

Details		Goch Northern Germany	Niederkirchen Southern Germany	Ottersum The Netherlands	Manningtree United Kingdom
Duration of study		24 months	24 months	24 months	24 months
Uncropped (bare) or cropped		-	-	Bare (spray plots)	Bare (spray plots)
Controls used		No	No	No	No
Number of plots		1 treated	1 treated	1 treated	1 treated
Treated plot dimensions:	Treated potato	8 m x 10 m (80 m^2)	8 m x 10 m (80 m^2)	8 m x 10 m (80 m^2)	2 m x 40 m (80 m^2)
	Spray study	-	-	20 m x 20 m (400 m^2)	10 m x 40 m (400 m^2)
Distance between control plot and treated plot		Not known	Not known	Not known	Not known
Application rate used (g a.i./ha)		120 mg a.i./ kg which at a rate of 5 ton seed potatoes ha^{-1} was equivalent to 600 g a.i. ha^{-1}	120 mg a.i./ kg which at a rate of 5 ton seed potatoes ha^{-1} was equivalent to 600 g a.i. ha^{-1}	120 mg a.i./ kg which at a rate of 5 ton seed potatoes ha^{-1} was equivalent to 600 g a.i. ha^{-1} 4.5 kg a.s./ha spray trials	120 mg a.i./ kg which at a rate of 5 ton seed potatoes ha^{-1} was equivalent to 600 g a.i. ha^{-1} 4.5 kg a.s./ha spray trials
Application date		5 May 1997	6 May 1997	5 May 1997 Both spray plots and tube treatments	25 April 1997 spray plot 28 April 1997 tube treatments
Application method		-	-	Movable field crop sprayer AGR-SP-02-069 1	Tractor mounted herbicide evaluation plot sprayer on John Deere tractor
Volume of spray solution applied		-	-	400 L/ha	296 L/ha
Identification and volume of carrier used		-	-	Not known	Not known
Pan evaporation data available?		No	No	No	No
Meteorological conditions during application spray sites only					
Air temperature (°C)		-	-	21	9
Wind		-	-	3.5 kph	11 kph

Sampling

Samples were taken at timepoints up to 24 months after application. Soil samples were taken prior to treatment, within four hours of application (time 0) and at approximately 2, 4, 6, 9, 12, 1 8 and 24 months after application. See table below.

Table B.8.1.2.2-5 Sampling details

Sampling Interval	Goch	Niederkirchen	Ottersum	Manningtree	Ottersum spray		Manningtree spray	
	Date	Date	Date	Date	Date	Depth (m)	Date	Depth (m)
Pre-study	02/05/97	06/05/97	02/05/97	24/04/97	02/05/97	0.6	24/04/97	0.6
Application	05/05/97	06/05/97	05/05/97	28/04/97	05/05/97	n/a	25/04/97	n/a
T= 0 +	05/05/97	06/05/97	05/05/97	28/04/97	05/05/97	0.2	25/04/97	0.2
2 months	04/07/97	08/07/97	04/07/97	24/06/97	04/07/97	0.3	24/06/97	0.3
4 months	03/09/97	13/09/97	03/09/97	21/08/97	03/09/97	0.3	21/08/97	0.3
6 months	12/11/97	13/11/97	11/11/97	21/10/97	11/11/97	0.3	22/10/97	0.3
9 months	11/02/98	12/02/98	13/02/98	21/01/98	13/02/98	0.3	21/01/98	0.3
12 months	04/05/98	05/05/98	06/05/98	06/05/98	06/05/98	0.6	06/05/98	0.6
18 months	03/11/98	04/11/98	05/11/98	10/11/98	05/11/98	0.6	09/11/98	0.6
24 months	26/04/99	27/04/99	26/04/99	21/04/99	26/04/99	0.6	22/04/99	0.6

After application at the spray trials, twenty soil cores were taken, five in each of the four subplots. At time 0, each soil core consisted of a single 0 - 20 cm increment which was taken with a 6.3 cm diameter stainless steel tube. The clean tube was inserted into the surface of the soil then removed containing soil which was released into a plastic mixing bag. The five cores from each subplot were combined in the same bag which was shaken and kneaded to thoroughly mix the soil. Samples down to 30 cm were collected using tubes and below 30 cm bucket augers were used. Segments from each layer were combined and homogenised for each sample. All samples were then frozen for transport to the analytical laboratory.

Table B.8.1.2.2-6 Soil sampling details

Details	
Method of sampling	Random sampling
Sampling intervals (months)	-1, 0 , 1, 2, 4, 6, 9, 12, 18 and 24
Method of soil collection	By soil core
Sampling depth	60 cm depth
Number of cores collected per plot	20 soil cores were taken, five from each of the four subplots per timepoint
Storage conditions	Frozen
Maximum storage length	Samples were analysed within 1 month of sampling

Analytical procedures

Soil cores were analysed separately for flutolanil. A brief description of the analytical procedures is provided below.

Aliquots of each soil sample and potato samples were extracted with acetone for 30 minutes at ambient temperature. Extracts were filtered, concentrated, subject to various clean up steps including liquid-liquid partioning with organic solvents and an aluminium oxide column clean-up before the concentrated residue was redissolved in ethyl acetate/hexane (30:70, *v/v*). Levels of flutolanil determined by gas chromatography mass spectrometry with D_{10}-anthracene as internal standard using a CP-Sil 5 CB fused silica WCOT column with helium. The masses of 173 (target ion) and 145 (qualifier ion) were selected for quantitative measurement of flutolanil with masses of 188 and 189 for the internal standard.

The limit of quantification (LOQ) of flutolanil in soil and soil/potato was 0.005 mg kg^{-1} and 0.01 mg kg^{-1}, respectively.

Storage Stability

Freezer storage stability of the soil residues showed there was no significant degradation of flutolanil up to the maximum storage time of 12 months.

Degradation kinetics

The degradation kinetics determined in the report were conducted prior to the issuing of the FOCUS guidance document on degradation kinetics and are no longer considered valid. For the renewal, DT_{50} and DT_{90} values for the degradation of flutolanil have been re-calculated from the reported data for the spray applications only following the recommendations of the FOCUS work group using the software CAKE (version 2.3). Full details are provided in Document CA 7.1.2.2.1/04. A brief summary is provided below.

Measured flutolanil residues in 0-60 cm in the two sites sprayed to bare soil with incorporation were used in the evaluation. The normalised dataset was best fit by the SFO model, with a $\chi 2$ error of 16.3% and 12.7% and acceptable visual fits for the Ottersum and Manningtree sites respectively. The estimated SFO DT_{50} of 116 and 67.6 days and DT_{90} of 386 and 225 days were selected as persistence endpoints for the Ottersum and Manningtree sites respectively.

II. RESULTS AND DISCUSSION

The soil and potato extraction method performance was verified by conducting recovery efficiency tests on the day of analysis. Mean recoveries of flutolanil from soil at 3 concentrations in the range LOQ to 200 times LOQ were in the range 98 to 107 % and mean recoveries from soil/potato at 5 concentrations in the range LOQ to 12000 times LOQ were in the range 71 to 122 %.

The results for flutolanil are presented in the following tables:

Table B.8.1.2.2-7 Residues of flutolanil in the treated potato trial at Goch, Northern Germany expressed in mg per tube

Post application interval (days)	Tube Replicate 1 (mg)	Tube Replicate 2 (mg)	Mean
0	12.00*	12.00*	12.00*
60	7.68	7.60	7.64
121	6.30	6.10	6.20
191	4.76	4.00	4.38
282	4.32	4.63	4.48
364	3.21	3.61	3.41
547	1.02	3.56	2.29
721	2.58	1.08	1.83

* A measured amount of 12.00 mg a.i. was the initial dose

Table B.8.1.2.2-8 Residues of flutolanil in the treated potato trial at Niederkirchen, Southern Germany expressed in mg per tube

Post application interval (days)	Tube Replicate 1 (mg)	Tube Replicate 2 (mg)	Mean
0	12.00*	12.00*	12.00*
63	8.44	5.99	7.22
119	8.26	6.95	7.61
191	8.47	4.85	6.66
282	4.93	6.06	5.50
364	3.33	3.26	3.30
547	0.81	1.58	1.20
721	1.64	1.14	1.39

* A measured amount of 12.00 mg a.i. was the initial dose

Table B.8.1.2.2-9 Residues of flutolanil in the treated potato trial at Ottersum, The Netherlands expressed in mg per tube

Post application interval (days)	Tube Replicate 1 (mg)	Tube Replicate 2 (mg)	Mean
0	12.00*	12.00*	12.00*
60	8.65	6.55	7.60
121	6.73	9.42	8.08
190	6.71	6.99	6.85
284	5.82	8.22	7.02
364	3.52	5.72	4.62
547	3.55	2.83	3.19
721	3.02	2.50	2.76

* A measured amount of 12.00 mg a.i. was the initial dose

Table B.8.1.2.2-10 Residues of flutolanil in the treated potato trial at Manningtree, United Kingdom expressed in mg per tube

Post application interval (days)	Tube Replicate 1 (mg)	Tube Replicate 2 (mg)	Mean
0	12.00*	12.00*	12.00*
57	9.37	7.65	8.51
115	7.16	7.37	7.27
176	6.53	6.82	6.68
268	6.06	5.82	5.94
373	3.65	5.63	4.64
561	1.35	1.16	1.26
723	1.46	2.44	1.95

* A measured amount of 12.00 mg a.i. was the initial dose

Table B.8.1.2.2-11 Residues of flutolanil in the soil spray trial at Ottersum, The Netherlands expressed in g ha^{-1}

Post application interval (days)	Subplot 1	Subplot 2	Subplot 3	Subplot 4	Mean Flutolanil (g ha^{-1})	Standard deviation

0	7755*	1806*	4215*	1773*	3887*	2821*
60	2625	2418	1442	3858	2586	993
121	2585	5600	1727	1216	2782	1962
190	1517	1730	1260	1007	1378	313
282	1275	798	1299	1047	1105	234
366	1232	2223	576	1200	1308	681
549	530	1353	285	650	704	458
721	1440	1292	485	542	939	497

* Residues calculated from the 0 - 20 cm depth increment

Table B.8.1.2.2-12 Residues of flutolanil in the soil spray trial at Manningtree, United Kingdom expressed in g ha^{-1}

Post application interval (days)	Subplot 1	Subplot 2	Subplot 3	Subplot 4	Mean Flutolanil (g ha^{-1})	Standard deviation
0	7320*	13650*	8925*	4755*	8663*	3742*
60	2930	4359	6953	3029	4317	1874
118	1776	2834	1505	6362	3119	2236
180	734	2048	3371	2679	2208	1121
271	174	854	3629	1727	1596	1497
376	572	453	524	522	518	49
563	243	387	60	156	212	139
727	23	225	504	510	315	236

* Residues calculated from the 0 - 20 cm depth increment

III. CONCLUSIONS

Flutolanil was found to have low mobility under field conditions at the six trials in Europe despite precipitation plus irrigation usually in excess of historical average precipitation. Greater than 95% of the applied flutolanil remained in the surface to 20 cm soil layer in all four soil types. In fact, at the two soil spray sites (Ottersum, Netherlands and Manningtree, UK) there were only a few sporadic residues detected below 20 cm and these residues were close to the limit of quantification. For the treated potato trials, small amounts of flutolanil were found in the 20 to 35 cm soil layer at a few sampling intervals but this did not exceed 5% of applied dose. Manningtree has the lightest soil with the highest sand content (sandy loam) and lowest organic carbon (0.9 % average) of the four sites and represents the worst case soil with respect to leaching potential. Even in this worst case soil with respect to leaching potential almost all of the parent stayed in the surface to 20 cm layer. No residues were found below 35 cm except for one sporadic detection at Manningtree close to the limit of quantification. This field study demonstrates the low potential for unsaturated zone movement and negligible -potential for flutolanil to appear in groundwater.

RMS remarks renewal

- Study can be used to derive half-lives, after normalisation. Check for outliers. The half-lives from the experiments with the treated tubers are indicative. Only one half-life per soil should be derived.
- To clarify the section on the distance of the weather station from the test site the RMS checked the approximate distances using digital maps (publicly available website):
  - Goch & Ottersum; for both locations weather data are taken from Agroplan, Berliner Straße 75 Goch D-47574 Germany, in the *same municipality* as the trial site Goch and *about 10 km* from trial site Ottersum (From February to April 1999 inclusive, air temperature, soil temperature and rainfall were measured at the Agroplan trial site), from Haus Riswick weather station: Landwirtschaftskammer Rheinland, Elsenpaß 5, Hausriswick, D-47533 Kleve-kellen, Germany (From May 1997 to January 1999 inclusive,

air temperature and rainfall, site about *7 km* from the Agroplan trial site, Goch and about *15 km* from Ottersum.), and from Liedener Ringstraße weather station: Deutscher Wetterdienst Aubenstelle Bocholt, Liedener Ringstraße, D-46395 Bocholt- Liedern, Germany (Evaporation was obtained from Liedener Ringstraße, Bocholt about *37 km* from the Agroplan trial site, and *about 50 km* from Ottersum)

- Niederkirchen; Station No. 02519, Neustadt, Einstrasse (Heidehof), Southern Germany *(about 10 km distance)*
- Manningtree; Rhone-Poulenc Agriculture Ltd, Aldhams Farm, Lawford, Manningtree, Essex, UK *(same municipality)*

- For a kinetic analysis of the data from this study, please refer to study CA 7.1.2.2.1/04, /05, and /06.

Previous evaluation	Submitted for the purpose of renewal
RMS remark	Acceptable

Report:	**CA 7.1.2.2.1/02. Ginzburg, N & Hardy, I. (2007)**
Title:	Field soil dissipation of flutolanil in a typical potato growing area following one application of Flutolanil 40SC under field conditions (the Netherlands – season 2005)
Document No:	FA-26-05-01, (E-3042)
Guidelines:	-
Testing laboratory:	Battelle Geneva Research Centres, Geneva, Switzerland
GLP:	Yes

Executive Summary:

The dissipation behaviour of flutolanil under field conditions was determined at two locations in the Netherlands, Ubachsberg and Amstenrade (loam and silt loam soils respectively), after a single application of Flutolanil 40SC at a nominal application rate of 4500 g a.s. /ha. Flutolanil was sprayed directly to the bare soil followed by incorporation into the soil matrix. Twenty replicate soil cores of 0-30 and 30-60 cm depth each were sampled from the treated plots and ten from the control plot before application, just after the application and at 7 more time points up to about 18 months. The soil cores were cut into 10 cm segments and the 20 replicate cores (10 for control plots) were homogenized by hand to provide a single sample for extraction and analysis by a validated GC/MSD method.

In the Ubachsberg trial (FA-26-05-01/01), flutolanil residues were found predominantly in the first layer (0-10 cm) and decreased with time from 2.5 mg/kg (3 hours after application) to 0.047 mg/kg at 537 DALA.

In the Amstenrade trial (FA-26-05-01/02), flutolanil residues were similarly found predominantly in the 0-10 cm layer and also decreased with time from 2.0 mg/kg (3 hours after application) to 0.11 mg/kg at 542 DALA.

MATERIALS AND METHODS

A. MATERIALS

1. Name (formulated products): Flutolanil 40 SC

Batch number:	3AE8801F
Active ingredient:	Flutolanil
Nominal active ingredient content:	40% (400 g a.s./kg)
Measured active ingredient content:	41 % (410 g a.s/kg)

B. STUDY DESIGN AND METHODS

In-life dates:

Field phase: 07 June 2005 - 04 December 2006

Analytical phase: 06 January 2006 – 05 March 2007

Experimental design

A terrestrial field dissipation study with flutolanil formulated as a suspension concentrate, with a nominal content of 400 g a.s./kg, was conducted at two sites in The Netherlands. The product was sprayed to bare soil and immediately incorporated into the top 10-15 cm of soil. Each trial consisted of one untreated (control) plot and one treated plot, with a separation distance of at least 20 m between the plots.

Table B.8.1.2.2-13 Test Site Description

Location:	Trial FA-26-05-01/01 was located at Ubachsberg, Limburg, trial FA-26-05-01/02 was situated at Amstenrade, Limburg, the Netherlands.
Pre-treatment history	Not treated with test item or structure analogs (benzanilides) in preceding 3 years.
Fertilizers used during study	In spring 2005 and spring 2006: cow semi-liquid manure (trial FA-26-05-01/01); in spring 2005 pig semi-liquid manure and in spring 2006 cow semi-liquid manure (trial FA-26-05-01/02).
Pesticides used just before and after application	The following products were used (all herbicides): Trial FA-26-05-01/01: Date / Product / Active ingredient 15/05/05 Dual Gold s-metolachlor 960 g/l Mikado sulcotrion 300 g/l Samson nicosulfuron 40 g/l Litarol bromoxynil 250 g/l 18/09/05 Roundup glyphosate 360 g/l 02/06/06 Frontier Optima dimethenamide-P 64% Mikado sulcotrion 300 g/l Samson nicosulfuron 40 g/l Litarol bromoxynil 250 g/l 08/06/06 Roundup glyphosate 360 g/l 09/09/06 Roundup glyphosate 360 g/l Trial FA-26-05-01/02: Date / Product / Active ingredient 16/05/05 Laddok bentazon 200 g/l+ terbutylazin 200 g/l Mineral oil 27/09/05 Roundup glyphosate 360 g/l 12/10/05 Roundup glyphosate 360 g/l 06/06/06 Roundup glyphosate 360 g/l 09/09/06 Roundup glyphosate 360 g/l
Pesticides used in preceding 2 years	FA-26-05-01/01: sulcotrione 300 g/l and nicosulfuron 40 g/L (2004), sulcotrione 300 g/l and nicosulfuron 40 g/L (2003). FA-26-05-01/02: chloridazon 65%, ethofumesate 128 g/L+ desmedifam 16g/L + phenmedifam 62 g/L, metamitron 70%, trilusulfuron methyl 50%, ethofumesate 128 g/L+phenmedifam 62 g/L+ desmedifam 61 g/L, chloridazon 65%, ethofumesate 51 g/L + phenmedifam 51 g/L + metamitron 153 g/L, , metamitron 70%, chloridazon 65%, trisulfuron-methyl 50%,

	fluazifop-P-butyl 125 g/L (2004); pendimethalin 400 g/L (2X), bentazone 480 g/L, ioxynil 200 g/L, bentazone 480 g/L, ioxynil 200 g/L, pendimethalin 400 g/L, ioxynil 200 g/L, chloorthalonil 500 g/L, mancozeb 80%, chloorthalonil 500 g/L, mancozeb 80%, chloorthalonil 500 g/L, mancozeb 80%, chloorthalonil 500 g/L, mancozeb 80%, chloorthalonil 500 g/L, mancozeb 80%, kresoxim-methyl 500 g/L, mancozeb 80%, kresoxim-methyl 500 g/L, mancozeb 80%, kresoxim-methyl 500 g/L, mancozeb 80%, lambda-cyhalothrin 50 g/L, chloorthalonil 500 g/L, mancozeb 80%, lambda-cyhalothrin 50 g/L, maleine hydrazide 188 g/L
Crop history	FA-26-05-01/01: Maize 2003, 2004; FA-26-05-01/02, Onions 2003, Sugar beet 2004
Meteorological measurements	Weather data were provided by the nearest station located at 15 km from trial FA-26-05-01/01 and at 11 km from trial FA-26-05-01/02. Meteorological measurements were available in the form of daily air temperature and rainfall for both sites. Rainfall of 1119.5 mm was recorded between the application and the last sampling. The temperature during the test period ranged from -8.0°C to 36.3°C. The average atmospheric humidity was 78.6 %.

Table B.8.1.2.2-14 Soil Characterisation

Characteristic	**Trial No. FA-26-05-01/01 (Ubachsberg)**	**Trial No. FA-26-05-01/02 (Amstenrade)**
Soil Type[(A)]:	Loam[(A)]	Silt loam[(A)]
Sand [%][(A)]	39.2	13.7
Silt [%][(A)]	45.8	70.3
Clay [%][(A)]	15.0	16.0
pH :	7.7	8.0
C [% dry weight]	1.16	0.75
Organic Matter [% d.w.]	2.0	1.3
$CaCO_3$ tot %	traces	3
CEC [meq]:	9.7	8.6
Biomass (µg/g soil) [(B)]	242.5	149.0

(A) Soil classification system not reported.
(B) Time of measurement not reported.

The formulated product was applied once at a nominal application rate of 11.25 kg product/ha, which represents 4500 g a.s./ha, in 400 L water/ha. The test item was applied using a bicycle sprayer equipped with 3.5 m boom and 7 nozzles (Teejet Brown XR 11005 VS) spacing 0.5 m. Sprayer calibration was performed just prior to the application. For Trial FA-26-05-01/01, the application was performed on June 7, 2005 and the applied amount of flutolanil based on the measured amount of spray liquid used was 4623 g a.s./ha. For Trial FA-26-05-01/02, the application was performed on June 15, 2005 and the applied amount of flutolanil based on the measured amount of spray liquid used was 4367 g a.s./ha. The application rate was confirmed by analysis of three petri dishes placed within the treatment area during application (measured rates (mean of 3 dishes) were 104% and 96.5% of the nominal rate in Trial FA-26-05-01/01 and Trial FA-26-05-01/02, respectively). Following application to bare soil, residues were incorporated to a depth of 10-15 cm using a rotary cultivator.

Table B.8.1.2.2-15 Experimental design, plot set up and application details

Details	Trial No. FA-26-05-01/01 (Ubachsberg)	Trial No. FA-26-05-01/02 (Amstenrade)
Duration of study	Ca 540 days	
Uncropped (bare) or cropped	Bare	
Number of plots per trial	1 treated and 1 untreated control	
Number of subplots per plot	4	
Treated plot dimensions:	29 m x 3.5 m (101.5 m^2)	
Untreated control plot dimensions:	15 m x 3.5 m (52.5 m^2)	
Distance between control plot and treated plot	20.5m	
Application rate used (g a.s./ha)	4500 g a.s./ha	
Application date	June 7, 2005	June 15, 2005
Application method	Bicycle sprayer equipped with 3.5 m boom and 7 nozzles	
Volume of spray solution applied	400 L/ha	
Identification and volume of carrier used	Tap water	
Meteorological conditions during application		
Air temperature (°C)	14.6	26.5
Wind	1.5 m/s (NW)	0 m/s

Sampling

Samples were collected using a Humax soil sampler. One soil sample was taken before application for soil characterisation. Twenty replicate soil cores of 0-30 and 30-60 cm depth each were sampled from the treated plots and ten from the control plot for each sampling. Samplings were performed before application (0 days, –1 hour) on the control plots and just after the application (0 days, +3hours) on the treated plots. On the treated plot of trial FA-26-05-01/01, the first sampling at 0 DALA was stopped due to a mechanical defect of the drilling machine. Therefore additional samplings on this plot were performed at 9 DALA to complete the first sampling. Further samplings were performed on both trials sites at 59-63, 119-120, 180-181, 271-272, 360-362, 450-454 and 537-542 DALA. The untreated plot was sampled first, followed by the treated plot, for both trials. Samples were frozen within a few hours from collection and kept frozen during transport to and storage at the analytical laboratory. At the analytical laboratory, the frozen soil cores were cut into 10 cm segments and the 20 replicate cores (10 for control plots) were homogenized by hand to provide a single sample for extraction and analysis.

Analytical procedures

Flutolanil was extracted from soil samples with acetone (three extractions). After evaporation, 25 mL saturated solution of sodium chloride was added followed by three extractions with petroleum ether. The combined organic phase was dried with anhydrous sodium sulphate, evaporated to dryness (35°C) and reconstituted with petroleum ether followed by clean-up on a column containing aluminium oxide. The column was eluted with diethyl ether, the diethyl ether was evaporated to dryness with a

stream of nitrogen and following reconstitution in hexane/ethyl acetate (7:3), the sample was analysed by GC-MSD . The method was validated in agreement with SANCO3029/99 rev.4 of 11/07/00 with respect to interference (none >30% of LOQ), linearity (linear in range 0.025-0.50 µg/mL, R^2 0.992), and recovery and repeatability by fortification of control soil samples with flutolanil (fortification levels ca 0.005 mg/kg (n=10, mean recovery 90.8%, RSD 10.5%), 0.05 mg/kg (n=10, mean recovery 82.8%, RSD 18.8%) and 0.01, 0.1, 1.8, 3.5 and 6.0 mg/kg (n=1 each, recoveries in range 83.3-114%). The validated LOQ was 0.005 mg/kg.

RESULTS

The results for the analysis of chlorothalonil are shown in the tables below.

In trial FA-26-05-01/01, flutolanil residues were found predominantly in the first layer (0-10 cm) and decreased with time from 2.5 mg/kg (3 hours after application) to 0.047 mg/kg at 537 DALA. In trial FA-26-05-01/02, flutolanil residues were also found predominantly in the first layer (0-10 cm) and decreased with time from 2.0 mg/kg (3 hours after application) to 0.112 mg/kg at 542 DALA.

For a kinetic analysis of the data from this study, please refer to study CA 7.1.2.2.1/04 (modelling endpoints) and -05 (trigger endpoints).

Table B.8.1.2.2-16 Residues of flutolanil in treated soil - Trial No. FA-26-05-01/01 (Ubachsberg)

Sample No.	DALA	0-10 cm (mg/kg)	10-20 cm (mg/kg)	20-30 cm (mg/kg)	30-60 (mg/kg)	Total (mg/kg)
NLS 107	0	2.488	0.020	-	-	2.508
NLS 108	9	2.263 *	0.035	-	-	2.298
NLS 113 and 114	59	1.727	0.038	0.007	0.006	1.790**
NLS 117 and 118	120	0.716	0.030	< LOQ	< LOQ	0.747
NLS 121 and 122	181	0.575	0.024	0.011	< LOQ	0.610
NLS 141 and 142	272	0.266	0.034	0.006	ND	0.307
NLS 151 and 152	360	0.059	0.012	ND	ND	0.071
NLS 157 and 158	454	0.129	0.012	< LOQ	ND	0.141
NLS 168 and 169	537	0.017*	0.030	< LOQ	ND	0.047

All residues expressed as mg/kg soil dry weight

- = Not extracted

** = Average of two extraction sets*

*** = Value recalculated to correct for summing error in report taking account of the change in soil depth in the 30-60 cm depth (reported value was 1.778 mg/kg.*

ND = Not detected (<30% of LOQ, i.e. <0.0015)

LOQ = 0.005 mg/kg

Table B.8.1.2.2-17 Residues of flutolanil in treated soil - Trial No. FA-26-05-01/02 (Amstenrade)

Sample No.	DALA	0-10 cm (mg/kg)	10-20 cm (mg/kg)	20-30 cm (mg/kg)	30-60 (mg/kg)	Total (mg/kg)
NLS 125	0	1.974	0.027	ND	-	2.001
NLS 129 and 130	63	0.769	0.060	0.005	0.029	0.921 **
NLS 133 and 134	119	0.513	0.092	< LOQ	ND	0.605
NLS 137 and 138	180	0.516	0.089	0.029	ND	0.634
NLS 145 and 146	271	0.447 *	0.202	0.013	ND	0.663
NLS 153 and 154	362	0.069	0.039	< LOQ	ND	0.108
NLS 161 and 162	450	0.160	0.025	< LOQ	ND	0.186
NLS 171 and 172	542	0.099	0.013	< LOQ	< LOQ	0.112

All residues expressed as mg/kg soil dry weight

- = Not extracted

* = Average of two extraction sets

** = Value recalculated to correct for summing error in report taking account of the change in soil depth in the 30-60 cm depth (reported value was 0.863 mg/kg).

ND = Not detected (<30% of LOQ, i.e. <0.0015)

LOQ = 0.005 mg/kg

Table B.8.1.2.2-18 Residues of flutolanil in control soil of Trial FA-26-05-01/01 and FA-26-05-01/02

Ubachsberg FA-26-05-01/01 Control Plot						
Sample N°	DALA	0-10cm [mg/kg]	10-20cm [mg/kg]	20-30cm [mg/kg]	30-60cm [mg/kg]	Total [mg/kg]
NLS 105 and 106	0	ND	ND	-	-	ND
NLS 111 and 112	59	ND	ND	-	-	ND
NLS 115 and 116	120	ND	-	ND	-	ND
NLS 119 and 120	181	ND	-	-	ND	ND
NLS 139 and 140	272	ND	ND	-	-	ND
NLS 149 and 150	360	ND	ND	-	-	ND
NLS 155 and 156	454	ND	ND	-	-	ND
NLS 167	537	< LOQ	ND	-	-	< LOQ

Amstenrade FA-26-05-01/02 Control Plot						
Sample N°	DALA	0-10cm [mg/kg]	10-20cm [mg/kg]	20-30cm [mg/kg]	30-60cm [mg/kg]	Total [mg/kg]
NLS 123 and 124	0	ND	ND	-	-	ND
NLS 127 and 128	63	ND	ND	-	-	ND
NLS 131 and 132	119	ND	-	ND	-	ND
NLS 135 and 136	180	ND	-	-	ND	ND
NLS 143 and 144	271	ND	ND	-	-	ND
NLS 147 and 148	362	ND	ND	-	-	ND
NLS 159 and 160	450	ND	ND	-	-	ND
NLS 170	542	< LOQ	< LOQ	-	-	< LOQ

" -" = Not extracted

ND = Not Detected (< 30 % LOQ) LOQ = 0.005 mg/kg

CONCLUSIONS

Under field conditions in the Netherlands following incorporation of the test item into the soil matrix (treatment in June 2005), flutolanil residues were found predominantly in the first layer (0-10 cm) and decreased from 2.0-2.5 mg/kg (3 hours after application) to 0.047-0.112 mg/kg at 537-542 days after application.

RMS remarks renewal

- At the analytical laboratory, the 10 cm segments of the 20 replicate frozen cores from each treated plot were homogenized to provide a single sample for extraction and analysis. This procedure is not in line with the recommendation by the EFSA Guidance Document for evaluating laboratory and field dissipation studies to obtain DegT50 values of active substances of plant protection products and transformation products of these active substances in soil (EFSA Journal 2014;12(5):3662), which states in Appendix E: "*It is unacceptable to mix all samples from the plot for each depth segment into one sample because it is essential for the DegT50matrix time-step normalisation procedure that there is information on the uncertainty of the measured residue at each sampling time. This allows measured time points with a large uncertainty to be allocated a lower weight in the inverse modelling procedure than measured time points with a small uncertainty (e.g. often the scatter immediately after application is larger than at later sampling times).*". This flaw does not exclude the acceptability of the study.
- During the study, a range of herbicides was applied. It was not reported that the plots were free of weeds throughout the study. Since flutolanil is a systemic compound, the presence of weeds on the test plots is not acceptable in case the study is used to derive DegT50 values. Notifier stated, in a personal communication, that the sites were maintained free of weeds for the duration of the study. This was mainly due to the application of a product containing glyphosate during the study. According to applicant, this resulted in the assumed clearance of weeds. No clear guidance is available on this point. OECD guidance for Conducting Pesticide Terrestrial Field Dissipation Studies does not describe clear criteria on the acceptable growth of weeds. Based on expert judgment, mainly due to the substance's sorption behavior, RMS considers it unlikely that the occurence of weeds would have lead to unacceptable removal of the substance via plant uptake. see also the applicant statement in study CA 7.1.2.2.1/04.
- The study states that soil samples may have been kept frozen for up to 19 months prior to analysis. Storage stability data in the DAR (Volume B.8, page 138) demonstrate that flutolanil is stable in soil at -20°C for up to 12 months. Notifier demonstrated, in a personal communication, that the maximum lenght of storage before analysis was in all cases < 12 months. The longest period of storage was 8 months for the zero and nine day samples from both trials.
- The classification system (USDA, BBA) for the soil texture data was not reported. It was not reported for which soil layer the soil properties were determined. Notifier demonstrated, in a personal communication, what the soil classification is:

	FA-26-05-01 Ubachsberg	**FA-26-05-01/ 02 Amstenrade**
Sand	39.2	13.7
Silt	45.8	70.3
clay	15.0	16.0
USDA	loam	Silt loam
BBA	Silty clay	Clayey silt

The soil sample was taken from the top 0-10 cm layer.

- Overall evaluation: The study is acceptable to derive DT50 values for dissipation and to derive DegT50 values for modelling.

- For a kinetic analysis of the data from this study, please refer to study CA 7.1.2.2.1/04 (modelling endpoints) and -05 (trigger endpoints).

Previous evaluation	Submitted for the purpose of renewal
RMS remark	Supporting

Report:	**CA 7.1.2.2.1/03. Castro, L. (1994)**
Title:	Dissipation of Flutolanil on Bare Soil Following Application of Flutolanil 50WP, USA, 1989
Document No:	E-3018
Guidelines:	164-1
Testing laboratory:	NOR-AM Chemical Company, NC, USA
GLP:	Yes

Executive Summary

The dissipation behaviour of flutolanil under field conditions was determined in a trial in Cantonment, Florida, USA. A single application of the formulation Flutolanil 50WP was applied to bare loam soil on 15 August 1989, at an application rate equivalent to 2.20 kg a.s./ha. Soil samples (5 replicate cores from each of three subplots) were collected to a depth of 90 cm on day 0, 1, 29, 63, 121, 182, 220, 274, 364, 455 and 546 following application, separated into segments (0-8, 8-15, 15-30, 30-46, 46-61, 61-76, and 76-91 cm increments) and analysed for flutolanil and its metabolite desisopropyl flutolanil (M-4) using a validated GC/NPD method (LOQ 0.01 mg/kg).

Residues of flutolanil were detected in the 0-8 cm soil horizon until 546 DAA. The highest flutolanil residue in the 0-8 cm depth occurred on Day zero at a concentration of 2.13 to 2.51 mg/kg which declined to 0.14-0.19 mg/kg by 546 DAA. Low concentrations of flutolanil were detected in the 8-15 cm layer between day 0 and 455 (max 0.10 mg/kg in any subplot). Flutolanil residues were also detected in the 15-30 cm layer between day 1 and day 182, with a maximum level in any subplot of 0.97 mg/kg on day 1. No residues above the LOQ (0.01 mg/kg) were found below the 15-30 cm layer. Desisopropyl flutolanil concentrations were detected on 3 occasions in the 0-8 cm soil depth at a maximum concentration of 0.02 mg/kg at 63 DAA (3 subplots), 182 DAA (1 subplot) and 220 DAA (1 subplot), and at one occasion (29DAA) in one subplot of the 15-30 cm segment, also at 0.02 mg/kg. No desisopropyl flutolanil residues above the LOQ (0.01 mg/kg) were detected at other soil depths in the treated plot.

MATERIALS AND METHODS

A. MATERIALS

1. Name (formulated product): Flutolanil 50WP
Batch number: 22971301
Active ingredient: Flutolanil
Nominal active ingredient content: 50 % w/w
Actual active ingredient content: 49.2 % w/w

B. STUDY DESIGN AND METHODS

In-life dates: 15 August 1989 – 28 January 1992

Experimental design

A terrestrial field dissipation study with flutolanil formulated as 50% WP, a wettable powder containing 49.2% a.s. w/w, was conducted under field conditions after application to bare soil at a site in Cantonment, Florida, USA. One treated plot and one control plot were maintained.

Table B.8.1.2.2-19 Test Site Description

Location:	Cantonment, Florida, USA
Pre-treatment history	Not treated with test item in preceding 3 years.
Crop history	Treated plot: Corn, Oats (1986); Soybeans, Wheat, Corn (1987); Wheat (1988).
Pesticides used in preceding 3 years	Treated plot: alachlor & atrazine (1986); none in 1987 and 1988.
Pesticides used just during trial	The following maintenance products were used (all herbicides):

Date	Formulation	Rate
5/31/89	BENEFIN 1.5EC	2.24 kg ai/ ha
8/24/89	GLYPHOSATE 4L*	2.24 kg ai/ ha
3/9/90	GLYPHOSATE 4L*	2% solution
3/26/90	PARAQUAT DICHLORIDE 1.5L	0.53 kg ai/ ha
4/23/90	GLYPHOSATE 4L* prime oil	2% solution 2.34 l fp/ ha
6/14/90	GLYPHOSATE 4L* prime oil	2% solution 27 mL/ 3.785 l water
11/19/90	GLYPHOSATE 4L* prime oil	2% solution 27 mL/ 3.785 l water

* applied to alleys only.

Prior to application soil cores for soil characterization (0-90 cm) were taken. Details are provided below.

Table B.8.1.2.2-20 Soil Characterisation Cantonment, Florida, USA

Parameter	**Depth**					
	0-15	**15-30**	**30-46**	**46-61**	**61-76**	**76-91**
Texture Class	loam	loam	loam	Sandy-clay loam	clay-loam	clay-loam
pH	6.4	6.4	5.6	5.4	5.3	5.2
Organic carbon (%)	2.2	2.4	nm	nm	nm	nm
Cation exchange capacity (meq/100 g)	6.3	8.6	5.5	4.9	5.4	4.7
Sand % Silt % Clay %	45 36 19	47 30 23	43 32 25	45 28 27	41 30 29	39 30 31
Moisture water holding capacity (%) at 0.33 bar	17	18	19	24	26	25

nm = not measured

The formulation Flutolanil 50WP was applied once at an application rate equivalent to 2.20 kg a.s./ha to a bare soil plot. Treated and untreated plots measured 12 x 48 m (576 m^2) and 24 m x 48 m (1152 m^2) respectively. Each plot was divided into 3 subplots.

Experimental design, plot set up and application details

Details	Cantonment, Florida, (USA)
Duration of study	546 days
Uncropped (bare) or cropped	Bare
Controls used	Yes
Number of plots	1 treated and 1 untreated (control)
Treated plot dimensions:	12 m x 48 m (576 m^2)
Untreated control plot dimensions:	24 m x 48 m (1152 m^2)
Distance between control plot and treated plot	Not reported
Application rate used (g a.s./ha)	2.20 kg a.s./ha
Application date	15 August 1989
Application method	Broadcast sprayer
Volume of spray solution applied	140 L/ha
Identification and volume of carrier used	Not reported
Meteorological conditions during application	
Air temperature (°C)	22
Wind	4.3 km / hour
Meteorological conditions during trial	Daily air temperature, soil temperature (at 50 and 200 mm depth) and rainfall data recorded on site were provided in the report. Rainfall was supplemented with irrigation to provide reasonable agreement with 10-year rainfall averages (dates 15-Aug-89, 12-Sep-89, 06-Nov-89, 06-Aug-90, 16-Aug-90 and 17-Oct-90, amounts of 6.35, 3.18, 28.7, 19.05, 33.02 and 29.46 mm, respectively). An overview of weather data and comparison with historical records is provided below:

Trial month	Average air temperatures (°C)			Total water on trial plots (mm)	
	during trial	previous ten years	difference	Trial month (cumulative)	previous ten years
Aug-89	27	26	0	46	177
Sep-89	24	24	0	284	325
Oct-89	19	19	0	343	405
Nov-89	15	15	0	647	508
Dec-89	7	11	-4	792	606
Jan-90	13	8	4	981	734
Feb-90	15	11	4	1198	882
Mar-90	16	15	2	1466	1049
Apr-90	18	18	0	1544	1156
May-90	23	22	1	1663	1267
Jun-90	26	26	0	1758	1395
Jul-90	27	27	0	1875	1564
Aug-90	27	26	1	1984	1741
Sep-90	25	24	0	2038	1889
Oct-90	20	19	0	2183	1969
Nov-90	16	15	0	2266	2073
Dec-90	14	11	3	2331	2170
Jan-91	11	8	3	2803	2298
Feb-91	13	11	3	2810	2446

Sampling

Samples from the treated plot were collected on the day before treatment, on day zero after application and at further intervals of 1, 29, 63, 121, 182, 220, 274, 364, 455 and 546 days after application (DAA). Cores from the control plot were sampled on the day before treatment and the

following days 1, 29, 182, 220 and 546 days after application (DAA). At each sampling date five replicate soil cores of 0-15cm depth, followed by five replicate soil cores 15-90cm depth were sampled from three subplots for both the treated and control plots. Soil cores were processed into the appropriate horizon (0-8, 8-15, 15-30, 30-46, 46-61, 61-76, and 76-91 cm increments). Segments from each layer were combined per subplot and homogenised. All samples were then frozen for transport to the analytical laboratory.

Analytical procedures

Soil cores were analysed separately for flutolanil and its metabolite desisopropyl flutolanil (M-4).

Flutolanil

Aliquots of each soil sample (50 g) were extracted with acetone / water (9:1, *v/v*) for 30 minutes at ambient temperature. Extracts were filtered, concentrated (40°C) and subjected to several clean up steps including liquid-liquid partioning with hexane and a Florisil column clean-up before the concentrated residue was redissolved in ethyl acetate/hexane (20:80, *v/v*) and analyzed by GC/NPD.

Desisopropyl flutolanil

Aliquots of each soil sample (50 g) were extracted with acetone / water (9:1, *v/v*) for 30 minutes at ambient temperature. Extracts were filtered, concentrated (40°C) and subjected to liquid-liquid partioning with dichloromethane before the desisopropyl flutolanil residues were derivatised with sodium iodide and sodium hydroxide to dimethyl desisopropyl flutolanil. The concentrated residue was dissolved in hexane and the levels of dimethyl desisopropyl flutolanil determined by GC/NPD.

The calibrated ranges were 0.05-5 mg/L and 0.4-1.2 mg/L for flutolanil and dimethyl desisopropyl flutolanil, respectively (calibration curves not provided). The efficiency of the analytical method for the determination of flutolanil and desisopropyl flutolanil was tested by fortifying untreated soil samples with each compound at target concentrations 0.01, 0.05, 0.2 and 0.5 mg/kg and analysing these samples concurrently with the study samples. Recovery and repeatability for flutolanil determined this way were acceptable: at 0.01 mg/kg mean recovery 98%, RSD 16%, n=26; at 0.05 mg/kg mean recovery 98%, RSD 9%, n=8; at 0.2 mg/kg mean recovery 101%, RSD 10%, n=17; at 0.5 mg/kg mean recovery 94%, RSD 8%, n=3. Recovery and repeatability for desisopropyl flutolanil were also acceptable: at 0.01 mg/kg mean recovery 83%, RSD 13%, n=26; at 0.05 mg/kg mean recovery 82%, RSD 17%, n=12; at 0.2 mg/kg mean recovery 84%, RSD 13%, n=14; at 0.5 mg/kg mean recovery 90%, RSD 2%, n=2. The LOQ for both compounds was 0.01 mg/kg. Reported residues were corrected for overall mean recovery (98% and 83% for flutolanil and desisopropyl flutolanil, respectively).

RESULTS

Measured residues of flutolanil and desisopropyl flutolanil in all of the control samples were <LOQ (<0.01 mg/kg). The measured residues of flutolanil and desisopropyl flutolanil in samples from the treated plot are presented in the tables below.

Residues of flutolanil were detected in the 0-8 cm soil horizon until 546 DAA. The highest flutolanil residue in the 0-8 cm depth occurred on Day zero at a concentration of 2.13 to 2.51 mg/kg which declined to 0.14-0.19 mg/kg by 546 DAA. Low concentrations of flutolanil were detected in the 8-15

cm layer between day 0 and 455 (max 0.10 mg/kg in any subplot). Flutolanil residues were also detected in the 15-30 cm layer between day 1 and day 182, with a maximum level in any subplot of 0.97 mg/kg on day 1. No residues above the LOQ (0.01 mg/kg) were found below the 15-30 cm layer. Desisopropyl flutolanil concentrations were detected on 3 occasions in the 0-8 cm soil depth at a maximum concentration of 0.02 mg/kg at 63 DAA (3 subplots), 182 DAA (1 subplot) and 220 DAA (1 subplot), and at one occasion (29DAA) in one subplot of the 15-30 cm segment, also at 0.02 mg/kg. No desisopropyl flutolanil residues above the LOQ (0.01 mg/kg) were detected at other soil depths in the treated plot.

Table B.8.1.2.2-21 Flutolanil residues in soil samples from Cantonment (Florida)

Sample Time (DAA)	Sample Date	Sub-plot	Residue Level (mg/kg_{dry})						
			0-8 cm	8-15 cm	15-30 cm	30-46 cm	46-61 cm	61-76 cm	76-91 cm
-1	14 August 1989	02	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
		53	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
		11	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
0	15 August 1989	76	2.51	0.02	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
		36	2.45	0.05	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
		30	2.13	0.10	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1	16 August 1989	45	2.24	< 0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01
		54	2.50	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
		05	2.37	< 0.01	0.97	< 0.01	< 0.01	-	-
29	13 September 1989	01	0.49	< 0.01	0.15	< 0.01	< 0.01	-	-
		13	0.66	< 0.01	0.20	< 0.01	< 0.01	-	-
		80	0.80	< 0.01	0.11	< 0.01	< 0.01	-	-
63	17 October 1989	27	0.45	< 0.01	0.02	< 0.01	< 0.01	-	-
		46	0.41	< 0.01	0.01	< 0.01	< 0.01	-	-
		41	0.70	0.02	0.05	< 0.01	< 0.01	-	-
121	14 December 1989	04	0.41	< 0.01	0.04	< 0.01	< 0.01	-	-
		22	< 0.01[a]	0.31[a]	< 0.01	< 0.01	< 0.01	-	-
		42	0.31	0.02	< 0.01	< 0.01	< 0.01	-	-
182	13 February 1990	48	0.34	0.03	< 0.01	< 0.01	< 0.01	-	-
		07	0.41	< 0.01	0.02	< 0.01	< 0.01	-	-
		08	0.76	0.02	0.04	< 0.01	< 0.01	-	-
220	23 March 1990	55	0.47	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-
		65	0.51	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-
		62	0.65	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-
274	16 May 1990	33	0.40	0.02	< 0.01	< 0.01	< 0.01	-	-
		09	0.22	< 0.01	< 0.01	< 0.01	< 0.01	-	-
		71	0.46	< 0.01	< 0.01	< 0.01	< 0.01	-	-
364	14 August 1990	37	0.21	0.02	< 0.01	< 0.01	< 0.01	-	-
		19	0.20	< 0.01	< 0.01	< 0.01	< 0.01	-	-
		29	0.17	0.02	< 0.01	< 0.01	< 0.01	-	-
455	13 Novembe	18	0.20	0.06	< 0.01	< 0.01	< 0.01	-	-
		83	0.22	0.03	< 0.01	< 0.01	< 0.01	-	-

	r 1990	68	0.21	< 0.01	< 0.01	< 0.01	< 0.01	-	-
546	12 February 1991	72	0.14	< 0.01	< 0.01	< 0.01	< 0.01	-	-
		66	0.14	< 0.01	< 0.01	< 0.01	< 0.01	-	-
		75	0.19	< 0.01	< 0.01	< 0.01	< 0.01	-	-

[a] The report stated: "*Residues reported for Day 121, Sub-plot 22, 0-3 and 3-6 inch horizons have been apparently transposed. The raw data show that no detectable mistakes were made in sample handling after the samples were taken. However, the residue data indicate that a switch must have occurred at some point for the dissipation pattern to be logical. The values reported in this table have not been rearranged to correct this suspected error.*"

Table B.8.1.2.2-22 Desisopropyl flutolanil residues in soil samples from Cantonment (Florida)

Sample Time (DAA)	**Sample Date**	**Sub-plot**	**Residue Level (mg/kg$_{dry}$)**						
			0-8 cm	**8-15 cm**	**15-30 cm**	**30-46 cm**	**46-61 cm**	**61-76 cm**	**76-91 cm**
-1	14 August 1989	02	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
		53	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
		11	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
0	15 August 1989	76	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
		36	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
		30	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1	16 August 1989	45	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
		54	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
		05	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
29	13 September 1989	01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
		13	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
		80	< 0.01	< 0.01	0.02	< 0.01	< 0.01	-	-
63	17 October 1989	27	0.02	< 0.01	< 0.01	< 0.01	< 0.01	-	-
		46	0.02	< 0.01	< 0.01	< 0.01	< 0.01	-	-
		41	0.02	< 0.01	< 0.01	< 0.01	< 0.01	-	-
121	14 December 1989	04	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
		22	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
		42	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
182	13 February 1990	48	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
		07	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
		08	0.02	< 0.01	< 0.01	< 0.01	< 0.01	-	-
220	23 March 1990	55	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-
		65	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-
		62	0.02	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-
274	16 May 1990	33	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
		09	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
		71	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
364	14 August 1990	37	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
		19	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
		29	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
455	13 November 1990	18	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
		83	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
		68	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
546	12	72	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-

	February 1991	66	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
		75	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-

CONCLUSIONS

Under field conditions in the USA (Florida) following) a single application of Flutolanil 50WP equivalent to 2.2 kg a.s./ha in August 1989, residues of flutolanil were mainly confined to the 0-8 cm soil horizon (max on day zero, 2.13 to 2.51 mg/kg, declining to 0.14-0.19 mg/kg by day 546). Low concentrations of flutolanil were detected in the 8-15 cm (max in any subplot 0.10 mg/kg) and 15-30 cm layer maximum level in any subplot 0.97 mg/kg on day 1, ≤0.20 mg/kg afterwards. No residues of flutolanil above the LOQ (0.01 mg/kg) were found below the 15-30 cm layer. Desisopropyl flutolanil concentrations were detected on 4 occasions in the 0-8 or 15-30 cm soil depth at a maximum concentration of 0.02 mg/kg in any subplot.

RMS remarks renewal

- Notifier has stated in personal communication that this study was only provided as supporting information, because it concerns a study that was carried out at a site in Cantonment, Florida in the USA (Florida/Alabama borders), which does not resemble EU conditions. RMS does not consider this a valid argument, since non-EU soils can potentially be used if the characteristics are in line with OECD protocol. The notifier suggests to not use the data to determine a modelling endpoint (DegT50). RMS accepts the non-inclusion of the endpoints of this study, based on the arguments presented below.
- During the study, several herbicides were applied (mostly “applied to alleys only”; not further detailed). It was not reported that the plots were free of weeds throughout the study. Since flutolanil is a systemic compound, the presence of weeds on the test plots is not acceptable in case the study is used to derive DegT50 values. However, in CA 7.1.2.2.1/04 a reasoned statement of the applicant concerning this issue was provided.
- On days 1 and 29, unexplained elevated levels of flutolanil were observed. These could result from contamination during sampling or sample preparation or from mislabelling.
- Soil samples were kept frozen for up to 11 months prior to analysis. Storage stability data in the original DAR (Volume B.8, page 138) demonstrate that flutolanil is stable in soil at -20°C for up to 12 months, which covers the period of frozen storage of the study samples.
- Reported residues were corrected for overall mean recovery (98% and 83% for flutolanil and desisopropyl flutolanil, respectively). Such a correction is not acceptable, considering that recoveries may differ significantly per analytical batch and per fortification level. The correction for flutolanil by a factor of 100/98 will have a negligible impact on the results however. The correction for desisopropyl flutolanil by a factor of 100/83 has also no impact on the conclusions.
- Desisopropyl flutolanil was detected at up to 0.02 mg/kg. If the amount of metabolite formed would be expressed on a molar basis, the molecular weight difference and the different recovery correction factor would have to be taken into account. It can however be safely assumed that levels will be below 5% AR.

- First order DT50 calculations (results not shown in summary) based on the total mean residue (mg/kg) in the soil column were performed under the assumption that there is a fast and a slow phase. Based on visual assessment of the data, the fast SFO DT50 (41 days) was calculated from the 0-121 day data, and the slow SFO DT50 (254 days) from the 121-546 day data. These calculations were not performed in agreement with the recommendations of FOCUS Kinetics (2014) and are therefore not acceptable.

Previous evaluation	Submitted for the purpose of renewal
RMS remark	Acceptable

Report:	**CA 7.1.2.2.1/04. Hardy, I.A.J., Agostini, F., & Jastrzebski, N. (2016b)**
Title:	Flutolanil: Kinetic Modelling Analysis of Data from Field Soil Dissipation Studies Conducted in Europe Normalised to 20ºC and pF2 (Spray Application Trials)
Document No:	XG/15/023A
Guidelines:	FOCUS (2006) Guidance Document on Estimating Persistence and Degradation Kinetics from Environmental Fate Studies on Pesticides in EU Registration. The Final Report of the Work Group on Degradation Kinetics of FOCUS SANCO/10058/2005, version 2.0, June 2006. FOCUS (2014) Generic Guidance for Estimating Persistence and Degradation Kinetics from Environmental Fate Studies on Pesticides in EU Registration. Version 1.1, December, 2014. EFSA (2014). EFSA Guidance Document for evaluating laboratory and field dissipation studies to obtain $DegT_{50}$ values of active substances of plant protection products and transformation products of these active substances in soil. Approved April 2014
Testing laboratory:	Battelle UK Ltd., Chelmsford, Essex, UK
GLP:	No

Executive Summary

The aim of this report was to derive a normalised $DegT_{50}$ value (20˚C and pF2) for flutolanil using data collected from four European trials conducted in The Netherlands and the United Kingdom. Applications were made to bare soil followed by incorporation into the soil matrix.

Normalisation was conducted for soil temperature only, with soil moisture conservatively assumed as being at pF2 throughout, according to FOCUS groundwater assumptions (Ea 65.4 KJ mol^{-1} [Q_{10} of 2.58]). Where measured daily soil temperature data was not recorded on site, estimates of soil temperature were calculated using PEARL. Where PET (Potential EvapoTranspiration) data were not available, they were taken from MARS grid squares. A timestep normalization approach (FOCUS, 2006) was taken for the standardization of transformation parameters to reference soil temperature (20°C) and soil moisture (pF2) conditions.

For the Manningtree trial, day 0 residues (8662 g a.s./ha) appeared to be very high compared to the application rate of 4500 g/ha and therefore, as a more conservative approach, the data was refitted excluding the day 0 residue data. The results for the data set excluding day 0 provide a more conservative endpoint and the endpoint for the Manningtree trial is taken from the data set excluding day 0.

The optimised model fits for flutolanil at all locations showed visually and statistically acceptable fits to the data. Normalized $DegT_{50}$ values were 67.6, 116, 66.3 and 60.4 days for the Manningtree, Ottersum, Amstenrade and Ubachsberg trial, respectively.

MATERIALS AND METHODS

The purpose of this study was to evaluate the four legacy European field dissipation studies conducted in The Netherlands and the United Kingdom for derivation of modelling endpoints. The datasets collected were evaluated following FOCUS kinetics guidance (FOCUS, 2014) and EFSA guidance (EFSA, 2014) .

At each trial flutolanil was sprayed directly to the bare soil followed by incorporation into the soil (0-10cm). At the Manningtree and Ottersum test locations, soil samples from 0-10, 10-20, 20-30 and 30-60 cm were collected, at intervals up to 727 days and analysed for flutolanil. True replicate residue data were reported for four sub-plots for the test-sites. At the Amstenrade and Ubachsberg sites soil samples from 0-30 (split into 10cm increments for analysis) and 30-60 cm were collected at intervals up to 542 days, all segments were combined and analysed for flutolanil, giving a single residue value per segment for each time point. The reported residue data for the Manningtree and Ottersum trials were expressed in g a.s./ha and used in the evaluations without further processing. Residue data for the Amstenrade and Ubachsberg trials from the different soil horizons were averaged to provide a total mean value for 0-60 cm. Data was processed following FOCUS kinetics guidance. In the Amstenrade and Ubachsberg trials, the reported limit of quantitation (LOQ) for Flutolanil was 0.005 mg/kg and the limit of determination (LOD) was 0.0015 mg/kg. Reported residue values below the LOQ were recorded as ½ (LOQ + LOD) (i.e. 0.0033 mg/kg). Reported residue values below the LOD (recorded as ND) were recorded as ½LOD (i.e. 0.0008 mg/kg).

Daily weather data (air temperature and rainfall) were measured on site or at local weather stations for each trial. Measured daily soil temperature data was recorded on site for the Manningtree trial and this was used directly in the normalisation procedure. Daily soil temperature data were not available from the study reports for the Amstenrade, Ottersum and Ubachsberg trials. Therefore, estimates of soil temperature were calculated using PEARL. PET (Potential EvapoTranspiration) data were available for the Manningtree trial, but PET values for Amstenrade, Ottersum and Ubachsberg were taken from MARS grid squares: 101098, 105098 and 102098, respectively. Daily soil moisture content data for all four locations were unavailable and soil moisture content estimates were calculated using PEARL. However, in the present modelling study a conservative approach was assumed and corrections in all sites were carried out only on the base of the soil temperature, with soil moisture conservatively assumed to be at pF2 throughout (hence no correction for soil moisture).

According to EFSA guidance (EFSA, 2014) modelling endpoints of parent compounds can be derived from the legacy field dissipation studies provided rainfall data is available from a weather station within 20 km of the trial site. In the Manningtree trial, rainfall data was recorded on site, and in the remaining three trials rainfall data were obtained from weather stations located at 7-15 km from the test site. A timestep normalization approach (FOCUS, 2006) was taken for the standardization of transformation parameters to reference soil temperature (20°C) and soil moisture (pF2) conditions. For temperature correction FOCUS recommends Arrhenius or Q10 approaches (using an average Ea of 65400 J Mol-1 or Q10 factor of 2.58 [EFSA, 2007]) and for moisture content correction the Walker equation, with a B-factor (moisture exponent) of 0.7 [FOCUS, 2000]. The Arrhenius and Walker approaches can be combined to derive the equation below:

$$DT_{50ref} = DT_{50act} * e^{\frac{Ea*(T-T_{ref})}{R*T*T_{ref}}} * \left(\frac{MC_{act}}{MC_{ref}}\right)^{B}$$

Where:
DT_{50ref} is the normalized half-life at MCref and Tref

DT_{50act} is the measured half-life at MCact and T

E_a is the activation energy, 65400 J Mol-1 [EFSA, 2007]

R is the gas constant, 8.315 J/mol/K

T is the mean soil temperature during the study (K)

T_{ref} is the reference temperature (e.g. 293 K)

MC_{act} is the measured soil moisture content

MC_{ref} is the soil moisture content at the reference tension (pF2)

B is the moisture exponent, 0.7 as the FOCUS default

Please note that in the present modelling study no correction for soil moisture was carried out.

For the determination of flutolanil modelling endpoints, the timestep normalised sampling times and the soil residue data were entered into CAKE (v3.2) and optimisations carried out for the initial soil residue (M0) and the degradation rate constant (Kp) using SFO kinetics. In the first instance, the data were directly fitted in CAKE un-weighted with the complete data set and unconstrained initial concentration (M0). Confidence in the resulting parameters has been assessed visually using a three-point scale (Poor = unacceptable fit; Acceptable = the fitted curve describes the trend of the data points, residuals may show some deviation from random distribution but it is not significant; Good = the fitted curve closely follows all the data points, residuals are randomly distributed). Confidence in the resulting parameters has been assessed statistically from the probability values for a t-test of the rate parameter. The χ^2 error% parameter has been used to determine goodness of fit.

Table B.8.1.2.2-23 Summary of terrestrial field dissipation studies

Document	Location	Rate (g a.s./ha)	Soil Texture	Duration
Wicks, R. (1999) (DAR)	Manningtree, UK	4500	Sandy loam	May 05 1997 – November 09, 1998
Wicks, R. (1999) (DAR)	Ottersum, Netherlands	4500	Sandy loam	April 24 1997 – November 05, 1998
CA 7.1.2.2.1/02, Ginzburg, N & Hardy, I. (2007)	Amstenrade, Netherlands	4500	Silt loam	June 07 2005 – December 04, 2006
CA 7.1.2.2.1/02, Ginzburg, N & Hardy, I. (2007)	Ubachsberg, Netherlands	4500	Loam	June 15 2005 – December 01, 2006

Table B.8.1.2.2-24 Summary of Residue Data from Manningtree, UK

Time	Flutolanil (g ha^{-1})				
(days)	Rep 1	Rep 2	Rep 3	Rep 4	Mean
0	7320	13650	8925	4755	8662.50
60	2930	4359	6953	3029	4317.75
118	1776	2834	1505	6362	3119.25
180	734	2048	3371	2679	2208.00
271	174	854	3629	1727	1596.00
376	572	453	524	522	517.75
563	243	387	60	156	211.50
727	23	225	504	510	315.50

Table B.8.1.2.2-25 Summary of Residue Data from Ottersum, Netherlands

Time	Flutolanil (g ha^{-1})				
(days)	Rep 1	Rep 2	Rep 3	Rep 4	Mean
0	7755	1806	4215	1773	3887.25
60	2625	2418	1442	3858	2585.75
121	2585	5600	1727	1216	2782.00
190	1517	1730	1260	1007	1378.50
282	1275	798	1299	1047	1104.75
366	1232	2223	576	1200	1307.75
549	530	1353	285	650	704.50
721	1440	1292	485	542	939.75

Table B.8.1.2.2-26 Summary of Processed Residue Data from Amstenrade, Netherlands

Time	Flutolanil (mg kg^{-1})				Average
(days)	0-10cm	10-20cm	20-30cm	30-60cm	0-60cm
0	1.9743	0.0270			0.3336
63	0.7691	0.0600	0.0052	0.0287	0.1534
119	0.5125	0.0925	0.0033	0.0008	0.1018
180	0.5159	0.0893	0.0289	0.0008	0.1061
271	0.4472	0.2020	0.0134	0.0033	0.1121
362	0.0688	0.0390	0.0008		0.0181
450	0.1604	0.0254	0.0033		0.0315
537	0.0992	0.0127	0.0033		0.0192

Table B.8.1.2.2-27 Summary of Processed Residue Data from Ubachsberg, Netherlands

Time (days)	Flutolanil (mg kg^{-1}) 0-10cm	10-20cm	20-30cm	30-60cm	Average 0-60cm
0	2.4882	0.0195			0.4180
9	2.2632	0.0347			0.3830
59	1.7271	0.0379	0.0073	0.0057	0.2982
120	0.7164	0.0303	0.0033	0.0033	0.1267
181	0.5748	0.0244	0.0108	0.0008	0.1021
272	0.2660	0.0343	0.0064	0.0008	0.0515
360	0.0593	0.0117	0.0008		0.0120
454	0.1292	0.0116	0.0008		0.0236
542	0.0170	0.0300	0.0033		0.0084

Table B.8.1.2.2-28 Timestep normalised sampling times (soil temperature correction)

Amstenrade, Netherlands		Manningtree, UK			
Sampling time (days)	Timestep (days)	Sampling time (days)	Timestep (days)	*Sampling time (days)	*Timestep (days)
0	0	0	0	0	
63	58.9	60	27.9	60	0.0
119	100.8	118	72.1	118	44.2
180	124.5	180	110.6	180	82.6
271	137.9	271	134.9	271	106.9
362	180.3	376	165.6	376	137.6
450	266.7	563	276.5	563	248.5
537	317.3	727	319.0	727	291.0

Ottersum, Netherlands		Ubachsberg, Netherlands	
Sampling time (days)	Timestep (days)	Sampling time (days)	Timestep (days)
0	0	0	0
60	36.7	9	4.9
121	94.3	59	55.0
190	127.1	120	100.4
282	146.8	181	127.3
366	174.8	272	140.6
549	288.6	360	177.8
721	329.3	454	267.3
		542	320.2

* Excluding day 0

RESULTS

Graphical summaries and decision charts are shown in the tables below. For the Manningtree trial, day 0 residues (8662 g a.s./ha) appeared to be very high compared to the application rate of 4500 g/ha and therefore, as a more conservative approach, the data was refitted excluding the day 0 residue data. Although both fits are acceptable, the results for the data set excluding day 0 provide a more conservative endpoint and the endpoint for the Manningtree trial is data set is taken from the data set excluding day 0.

The optimised model fits for flutolanil at all locations showed visually and statistically acceptable (minimum Chi^2 error 12.7 – 16.3% and t-test parameter significance of >99%) fits to the data with the residual analysis plots also being satisfactory (random scatter of residuals). A high significance level

was obtained for the estimated rate parameters. Normalised $DegT_{50}$ values are summarised in Table B.8.1.2.2-34.

The report provided a comparison of the field and laboratory data using the EFSA $DegT_{50}$ comparison tool [EFSA, 2014], which indicated that the field and laboratory datasets are from different distributions and that field data should be selected for exposure assessment. This is not further considered since this exercise should be carried out after completion of the evaluation of all laboratory and field studies.

Table B.8.1.2.2-29 Graphical summary: Manningtree, UK [time zero included]

Study reference - Soil	Manningtree [time zero included] (Wicks, 1999)
Model	SFO
Visual Fit	Acceptable
Residuals (visual)	Acceptable
χ^2 error (%)	16.0
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.01413 σ: 0.01413y p (k): 2.94 x 10^{-6}
Modelling DT_{50} (days)	**49.1**
FOCUS decision step (Modelling)	SFO acceptable; SFO DT_{50} not selected since day 0 residues were very high compared to the application rate of 4500 g/ha and in a conservative approach the endpoint was taken from the refitted data excluding the day 0 residue data (see below)

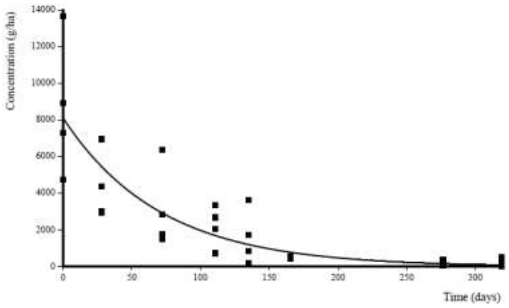
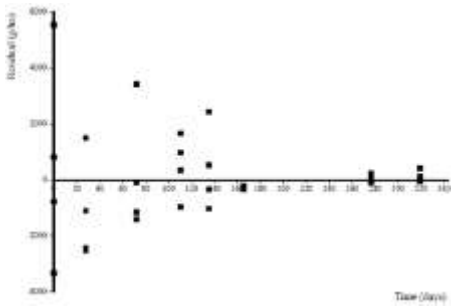
Model	Visual Fit	Residuals plot
SFO		

Table B.8.1.2.2-30 Graphical summary: Manningtree, UK [time zero excluded]

Study reference - Soil	Manningtree [time zero excluded] (Wicks, 1999)
Model	SFO
Visual Fit	Acceptable
Residuals (visual)	Acceptable
χ^2 error (%)	12.7
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.01025 σ: 0.01025y p (k): 9.30 x 10^{-5}
Modelling DT_{50}	**67.6**

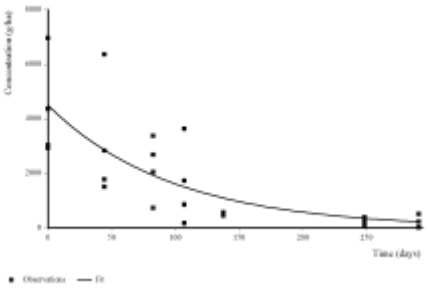
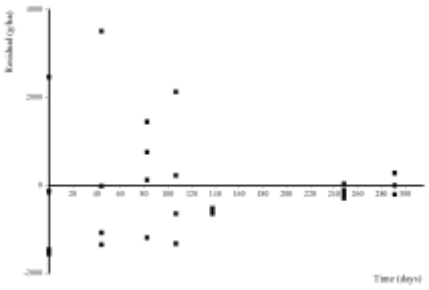
(days)		
FOCUS decision step (Modelling)	SFO acceptable; SFO DT_{50} selected	
Model	Visual Fit	Residuals plot
SFO		

Table B.8.1.2.2-31 Graphical summary: Ottersum, Netherlands

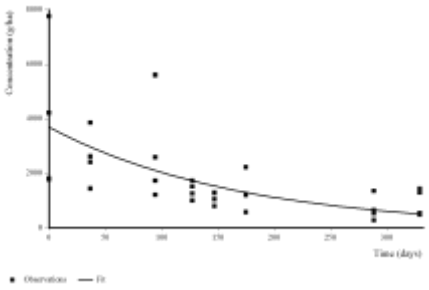
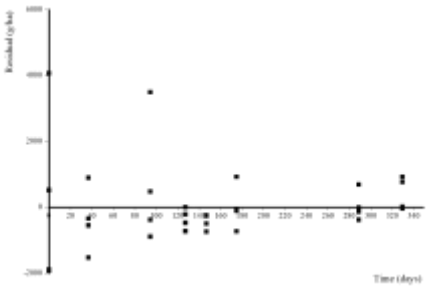
Study reference - Soil	Ottersum (Wicks, 1999)	
Model	SFO	
Visual Fit	Acceptable	
Residuals (visual)	Acceptable	
χ^2 error (%)	16.3	
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.005966 σ: 0.001577 p (k): 3.45 x 10^{-4}	
Modelling DT_{50} (days)	**116**	
FOCUS decision step (Modelling)	SFO acceptable; SFO DT_{50} selected	
Model	Visual Fit	Residuals plot
SFO		

Table B.8.1.2.2-32 Graphical summary: Amstenrade, Netherlands

Study reference - Soil	Amstenrade (Ginzburg & Hardy, 2007)	
Model	SFO	
CAKE output location (report page)	50	
Visual Fit	Acceptable	
Residuals (visual)	Acceptable	
χ^2 error (%)	15.0	
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.01046 σ: 0.001172 p (k): 5.52 x 10^{-5}	
Modelling DT_{50} (days)	**66.3**	
FOCUS decision step (Modelling)	SFO acceptable; SFO DT_{50} selected	
Model	Visual Fit	Residuals plot

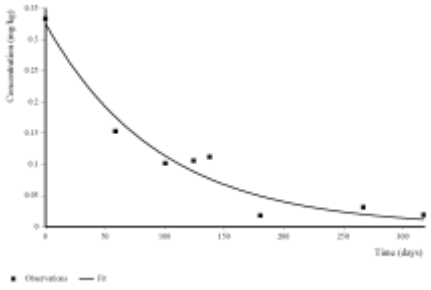
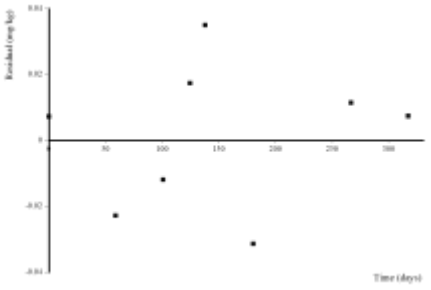
SFO		

Table B.8.1.2.2-33 Graphical summary: Ubachsberg, Netherlands

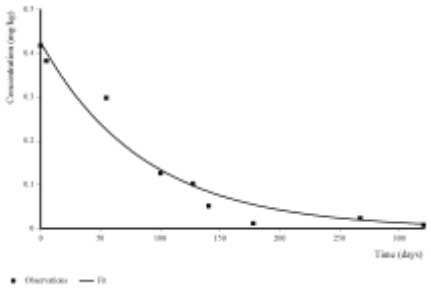
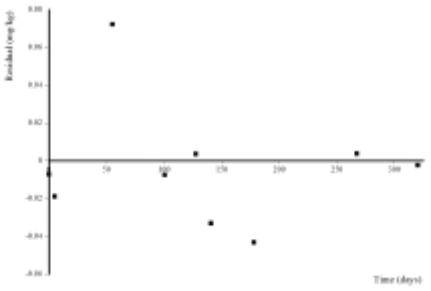
Study reference - Soil	Ubachsberg (Ginzburg & Hardy, 2007)	
Model	SFO	
Visual Fit	Acceptable	
Residuals (visual)	Acceptable	
χ^2 error (%)	15.7	
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.01148 σ: 0.00142 p (k): 4.25 x 10^{-5}	
Modelling DT_{50} (days)	**60.4**	
FOCUS decision step (Modelling)	SFO acceptable; SFO DT_{50} selected	
Model	Visual Fit	Residuals plot
SFO		

Table B.8.1.2.2-34 Modelling degradation endpoints for flutolanil in field soils with normalised datasets following FOCUS (2014) Guidance and EFSA (2014) Guidance

Trial	**M_0**	**SFO DT_{50} (days)**	**Minimum Chi^2 error (%)**	**t-test (-)**
Manningtree	4490 (g ha^{-1})	67.6	12.7	9.30E-05, >99%
Ottersum	3690 (g ha^{-1})	116	16.3	3.45E-04, >99%
Amstenrade	0.326 (mg kg^{-1})	66.3	15.0	5.52E-05, >99%
Ubachsberg	0.425 (mg kg^{-1})	60.4	15.7	4.25E-05, >99%

CONCLUSIONS

A normalised $DegT_{50}$ of flutolanil was derived from four legacy European field dissipation studies (from 1997 and 2006, spray application to bare soil, seed potato crop in two trials) following FOCUS kinetic guidance (FOCUS, 2014) and EFSA guidance (EFSA, 2014). Normalized $DegT_{50}$ values were 67.6,

116, 66.3 and 60.4 days for the Manningtree, Ottersum, Amstenrade and Ubachsberg trial, respectively.

RMS remarks

- A few discrepancies were noted in the data sets used for modelling and those in the original study report by Ginzburg & Hardy (2007). The day of the last sampling was exchanged (537 days in Amstenrade instead of 542 days; 542 days in Ubachsberg instead of 537 days) and in a few cases values reported as <LOQ were taken as <LOD or vice versa. These discrepancies are minor and considered to have a negligible impact on the modelling results.
- During the PEARL estimations for the Ottersum trial, the organic matter content of the top 0-30 and 30-60 cm, respectively, of the soil was set at 0.014 and 0.009 kg/kg, equivalent to 1.4% and 0.9%. The reported organic carbon content of the top 0-30 and 30-60 cm of the Ottersum soil however was 2.4% and 1.5%, equivalent to 4.1% and 2.6% organic matter. This parameters is shown in the PEARL output as the CntOm factor. At the RMS request, the applicant provided new simulations with an adjusted organic matter content of the PEARL modelling for the Ottersum trial. This had limited effect on the time-steps, and therefore the kinetic results are still valid.
- The residue levels in Amstenrade and Ubachsberg trials were expressed in mg/kg and were not converted to g a.s./ha, presumably due to missing soil density data at each sampling time. This may lead to some inaccuracy but the visual fits showed a regular decline and residuals distributions were acceptable for these trials and did not suggest a relevant influence of this factor.
- At the Manningtree and Ottersum trial plots, seed potatoes were planted to a depth of about 20 cm prior to treatment and flutolanil was sprayed onto the bare ground and incorporated to about 10 cm. At the normal harvest date the potato crop was treated with a non-residual total herbicide and left undisturbed in the soil. A grass cover crop was then sown with minimal disturbance of the soil. Since flutolanil is a systemic compound, the presence of a potato crop, grass or weeds on the test plots is not acceptable since uptake and metabolism by plants may contribute to the disappearance of flutolanil from the soil.

  The notifier was requested to justify why the normalized DT50 values from the Manningtree and Ottersum trials are valid in spite of the potential uptake and metabolism of flutolanil by potato crop, grass or weeds on the test plots.

  Notifier replied with reference to a potato metabolism study (KCA 6.2.1/06) and modelling evaluations of the field study:

Reaction notifier to RMS requests.

When 253.02 mg of flutolanil was applied to soil in a greenhouse at rate equivalent to 2530.2 g a.s/ha planted with potatoes at a rate of 10 potatoes per 1 m^2 only 2.9% of the applied flutolanil was removed from the soil by the plants over the duration of the study see table below.

Sample	Quantity of crop removed	Sampling interval after application (days)	Harvest interval	Weight (g)	mg a.s/kg	mg flutolanil
Immature Harvest 09/03/2015	Approximately 50% of crop	90 days after application	Immature Foliage	2142	2.459	5.267
			Immature tuber	1480	0.726	1.074
Mature Harvest 10/04/2015	Remainder of crop	122 days after application	Mature tuber	1937	0.492	0.953
					Total in plants	7.295
					% removed by plants	2.9

As this shows that such a small percentage of flutolanil is taken up by the plants. The notifier feels the normalised DT_{50} values determined from the Manningtree and Ottersum trials planted with potatoes are therefore valid.

The EFSA Guidance Document to obtain $DegT_{50}$ values Appendix A, Section B, page 20 states where robust data are available in the dossier to allow it to be confirmed that crop uptake is not a significant route of dissipation from soil for any of the compounds of interest (for example evidence from following crop metabolism studies), it is an option that both plots maintained bare and plots where grass will germinate be prepared, with parallel experiments being set up on both types at each study site. The notifier would therefore like to reiterate that as it has been shown that minimal flutolanil is taken up by plants, less than 3% in the potato metabolisim study above, the $DegT_{50}$ values from the available field trials are valid.

Estimates of plant uptake from the Manningtree and Ottersum field dissipation trials have also been made with PEARL simulations. Site-specific soil, climatic and crop data was entered into PEARL 4.4.4 and simulations for flutolanil made using parameters as for the reported PECgw evaluations, with one difference that PUF was set as 0.5:

Manningtree trial 1997-1999:

Year	Crop	AmApp (kg/ha)	AmUpt (kg/ha)
1997	Potato	4.5	9.86E-02
1998	Grass	0.0	1.66E-02
1999	Grass	0.0	1.11E-03
		Total uptake	1.16E-01
		Percent of applied	**2.58%**

Ottersum trial 1997-1999:

Year	Crop	AmApp (kg/ha)	AmUpt (kg/ha)
1997	Potato	4.5	4.46E-02
1998	Grass	0.0	9.15E-03
1999	Grass	0.0	4.74E-04
		Total uptake	5.42E-02

		Percent of applied	**1.21%**

The total uptake values that have been derived show total uptake of between 1.2 - 2.6% which are in line with the result calculated for the potato metabolism study above. This adds to the weight of evidence that plant uptake of flutolanil is very minimal.

Additional evaluations have also been made using the FOCUSgw scenarios in PEARL 4.4.4, with annual applications and cropping of potatoes along with PUF 0.5. Cumulative (Total) uptake over the 26 year evaluations was derived from the PEARL files and calculated as a percentage of applied:

Scenario	**26 year Cumulative uptake (kg/m^2)**	**Average annual uptake (kg/m^2)**	**Application rate (kg/m^2)**	**Uptake (% applied)**
Chateaudun	1.25E-05	4.80E-07	3.68E-05	1.30
Hamburg	1.00E-05	3.85E-07	3.68E-05	1.05
Jokioinen	6.68E-06	2.57E-07	3.68E-05	0.70
Kremsmunster	7.51E-06	2.89E-07	3.68E-05	0.78
Okehampton	9.66E-06	3.71E-07	3.68E-05	1.01
Piacenza	1.93E-05	7.43E-07	3.68E-05	2.02
Porto	1.07E-05	4.10E-07	3.68E-05	1.12
Seville	2.36E-05	9.09E-07	3.68E-05	2.47
Thiva	2.57E-05	9.88E-07	3.68E-05	2.68

The comment is not relevent to the Amstenrade and Ubachsberg trials as they were kept free of weeds for the duration of the study.

RMS agrees on the above presented argumentation for the limited plant uptake via potatoes. The potential uptake via weeds was not excluded in the notifier argumentation, however, RMS considers it likely that the arguments that apply to potatoes, also apply to weeds. All-in-all, the impact of uptake via vegetation is limited and the residue results can be used to determine a DegT50 from the field results.

Previous evaluation	Submitted for the purpose of renewal
RMS remark	Acceptable

Report:	**CA 7.1.2.2.1/05. Hardy, I.A.J., Agostini, F., & Jastrzebski, N. (2016c)**
Title:	Flutolanil: Kinetic Modelling Analysis of Data from Field Soil Dissipation Studies Conducted in Europe
Document No:	XG/15/023B
Guidelines:	FOCUS (2006) Guidance Document on Estimating Persistence and Degradation Kinetics from Environmental Fate Studies on Pesticides in EU Registration. The Final Report of the Work Group on Degradation Kinetics of FOCUS SANCO/10058/2005, version 2.0, June 2006. FOCUS (2014) Generic Guidance for Estimating Persistence and Degradation Kinetics from Environmental Fate Studies on Pesticides in EU Registration. Version 1.1, December, 2014. EFSA (2014). EFSA Guidance Document for evaluating laboratory and field dissipation studies to obtain $DegT_{50}$ values of active substances of plant protection products and transformation products of these active substances in soil. Approved April 2014
Testing laboratory:	Battelle UK Ltd., Chelmsford, Essex, UK

GLP:	No

Executive Summary

The purpose of this study was to evaluate eight legacy European field dissipation studies conducted in The Netherlands, Germany and the United Kingdom for derivation of endpoints for modelling (non-normalized) and for comparison with triggers. As non-normalized "modelling" DT50 values are not used in risk assessment they have been included in the decision schemes with the modelling output, but they are not further referred to in the study conclusions. In four trials, applications were made to bare soil followed by incorporation into the soil matrix, in four other trials potato tubers treated with flutolanil were placed at a depth of 10 cm in the soil. The datasets collected were evaluated following FOCUS kinetics guidance (FOCUS, 2014) and EFSA guidance on evaluating laboratory and field studies to obtain $DegT_{50}$ values (EFSA, 2014). In all cases, individual replicate or subplot data were used in the modelling. In the first instance, the data were directly fitted in CAKE (v3.2) un-weighted with the complete data set and unconstrained initial concentration (M0). SFO, and where required FOMC and DFOP were run. All datasets were evaluated against FOCUS Kinetics criteria for trigger endpoints of parent substance based on visual assessment, minimum chi^2 error of preferably <15% (but it may be higher than 15% in field studies), t-test parameter significance ≥95% and 90th confidence interval of α and β parameters of FOMC should not include zero.

For the Manningtree trial (spray application), day 0 residues (8662 g a.s./ha) appeared to be very high compared to the application rate of 4500 g/ha and therefore, as a more conservative approach, the data was refitted by the RMS excluding the day 0 residue data, using CAKE v 3.2.

The optimised model fits for flutolanil at all locations showed visually and statistically acceptable fits to the data with the residual analysis plots also being satisfactory (random scatter of residuals). A high significance level was obtained for the estimated rate parameters except in one case (Goch, tuber application, p-value for DFOP k_1 slightly higher than 0.05), but a justification to accept the DFOP fit has been provided. The endpoints are summarised below:

Table B.8.1.2.2-35 Trigger DT_{50} values for flutolanil from spray application trials

Location	Kinetic	Parameter value	DT_{50} (days)	DT_{90} (days)
Manningtree, UK	SFO	k = 0.005464 day^{-1}	127	421
Ottersum, Netherlands	SFO	k = 0.003287 day^{-1}	211	701
Amstenrade, Netherlands	SFO	k = 0.006641 day^{-1}	104	347
Ubachsberg, Netherlands	SFO	k = 0.008059 day^{-1}	86.0	286

Table B.8.1.2.2-36 Trigger DT_{50} values for flutolanil from tuber application trials

Location	Kinetic	Parameter value	DT_{50} (days)	DT_{90} (days)
Goch, Germany	DFOP	k_1 = 0.01156 day^{-1} k_2 = 0.001748 day^{-1} g = 0.3719	184	1050
Manningtree, UK	SFO	k = 0.002449 day^{-1}	283	940
Niederkirchen, Germany	SFO	k = 0.00268 day^{-1}	259	859
Ottersum, Netherlands	SFO	k = 0.002025 day^{-1}	342	1140

MATERIALS AND METHODS

The purpose of this study was to evaluate eight legacy European field dissipation studies conducted in The Netherlands, Germany and the United Kingdom for derivation of endpoints for modelling and for comparison with triggers. The datasets collected were evaluated following FOCUS kinetics guidance (FOCUS, 2014) and EFSA guidance on evaluating laboratory and field studies to obtain $DegT_{50}$ values (EFSA, 2014).

Please note that the report derived “modelling” DT50 values (not normalized for moisture content and temperature), according to Figure 7.2 (Recommended tier 1 procedure to derive degradation parameters for modelling the fate of a parent compound from degradation kinetics without a lag phase) in FOCUS Kinetics (2014). For the sake of completeness, the non-normalized “modelling” DT50 values have been included in the decision schemes in the Tables in the Results section, but as they are not used in risk assessment they have not been further referred to.

Details of the terrestrial field dissipation studies used in the kinetic evaluation are summarised in the table below. In the case of spray trials flutolanil was sprayed directly to the bare soil followed by incorporation into the soil (0-10cm). In the case of tuber treatment potato tubers treated with flutolanil were placed at a depth of 10 cm in the soil, within a plastic tube of 30 cm diameter and 50 cm long open at both ends inserted vertically in the ground. At the normal harvest date the potato crop was treated with a non-residual total herbicide and left undisturbed in the soil. A grass cover crop was then sown with minimal disturbance of the soil.

The data sets used for the spray application were the same as those used in the previous study. The residue data from the tuber treatment trials used during evaluation are presented in the tables below. In all cases, individual replicate or subplot data were used in the modelling. In the first instance, the data were directly fitted in CAKE (v3.2) un-weighted with the complete data set and unconstrained initial concentration (M0). SFO, and where required FOMC and DFOP were run. Confidence in the resulting parameters has been assessed visually using a three-point scale (Poor = unacceptable fit; Acceptable = the fitted curve describes the trend of the data points, residuals may show some deviation from random distribution but it is not significant; Good = the fitted curve closely follows all the data points, residuals are randomly distributed). All datasets were evaluated against FOCUS Kinetics criteria for trigger endpoints of parent substance (Figure 7.1 in FOCUS Kinetics (2014)) based on visual assessment, minimum chi^2 error of preferably <15% (but it may be higher than 15% in field studies), t-test parameter significance ≥95% and 90^{th} confidence interval of α and β parameters of FOMC should not include zero.

For the Manningtree data set (spray application), the applicant provided fitting only for the data set including day 0. For the Manningtree trial (spray application), however, day 0 residues (8662 g a.s./ha) appeared to be very high compared to the application rate of 4500 g/ha and therefore, as a more conservative approach, the data was refitted by the RMS excluding the day 0 residue data, using CAKE v 3.2.

Table B.8.1.2.2-37 Summary of terrestrial field dissipation studies

Document	Location	Application	Rate (g a.s./ha)	Soil Texture	Duration
Wicks, R. (1999) (DAR)	Manningtree, UK	Tuber	600	Sandy loam	May 05 1997 – April 24, 1999

Document	Location	Application	Rate (g a.s./ha)	Soil Texture	Duration
Wicks, R. (1999) (DAR)	Ottersum, Netherlands	Tuber	600	Sandy loam	April 24 1997 – April 26, 1999
Wicks, R. (1999) (DAR)	Goch, Germany	Tuber	600	Silt loam	May 05 1997 – April 24, 1999
Wicks, R. (1999) (DAR)	Niederkirchen, Germany	Tuber	600	Sandy loam	May 05 1997 – April 24, 1999
Wicks, R. (1999) (DAR)	Manningtree, UK	Spray	4500	Sandy loam	May 05 1997 – November 09, 1998
Wicks, R. (1999) (DAR)	Ottersum, Netherlands	Spray	4500	Sandy loam	April 24 1997 – November 05, 1998
CA 7.1.2.2.1/02. Ginzburg, N & Hardy, I. (2007)	Amstenrade, Netherlands	Spray	4500	Silt loam	June 07 2005 – December 04, 2006
CA 7.1.2.2.1/02. Ginzburg, N & Hardy, I. (2007)	Ubachsberg, Netherlands	Spray	4500	Loam	June 15 2005 – December 01, 2006

Table B.8.1.2.2-38 Summary of Residue Data from Goch, Germany (Tuber)

Time	Flutolanil (mg tube^{-1})	
(days)	Rep 1	Rep 2
0	10.30	9.78
60	7.68	7.60
121	6.30	6.10
191	4.76	4.00
282	4.32	4.63
364	3.21	3.61
547	1.02	3.56
721	2.58	1.08

Table B.8.1.2.2-39 Summary of Residue Data from Manningtree, UK (Tuber)

Time	Flutolanil (mg tube^{-1})	
(days)	Rep 1	Rep 2
0	10.40	10.00
57	9.37	7.65
115	7.16	7.37
176	6.53	6.82
268	6.06	5.82
373	3.65	5.63
561	1.35	1.16
723	1.46	2.44

Table B.8.1.2.2-40 Summary of Residue Data from Ottersum, Netherlands (Tuber)

Time (days)	Flutolanil (mg tube^{-1}) Rep 1	Rep 2
0	11.30	12.10
60	8.65	6.55
121	6.73	9.42
190	6.71	6.99
284	5.82	8.22
366	3.52	5.72
549	3.55	2.83
721	3.02	2.50

Table B.8.1.2.2-41 Summary of Residue Data from Niederkirchen, Germany (Tuber)

Time (days)	Flutolanil (mg tube^{-1}) Rep 1	Rep 2
0	9.98	9.75
63	8.44	5.99
119	8.26	6.95
191	8.47	4.85
282	4.93	6.06
364	3.33	3.26
547	0.81	1.58
721	1.64	1.14

RESULTS

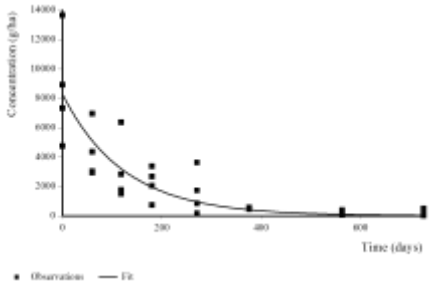
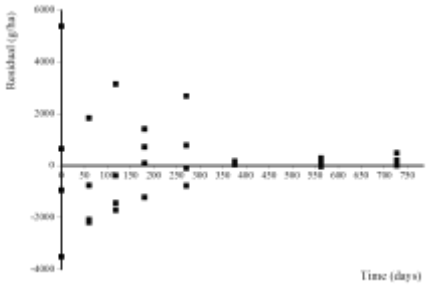
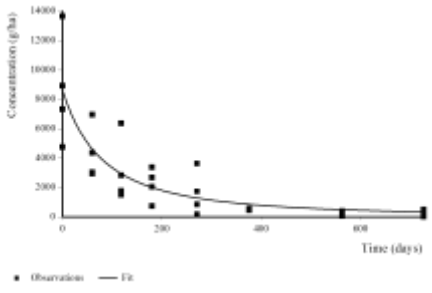
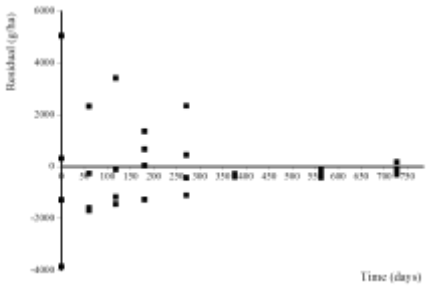
For the sake of completeness, the non-normalized “modelling” DT50 values have been included in the decision schemes in the tables below, but as they are not used in risk assessment they have not been further referred to.

The optimised model fits for flutolanil at all locations showed visually and statistically acceptable fits to the data with the residual analysis plots also being satisfactory (random scatter of residuals). A high significance level was obtained for the estimated rate parameters except in one case (Goch, tuber application, p-value for DFOP k_1 slightly higher than 0.05), but a justification to accept the DFOP fit has been provided (see footnote (A). For the Manningtree data set (spray application), both fits (including and excluding day 0) are acceptable, but the results for the data set excluding day 0 provide a more conservative endpoint and the endpoint for the Manningtree trial (spray application) is taken from the data set excluding day 0.

The DT_{50} values for comparison with triggers were in the range 86.0-211 days for the four spray application trials (all determined using SFO) and in the range 184-342 days for the four tuber treatment trials (DT50=184 days determined by DFOP, the others by SFO). The corresponding DT90 values for comparison with triggers were in the range 286-701 days for spray application and 859-1140 days for tuber treatment.

Table B.8.1.2.2-42 Graphical summary: Manningtree UK - spray application (including day 0)

Study reference - Soil	Manningtree [spray application] (Wicks, 1999) – **including day 0**		
Model	SFO	FOMC	DFOP
Visual Fit	Acceptable	Acceptable	Acceptable
Residuals (visual)	Acceptable	Acceptable	Acceptable
χ^2 error (%)	12.7	7.7	5.02
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.00800 σ: 0.008009 p (k): 3.29 x 10^{-6}	α: 1.845 σ: 1.651 90th %ile CI contains 0 β: 149.7 σ: 192.5 90th %ile CI contains 0	k_1: 0.08914 σ: 2.304 p (k_1): 0.48470 k_2: 0.00545 σ: 0.034445 p (k_2): 0.03444 g: 0.3109 σ: 0.3109
Trigger DT_{50} (days)	86.6	68.3	59.4
DT_{90} (days)	288	372	354
FOCUS decision step (Trigger)	SFO acceptable; compare with FOMC	FOMC better than SFO but α and β parameter not robust; compare with DFOP	DFOP better than SFO but k_1 and g not robust; SFO is best fit, but endpoints are taken from fit excluding day 0 (see next Table)
Modelling DT_{50} (days)	86.6		
FOCUS decision step (Modelling)	SFO acceptable; SFO DT_{50} selected		

Model	Visual Fit	Residuals plot
SFO		
FOMC		

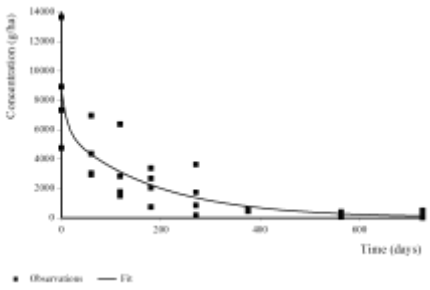
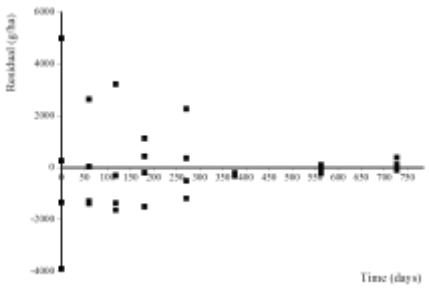
DFOP		

Table B.8.1.2.2-43 Graphical summary: Manningtree UK - spray application (excluding day 0)

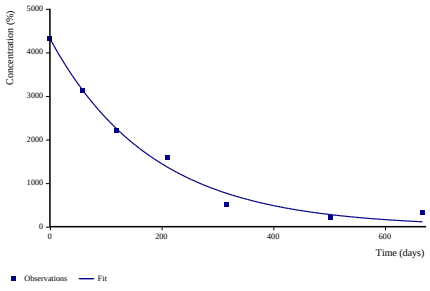
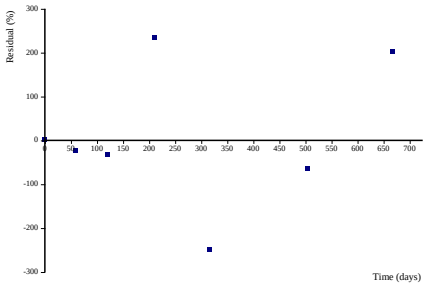
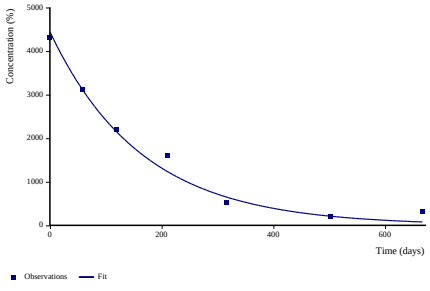
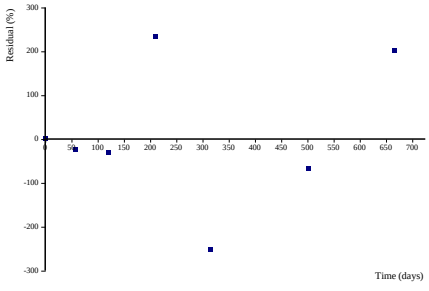
Study reference - Soil	Manningtree [spray application] (Wicks, 1999) – **excluding day 0**	
Model	SFO	FOMC
Visual Fit	Acceptable	Acceptable
Residuals (visual)	Acceptable	Acceptable
χ^2 error (%)	6.93	7.49
Rate Parameters: probability & confidence	k: 0.00546 p (k): 2.52 x 10^{-5}	α: 401.7 95th %ile CI does not contain 0 β: 65900 95th %ile CI does not contain 0
Trigger DT_{50} (days)	**127**	114
DT_{90} (days)	**421**	379
FOCUS decision step (Trigger)	SFO acceptable; compare with FOMC	SFO better than FOMC; SFO selected as best fit
Modelling DT_{50} (days)	127	
FOCUS decision step (Modelling)	SFO acceptable; SFO DT_{50} selected	
Model	Visual Fit	Residuals plot
SFO		
FOMC		

Table B.8.1.2.2-44 Graphical summary: Ottersum, Netherlands - spray application

Study reference	Ottersum [spray application] (Wicks, 1999)		
Model	SFO	FOMC	DFOP
Visual Fit	Acceptable	Acceptable	Acceptable
Residuals (visual)	Acceptable	Acceptable	Acceptable
χ^2 error (%)	16.7	13.9	16.9
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.00329 σ: 0.003293 p (k): 7.69 x 10^{-4}	α:0.9695 σ: 1.071 90th %ile CI contains 0 β: 147.2 σ: 274.9 90th %ile CI contains 0	k_1: 0.29110 σ: 41.6 p (k_1): 0.49720 k_2: 0.00255 σ: 0.000848 p (k_2): 0.00278 g: 0.2181 σ: 0.2106
DT_{50} (days)	**211**	154	176
DT_{90} (days)	**701**	1440	807
FOCUS decision step (Trigger)	SFO acceptable; compare with FOMC	FOMC better than SFO but α and β parameter not robust; compare with DFOP	SFO better than DFOP; DFOP parameters k_1 and g not robust; SFO selected as best fit
Modelling DT_{50} (days)	211		
FOCUS decision step (Modelling)	SFO acceptable; SFO DT_{50} selected		

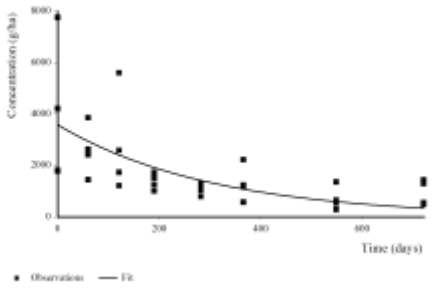
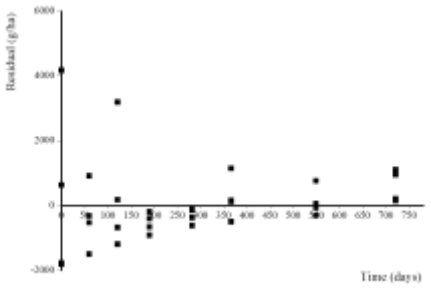
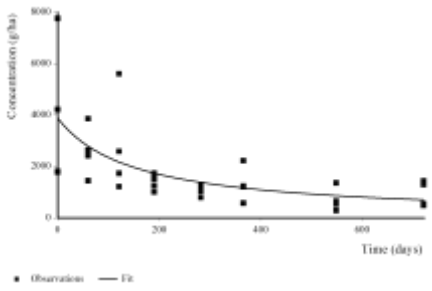
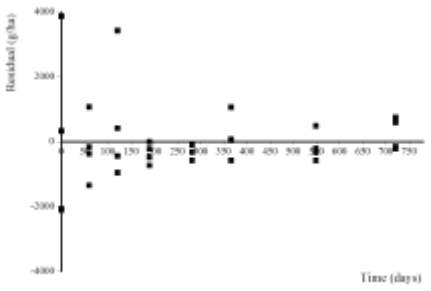
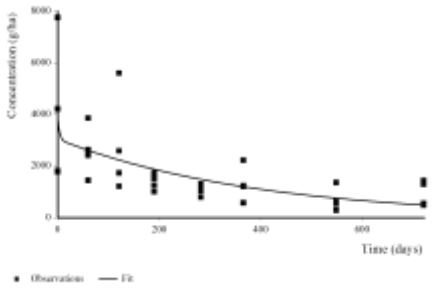
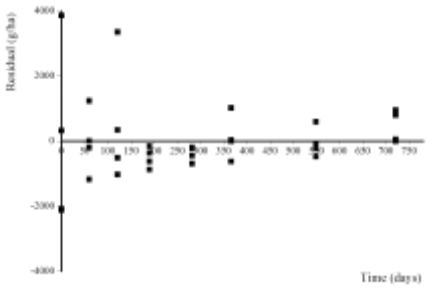
Model	Visual Fit	Residuals plot
SFO		
FOMC		
DFOP		

Table B.8.1.2.2-45 Graphical summary: Amstenrade, Netherlands - spray application

Study reference - Soil	Amstenrade [spray application] (Ginzburg & Hardy, 2007)		
Model	SFO	FOMC	DFOP
Visual Fit	Acceptable	Good	Good
Residuals (visual)	Acceptable	Acceptable	Good
χ^2 error (%)	24.2	18.4	17.2
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.00664 σ: 0.006648 p (k): 0.001811	α: 0.947 σ: 0.5291 90th %ile CI contains 0 β: 56.14 σ: 59.58 90th %ile CI contains 0	k_1: 0.05686 σ: 0.1993 p (k_1): 0.39480 k_2: 0.00367 σ: 0.001635 p (k_2): 0.04407 g: 0.4415 σ: 0.2162
Trigger DT_{50} (days)	**104**	60.6	47.2
DT_{90} (days)	**347**	583	469
FOCUS decision step (Trigger)	SFO acceptable; compare with FOMC	FOMC better than SFO but α and β parameter not robust; compare with DFOP	SFO better than DFOP; DFOP parameters k_1 and g not robust; SFO selected as best fit
Modelling DT_{50} (days)	104		
FOCUS decision step (Modelling)	SFO acceptable; SFO DT_{50} selected		

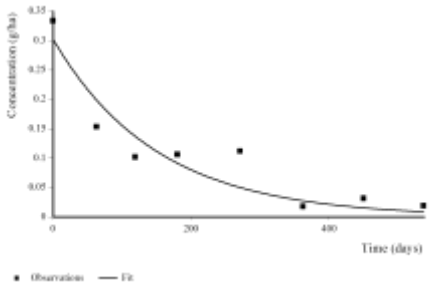
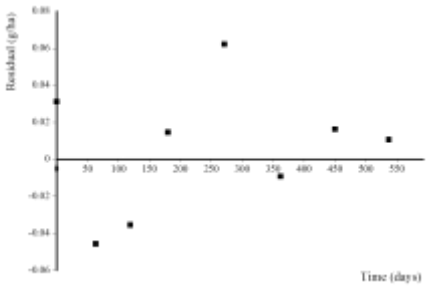
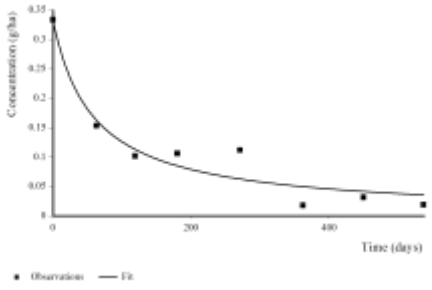
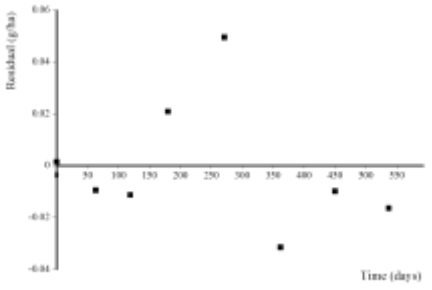
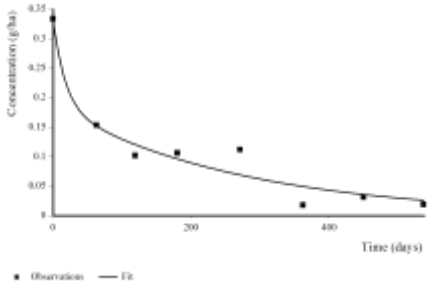
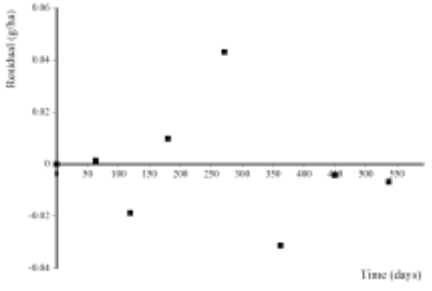
Visual Fit	Residuals plot	Visual Fit
SFO		
FOMC		
DFOP		

Table B.8.1.2.2-46 Graphical summary: Ubachsberg, Netherlands - spray application

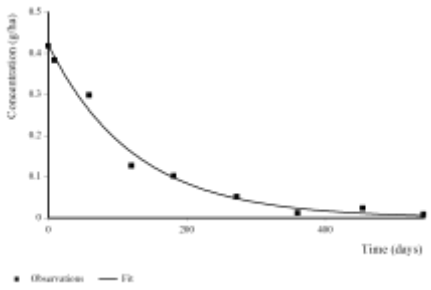
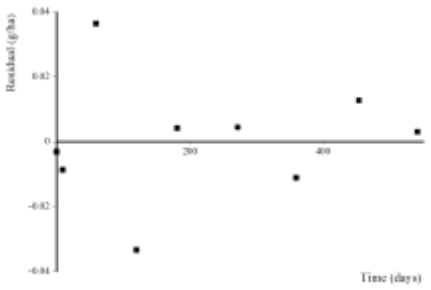
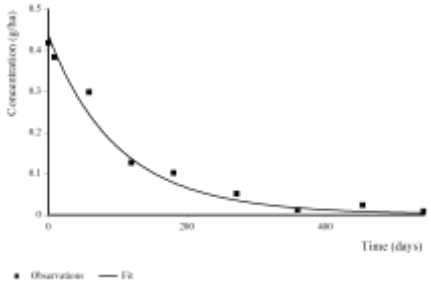
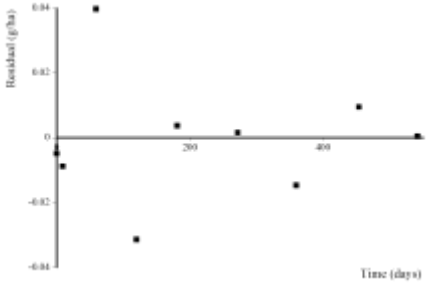
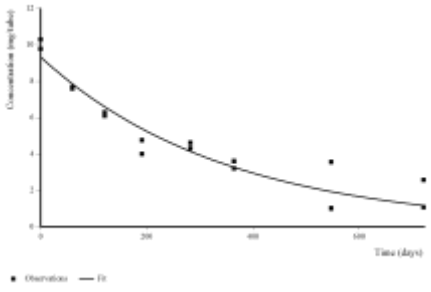
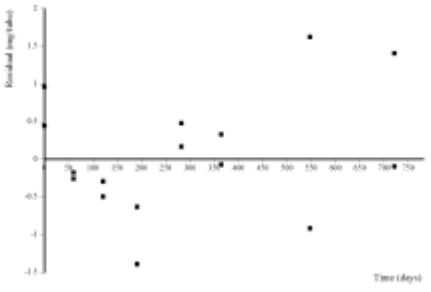
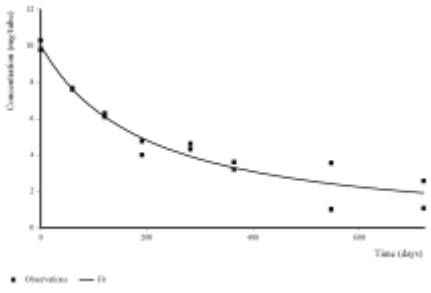
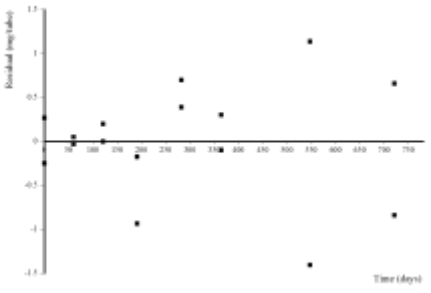
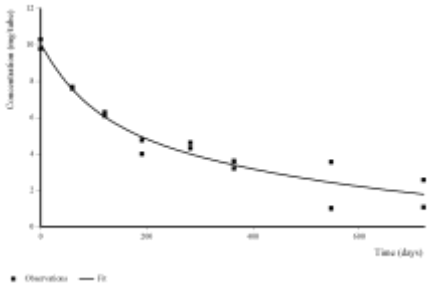
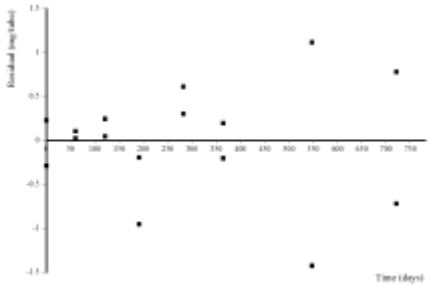
Study reference - Soil	Ubachsberg [spray application] (Ginzburg & Hardy, 2007)	
Model	SFO	FOMC
Visual Fit	Good	Good
Residuals (visual)	Good	Good
χ^2 error (%)	9.02	9.75
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.00806 σ: 0.008067 p (k): 3.04 x 10^{-6}	α: 16.32 σ: 8.402 90th %ile CI contains 0 β: 1630 σ: 1020 90th %ile CI contains 0
Trigger DT_{50} (days)	**86.0**	70.6
DT_{90} (days)	**286**	247
FOCUS decision step (Trigger)	SFO acceptable; compare with FOMC	SFO better than FOMC; SFO selected as best fit
Modelling DT_{50} (days)	86.0	
FOCUS decision step (Modelling)	SFO acceptable; SFO DT50 selected	
Visual Fit	Residuals plot	Visual Fit
SFO		
FOMC		

Table B.8.1.2.2-47 Graphical summary: Goch, Germany - tuber application

Study reference - Soil	Goch [tuber application] (Wicks, 1999)		
Model	SFO	FOMC	DFOP
Visual Fit	Acceptable	Good	Good
Residuals (visual)	Acceptable	Good	Good
χ^2 error (%)	8.67	4.82	4.95
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.002874 σ: 3.01 x 10^{-4} p (k): 8.24 x 10^{-8}	α: 1.143 σ: 0.4621 95th %ile CI does not contain 0 β: 222.2 σ: 140 90th %ile CI contains 0	k_1: 0.01156 σ: 0.007131 p (k_1): 0.06541 k_2: 0.001748 σ: 4.10 x 10^{-4} p (k_2): 5.56 x 10^{-4} g: 0.3719 σ: 0.3719
Trigger DT_{50} (days)	241	185	**184**
DT_{90} (days)	801	1440	**1050**
FOCUS decision step (Trigger)	SFO acceptable; compare with FOMC	FOMC better than SFO but β parameter not robust; compare with DFOP	DFOP better than SFO and DFOP parameters robust$^{(A)}$; DFOP chosen as best fit
Modelling DT_{50} (days)	241		
FOCUS decision step (Modelling)	SFO acceptable; SFO DT_{50} selected		

Visual Fit	Residuals plot	Visual Fit
SFO		
FOMC		

DFOP		

(A) It was noted that the p-value for the fast rate constant (p=0.06541) was slightly higher than 0.05. However, DFOP is the preferred fit as it accurately models the decline during the last two sampling times, whereas SFO tends to overestimate the decline during the last two sampling times.

Table B.8.1.2.2-48 Graphical summary: Manningtree, UK - tuber application

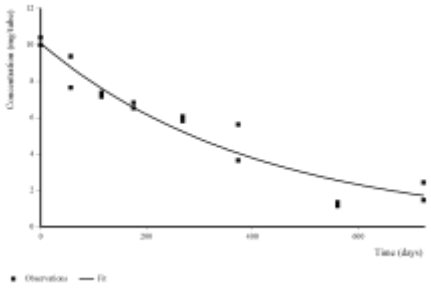
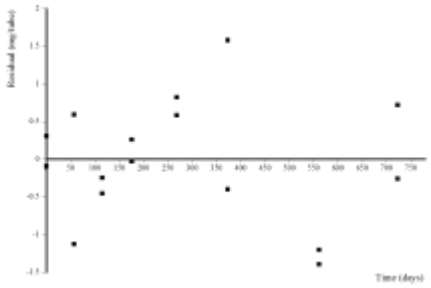
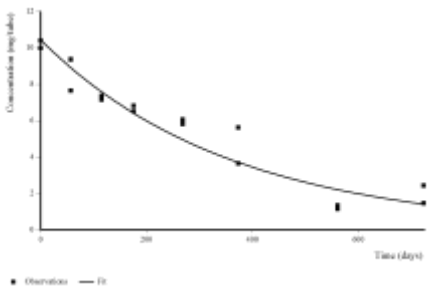
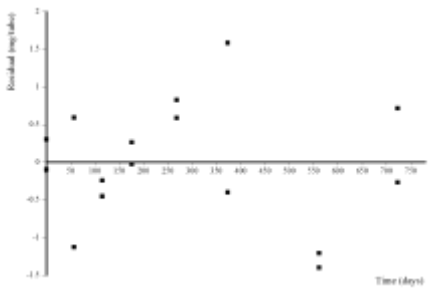
Study reference	Manningtree [tuber application] (Wicks, 1999)	
Model	SFO	FOMC
Visual Fit	Good	Good
Residuals (visual)	Good	Good
χ^2 error (%)	8.14	8.70
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.002449 σ: 2.43 x 10^{-4} p (k): 4.23 x 10^{-8}	α: 153 σ: not calculated 90th & 95th %ile CI not calculated β: 55000 σ: not calculated 90th %ile CI not calculated
DT_{50} (days)	**283**	250
DT_{90} (days)	**940**	834
FOCUS decision step (Trigger)	SFO acceptable; compare with FOMC	SFO better than FOMC; SFO selected as best fit
Modelling DT_{50} (days)	283	
FOCUS decision step (Modelling)	SFO acceptable; SFO DT_{50} selected	
Visual Fit	Residuals plot	Visual Fit
SFO		
FOMC		

Table B.8.1.2.2-49 Graphical summary: Niederkirchen, Germany - tuber application

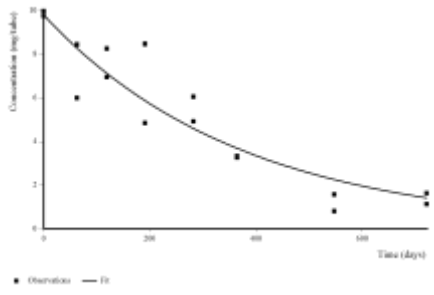
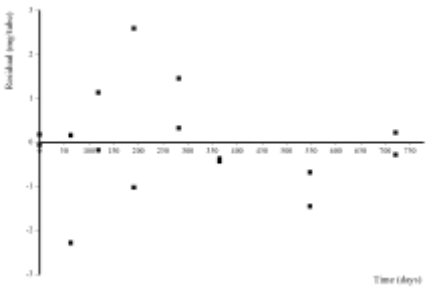
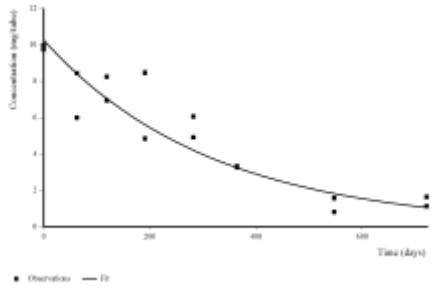
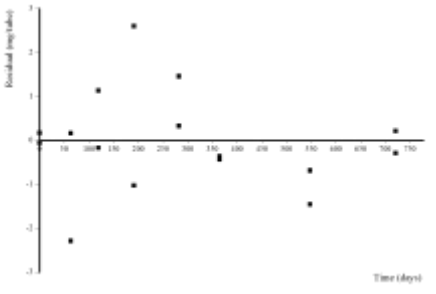
Study reference - Soil	Niederkirchen [tuber application] (Wicks, 1999)	
Model	SFO	FOMC
Visual Fit	Good	Good
Residuals (visual)	Good	Good
χ^2 error (%)	10.7	11.4
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.00268 σ: 3.83 x 10^{-4} p (k): 3.15 x 10^{-6}	α: 230.6 σ: 16.02 95th %ile CI does not contain 0 β: 72900 σ: not calculated 90th & 95th %ile CI not calculated
Trigger DT_{50} (days)	**259**	219
DT_{90} (days)	**859**	731
FOCUS decision step (Trigger)	SFO acceptable; compare with FOMC	SFO better than FOMC; SFO selected as best fit
Modelling DT_{50} (days)	259	
FOCUS decision step (Modelling)	SFO acceptable; SFO DT_{50} selected	
Visual Fit	Residuals plot	Visual Fit
SFO		
FOMC		

Table B.8.1.2.2-50 Graphical summary: Ottersum, Netherlands - tuber application

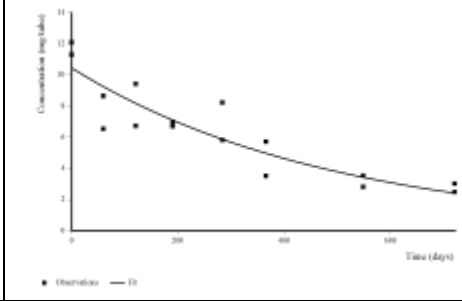
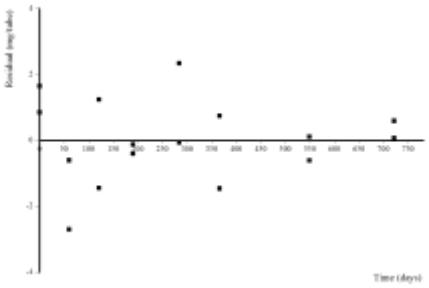
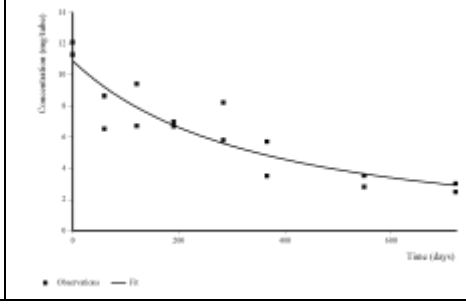
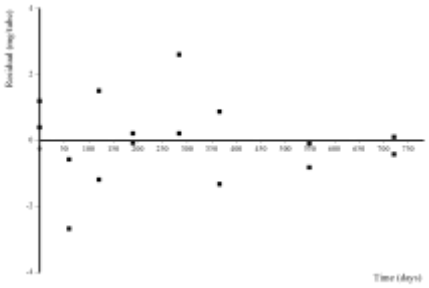
Study reference - Soil	Ottersum [tuber application] (Wicks, 1999)	
Model	SFO	FOMC
Visual Fit	Good	Good
Residuals (visual)	Good	Good
χ^2 error (%)	10.6	11.0
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.002025 σ: 3.12 x 10^{-4} p (k): 7.01 x 10^{-6}	α: 1.474 σ: 1.694 90^{th} %ile CI contains 0 β: 498.9 σ: 781.8 90^{th} %ile CI contains 0
Trigger DT_{50} (days)	**342**	300
DT_{90} (days)	**1140**	1880
FOCUS decision step (Trigger)	SFO acceptable; compare with FOMC	SFO better than FOMC; SFO selected as best fit
Modelling DT_{50} (days)	342	
FOCUS decision step (Modelling)	SFO acceptable; SFO DT50 selected	
Visual Fit	Residuals plot	Visual Fit
SFO		
FOMC		

Table B.8.1.2.2-51 Trigger DT_{50} values for flutolanil from spray application trials

Location	Kinetic	Parameter value	DT_{50} (days)	DT_{90} (days)
Manningtree, UK	SFO	k = 0.005464 day^{-1}	127	421
Ottersum, Netherlands	SFO	k = 0.003287 day^{-1}	211	701
Amstenrade, Netherlands	SFO	k = 0.006641 day^{-1}	104	347
Ubachsberg, Netherlands	SFO	k = 0.008059 day^{-1}	86.0	286

Table B.8.1.2.2-52 Trigger DT_{50} values for flutolanil from tuber application trials

Location	Kinetic	Parameter value	DT_{50} (days)	DT_{90} (days)
Goch, Germany	DFOP	k_1 = 0.01156 day^{-1} k_2 = 0.001748 day^{-1} g = 0.3719	184	1050
Manningtree, UK	SFO	k = 0.002449 day^{-1}	283	940
Niederkirchen, Germany	SFO	k = 0.00268 day^{-1}	259	859
Ottersum, Netherlands	SFO	k = 0.002025 day^{-1}	342	1140

CONCLUSIONS

Acceptable model fits were obtained during kinetic modelling analysis of the data from field studies of flutolanil (applied by spraying on four soils and by tuber treatment in four soils) to determine DT50 and DT90 values for comparison with triggers. DT50 values were in the range 86.0-211 and 184-342 days for the spray application and tuber treatment trials, respectively (corresponding DT90 values in the range 286-701 and 859-1140 days).

Comments by RMS

- Acceptable study residue data, and acceptable endpoints after kinetic recalculation of RMS. New kinetic fits have been adjusted in the summary presented above.
- A few discrepancies were noted in the data sets used for modelling and those in the original study report by Ginzburg & Hardy (2007). The day of the last sampling was exchanged (537 days in Amstenrade instead of 542 days; 542 days in Ubachsberg instead of 537 days) and in a few cases values reported as <LOQ were taken as <LOD or vice versa. These discrepancies are minor and considered to have a negligible impact on the modelling results.
- The residue levels in 6 out of 8 trials were expressed in mg/kg and were not converted to g a.s./ha, presumably due to missing soil density data at each sampling time. This may lead to some inaccuracy but the visual fits showed a regular decline and residuals distributions were acceptable for the trials concerned and did not suggest a relevant influence of this factor.

Previous evaluation	Submitted for the purpose of renewal
RMS remark	Acceptable

Report:	**CA 7.1.2.2.1/06. Hardy, I.A.J. & Jastrzebski, N. (2016a)**
Title:	Flutolanil: Kinetic Modelling Analysis of Data from Field Soil Dissipation Studies Conducted in Europe Normalised to 20ºC and pF2 (Tuber Application Trials)
Document No:	XG/15/023C
Guidelines:	FOCUS (2006) Guidance Document on Estimating Persistence and Degradation Kinetics from Environmental Fate Studies on Pesticides in EU Registration. The Final Report of the Work Group on Degradation Kinetics of FOCUS SANCO/10058/2005, version 2.0, June 2006.

	FOCUS (2014) Generic Guidance for Estimating Persistence and Degradation Kinetics from Environmental Fate Studies on Pesticides in EU Registration. Version 1.1, December, 2014. EFSA (2014). EFSA Guidance Document for evaluating laboratory and field dissipation studies to obtain $DegT_{50}$ values of active substances of plant protection products and transformation products of these active substances in soil. Approved April 2014
Testing laboratory:	Battelle UK Ltd., Chelmsford, Essex, UK
GLP:	No

Executive Summary

The aim of this report was to derive a normalised $DegT_{50}$ value (20˚C and pF2) for flutolanil using data collected from four European trials conducted in Germany, The Netherlands and the United Kingdom. Applications were made to tubers followed by planting of the treated tubers at a soil depth of 10cm.

Normalisation was conducted for soil temperature only, with soil moisture conservatively assumed as being at pF2 throughout, according to FOCUS groundwater assumptions (Ea 65.4 KJ mol^{-1} [Q_{10} of 2.58]). Where measured daily soil temperature data was not recorded on site, estimates of soil temperature were calculated using PEARL. Where PET (Potential EvapoTranspiration) data were not available, they were taken from MARS grid squares. A timestep normalization approach (FOCUS, 2006) was taken for the standardization of transformation parameters to reference soil temperature (20°C) and soil moisture (pF2) conditions.

The optimised model fits for flutolanil at all locations showed visually and statistically acceptable fits to the data. Normalized $DegT_{50}$ values were 125, 137, 171 and 166 days for the Goch, Manningtree, Ottersum and Niederkirchen trial, respectively.

MATERIALS AND METHODS

The purpose of this study was to evaluate the four legacy European field dissipation studies conducted in Germany, The Netherlands and the United Kingdom for derivation of modelling endpoints. The datasets collected were evaluated following FOCUS kinetics guidance (FOCUS, 2014) and EFSA guidance on evaluating laboratory and field studies to obtain $DegT_{50}$ values (EFSA, 2014).

At each trial, flutolanil was applied directly to tubers, which were then planted in the soil, to a depth of 10 cm, within a plastic tube of 30 cm diameter and 50 cm long open at both ends inserted vertically in the ground (nominal application rate 600 g a.i./ha). True replicate residue data were reported for two sub-plots at each test-site. The reported residue data expressed in mg a.s./tube were used in the evaluations without further processing.

Daily weather data (air temperature and rainfall) were measured on site or at local weather

Stations (located within 7-8 km from the trials site). Measured daily soil temperature data was recorded on site for the Manningtree and Niederkirchen trials and this was used directly in the normalization procedure. Daily soil temperature data were not available from the study reports for the Ottersum and Goch trials. Therefore, robust estimates of soil temperature were calculated using PEARL 4.4.4. PET data were available for the Manningtree and Goch trial, but PET values for Ottersum and Goch were taken from MARS grid squares. Daily soil moisture content data for all four locations were unavailable and soil moisture content estimates were calculated using PEARL. However, in the present modelling study a conservative approach was assumed and corrections in all

sites were carried out only on the base of the soil temperature, with soil moisture conservatively assumed to be at pF2 throughout (hence no correction for soil moisture).

A timestep normalization approach (FOCUS, 2006) was taken for the standardization of transformation parameters to reference soil temperature (20°C) and soil moisture (pF2) conditions. For temperature correction FOCUS recommends Arrhenius or Q10 approaches (using an average Ea of 65400 J Mol-1 or Q10 factor of 2.58 [EFSA, 2007]) and for moisture content correction the Walker equation, with a B-factor (moisture exponent) of 0.7 [FOCUS, 2000]. The Arrhenius and Walker approaches can be combined to derive the equation below:

$$DT_{50ref} = DT_{50act} * e^{\frac{Ea*(T-T_{ref})}{R*T*T_{ref}}} * \left(\frac{MC_{act}}{MC_{ref}}\right)^{B}$$

Where:

DT_{50ref} is the normalized half-life at MCref and Tref

DT_{50act} is the measured half-life at MCact and T

E_a is the activation energy, 65400 J Mol-1 [EFSA, 2007]

R is the gas constant, 8.315 J/mol/K

T is the mean soil temperature during the study (K)

T_{ref} is the reference temperature (e.g. 293 K)

MC_{act} is the measured soil moisture content

MC_{ref} is the soil moisture content at the reference tension (pF2)

B is the moisture exponent, 0.7 as the FOCUS default

Please note that in the present modelling study no correction for soil moisture was carried out.

The actual and timestep normalized sampling times (corrected for soil temperature) are presented in the tables below.

For the determination of flutolanil modelling endpoints, the timestep normalised sampling times and the soil residue data were entered into CAKE (v3.2) and optimisations carried out for the initial soil residue (M0) and the degradation rate constant (Kp) using SFO and FOMC kinetics. Since in all cases SFO kinetics were acceptable, FOMC fits are not further considered in this summary. In the first instance, the data were directly fitted in CAKE un-weighted with the complete data set and unconstrained initial concentration (M0). Confidence in the resulting parameters has been assessed visually using a three-point scale (Poor = unacceptable fit; Acceptable = the fitted curve describes the trend of the data points, residuals may show some deviation from random distribution but it is not significant; Good = the fitted curve closely follows all the data points, residuals are randomly distributed). Confidence in the resulting parameters has been assessed statistically from the probability values for a t-test of the rate parameter. The χ^2 error% parameter has been used to determine goodness of fit.

Table B.8.1.2.2-53 Summary of terrestrial field dissipation studies

Document	Location	Rate (g a.s./ha)	Soil Texture	Duration
Wicks, R. (1999) (DAR)	Manningtree, UK	600	Sandy loam	May 05 1997 – April 24, 1999
Wicks, R. (1999) (DAR)	Ottersum, Netherlands	600	Sandy loam	April 24 1997 – April 26, 1999
Wicks, R. (1999) (DAR)	Goch, Germany	600	Silt loam	May 05 1997 – April 24, 1999
Wicks, R. (1999) (DAR)	Niederkirchen, Germany	600	Sandy loam	May 05 1997 – April 24, 1999

Table B.8.1.2.2-54 Timestep normalised sampling times (soil temperature correction)

Goch, Germany		Manningtree, UK	
Sampling time (days)	Timestep (days)	Sampling time (days)	Timestep (days)
0	0.0	0	0.0
60	36.5	57	26.3
121	93.8	115	69.2
191	127.1	176	108.8
282	147.0	268	134.3
364	174.2	373	164.5
547	287.8	561	275.9
721	329.3	723	317.7

Ottersum, Netherlands		Niederkirchen, Germany	
Sampling time (days)	Timestep (days)	Sampling time (days)	Timestep (days)
0	0.0	0	0.0
60	36.7	63	49.6
121	94.3	119	112.3
190	127.1	191	156.9
284	147.3	282	174.4
366	174.8	364	203.1
549	288.6	547	354.5
721	329.3	721	399.7

RESULTS

Graphical summaries and decision charts are shown in the tables below. The optimised model fits for flutolanil at all locations showed visually and statistically acceptable (minimum Chi^2 error 5.08 – 14.6% and t-test parameter significance of >99.99%) fits to the data with the residual analysis plots also being satisfactory (random scatter of residuals). A high significance level was obtained for the estimated rate parameters. Normalised $DegT_{50}$ values are summarised below the graphical summaries of the individual soils.

Table B.8.1.2.2-55 DT_{50} values for flutolanil - Goch trial

Study reference - Soil	Goch (Wick, 1999)
Model	SFO
Visual Fit	Good
Residuals (visual)	Good
χ^2 error (%)	5.08
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.005536 σ: 4.36 x 10^{-4} p (k) 2.25 x 10^{-9}

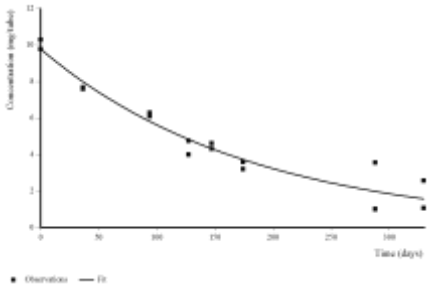
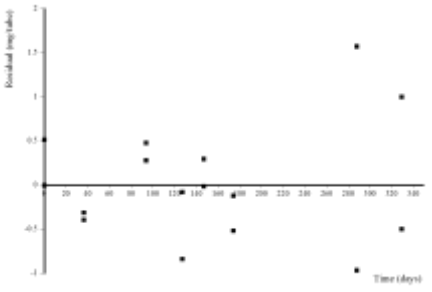
DT_{50} (days)	**125**	
DT_{90} (days)	**416**	
FOCUS decision step (Modelling)	SFO acceptable; SFO DT_{50} selected	
Modelling DT_{50} (days)	**125**	
Visual Fit	Residuals plot	Visual Fit
SFO		

Table B.8.1.2.2-56 DT_{50} values for flutolanil - Manningtree trial

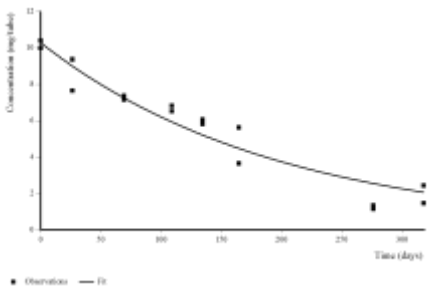
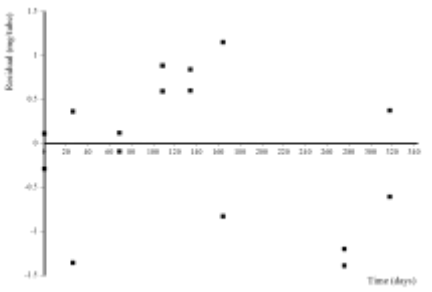
Study reference - Soil	Manningtree (Wicks, 1999)	
Model	SFO	
Visual Fit	Acceptable	
Residuals (visual)	Acceptable	
χ^2 error (%)	8.47	
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.005054 σ: 4.90 x 10^{-4} p (k) 3.15 x 10^{-8}	
DT_{50} (days)	**137**	
DT_{90} (days)	**456**	
FOCUS decision step (Modelling)	SFO acceptable; SFO DT_{50} selected	
Modelling DT_{50} (days)	**137**	
Visual Fit	Residuals plot	Visual Fit
SFO		

Table B.8.1.2.2-57 DT_{50} values for flutolanil - Niederkirchen trial

Study reference - Soil	Niederkirchen (Wicks, 1999)
Model	SFO
Visual Fit	Acceptable

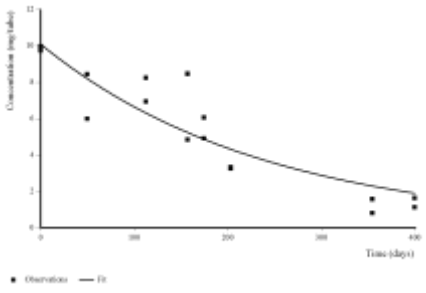
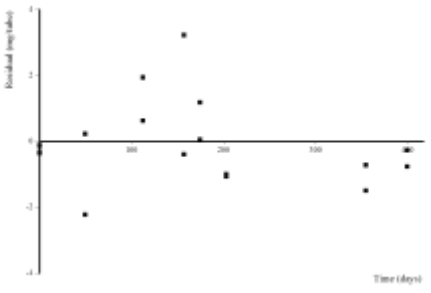
Residuals (visual)	Acceptable	
χ^2 error (%)	14.6	
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.004176 σ: 0.004176 x 10^{-4} p (k) 9.57 x 10^{-6}	
DT_{50} (days)	**166**	
DT_{90} (days)	**551**	
FOCUS decision step (Modelling)	SFO acceptable; SFO DT_{50} selected	
Modelling DT_{50} (days)	**166**	
Visual Fit	Residuals plot	Visual Fit
SFO		

Table B.8.1.2.2-58 DT_{50} values for flutolanil - Ottersum trial

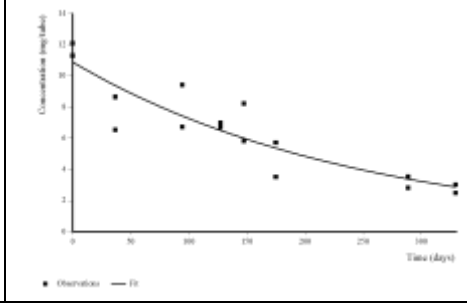
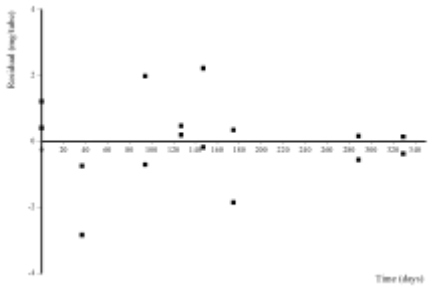
Study reference - Soil	Ottersum (Wicks, 1999)	
Model	SFO	
Visual Fit	Acceptable	
Residuals (visual)	Acceptable	
χ^2 error (%)	10.7	
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.004045 σ: 5.89 x 10^{-4} p (k) 3.85 x 10^{-6}	
DT_{50} (days)	**171**	
DT_{90} (days)	**569**	
FOCUS decision step (Modelling)	SFO acceptable; SFO DT_{50} selected	
Modelling DT_{50} (days)	**171**	
Visual Fit	Residuals plot	Visual Fit
SFO		

Table B.8.1.2.2-59 Modelling degradation endpoints for flutolanil in field soils with normalised datasets following FOCUS (2014) Guidance and EFSA (2014) Guidance

Trial	M_0 (mg a.s./tube)	DT_{50} (days)	DT_{90} (days)	Minimum Chi^2 error (%)	t-test (-)
Goch	9.786	125	416	5.08	2.25E-09, >99.99%
Manningtree	10.29	137	456	8.47	3.15E-08, >99.99%
Ottersum	10.89	171	569	10.7	3.85E-06, >99.99%
Niederkirchen	10.10	166	551	14.6	9.57E-06, >99.99%
Geometric mean		**148**	**494**		

CONCLUSIONS

A normalised $DegT_{50}$ of flutolanil was derived from four legacy European field dissipation studies (from 1997; treated seed potatoes were planted to a depth of 10 cm) following FOCUS kinetic guidance (FOCUS, 2014) and EFSA guidance (EFSA, 2014). Normalized $DegT_{50}$ values were 125, 137, 171 and 166 days for the Goch, Manningtree, Ottersum and Niederkirchen trial, respectively.

RMS remarks renewal

- The residue levels were expressed in mg a.s./tube and were not converted to g a.s./ha, presumably due to missing soil density data at each sampling time. This may lead to some inaccuracy but the visual fits showed a regular decline and residuals distributions were acceptable and did not suggest a relevant influence of this factor (with the exception possibly of the Nierderkirchen trial, last two data points, but fitted curve is worst case).
- During the PEARL estimations for the Ottersum trial, the organic matter content of the top 0-30 and 30-60 cm, respectively, of the soil was set at 0.014 and 0.009 kg/kg, equivalent to 1.4% and 0.9%. The reported organic carbon content of the top 0-30 and 30-60 cm of the Ottersum soil however was 2.4% and 1.5%, equivalent to 4.1% and 2.6% organic matter. This parameters is shown in the PEARL output as the CntOm factor. A similar mistake was observed for the spray applications (KCA 7.1.2.2.1-04). At the RMS request, the applicant provided new simulations for the *spray trials*, with an adjusted organic matter content of the PEARL modelling for the Ottersum trial. This had limited effect on the *spray trials* time-steps, and therefore the kinetic results are still valid. It is therefore concluded that the OM% would have limited effect on the *tuber trial* results and the corresponding kinetic fits.
- In all trials, treated seed potatoes were planted to a depth of 10 cm. At the normal harvest date the potato crop was treated with a non-residual total herbicide and left undisturbed in the soil. A grass cover crop was then sown with minimal disturbance of the soil. The plots were maintained relatively weed-free according to normal practice (weeding either by hand or using strimming machinery). Since flutolanil is a systemic compound, the presence of a potato crop or grass on the test plots could have contributed to the disappearance of flutolanil from the soil via uptake and metabolism by plants. However, the applicant provided a justification on why the normalized DT50 values from the above trials are valid in spite of the potential uptake and metabolism of flutolanil by potato crop or grass on the test plots: please refer to the RMS remarks for CA 7.1.2.2.1/04 (Hardy et al, 2016b).

B.8.1.2.2.2 Soil accumulation studies

Previous evaluation	Submitted for the purpose of renewal
RMS remark	Acceptable

Report:	**CA 7.1.2.2.2/01. Castro, L. (1993)**
Title:	Long-term field dissipation of flutolanil under conditions of peanut cultivation initiated 1989, USA
Document No:	E-3023
Guidelines:	EPA Pesticides Assessment Guidelines Subdivision N, Section 164-5
Testing laboratory:	NOR-AM Chemical Company, NC, USA
GLP:	Yes

Executive Summary

The possible accumulation of flutolanil under field conditions was determined in a soil trial site in Molino, Florida, USA, 1989. A single repeated application of the formulation Flutolanil 50WP was made over three years.

One control and one test plot were selected and subdivided into subplots for the purpose of sampling. Every year for three years, peanuts were planted on both plots and those in the test plot were treated once with FLUTOLANIL 50 WP at a rate of 4.41 kg ai/ha (banded, equivalent to 2.02 kg ai/ha on a broadcast basis). Randomized samples were taken from the test plot before the first application; immediately after each application; one day after each application; and one, three, six, nine and twelve months after each application. Samples were also taken from the control plot, although not as frequently as the test plot. Samples consisting of five 91 cm cores each were taken from each of three subplots per sampling day. The five cores were divided into seven horizons (0-8, 8-15, 15-30, 30-46, 46-61, 61-76 and 76-91 cm) and the corresponding horizons were combined per subplot.

All soil samples were analysed for residues of flutolanil and its metabolite desisopropyl flutolanil using validated GC/NPD methods. The validated limit of quatification (LOQ) for both parent and metabolite was 0.01 mg/kg.

Residues of flutolanil were confined to the 0-8, 8-15 and 15-30 cm soil horizons. No residues above the LOQ (0.01 mg/kg) were found below the 15-30 cm layer. Maximum residues in the 0-8 and 8-15 cm layers (range for 3 subplots) after the first, second and third annual application, respectively, were 0.64-1.19, 0.30-1.38 and 0.55-1.5 mg/kg, recorded at 1 day after the first annual application, 30 days after the second annual application and on the day of the third annual application. At 12 months after the first, second and third annual application, respectively, residues of flutolanil were only detected in the 0-8 cm segments, and were in the range 0.07-0.13, 0.07-0.12 and 0.08-0.08 mg/kg. The study data provided no evidence for accumulation of flutolanil.
Desisopropyl flutolanil residues were detected in the 0-8 cm segment only. Maximum levels in the 0-8 cm layer (range for 3 subplots) after the first, second and third annual application, respectively, were 0.02-0.03, 0.03-0.09 and 0.04-0.04 mg/kg, in all cases recorded 30 days after each application.

MATERIALS AND METHODS

A. MATERIALS

1.

Name (formulated product):	Flutolanil 50WP
Batch number:	22971301
Active ingredient:	Flutolanil
Nominal active ingredient content:	50 % w/w
Actual active ingredient content:	49.2 % w/w

B. STUDY DESIGN AND METHODS

In-life dates: 31 July 1989 – 18 November 1992

Experimental design

A terrestrial field dissipation study with flutolanil formulated as 50% WP, a wettable powder containing 49.2% a.s. w/w, was conducted under field conditions after application to peanuts at a site in Molina, Florida, USA. One treated plot and one control plot were maintained.

Test Site Description

Location:	Molino, Florida, USA
Pre-treatment history	Not treated with test item in preceding 3 years.

Crop history	Treated plot: Corn, Oats (1986); Soybeans, Wheat, Corn (1987); Wheat (1988).
Pesticides used in preceding 3 years	Alachlor 4EC @ 2.24 kg ai/h and Atrazine 4L@ 2.24 kg ai/ha in 1986; none in 1987; none in 1988.
Maintenance applications	Between 31 May 1989 and 13 March 1992, a range of herbicides, fungicides and insecticides was applied according to normal agricultural practice.
Tilling	Tilling was performed on 6, 10 and 13 occasions in 1989, 1990 and 1991, respectively.

Prior to application soil cores for soil characterisation (0-90 cm) were taken. Details are provided below.

Table B.8.1.2.2-60 Soil Characterisation Molino, Florida, USA

Depth (cm)	0-15	15-30	30-45	45-60	60-75	75-90
MHC (a) at 1/3 bar	15.4	16.9	17.5	18.5	14.1	21.2
CEC (b)	7.6	7.2	4.8	4.6	5.5	4.5
Sand (%)	45.2	47.2	39.2	47.2	56.2	41.2
Silt (%)	34	32	32	28	20	28
Clay (%)	20.8	20.8	28.8	24.8	24.8	30.8
pH	6.3	6.2	5.4	5.4	5.4	5.3
OMC (c)	1.96	NM (d)	NM	NM	NM	NM

(a) MHC = moisture holding capacity (%).
(b) CEC = cation exchange capacity as meq/ 100 g.
(c) OMC = organic matter content as percent weight.
(d) NM = not measured.

Note: soil texture (USDA) in the 0-15 and 15-30 cm segment was loam.

The formulation Flutolanil 50WP was applied once to peanut plants with a boom sprayer. The application was banded and each band was centered on one row of peanut plants (91 cm apart and 48 m long with 5.7 cm between plants). The application band width was 45.7 cm. The application rate was 4.48 kg a.s./ha within the banded area (0.0527 ha) and the average application rate over the entire plot (0.115 ha) was 2.02 kg a.s./ha. The control plot was divided into 48 subplots and the treated plot 96 subplots. Each subplot measured 2 x 3 m. The annual peanut crop was not harvested at maturity but mowed and incorporated into the soil with a rototiller

Table B.8.1.2.2-61 Experimental design, plot set up and application details

Details	**Molino, Florida, (USA)**
Duration of study	Three years
Uncropped (bare) or cropped	Cropped with peanuts (variety florunner) (1989, 1990 and 1991).
Controls used	Yes
Number of plots	1 treated and 1 untreated control
Treated plot dimensions:	24 m x 48 m, 96 subplots of 3 m x 2 m
Untreated control plot dimensions:	12 m x 48 m, 48 subplots of 3 m x 2 m
Distance between control plot and treated plot	72 m

Details	Molino, Florida, (USA)		
Application rate used (g a.s./ha)	4.48 kg a.s./ha within the banded area, average over the whole plot 2.02 kg a.s./ha		
Application year	1989	1990	1991
Application date	31 July 1989	31 July 1990	27 August 1991
Crop stage	flowering	pegging	flowering
Application method	Banded application using a head and boom sprayer with two nozzles 91 cm apart.		
Volume of spray solution applied	140 L/ha within the banded area, average over the whole plot 64 L/ha		
Identification and volume of carrier used	Not reported		
Meteorological conditions during application			
Air temperature (°C)	28	28	26
Wind	4.4 km/hr	3.9 km / hr	7.6 km / hr
Meteorological conditions during trial	Daily air temperature, soil temperature (at 50 and 200 mm depth) and rainfall data recorded on site were provided in the report. Rainfall was supplemented with irrigation on 3 occasions in 1989 (amount per event 2.54-28.70 mm), on 4 occasions in 1990 (amount per event 6.35-33.02 mm), on 7 occasions in 1991 (amount per event 3.18-37.47 mm) and on 1 occasion in 1992 (29.21 mm).		

Sampling

Samples from the treated band of each plot were collected on the day before treatment, and at further intervals of 0, 1, 30, 91, 183, 273 and 364 days after the first treatment; 0 , 1, 30, 90, 196, 281 and 363 days after the second treatment; and 0, 1, 30, 91, 177, 273 and 364 days after the third treatment. In addition, three samples outside the treated band were taken 12 months after the first and second application. At each sampling date, five replicate soil cores of 0-15 cm depth, followed by five replicate soil cores 15-91 cm depth, were sampled from three subplots for both the treated and control plots. Soil cores were processed into the appropriate horizon (0-8, 8-15, 15-30, 30-46, 46-61, 61-76, and 76-91 cm increments). Segments from each layer were combined per subplot and homogenised. All samples were then frozen for transport to the analytical laboratory.

Analytical procedures

Soil cores were analysed separately for flutolanil and its metabolite desisopropyl flutolanil (M-4). The analytical phase was conducted at two different laboratories (ABC and NOR-AM).

Flutolanil

Aliquots of each soil sample (50 g) were extracted with acetone / water (9:1, *v/v*) for 30 minutes at ambient temperature. Extracts were filtered, concentrated (40°C) and subjected to several clean up steps including liquid-liquid partioning with hexane and a Florisil column clean-up before the concentrated residue was redissolved in ethyl acetate/hexane (20:80, *v/v*) or acetone/hexane (10:90, *v/v*) and analyzed by GC/NPD.

Desisopropyl flutolanil

Aliquots of each soil sample (50 g) were extracted with acetone / water (9:1, *v/v*) for 30 minutes at ambient temperature. Extracts were filtered, concentrated (40°C) and subjected to liquid-liquid partioning with dichloromethane before the desisopropyl flutolanil residues were derivatised with sodium iodide and sodium hydroxide to dimethyl desisopropyl flutolanil . The concentrated residue was dissolved in hexane or ethyl acetate/hexane (20:80, *v/v*) and the levels of dimethyl desisopropyl flutolanil determined by GC/NPD.

The efficiency of the analytical method for the determination of flutolanil was tested by fortifying untreated soil samples with flutolanil at target concentrations 0.01 mg/kg (n=7 and n=23 at lab NOR-AM and ABC, respectively), 0.05 mg/kg (n=3 and n=6 at lab NOR-AM and ABC, respectively), 0.1 mg/kg (n=4 at lab NOR-AM, not included at lab ABC), 0.2 mg/kg (n=13 at lab ABC, not included at lab NOR-AM), 0.5 mg/kg (n=2 at lab ABC, not included at lab NOR-AM), 1 mg/kg (n=1 and n=5 at lab NOR-AM and ABC, respectively) and 2 mg/kg (n=1 at both labs). The efficiency of the analytical method for the determination of desisopropyl flutolanil was tested by fortifying untreated soil samples with desisopropyl flutolanil at target concentrations 0.01 mg/kg (n=6 and n=30 at lab NOR-AM and ABC, respectively), 0.05 mg/kg (n=4 and n=8 at lab NOR-AM and ABC, respectively), 0.1 mg/kg (n=5 at lab NOR-AM, not included at lab ABC), 0.2 mg/kg (n=16 at lab ABC, not included at lab NOR-AM), 0.5 mg/kg (n=2 at lab ABC, not included at lab NOR-AM), 1 mg/kg (n=1 and n=5 at lab NOR-AM and ABC, respectively) and 2 mg/kg (n=1 at lab NOR-AM, not included at lab ABC). These samples were analysed concurrently with the study samples. All mean recoveries for flutolanil were in the range 88-105%, with CV in the range 5-15%. All mean recoveries for desisopropyl flutolanil were in the range 75-102%, with CV in the range 6-20%. The LOQ for both compounds was 0.01 mg/kg. Reported residues were corrected for overall mean recovery (98% for flutolanil for both labs, and 80% and 96% for desisopropyl flutolanil at ABC and NOR-AM labs, respectively).

RESULTS

Measured residues of flutolanil and desisopropyl flutolanil in all of the control samples were <LOQ (<0.01 mg/kg). The measured residues of flutolanil and desisopropyl flutolanil in samples from the treated plot are presented in the Tables below.

Residues of flutolanil were confined to the 0-8, 8-15 and 15-30 cm soil horizons. No residues above the LOQ (0.01 mg/kg) were found below the 15-30 cm layer. Maximum residues in the 0-8 and 8-15 cm layers (range for 3 subplots) after the first, second and third annual application, respectively, were 0.64-1.19, 0.30-1.38 and 0.55-1.5 mg/kg, recorded at 1 day after the first annual application, 30 days after the second annual application and on the day of the third annual application. At 12 months after the first, second and third annual application, respectively, residues of flutolanil were only detected in the 0-8 cm segments, and were in the range 0.07-0.13, 0.07-0.12 and 0.08-0.08 mg/kg. The study data provided no evidence for accumulation of flutolanil.

Desisopropyl flutolanil residues were detected in the 0-8 cm segment only. Maximum levels in the 0-8 cm layer (range for 3 subplots) after the first, second and third annual application, respectively, were 0.02-0.03, 0.03-0.09 and 0.04-0.04 mg/kg, in all cases recorded 30 days after each application.

Table B.8.1.2.2-62 Flutolanil residues in soil samples from Molina (Florida)

Nominal Time (point)	Sample Date		Sub-plot	Residue (mg/kg_{dry}) Level						
	1st appl	Latest appl		0-8 cm	8-15 cm	15-30 cm	30-46 cm	46-61 cm	61-76 cm	76-91 cm
Pre appl #1	-4	-4	86	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-
			44	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-
			21	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-
0 DAT #1	0	0	49	0.47	< 0.01	0.15	< 0.01	< 0.01	< 0.01	-
			73	0.21	0.05	0.06	< 0.01	< 0.01	< 0.01	-
			76	0.20	< 0.01	0.03	< 0.01	< 0.01	< 0.01	-
1 DAT #1	1	1	53	< 0.01	0.72	0.03	< 0.01	< 0.01	< 0.01	-
			24	0.64	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-
			27	1.19	0.07	0.05	< 0.01	< 0.01	< 0.01	-
1 MAT #1	30	30	66	0.59	0.13	0.03	< 0.01	< 0.01	< 0.01	-
			79	0.49	< 0.01	0.07	< 0.01	< 0.01	< 0.01	-
			41	0.83	0.05	0.05	< 0.01	< 0.01	< 0.01	-
3 MAT #1	91	91	12	0.31	< 0.01	0.03	< 0.01	< 0.01	< 0.01	-
			6	0.36	< 0.01	0.07	< 0.01	< 0.01	< 0.01	-
			92	0.15	< 0.01	0.04	< 0.01	< 0.01	< 0.01	-
6 MAT #1	183	183	59	0.53	0.07	0.12	< 0.01	< 0.01	< 0.01	-
			63	0.35	0.01	0.04	< 0.01	< 0.01	< 0.01	-
			71	0.05	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-
9 MAT #1	273	273	28	0.12	< 0.01	< 0.01	< 0.01	< 0.01	-	-
			56	0.17	< 0.01	< 0.01	< 0.01	< 0.01	-	-
			91	0.12	< 0.01	< 0.01	< 0.01	< 0.01	-	-
12 MAT #1(A)	364	364	70	0.12	< 0.01	< 0.01	< 0.01	< 0.01	-	-
			7	0.07	< 0.01	< 0.01	< 0.01	< 0.01	-	-
			4	0.13	< 0.01	< 0.01	< 0.01	< 0.01	-	-
0 DAT #2	365	0	29	0.23	0.08	< 0.01	< 0.01	< 0.01	-	-
			50	0.79	0.03	< 0.01	< 0.01	< 0.01	-	-
			13	0.19	< 0.01	< 0.01	< 0.01	< 0.01	-	-
1 DAT #2	366	1	1	0.58	< 0.01	< 0.01	< 0.01	< 0.01	-	-
			60	0.52	0.04	< 0.01	< 0.01	< 0.01	-	-
			31	0.95	0.04	< 0.01	< 0.01	< 0.01	-	-
1 MAT #2	395	30	5	1.38	0.02	< 0.01	< 0.01	-	-	-
			62	0.30	< 0.01	< 0.01	-	-	-	-
			78	1.02	0.02	< 0.01	< 0.01	-	-	-
3 MAT #2	455	90	25	0.14	< 0.01	< 0.01	-	-	-	-
			87	0.25	< 0.01	< 0.01	-	-	-	-
			57	0.16	< 0.01	< 0.01	-	-	-	-
6 MAT #2	561	196	9	0.21	< 0.01	< 0.01	-	-	-	-
			88	0.23	< 0.01	< 0.01	-	-	-	-
			93	0.14	< 0.01	< 0.01	-	-	-	-
9 MAT #2	646	281	26	0.13	< 0.01	< 0.01	-	-	-	-
			8	0.10	< 0.01	< 0.01	-	-	-	-
			22	0.10	< 0.01	< 0.01	-	-	-	-

Nominal Time (point)	Sample Date		Sub-plot	Residue (mg/kg_{dry}) Level						
	1st appl	Latest appl		0-8 cm	8-15 cm	15-30 cm	30-46 cm	46-61 cm	61-76 cm	76-91 cm
12 MAT #2(B)	728	363	37	0.07	< 0.01	< 0.01	-	-	-	-
			2	0.11	< 0.01	< 0.01	-	-	-	-
			72	0.12	< 0.01	< 0.01	-	-	-	-
0 DAT #3	757	0	10	1.5	< 0.01	< 0.01	-	-	-	-
			14	0.57	0.04	< 0.01	< 0.01	-	-	-
			23	0.55	< 0.01	< 0.01	-	-	-	-
1 DAT #3	758	1	18	0.83	0.06	< 0.01	< 0.01	-	-	-
			39	0.25	0.02	< 0.01	< 0.01	-	-	-
			15	0.61	< 0.01	< 0.01	-	-	-	-
1 MAT #3	787	30	47	0.34	< 0.01	< 0.01	-	-	-	-
			51	0.29	< 0.01	< 0.01	-	-	-	-
			11	0.40	0.03	< 0.01	< 0.01	-	-	-
3 MAT #3	848	91	65	0.27	< 0.01	< 0.01	-	-	-	-
			90	0.15	< 0.01	< 0.01	-	-	-	-
			17	0.18	< 0.01	< 0.01	-	-	-	-
6 MAT #3	934	177	46	0.27	0.02	< 0.01	< 0.01	-	-	-
			35	0.28	< 0.01	< 0.01	-	-	-	-
			34	0.31	0.02	< 0.01	< 0.01	-	-	-
9 MAT #3	1030	273	40	0.10	< 0.01	< 0.01	-	-	-	-
			33	0.12	< 0.01	< 0.01	-	-	-	-
			45	0.10	< 0.01	< 0.01	-	-	-	-
12 MAT #3	1121	364	32	0.08	< 0.01	< 0.01	-	-	-	-
			68	0.08	< 0.01	< 0.01	-	-	-	-
			3	0.08	< 0.01	< 0.01	-	-	-	-

(A) Residues in the 0-8 cm segment outside the banded area were 0.04, 0.04 and 0.07 mg/kg in subplot 70, 7 and 4, respectively (and <0.01 mg/kg in all deeper segments).

(B) Residues in the 0-8 cm segment outside the banded area were 0.07, 0.11 and 0.12 mg/kg in subplot 37, 2 and 72, respectively (and <0.01 mg/kg in all deeper segments).

Table B.8.1.2.2-63 Desisopropyl flutolanil residues in soil samples from Molina (Florida)

Nominal Time (point)	Sample Date		Sub-plot	Residue (mg/kg_{dry}) Level						
	1st appl	Latest appl		0-8 cm	8-15 cm	15-30 cm	30-46 cm	46-61 cm	61-76 cm	76-91 cm
Pre appl #1	-4	-4	86	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-
			44	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-
			21	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-
0 DAT #1	0	0	49	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-
			73	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-
			76	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-
1 DAT #1	1	1	53	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-
			24	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-
			27	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-
1 MAT #1	30	30	66	0.02	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-
			79	0.02	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-
			41	0.03	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-
3 MAT #1	91	91	12	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-
			6	0.02	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-
			92	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-
6 MAT #1	183	183	59	0.03	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-
			63	0.03	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-
			71	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-
9 MAT #1	273	273	28	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
			56	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
			91	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
12 MAT #1(A)	364	364	70	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
			7	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
			4	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
0 DAT #2	365	0	29	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
			50	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
			13	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
1 DAT #2	366	1	1	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
			60	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
			31	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
1 MAT #2	395	30	5	0.09	< 0.01	< 0.01	-	-	-	-
			62	0.03	< 0.01	< 0.01	-	-	-	-
			78	0.07	< 0.01	< 0.01	-	-	-	-
3 MAT #2	455	90	25	0.01	< 0.01	< 0.01	-	-	-	-
			87	0.02	< 0.01	< 0.01	-	-	-	-
			57	0.01	< 0.01	< 0.01	-	-	-	-
6 MAT #2	561	196	9	0.02	< 0.01	< 0.01	-	-	-	-
			88	0.02	< 0.01	< 0.01	-	-	-	-
			93	0.02	< 0.01	< 0.01	-	-	-	-
9 MAT #2	646	281	26	0.01	< 0.01	< 0.01	-	-	-	-
			8	<0.01	< 0.01	< 0.01	-	-	-	-

			22	0.01	< 0.01	< 0.01	-	-	-	-

Nominal Time (point)	Sample Date		Sub-plot	Residue (mg/kg_{dry}) Level						
	1st appl	Latest appl		0-8 cm	8-15 cm	15-30 cm	30-46 cm	46-61 cm	61-76 cm	76-91 cm
12 MAT #2(A)	728	363	37	< 0.01	< 0.01	< 0.01	-	-	-	-
			2	< 0.01	< 0.01	< 0.01	-	-	-	-
			72	0.01	< 0.01	< 0.01	-	-	-	-
0 DAT #3	757	0	10	< 0.01	< 0.01	< 0.01	-	-	-	-
			14	< 0.01	< 0.01	< 0.01	-	-	-	-
			23	< 0.01	< 0.01	< 0.01	-	-	-	-
1 DAT #3	758	1	18	0.02	< 0.01	< 0.01	-	-	-	-
			39	< 0.01	< 0.01	< 0.01	-	-	-	-
			15	< 0.01	< 0.01	< 0.01	-	-	-	-
1 MAT #3	787	30	47	0.04	< 0.01	< 0.01	-	-	-	-
			51	0.04	< 0.01	< 0.01	-	-	-	-
			11	0.04	< 0.01	< 0.01	-	-	-	-
3 MAT #3	848	91	65	0.03	< 0.01	< 0.01	-	-	-	-
			90	0.02	< 0.01	< 0.01	-	-	-	-
			17	0.02	< 0.01	< 0.01	-	-	-	-
6 MAT #3	934	177	46	0.03	< 0.01	< 0.01	-	-	-	-
			35	0.03	< 0.01	< 0.01	-	-	-	-
			34	0.03	< 0.01	< 0.01	-	-	-	-
9 MAT #3	1030	273	40	< 0.01	< 0.01	< 0.01	-	-	-	-
			33	< 0.01	< 0.01	< 0.01	-	-	-	-
			45	< 0.01	< 0.01	< 0.01	-	-	-	-
12 MAT #3	1121	364	32	< 0.01	< 0.01	< 0.01	-	-	-	-
			68	< 0.01	< 0.01	< 0.01	-	-	-	-
			3	< 0.01	< 0.01	< 0.01	-	-	-	-

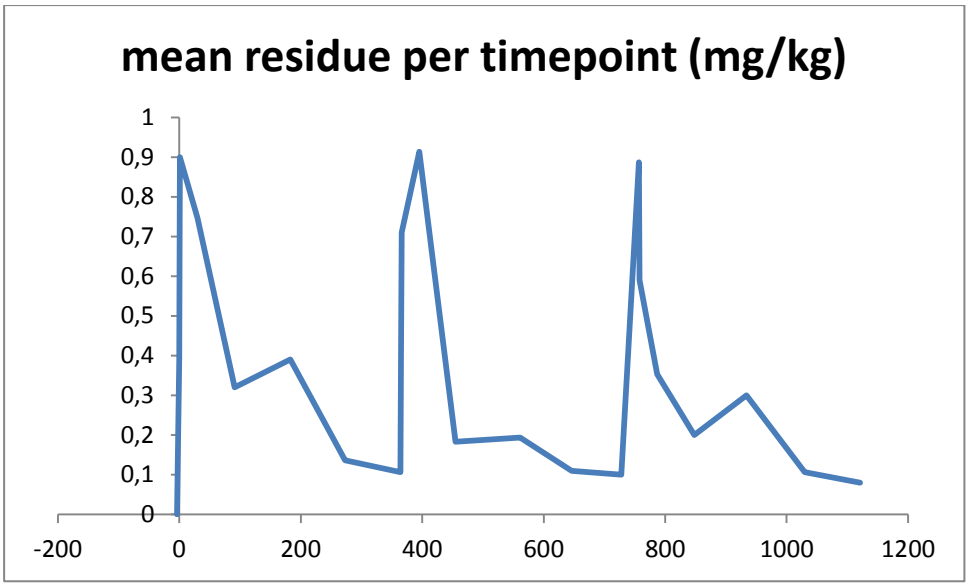
(A) Residues in all segments of all three subplots outside the banded area were <0.01 mg/kg.

CONCLUSIONS

Under field conditions in the USA (Florida) following three annual banded applications to peanut of Flutolanil 50WP equivalent to 4.48 kg a.s./ha within the banded area (2.02 kg a.s./ha over the entire plot), no residues of flutolanil were found above the LOQ (0.01 mg/kg) below the 15-30 cm layer; residue data over the three years describe a level pattern of observed residues with no increasing trend (maximum in first, second and third year 0.64-1.19, 0.30-1.38 and 0.55-1.5 mg/kg, respectively; at 12 months after the first, second and third annual application 0.07-0.13, 0.07-0.12 and 0.08-0.08 mg/kg, respectively); desisopropyl flutolanil residues were detected in the 0-8 cm segment only (maximum after the first, second and third annual application, respectively, 0.02-0.03, 0.03-0.09 and 0.04-0.04 mg/kg).

RMS remarks renewal

- Storage stability data in the original DAR (Volume B.8, page 138) demonstrate that flutolanil is stable in soil at -20°C for up to 12 months. This covers the period of frozen storage of the study samples, except for the samples of 1MAT#2 and 3MAT#2, which were stored frozen for up to 23 and 21 months, respectively, prior to analysis. This is not considered to affect the study conclusion (no accumulation under the conditions of the study).
- Reported residues were corrected for overall mean recovery (98% for flutolanil for both labs, and 80% and 96% for desisopropyl flutolanil at ABC and NOR-AM labs, respectively). Such a correction is not acceptable, considering that recoveries may differ significantly per analytical batch and per fortification level. The correction for flutolanil by a factor of 100/98 will have a negligible impact on the results however. The correction for desisopropyl flutolanil by a factor of 100/80 or 100/96 also has no impact on the conclusions.
- First order DT50 calculations based on the total mean residue (mg/kg) in the soil column were performed using the residues in the banded area, which gave SFO DT50 values for dissipation of 118, 126 and 123 days (R^2 0.96. 0.85 and 0.92) for the first, second and third year, respectively. These calculations were not performed in agreement with the recommendations of FOCUS Kinetics (2014) (e.g., based on mean residue instead of residues in individual subplots, no biphasic decline investigated) and are therefore not acceptable. The calculation of reliable DT50 values for comparison with trigger values based on the study data is hampered by the fact that, with the exception of two time points, only residue levels in the banded area were determined, hence the total residue per ha is unknown. Therefore the study results are not suitable to derive DT50 values for modelling and comparison with triggers. However, this is not required since sufficient field dissipation trials are available to derive trigger and modelling endpoints.
- The rather high variability in results (flutolanil) shortly after each application is probably a result of the band application. Since only residue levels in the banded area were determined, and hence the total residue per ha is unknown, the study results are not suitable to derive DT50 values for modelling and comparison with triggers.
- Overall evaluation: The study is acceptable, but the study results are not suitable to derive DT50 values for modelling and comparison with triggers. Based on the results it can be excluded that significant accumulation takes place. See graphical representation of the average residue pattern over time (values below LOQ neglected).


mean residue per timepoint (mg/kg)
1
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
-200
0
200
400
600
800
1000
1200

B.8.1.3 Adsorption and desorption in soil

B.8.1.3.1 Adsorption and desorption

B.8.1.3.1.1 Adsorption and desorption of the active substance

Previous evaluation	Submitted for first approval, DAR 2005
RMS remark	Not acceptable

Report:	**CA 7.1.3.1.1/01, Daly, D., (1987)**
Title:	Soil/Sediment Adsorption-Desorption with ^{14}C-Flutolanil
Document No:	#35398 (E3015)
Guidelines:	US EPA Subdivision N-163-1
Testing laboratory:	Analytical Bio-Chemistry Laboratories, Missouri
GLP:	Yes

Executive Summary

The adsorption/desorption of [aniline-^{14}C]-flutolanil was investigated in four soils and an aquatic sediment. The soil characteristics were as follows:

Table B.8.1.3.1-1 Soil characteristics

Soil ID	**Texture**	**pH**	**OC [%]**
#32 Sand	sand	6.5	0.12
#36 Clay	clay	6.7	1.40
#58 Mississippi Sediment	aquatic sediment	7.5	2.27
#53 Clay Loam	clay loam	7.8	2.85
#57 Sandy Loam	sandy loam	6.1	3.60

A soil : solution ratio of either 1:5 or 1:10 was used for the soils and an adsorption equilibrium time of either 24 or 63 hours was found to be appropriate. [^{14}C]-flutolanil was shown to be stable in the time scale of the test and radioactivity could therefore be used to determine flutolanil concentrations.

The definitive adsorption and desorption studies were conducted in pyrex culture tubes (10 mL), in the dark at 25 °C. Soil samples were treated with solutions of [^{14}C]-flutolanil in calcium chloride to produce duplicate samples per soil, with initial concentrations in the aqueous phase of 0.5, 1.0, 2.0 and 5.0 mg/L The adsorption phase was followed by a single desorption phase. Mean recovery of applied radioactivity ranged from 91 - 99% in all soils by radioassay of the adsorption and desorption supernatants and remaining soil.

Freundlich adsorption coefficients related to organic carbon content (K_{oc}) for the four soils and the sediment are summarised in the table below and were in the range of 454 to 1152 mL/g. Freundlich desorption K_{ocdes} coefficients were in the range 631 to 5521 mL/g.

The Freundlich adsorption and desorption constants for flutolanil in soil are summarised below.

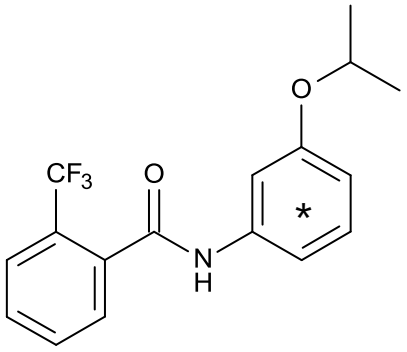
Table B.8.1.3.1-2 Adsorption and desorption constants

Soil name	Adsorption		Desorption	
	K_f	K_{oc}	K_f	K_{ocdes}
#32 Sand	1.34	1152	6.42	5521
#36 Clay	10.6	760	14.4	1032
#58 Mississippi Sediment	10.3	454	14.3	631
#53 Clay Loam	16.0	562	22.6	793
#57 Sandy Loam	35.5	985	48.9	1357

Flutolanil has a low leaching potential in all soil types tested, including an aquatic sediment.

I. MATERIALS AND METHODS

1. Test Material: [aniline-U-^{14}C]-flutolanil



* indicates position of ^{14}C radiolabel

Chemical name (IUPAC): α,α,α-trifluoro-3'-isopropoxy-*o*-toluanilide

Lot or batch number: CP-843

Specific radioactivity: 22.4 mCi/mM, (1.54 x 10^5 dpm/µg)

Radiochemical purity: 99.2%

CA registry number: 66332-96-5

Stability of test compound: Stable, determined within study

Application vehicle: Calcium chloride

2. Soils Four agricultural soils and an aquatic sediment were collected from various sites in the USA. The soils and sediment were selected to cover a range of pH, organic matter and clay content.

Table B.8.1.3.1-3 Soil properties

Parameter	**Results and Units**				
Soil Designation	#32	#36	#58	#53	#57

Textural Class	sand	clay	Mississippi sediment	clay loam	sandy loam
Sand	93.0%	8.0%	28.0%	26.0%	76.0%
Silt	3.0%	34.0%	38.0%	46.0%	16.0%
Clay	4.0%	58.0%	34.0%	28.0%	8.0%
pH	6.5	6.7	7.5	7.8	6.1
Organic Matter	0.2%	2.4%	3.9%	4.9%	6.2%
Organic Carbon	0.12%	1.40%	2.27%	2.85%	3.60%
Cation Exchange Capacity	3.8 meq/100 g	25.8 meq/100 g	20.9 meq/100 g	25.3 meq/100 g	10.9 meq/100 g
Field Capacity @ 1/3 Bar	7.77%	36.97%	36.85%	38.18%	17.62%

B. STUDY DESIGN AND METHODS

Experimental design

Preliminary tests established a pseudo-equilibration time for flutolanil between soil and 0.01 M $CaCl_2$ as a minimum of 21 hours and that flutolanil was stable in 0.01 M $CaCl_2$ over a 63 hour period. Adsorption studies were carried out by shaking soil samples (1 g or 2 g dry weight) with 0.01 M $CaCl_2$ (10 mL) containing [^{14}C]flutolanil at nominal concentrations of 4.8, 2.0, 1.0 and 0.5 mg/L in the dark for 24 or 63 hours. Following centrifugation and removal of supernatant, soil samples were weighed and desorption characteristics determined by shaking for further 20 hours with fresh 0.01 M $CaCl_2$ (10 mL).

Table B.8.1.3.1-4 Adsorption phase

Parameter		**Description**
Soil condition		Soils were air-dried for 24 hours, sieved to ≤ 20 mesh screen, autoclaved at 121°C and 15 psi for 1 hour. then oven dried at 150°C for 1 hour.
Soil sample weight		1 g (dry weight) per replicate for #53 clay loam, #57 sandy loam, 2 g (dry weight) per replicate for #32 sand, #36 clay and sediment #58 Mississippi
Equilibration solution		0.01M $CaCl_2$ (10 mL per replicate)
Control		No soil (test item in 0.01M $CaCl_2$ only)
Test item concentration	Nominal application rates	Nominal concentrations in test solution: 0.00 µg/mL, 0.5 µg/mL, 1.0 µg/mL, 2.0 µg/mL and 4.8 µg/mL
	Analytically measured concentrations	Concentrations in test solution: 0.495 mg/L, 0.983 mg/L, 1.96 mg/L and 4.66 mg/L for soils #53 clay loam, #57 sandy loam.

Parameter		Description
		Concentrations in test solution: 0.531 mg/L, 0.972 mg/L, 1.99 mg/L and 4.56 mg/L for soils for #32 sand, #36 clay and sediment #58 Mississippi
Identity and concentration of co-solvent		Calcium chloride
Soil: Solution ratio		1:10 i.e. 1 g soil dry weight equivalent to 10 mL solution #53 clay loam, #57 sandy loam, 1:5 i.e. 2 g soil dry weight equivalent to 10 mL solution for #32 sand, #36 clay and #58 Mississippi sediment
Number of replicates	Control	N/A
	Treatments	Duplicate
Equilibration conditions	Time	#53 clay loam, #57 sandy loam 24 hours, #32 sand, #36 clay and #58 Mississippi sediment 63 hours.
	Temperature	25 ± 1°C
	Dark	Yes
	Shaking method	Mechanical shaker
Method of separation of supernatant		Centrifugation
Centrifugation	Speed (g)	2000 rpm
	Duration	15 minutes
	Method of separating supernatant	Supernatant was carefully decanted.

Table B.8.1.3.1-5 Desorption phase

Parameter		Description
Soil samples from adsorption phase used		Yes
Amount of test item present in the adsorbed state/adsorbed amount (mg a.i./kg soil)		The amounts of test item adsorbed to soil after adsorption ranged from 17.7 to 80.4% AR.
Number of desorption cycles		1
Equilibrium solution and quantity used per treatment for desorption		The decanted solution was replaced by fresh aqueous 0.01 M $CaCl_2$ solution. A total volume of 10 mL was used as equilibration solution.
Soil: Solution ratio		1:10 i.e. 1 g soil dry weight equivalent to 10 mL solution #53 clay loam, #57 sandy loam, 1:5 i.e. 2 g soil dry weight equivalent to 10 mL solution for #32 sand, #36 clay and #58 Mississippi sediment
Number of replicates	Control	N/A

Parameter		Description
	Treatments	Duplicate
Desorption Equilibration conditions	Time	20 hours
	Temperature	25 ± 1°C
	Dark	Yes
	Shaking method	Mechanical shaker
Method of separation of supernatant		Centrifugation
Centrifugation	Speed (g)	1900 rpm
	Duration	10 minutes
	Method of separating supernatant	Supernatant was carefully pipetted off and filtered through Whatman GF I A glass fibre filter paper.

Analytical procedures

Radioactivity in supernatants was determined by LSC and analysed by TLC. The radioactivity in the soil phase was determined by combustion/LSC.

II. RESULTS AND DISCUSSION

Total recovery of applied radioactivity (aqueous phase plus soil) was in the range 85.9 - 94.4% mean 90.5% #32 sand, 89.9 – 103.0% mean 96.2 #36 clay, 88.9 – 95.7% mean 91.1 #58 sediment, 84.7 – 95.9% mean 92.1 #53 clay loam and 93.5 – 107% mean 98.9 #57 sandy loam.

In the definitive adsorption test 17.7 – 26.5% AR, 66.9 – 72.1% AR, 65.8 – 70.4% AR, 59.4 – 64.0% AR and 76.1 – 80.4% AR were adsorbed in soil #32 sand, #36 clay, #58 sediment, #53 clay loam and #57 sandy loam respectively.

The Freundlich adsorption and desorption constants for flutolanil in soil and sediment are summarised below.

Table B.8.1.3.1-6 Adsorption and desorption constants for flutolanil in soil

Soil Texture	pH	OC [%]	Adsorption			Desorption		
			K_f [mL/g]	K_{oc} [mL/g]	1/n	K_f [mL/g]	K_{oc} [mL/g]	1/n
#32 Sand	6.5	0.12	1.34	1152	1.164	6.42	5521	1.115
#36 Clay	6.7	1.40	10.6	760	0.913	14.4	1032	0.922
#58 Mississippi Sediment	7.5	2.27	10.3	454	0.947	14.3	631	0.974

#53 Clay Loam	7.8	2.85	16.0	562	0.942	22.6	793	0.898
#57 Sandy Loam	6.1	3.60	35.5	985	0.979	48.9	1357	0.979
Mean	-	-	18.1	782.6	0.989	21.3	1866.8	0.978

Adsorption and first desorption characteristics on the 4 soils and 1 sediment showed good fits to the Freundlich equation (1/n 0.945 for adsorption, 1/n 0.943 for desorption step).

III. CONCLUSIONS

From the K_{oc} values for adsorption the leaching potential of flutolanil was estimated to be low in all soil types tested, since K_{oc} values ranged from 454 to 1152 L/kg.

RMS remarks renewal

- It appears that soils/sediment were air-dried, autoclaved and dried at 150 °C before the adsorption test. This treatment may have drastically changed the structure of the organic matter in the soil. Therefore the calculated sorption constants and sorption exponents are not reliable.
- The report did not mention the nature of the pH measurement method.
- The range in concentrations is too low to derive the Freundlich exponent reliably.
- The organic matter content of #32 sand is below the limit of acceptability (0.5% organic matter).

Previous evaluation	Submitted for first approval, DAR 2005
RMS remark	Acceptable with remarks

Report:	**CA 7.1.3.1.1/02, Williams, M. (1992a)**
Title:	Soil/Sediment Adsorption-Desorption with ^{14}C-Flutolanil
Document No:	#40130 (E-3019)
Guidelines:	US EPA Subdivision N-163-1
Testing laboratory:	Analytical Bio-Chemistry Laboratories, Missouri
GLP:	Yes

Executive Summary

The adsorption/desorption of [aniline-^{14}C]-flutolanil was investigated in five soils. The soil characteristics were as follows:

Table B.8.1.3.1-7 Soil characteristics

Soil ID	**Texture**	**pH (water)**	**OC [%]**
#92 Sand	sand	8.0	0.17

#110 Loam	loam	8.0	0.47
#90 Clay loam	clay loam	7.4	2.85
#86 Clay loam	clay loam	6.2	0.64
#126 Loamy sand	loamy sand	4.8	1.57

A soil : solution ratio of 1:5 (*w/v*) was used for the soils and an adsorption equilibrium time of 24 hours was found to be appropriate. [^{14}C]-flutolanil was shown to be stable in the time scale of the test and radioactivity could therefore be used to determine flutolanil concentrations.

The definitive adsorption and desorption studies were conducted in Pyrex culture tubes (10 mL), in the dark at 25°C. Soil samples were treated with solutions of [^{14}C]-flutolanil in calcium chloride to produce duplicate samples per soil, with initial concentrations in the aqueous phase of 0.5, 1.0, 2.0 and 4.8 mg/L The adsorption phase was followed by a single desorption phase. Mean recovery of applied radioactivity ranged from 86 - 110% in all soils by radioassay of the adsorption and desorption supernatants and remaining soil.

Freundlich adsorption coefficients related to organic carbon content (K_{oc}) for the five soils are summarised in the table below and were in the range of 457 to 1005 mL/g. Freundlich desorption K_{ocdes} coefficients were in the range 659 to 1600 mL/g.
The Freundlich adsorption and desorption constants for flutolanil in soil are summarised below.

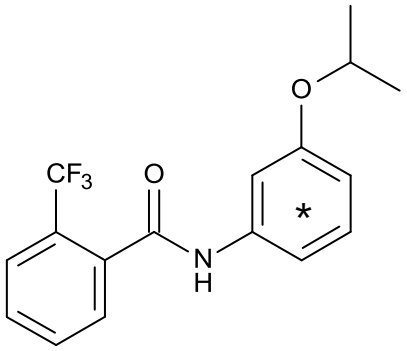
Table B.8.1.3.1-8 Adsorption and desorption

Soil name	Adsorption		Desorption	
	K_f	K_{oc}	K_f	K_{ocdes}
#92 Sand	0.996	571	2.79	1600
#110 Loam	2.76	594	3.86	830
#90 Clay loam	13.0	457	18.8	659
#86 Clay loam	4.02	628	5.71	892
#126 Loamy sand	15.8	1005	20.8	1327

Flutolanil has a low leaching potential in all soil types tested.

I. MATERIALS AND METHODS

1. Test Material: [aniline-U-^{14}C]-flutolanil



* indicates position of ^{14}C radiolabel

Chemical name (IUPAC): α,α,α-trifluoro-3'-isopropoxy-*o*-toluanilide

Lot or batch number: CP-1286

Specific radioactivity: 63.8 µCi/mg, (1.42 x 10^5 dpm/µg)

Radiochemical purity: 99.4%

CA registry number: 66332-96-5

Stability of test compound: Stable, determined within study

Application vehicle: Calcium chloride

2. Soils Five agricultural soils were collected from various sites in the USA. The soils were selected to cover a range of pH, organic matter and clay content.

Table B.8.1.3.1-9 Soil properties

Parameter	**Results and Units**				
Soil Designation	#92	#110	#90	#86	#126
Soil Series	Tiffany	Boonton	Gardena	Dundee	Norfolk
Textural Class	sand	loam	clay loam	clay loam	loamy sand
Sand	98%	50%	28%	22%	83%
Silt	2%	40%	34%	44%	13%
Clay	0%	10%	38%	34%	4%
pH (water)	8.0	8.0	7.4	6.2	4.8
Organic Matter	0.3%	0.8%	4.9%	1.1%	2.7%
Organic Carbon	0.17%	0.47%	2.85%	0.64%	1.57%
Cation Exchange Capacity	11.5 meq/100 g	23.8 meq/100 g	30.5 meq/100 g	24.0 meq/100 g	6.2 meq/100 g
Bulk Density g/cm^3	1.16	1.20	1.13	1.13	1.26
Field Capacity @ 1/3 Bar	2.3%	16.3%	36.7%	29.0%	13.0%

B. STUDY DESIGN AND METHODS

Experimental design

Preliminary tests established a pseudo-equilibration time for flutolanil between soil and 0.01 M $CaCl_2$ of 21 hours and that flutolanil was stable in 0.01 M $CaCl_2$ over a 48 hour period. Adsorption studies were carried out by shaking soil samples (2 g dry weight) with 0.01 M $CaCl_2$ (10 mL) containing [^{14}C]flutolanil at nominal concentrations of 4.8, 2.0, 1.0 and 0.5 mg/L in the dark for 48 hours. Following centrifugation and removal of supernatant, soil samples were weighed and desorption characteristics determined by shaking for further 48 hours with fresh 0.01 M $CaCl_2$ (10 mL).

Table B.8.1.3.1-10 Adsorption phase

Parameter		**Description**
Soil condition		Soils were sieved to 2 mm.
Soil sample weight		2 g (dry weight) per replicate
Equilibration solution		0.01M $CaCl_2$ (10 mL per replicate)
Control		No soil (test item in 0.01M $CaCl_2$ only)
Test item concentration	Nominal application rates	Nominal concentrations in test solution: 0.00 µg/mL, 0.5 µg/mL, 1.0 µg/mL, 2.0 µg/mL and 4.8 µg/mL
	Analytically measured concentrations	Concentrations in test solution: 0.502 mg/L, 1.04 mg/L, 2.11 mg/L and 4.91 mg/l for soils #92 sand, #110 loam, #90 clay loam and #86 clay loam Concentrations in test solution: 0.464 mg/L, 0.686 mg/L, 1.39 mg/L and 2.95 mg/L for #126 loamy sand
Identity and concentration of co-solvent		Calcium chloride
Soil: Solution ratio		1:5 i.e. 2 g soil dry weight equivalent to 10 mL solution
Number of replicates	Control	N/A
	Treatments	Duplicate
Equilibration conditions	Time	48 hours
	Temperature	25 ± 1°C
	Dark	Yes
	Shaking method	Mechanical shaker
Method of separation of supernatant		Centrifugation
Centrifugation	Speed (g)	2000 rpm
	Duration	5 minutes
	Method of separating supernatant	Supernatant was carefully decanted.

Table B.8.1.3.1-11 Desorption phase

Parameter	**Description**

Parameter		Description
Soil samples from adsorption phase used		Yes
Amount of test item present in the adsorbed state/adsorbed amount (mg a.i./kg soil)		The amounts of test item adsorbed to soil after adsorption ranged from 14.5 to 85.9% AR.
Number of desorption cycles		1
Equilibrium solution and quantity used per treatment for desorption		The decanted solution was replaced by fresh aqueous 0.01 M $CaCl_2$ solution. A total volume of 10 mL was used as equilibration solution.
Soil: Solution ratio		1:5 i.e. 2 g soil dry weight equivalent to 10 mL solution
Number of replicates	Control	N/A
	Treatments	Duplicate
Desorption Equilibration conditions	Time	48 hours
	Temperature	25 ± 1°C
	Dark	Yes
	Shaking method	Mechanical shaker
Method of separation of supernatant		Centrifugation
Centrifugation	Speed (g)	2000 rpm
	Duration	5 minutes
	Method of separating supernatant	Supernatant was decanted off

Analytical procedures

Radioactivity in supernatants was determined by LSC and analysed by TLC. The radioactivity in the soil phase was determined by combustion/LSC.

II. RESULTS AND DISCUSSION

Total recovery of applied radioactivity (aqueous phase plus soil) was in the range 93.4 –97.2% mean 95.9% #92 sand, 93.9 – 102% mean 98.6 #110 loam, 87.0 – 103% mean 95.7 #90 loam, 90.6 – 96.3% mean 93.6 #86 clay loam and 99.3 – 106% mean 102 #126 loamy sand.

In the definitive adsorption test 14.5 – 20.4% AR, 32.5 – 42.6% AR, 71.7 – 85.9% AR, 43.9 – 52.9% AR and 77.7 – 81.2% AR were adsorbed in soil #92 sand, #110 loam, #90 clay loam, #86 clay loam and #126 loamy sand respectively.

The Freundlich adsorption and desorption constants for flutolanil in soil are summarised below.

Table B.8.1.3.1-12 Adsorption and desorption constants for flutolanil in soil

Soil	pH	OC	Adsorption	Desorption

Texture		[%]	K_f [mL/g]	K_{oc} [mL/g]	1/n	K_f [mL/g]	K_{oc} [mL/g]	1/n
#92 Sand	8.0	0.17	0.996	571	0.962	2.79	1600	0.970
#110 Loam	8.0	0.47	2.76	594	0.835	3.86	830	0.892
#90 Clay loam	7.4	2.85	13.0	457	0.714	18.8	659	0.726
#86 Clay loam	6.2	0.64	4.02	628	0.901	5.71	892	0.714
#126 Loamy sand	4.8	1.57	15.8	1005	0.926	20.8	1327	0.936
Mean	-	-		651	0.892		1062	0.848

Adsorption and first desorption characteristics on the 5 soils showed good fits to the Freundlich equation (1/n 0.872 for adsorption, 1/n 0.848 for desorption step).

III. CONCLUSIONS

From the K_{oc} values for adsorption the leaching potential of flutolanil was estimated to be low in all soil types tested, since K_{oc} values ranged from 457 to 1005.

RMS remarks renewal

- Organic carbon content of #92 sand is below the acceptable range of 0.3% OC, organic matter ≥0.5%. Results for this soil should not be used for the derivation of endpoints for exposure assessment. The geometric mean of the remaining four soils is 643 L/kg.
- The range in concentrations is too low to derive the Freundlich exponent reliably; a factor of 10 between lowest and highest was applied whereas a factor of at least 100 is needed. There were no arguments as to why the two orders of magnitude was not applied. Sorption Freundlich exponents (1/n) are not reliable (One of the criteria on page 31 of the EFSA Journal 2015;13(7):4175 [54 pp.] on aged sorption. This EFSA opinion describes the reliability of the sorption exponents that are derived from OECD 106.). Therefore the use of the default value is proposed by RMS (page 40 FOCUS GW guidance, v2.2). This default of 0.9 is set when Tier 3 OECD 106 has been performed, but no reliable endpoint could be determined. This provides a slightly more conservative exposure assessment since the arithmetic mean 1/n value is just below 0.9.

B.8.1.3.1.2 Adsorption and desorption of metabolites, breakdown and reaction products

Previous evaluation	Submitted for first approval, DAR 2005
RMS remark	Acceptable with remarks

Report:	**CA 7.1.3.1.2/01, Williams, M. (1992b)**
Title:	Soil/Sediment Adsorption-Desorption with ^{14}C-Desisopropylflutolanil
Document No:	#40410 (E3020)
Guidelines:	US EPA Subdivision N-163-1
Testing laboratory:	Analytical Bio-Chemistry Laboratories, Missouri
GLP:	Yes

Executive Summary

The adsorption/desorption of ^{14}C-desisopropylflutolanil (M4) was investigated in four soils. The soil characteristics were as follows:

Table B.8.1.3.1-13 Soil characteristics

Soil ID	**Texture**	**pH (water)**	**OC [%]**
#92 Sand	sand	8.0	0.17
#110 Loam	loam	8.0	0.47
#90 Clay loam	clay loam	7.4	2.85
#126 Loamy sand	loamy sand	4.8	1.57

A soil : solution ratio of either 1:2.5 or 1:5 (*w/v*) was used for the soils and an adsorption equilibrium time of 48 hours was found to be appropriate. [^{14}C]-desisopropylflutolanil was shown to be stable in the time scale of the test and radioactivity could therefore be used to determine desisopropylflutolanil concentrations.

The definitive adsorption and desorption studies were conducted in Pyrex culture tubes (10 mL), in the dark at 25 °C. Soil samples were treated with solutions of [^{14}C]-desisopropylflutolanil in calcium chloride to produce duplicate samples per soil, with initial concentrations in the aqueous phase of 0.5, 1.0, 2.0 and 4.8 mg/L. The adsorption phase was followed by a single desorption phase. Mean recovery of applied radioactivity ranged from 90–110% in all soils by radioassay of the adsorption and desorption supernatants and remaining soil.

Freundlich adsorption coefficients related to organic carbon content (K_{oc}) for the four soils are summarised in the table below and were in the range of 288 to 396 mL/g. Freundlich desorption K_{ocdes} coefficients were in the range 339 to 527 mL/g.
The Freundlich adsorption and desorption constants for desisopropylflutolanil in soil are summarised below.

Table B.8.1.3.1-14 Adsorption and desorption

Soil name	**Adsorption**		**Desorption**	
	K_f	**K_{oc}**	**K_f**	**K_{ocdes}**
#92 Sand	0.503	288	0.591[a] (0.205)	339[a] (118)
#110 Loam	1.36	293	1.74	375
#90 Clay loam	11.3	396	14.9	522

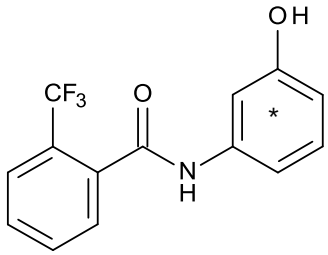
#126 Loamy sand	4.98	317	8.27	527

[a] Due to poor correlation and a percent adsorbed of < 20%, the desorption isotherm for sand #92 was also calculated using the measured amount of 1^4C-activity remaining on the soil.

Desisopropylflutolanil was demonstrated to adsorb to soil. The extent of the sorption of desisopropylflutolanil to soils is related to the organic content of the soil. Desisopropylflutolanil would be expected to have medium mobility on most agricultural soils.

I. MATERIALS AND METHODS

1. Test Material: [aniline-U-^{14}C]-desisopropylflutolanil



* indicates position of ^{14}C radiolabel

Chemical name (IUPAC): α,α,α-trifluoro-3'-hydroxy-*o*toluanilide

Lot or batch number: #CP-1413

Specific radioactivity: 85.4 µCi/mg, (1.90 x 10^5 dpm/µg)

Radiochemical purity: 98.6%

Stability of test compound: Stable, determined within study

Application vehicle: Calcium chloride

2. Soils Four agricultural soils were collected from various sites in the USA. The soils were selected to cover a range of pH, organic matter and clay content.

Table B.8.1.3.1-15 Soil properties

Parameter	**Results and Units**			
Soil Designation	#92	#110	#90	#126
Soil Series	Tiffany	Boonton	Gardena	Norfolk
Textural Class	sand	loam	clay loam	loamy sand
Sand	98%	50%	28%	83%
Silt	2%	40%	34%	13%
Clay	0%	10%	38%	4%
pH	8.0	8.0	7.4	4.8
Organic Matter	0.3%	0.8%	4.9%	2.7%
Organic Carbon	0.17%	0.47%	2.85%	1.57%
Cation Exchange Capacity	11.5 meq/100 g	23.8 meq/100 g	30.5 meq/100 g	6.2 meq/100 g
Bulk Density g/cm^3	1.16	1.20	1.13	1.26
Field Capacity @ 1/3 Bar	2.3%	16.3%	36.7%	13.0%

B. STUDY DESIGN AND METHODS

1. In-life dates:

27 July 1992 – 12 August 1992

2. Test System

Preliminary tests established a pseudo-equilibration time for desisopropylflutolanil between soil and 0.01 M $CaCl_2$ of 48 hours and that desisopropylflutolanil was stable in 0.01 M $CaCl_2$ over a 48 hour period. Adsorption studies were carried out by shaking soil samples (2 g dry weight) with 0.01 M $CaCl_2$ (5 or 10 mL) containing [^{14}C]-desisopropylflutolanil at nominal concentrations of 4.8, 2.0, 1.0 and 0.5 mg/L in the dark for 48 hours. Following centrifugation and removal of supernatant, soil samples were weighed and desorption characteristics determined by shaking for further 48 hours with fresh 0.01 M $CaCl_2$ (5 or 10 mL).

Table B.8.1.3.1-16 Adsorption phase

Parameter		**Description**
Soil condition		Soils were sieved to 2 mm.
Soil sample weight		2 g (dry weight) per replicate
Equilibration solution		0.01 M $CaCl_2$ (5 mL or 10 mL per replicate)
Control		No soil (test item in 0.01M $CaCl_2$ only)
Test item concentration	Nominal application rates	Nominal concentrations in test solution: 0.00 µg/mL, 0.5 µg/mL, 1.0 µg/mL, 2.0 µg/mL and 4.8 µg/mL
	Analytically measured concentrations	Concentrations in test solution: 0.533 mg/L, 1.04 mg/L, 2.12 mg/L and 4.85 mg/l
Identity and concentration of co-solvent		Calcium chloride
Soil: Solution ratio		1:5 i.e. 2 g soil dry weight equivalent to 10 mL solution #90 clay loam and #126 loamy sand, 1:2.5 i.e. 2 g soil dry weight equivalent to 5 mL solution for #92 sand, #110 loam
Number of replicates	Control	N/A
	Treatments	Duplicate
Equilibration conditions	Time	48 hours
	Temperature	25 ± 1°C
	Dark	Yes
	Shaking method	Mechanical shaker
Method of separation of supernatant		Centrifugation
Centrifugation	Speed (g)	2000 rpm
	Duration	5 minutes
	Method of separating supernatant	Supernatant was carefully decanted.

Table B.8.1.3.1-17 Desorption phase

Parameter	**Description**
Soil samples from adsorption phase used	Yes
Amount of test item present in the adsorbed state/adsorbed amount (mg a.i./kg soil)	The amounts of test item adsorbed to soil after adsorption ranged from 14.0 to 82.0% AR.
Number of desorption cycles	1
Equilibrium solution and quantity used per treatment for desorption	The decanted solution was replaced by fresh aqueous 0.01 M $CaCl_2$ solution. A total volume of 10 mL was used as equilibration solution.
Soil: Solution ratio	1:5 i.e. 2 g soil dry weight equivalent to 10 mL solution #90 clay loam and #126 loamy sand, 1:2.5 i.e. 2 g soil dry weight equivalent to 5 mL solution for #92 sand, #110 loam

Parameter		Description
Number of replicates	Control	N/A
	Treatments	Duplicate
Desorption Equilibration conditions	Time	48 hours
	Temperature	25 ± 1°C
	Dark	Yes
	Shaking method	Mechanical shaker
Method of separation of supernatant		Centrifugation
Centrifugation	Speed (g)	2000 rpm
	Duration	5 minutes
	Method of separating supernatant	Supernatant was decanted off

Analytical procedures

Radioactivity in supernatants was determined by LSC and analysed by TLC. The radioactivity in the soil phase was determined by combustion/LSC.

II. RESULTS AND DISCUSSION

Total recovery of applied radioactivity (aqueous phase plus soil) was in the range 98.8 – 103% mean 101%, #92 sand, 96.8 – 103% mean 101%, #110 loam, 96.8 – 99.7% mean 98.7, #90 clay loam, and 89.5 – 98.1% mean 94.9, #126 loamy sand.

In the definitive adsorption test 14.0 – 21.6% AR, 36.9– 45.1% AR, 69.2 – 82.0% AR and 44.8 – 61.5% AR were adsorbed in soil #92 sand, #110 loam, #90 clay loam and #126 loamy sand respectively.

The Freundlich adsorption and desorption constants for desisopropyl flutolanil in soil are summarised below.

Table B.8.1.3.1-18 Adsorption and desorption constants for desisopropyl flutolanil in soil

Soil Texture	pH	OC [%]	Adsorption			Desorption		
			K_f [mL/g]	K_{oc} [mL/g]	1/n	K_f [mL/g]	K_{oc} [mL/g]	1/n
#92 Sand	8.0	0.17	0.503	288	0.805	0.591[a] (0.205)	339[a] (118)	0.6286 0.9763
#110 Loam	8.0	0.47	1.36	293	0.859	1.74	375	0.702
#90 Clay loam	7.4	2.85	11.3	396	0.750	14.9	522	0.756
#126 Loamy sand	4.8	1.57	4.98	317	0.752	8.27	527	0.684

[a] Due to poor correlation and a percent adsorbed of < 20%, the desorption isotherm for sand #92 was also calculated using the measured amount of 1^4C-activity remaining on the soil.

Adsorption characteristics on the four soils showed good fits to the Freundlich equation (1/n > 0.70 for adsorption).

III. CONCLUSIONS

The results of this study for desisopropyl flutolanil on the four soil types studied yield a mean adsorption K_{oc} value of 324 indicating medium mobility.

RMS remarks renewal

- The investigated metabolite is also referred to as M4 (major water metabolite). M4 is not a major soil metabolite, but a major water metabolite (please refer to water/sediment studies).
- Organic carbon content of #92 sand is below the acceptable range (%OC ≥0.3, organic matter ≥0.5%). Results for this soil should not be used for the derivation of endpoints for exposure assessment. The geometric mean of the remaining three soils is 333 L/kg.

- The range in concentrations is too low to derive the Freundlich exponent reliably; a factor of 10 between lowest and highest was applied whereas a factor of at least 100 is needed. Sorption exponents are not reliable for these soils. Therefore the use of the default values is proposed by RMS. This default of 0.9 is set when Tier 3 OECD 106 has been performed, but no reliable endpoint could be determined (page 40 FOCUS GW guidance, v2.2). This provides a more conservative exposure assessment since the arithmetic mean 1/n value is below 0.9.

B.8.1.3.2 Aged Sorption

Please refer to the study of Daly (1991b, study CA 7.1.1.1/06) in section B.1.1.1.
No aged sorption endpoint available or required.

B.8.1.4 Mobility in soil

B.8.1.4.1 Column leaching studies

Previous evaluation	Submitted for first approval, DAR 2005
RMS remark	Supporting

Report:	**CA 7.1.4.1.1/01, Ellgehausen E., (1986)**
Title:	Leaching Characteristics of MONCUT (Flutolanil) in Three Soils
Document No:	#066330 (E-3005)
Guidelines:	Merkblatt 37, Biologische Bundesanstalt fur Land - und Forstwirtschaft <FRG), 1. Auflage, March 1973.
Testing laboratory:	RCC UMWELTCHEMIE AG CH-4452 Itingen/Switzerland
GLP:	Yes

Executive summary:

The leaching characteristics of MONCUT, i.e. FLUTOLANIL SC 400 (= CGD 94370 F) was studied in three standard German soils (Speyer 2.1 sand, Speyer 2.2 sand and Speyer 2.3 sandy loam).

The soil columns were filled with air dried soil up to 30 cm. Soils were then saturated with water. Formulation was applied on the top of the soil columns at a field rate of 1000 g as./ha (0.2 mg/column). The soil surface was covered with a filter paper. A target of 385 mL (corresponding to 200 mm of artificial rain fall) of water was delivered on the top of the columns over a period of 48

hours at room temperature in the dark. Any flutolanil in the leachate was collected, extracted into dichloromethane and analysed by gas chromatography.

No flutolanil was found in the leachates of the three soils. Flutolanil is therefore considered not to leach into the adjacent groundwater when applied at its recommended field rate.

I. MATERIALS AND METHODS

1. Formulated product: FLUTOLANIL SC 400 (= CGD 94 370 F) i.e. α,α,α-trifluoro-3'-isopropoxy-*o*-toluanilide

Lot or batch number: Acc. to delivery 287/86

Active ingredient: Flutolanil

Purity: 97.5%

Concentration of active ingredient: 400 g/l

2. Soils: The leaching behaviour of MONCUT (Flutolanil SC 400 (CGD 94370 F) was investigated in soil columns using German standard soils Speyer 2.1, Speyer 2.2 and Speyer 2.3.

Table B.8.1.4.1-1 Soil Characteristics

Soil	Speyer 2.1 Germany	Speyer 2.2 Germany	Speyer 2.3 Germany
	sand	sand	sandy loam
pH (KCl)	6.0	6.0	6.6
Organic carbon (%)	0.48	2.55	0.74
CEC (meq/100 g)	3.6	7.2	4.5
Particle size			
<0.002	5.3	4.9	10.9
0.002 - 0.02	3.8	7.1	13.4
0.02 - 0.2	23.3	39.6	31.2
>0.2	67.6	46.4	44.5

B. STUDY DESIGN

1. In-life dates:

02 May 1986 – 03 June 1986

2. Test System

The soil columns (length 40 cm; inner diameter 5 cm) were filled with the air dried and sieved (2 mm) soil up to 30 cm. Soils were then saturated with water overnight. Moncut was applied on the top of the soil columns. The dose rate was equivalent to a recommended field rate of 1000 g a s./ha (0.02 mg/column). The soil surface was covered with a filter paper. A target of 393 mL (corresponding to 200 mm of artificial rain fall) of water solution was delivered on the top of the columns over a period of 4 days (peristaltic pump delivering approx. 0.14 mL/min, at room temperature in the dark).

2. Sampling

A 100 ml aliquot of the respective leachates was partitioned two times with 20 ml dichloromethane by shaking for 3 minutes. The organic phases (lower layers) were separated and combined. The combined organic extracts were dried over anhydrous sodium sulphate. The dichloromethane extract was evaporated to dryness and dissolved in 10.0 ml n-hexane and analysed by Gas Liquid Chromatography (GLC).

3. Description of analytical procedures

The samples were analysed by ECD detection on a gas chromatograph fitted with a SE-54 borosilicate capillary column. The carrier gas was hydrogen set at 0.4 bar and the make-up gas nitrogen at 30 mL/min. Quantification of the samples was performed against a calibration curve consisting of standard solutions containing from 0.025 µg/mL to 1.0 µg/mL of flutolanil in hexane. LOQ in the leachate was 0.001 µg/mL of leachate corresponding to 0.48 µg in the total volume of leachate. The recovery of flutolanil from aqueous samples was determined at 0.01 and 0.05 µg/ml. A mean recovery of 116.2 % was determined for flutolanil.

II. RESULTS AND DISCUSSION

Findings

No flutolanil (<0.48 µg) was collected in the leachates of the standard soils I, II and III, respectively. When expressed as a percentage of the amount of flutolanil applied onto the soil columns, these figures corresponded to a value of less than 0.24% (below the limit of quantification).

Table B.8.1.4.1-2 Column leaching behaviour of flutolanil

Soil name Soil type	Application rate [g as./ha]	Leachate [mL]	Total flutolanil in leachate [µg]	Flutolanil in % applied to the column [%]
Speyer 2.1 sand	200	385	<0.48	<0.24
Speyer 2.2 sand	200	385	<0.48	<0.24
Speyer 2.3 sandy loam	200	385	<0.48	<0.24

III. CONCLUSIONS

No flutolanil was found in the leachates of the three soils. Flutolanil is therefore considered not to leach into the adjacent ground-water when applied at its recommended field rate.

Remarks RMS renewal

- The soils were not fractioned after the leaching. It would be possible to calculate very conservative sorption constants from the results. More reliable sorption values are available from batch equilibrium sorption studies. These batch equilibrium sorption studie results are used for modelling.

B.8.2 Fate and behaviour in water and sediment

B.8.2.1 Route and rate of degradation in aquatic systems (chemical and photochemical degradation)

B.8.2.1.1 Hydrolytic degradation

Previous evaluation	Submitted for first approval, DAR 2005
RMS remark	Acceptable

Report:	**CA 7.2.1.1/01, Daly D., & Ediger K. (1987)**
Title:	Hydrolysis of ^{14}C-Flutolanil as a Function of pH at 25°C
Document No:	35399 (E-3016)
Guidelines:	EPA N-161-1
Testing laboratory:	ABC Laboratories, Inc., Missouri, USA
GLP:	Yes

Executive summary:

A 30-day hydrolysis study was conducted with ^{14}C-flutolanil universally labelled in the aniline ring in the dark at 25 ± 1 °C in four aqueous buffered solutions, pH 5, pH 7-TRIS, pH 7-HEPES and pH 9 at a nominal concentration of 4.5 µg/mL. All buffers and glassware used in the study were sterilized prior to use.

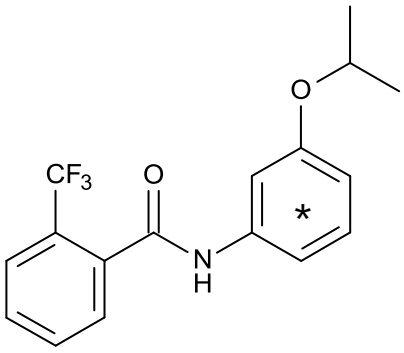
Mean ^{14}C-accountability for pH 5, pH 7-TRIS, pH 7-HEPES and pH 9 buffered systems was 101%, 104%, 104% and 101% (mean of duplicate studies), respectively. Characterization of ^{14}C-flutolanil and possible hydrolysis products was by normal phase thin layer chromatography (TLC). Quantification of ^{14}C-residues was by liquid scintillation counting (LSC).

No hydrolysis products were observed at any time point in any of the buffered systems tested during the study.

.I. MATERIALS AND METHODS

A. MATERIALS

1. Test material: [aniline-U-^{14}C]-flutolanil



* indicates position of ^{14}C radiolabel

Chemical name (IUPAC): α,α,α-trifluoro-3'-isopropoxy-*o*-toluanilide

Specific activity: 22.4 mCi/mmol (1.54 x 10^5 dpm/µg)
Lot or batch number: CP-843 Flutolanil - ^{14}C
Radiochemical purity: >99%
CAS registry number: 66332-96-5
Stability of test compound: Stable, determined within study

Application vehicle: Acetonitrile

B. STUDY DESIGN AND METHODS

1. In-life dates:

04 February 1987 – 30 April 1987

2. Test System

This study was performed in 0.1 M pH 5 acetate buffer, pH 7 TRIS buffer and pH 9 borate buffer. Sodium acetate was dissolved in sterilised deionised water and the resulting solution adjusted to pH 5 with acetic acid and then diluted to volume. Tris (hydroxymethyl) aminomethane was dissolved in sterilised deionised water and the resulting solution adjusted to pH 7 with 0.2 M hydrochloric acid and then diluted to volume. A second buffer system at pH 7 was prepared with HEPES (N-2-hydroxyethylpiperazine-N'-2-ethanesulfonic acid) in sterilised deionised water. Glycine was mixed with 0.2 M sodium hydroxide to prepare a buffer solution at pH 9. The buffer was sterilised by autoclaving for 1 hour at 15 psi (103 kPa) and 250 °F (120 °C), pH of the buffers were checked after sterilisation.

Table B.8.2.1.1-1 Experimental design

Parameter		**Description**
Duration of the test		30 days
Buffer condition		Sterile, autoclaved for 1 hour at 15 psi (103 kPa) and 250° F (120 °C), pH checked following sterilisation
Sample size (mL per test vessel)		10 mL
Test concentration (mg ai/mL total buffer)		4.5 µg/mL (nominal)
Control conditions sterility samples		Yes
Number of replicates		Aliquot taken from the stock solution at each sampling interval
Test apparatus		24 mL amber glass vials
Incubation conditions		pH 5 acetate buffer, pH 7 tris buffer and HEPES buffer, pH 9 glycine buffer (0.1 mol/L)
Traps for CO_2 & organic volatiles		Not applicable
Test material application	Identity of solvent	Acetonitrile
	Volume of test solution used/treatment	161 µL in 10 mL of buffer under nitrogen
Indication of test material adsorbing to walls of test apparatus		No
Experimental conditions	Temperature (°C)	25 ± 1°C
	Continuous darkness:	Yes
	Agitation	No

Table B.8.2.1.1-2 Sampling

Parameter		**Details,**
Sampling intervals for the parent/transformation products		0, 7, 14, 22 and 30 days
Sampling procedure		Aliquots were taken for LSC analysis and an aliquot was taken for TLC analysis.
Collection of CO_2 and other volatiles		Not applicable
Measurements intervals	pH measurement	Time zero and at 30 days.
Sample storage before analysis		Samples were analysed immediately after sampling
Temperature		25.0 °C

Description of analytical procedures

Aqueous samples were radioassayed using LSC and analysed by TLC (co-chromatography with unlabelled compounds to determine the levels of parent and significant degradates in each sample.

II. RESULTS AND DISCUSSION

The recoveries at the beginning and end of the study are summarised below.

Table B.8.2.1.1-3 Mass Balance

Total radioactivity	Sum of activity in the treatment solution
Recovery at 0 DAT	pH 5 100% AR pH 7 100% AR TRIS, pH 7 100% AR HEPES pH 9 100% AR
Overall recovery (all samples)	pH 5 Range 99% to 103%, Average 101% AR pH 7 Range 100% to 107%, Average 104% AR TRIS, pH 7 Range 100% to 108%, Average 104% AR HEPES pH 9 Range 100% to 110%, Average 100.8% AR pH 9 (repeat) Range 89.5% to 110%, Average 94.5% AR

Table B.8.2.1.1-4 Volatilisation

$^{14}CO_2$ and other volatiles	Not applicable

Transformation of Parent Material

No significant variation in pH occurred in any of the tests. Mean ^{14}C accountability of the five buffered test solutions (pH 5, pH 7-TRIS, pH 7-HEPES, pH 9 and pH 9 (repeat)) was 101%, 104%, 104%, 107%, and 94. 5%, respectively, of the initial (day 0) concentration.

The ^{14}C-flutolanil did not hydrolyse in any of the four pH solutions. By TLC analysis, parent ^{14}C-flutolanil accounted for 99. 5%, 99.3%, 99.0%, 98.1% and 98.3% of the dpm recovered in the day 30 pH 5, pH 7-TRIS, pH 7-HEPES, pH 9 and pH 9 (repeat) solutions, respectively. No degradation products were observed.

Table B.8.2.1.1-5 Distribution and composition of radioactivity at pH 5 buffer as % of applied radioactivity

pH 5	Sample Time (Days)				
Sample Time (Days)	0	7	14	22	30
Recovery	100	102	99	101	103
Flutolanil	-	98.9	99.6	98.6	99.5

- no analysis done

Table B.8.2.1.1-6 Distribution and composition of radioactivity at pH 7 TRIS and HEPES buffer as % of applied radioactivity

pH 7	Sample Time (Days)				
Sample Time (Days)	0	7	14	22	30
Recovery	100 (100)	104 (108)	103 (105)	105 (100)	107 (108)
Flutolanil	96.4 (99.1)	99.0 (99.0)	98.9 (97.9)	96.0 (97.5)	99.1 (99.0)

( ) HEPES buffer

Table B.8.2.1.1-7 Distribution and composition of radioactivity at pH 9 as % of applied radioactivity

pH 9	Sample Time (Days)				
Sample Time (Days)	0	7	14	22	30
Recovery	100 (100)	108 (96.3)	108 (93.8)	108 (89.5)	110 (93.0)
Flutolanil	98.0 (99.2)	98.9 (98.7)	99.0 (98.8)	91.3 (98.6)	98.1 (98.3)

( ) repeat samples. pH 9 samples were repeated because on the completion of the first set of sample, it was found that the pH of the solution had dropped to pH 8.61.

III. CONCLUSIONS

Flutolanil is stable to hydrolysis within the pH range generally encountered in the environment.

Remarks RMS renewal

The conclusion that flutolanil is stable in the range pH5 – pH9 is acceptable.

Previous evaluation	Submitted for the purpose of renewal
RMS remark	Acceptable

Report:	**CA 7.2.1.1/02, O, Connell C. & Adams, A. (2015)**
Title:	[^{14}C]-Flutolanil: Aqueous Hydrolysis as a Function of pH
Document No:	XG/15/010 (E-3053)
Testing laboratory:	Battelle UK Ltd, Essex, UK
Guidelines:	OECD 111
GLP:	Yes

Executive summary:

The route and rate of hydrolysis of 14C-flutolanil has been studied, in the dark, in sterile aqueous buffered oxygen-free solutions, at pH 4, pH 7 and pH 9 at a nominal concentration of 0.5 mg L^{-1} (<1% co-solvent acetonitrile).

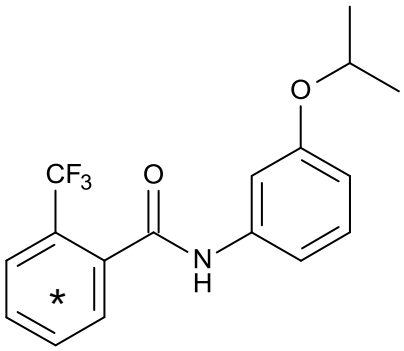
A Tier 1 study was conducted at pH 4, 7 and 9 at 50°C. Duplicate samples for each pH value were analysed at zero time and after five days incubation. The aqueous solutions were analysed directly by liquid scintillation counting (LSC) and high performance liquid chromatography (HPLC). The overall recovery of radioactivity ranged from 97.5 to 101.9% of applied radioactivity (AR). Flutolanil was the only component observed by HPLC), and confirmed by thin layer chromatography (TLC), using co-chromatography with a certified reference standard.

Flutolanil was stable at pH 4, 7 and 9 for 5 days at 50°C.

MATERIALS AND METHODS

A. MATERIALS

1. Test material: [phenyl-U-^{14}C]-flutolanil



* indicates position of ^{14}C radiolabel

Specific activity: 118 mCi/mmol (360.8 µCi/mg, 801,000 dpm/µg)
4.37 GBq/mmol (13.3 MBq/mg)

Lot or batch number: Quotient BioResearch (CFQ42127, original batch), PTRL West (2747W, repurified batch)

Radiochemical purity: 99.38%

B. STUDY DESIGN AND METHODS

1. In-life dates:

13 May 2015 – 4 August 2015

2. Test System

The study was conducted to investigate the rate and route of hydrolysis of flutolanil, in the dark, in sterile aqueous buffered solutions, at pH 4 (0.01 M sodium acetate), pH 7 (0.01 M tris (hydroxymethyl)

aminomethane hydrochloride) and pH 9 (0.01 M disodium tetraborate) at a nominal concentration of 0.5 mg/L. The buffers were sterilized by filtration through a 0.22 µm filter, sample tubes (amber glass vials) were sterilized in an autoclave and sample caps and other items were sterilized by rinsing with 70% ethanol. Each solution was purged with nitrogen before use for approximately five minutes. The sterility of the buffer solutions was tested by dispensing an aliquot onto a nutrient agar plate followed by incubation for several days. For each buffer, aliquots (5 mL) were treated with radiolabelled test item solution in acetonitrile (0.025 mL, 2.46 µg) giving a nominal concentration of 0.5 mg/L (0.5% acetonitrile). After treatment aliquots were taken for radioassay to verify the application rate and an aliquot was taken for HPLC to assess the radiochemical purity. For each pH, two samples containing the radiolabelled test solutions were processed immediately after treatment as time zero samples. All remaining sample vials were sealed with PTFE lids and PTFE tape and maintained at 50°C ± 0.5°C for five days. After the incubation time had elapsed, duplicate samples were taken for analysis. Analysis involved addition of acetonitrile (2 mL) followed by LSC. Further analyses to quantify and identify the radiolabelled materials present in the test solutions were conducted using reversed phase HPLC and normal phase TLC.

RESULTS

During sterility measurements, no microbial colonies were observed in pH 4 and 7 samples therefore these samples were sterile throughout the incubation. Three colonies were observed from the pH 9 sample. Since no degradation of the test item was observed, these results have no impact on the outcome of the study.

The pH measurements before and after sterilization and at the end of incubation were in the range 4.04-4.06, 6.93-7.02 and 8.97-9.03 at pH 4, 7 and 9, respectively.

The identity of the test item was confirmed by mass spectrometry upon receipt at the test facility. HPLC column recovery was determined for 2 samples (one each at pH 4 and pH 9) from incubations after five days (recovery 97.5 and 108.4%).

The initial concentration, as measured by LSC, was 0.51 mg/L. The recoveries ranged from 97.5 to 101.9% AR. In the time zero samples, Flutolanil was the only component observed (by HPLC) accounting for 100.7, 101.2 and 99.3% of applied radioactivity under pH 4, pH 7 and pH 9 conditions. Following incubation at 50°C for five days, Flutolanil was still the only component observed (by HPLC), accounting for 97.7% AR, 99.7% AR and 99.6% AR under pH 4, pH 7 and pH 9 conditions respectively. No degradation products were observed. The presence of Flutolanil in selected samples (pH 4, 0 and 5 days; pH 7, 0 and 5 days and pH 9, 0 and 5 days) was confirmed following TLC analysis by comparison with a certified reference standard.

The study showed that Flutolanil was stable at pH 4, 7 and 9 for 5 days at 50°C.

Table B.8.2.1.1-8 Recovery of Radioactivity (all results as % AR)

Process	Time point	Vessel ID	% Recovery
pH 4	T0	D2	101.8
		D3	99.6
		Mean	**100.7**
	5 days	D9	97.5
		D10	97.9
		Mean	**97.7**
pH 7	T0	D4	100.4
		D5	101.9
		Mean	**101.2**
	5 days	D11	99.2
		D12	100.1
		Mean	**99.7**
pH 9	T0	D6	98.8
		D7	99.7
		Mean	**99.3**
	5 days	D13	98.9
		D14	100.2
		Mean	**99.6**

Note: Flutolanil was the only component observed (by HPLC and TLC) in all test solutions

CONCLUSIONS
Flutolanil was stable at pH 4, 7 and 9 for 5 days at 50°C.

B.8.2.1.2 Direct photochemical degradation

Previous evaluation	Submitted for first approval, DAR 2005
RMS remark	Acceptable with remarks

Report:	**CA 7.2.1.2/01, Carpenter,. M. & Fennessey,. M. (1991)**
Title:	Determination of Photodegradation of ^{14}C-Flutolanil in Aqueous Solution
Document No:	#35176R (E-3010)
Guidelines:	N-161-2
Testing laboratory:	ABC Laboratories, Inc., Missouri, USA
GLP:	Yes

Executive Summary

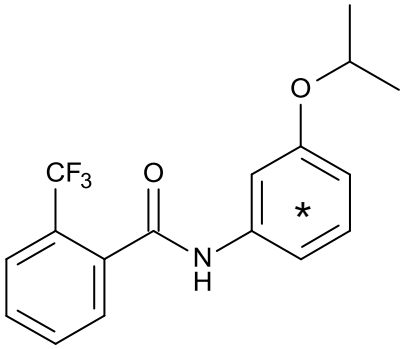
The photolysis by light from a Xenon arc of [aniline-U-^{14}C] flutolanil in a solution of tris (hydroxymethyl) aminomethane buffered to pH 7 with hydrochloric acid was studied over a 30 day period under photosensitised (with 1% acetone) and non-photosensitized conditions. The concentration of the flutolanil was 3.88 µg/ml in the non-sensitized systems and 3.93 µg/ml in the sensitized systems. The results from the samples exposed to light were compared with those from identical controls maintained in the dark. Samples were taken for analysis at seven time points over 30 days. Analysis was by liquid scintillation counting to determine total radioactivity present, followed by TLC to establish the proportion present as parent compound. Accountability of applied radioactivity was good under all conditions (>97% in the light and dark non-sensitized systems and >93% in the sensitized systems). Less than 1% of the total applied activity in the sensitized system was found to be volatile by use of gas trapping apparatus. No detectable degradation was found in the dark controls.

Half -lives for the sensitized and non-sensitized systems were calculated to be 51 and 277 days, respectively. TLC analysis of the exposed test solutions showed a steady increase in origin material throughout the study to 5.2% of total in the non-sensitised system at the final time point. Several other components were observed in both systems, but only represented trace amounts of the total.

I. MATERIALS AND METHODS

A. MATERIALS

1. Test material: [aniline-U-^{14}C]-flutolanil



* indicates position of ^{14}C radiolabel

Chemical name (IUPAC):	α,α,α-trifluoro-3'-isopropoxy-*o*-toluanilide
Specific activity:	81.53 µCi/mg
Lot or batch number:	CP843
Radiochemical purity:	96.4%
CAS registry number:	66332-96-5
Stability of test compound:	Stable, determined within study
Application vehicle:	Acetonitrile

B. STUDY DESIGN AND METHODS

1. In-life dates:

23 February 1987 – 07 April 1987

2. Test System

This study was performed in 0.2 M pH 7 tris buffer. The buffer solution was prepared by adding 0.2 M hydrochloric acid solution to 500 ml of a 0.2 M tris(hydroxymethyl) aminomethane to adjust the pH to 7.0. The buffer was sterilised by autoclaving.

Table B.8.2.1.2-1 Experimental design

Parameter			Description
Nature of light source			Xenon lamp
Emission wavelength spectrum			290 - 750 nm
Filters used			UV filter that cuts out wavelengths of <290 nm
Relationship to natural sunlight			Similar spectral distribution
Duration of the test			30 days
Test system			Irradiated sample and dark control samples, 280 mL of sterile pH 7.0 buffer
Test concentration			3.88 µg/mL
Control conditions			Darkness
Number of replicates		Irradiated	Duplicate
		Dark Controls	Duplicate
Test apparatus		Irradiated	Tubes exposed to the output of the Xenon lamp
		Dark Controls	Reaction vessels wrapped in aluminium foil
Traps for CO_2 & organic volatiles			Out coming air passed through series of traps ethylene glycol, 1 N sulphuric acid and 1 N potassium hydroxide from one individual sample continuing sensitised test solution, traps were sampled after 3, 7, 14, 21 and 30 days.
Test material application	Identity of solvent		Acetonitrile
	Volume of application solution		4.04 mL in 280 mL of buffer divided between 10 mL tubes
	Evaporation of application solvent		Yes
Indication of test material adsorbing to walls of test apparatus			At the end of the experiment the vessels were washed with acetonitrile /distilled water (1/1 *v/v*).
Experimental conditions		Temperature (°C)	25 ± 1 °C
		Continuous irradiation	Yes

Table B.8.2.1.2-2 Sampling

Parameter		Details,
Sampling intervals for the parent/transformation products		0, 1, 2.96, 6.95, 13.9, 21.0 and 30 days irradiated
Sampling procedure		Aliquots were taken for LSC analysis and an aliquot was taken for TLC analysis.
Collection of CO_2 and other volatiles		Analysed at 30 day interval.
Measurements intervals	pH measurement	Initial buffer solution
	Sterility check	n/a
Temperature		25 °C

Description of analytical procedures

Aqueous samples were radioassayed using LSC and analysed by TLC to determine the levels of parent and significant photodegradates in each sample.

Rate constants for flutolanil degradation were calculated on the assumption of first order kinetics.

II RESULTS AND DISCUSSION

The total recoveries and distribution of radioactivity are shown in detail in Table B.8.2.1.2-3 to Table B.8.2.1.2-4. The recoveries and trap contents at the beginning and end of the study are summarised below.

Mass Balance

Total radioactivity	Sum of activity in the treatment solution
Recovery at 0 DAT	Irradiated & Dark Control 100% AR
Overall recovery (all samples)	Irradiated: Range 97.4% to 102%, mean 100% Dark control: Range 97.4% to 100%, mean 99.4%

Volatilisation

$^{14}CO_2$ and other volatiles	No $^{14}CO_2$ or organic volatiles evolved.

Transformation of Parent Material

The mean recoveries were in the range of 97.4% to 102% of the initially applied radioactivity.

TLC analysis of the dark control samples under both sensitized and non-sensitized conditions showed no decline in the concentration of flutolanil over the 30-day period.

Limited breakdown of flutolanil was observed in the non-sensitized system exposed to light. The concentration of flutolanil fell by 7.6% to 91.2% after 30 days. In the sensitized, light exposed samples, the rate of degradation of the flutolanil was more significant, only 64.1 % of parent compound remained intact at the 30-day time point. Degradation products generated in the non-sensitized exposed test system were minor, i.e. 5.2% or less.

Table B.8.2.1.2-3 Distribution of radioactivity in irradiated samples pH 7 (non-sensitized)

	Sample Time (Days)						
	0	1	2.96	6.95	13.9	21.0	30.0
Aqueous extract	100	101	102	98.7	102	98.7	99.5
Mean ± sd	100 ± 1.42						
Flutolanil	98.8	95.7	95.0	97.1	94.9	93.6	91.2

Table B.8.2.1.2-4 Distribution of radioactivity in dark control samples pH 7

	Sample Time (Days)						
	0	1	2.96	6.95	13.9	21.0	30.0
Aqueous extract	100	100	98.2	97.4	100	100	100
Mean ± sd	99.4 ± 1.10						
Flutolanil	98.8	97.6	95.4	98.8	98.8	97.8	99.4

III. CONCLUSIONS

Half-lives for the sensitized and non-sensitized systems were calculated to be 51 and 277 days, respectively. TLC analysis of the exposed test solutions showed a steady increase in origin material throughout the study to 5.2% of total in the non-sensitised system at the final time point. Several other components were observed in both systems, but only represented trace amounts of the total.

Remarks RMS renewal

- Analytical results are considered to be acceptable.
- Recalculation using FOCUS degradation kinetics is necessary to derive reliable half-lives (exposed conditions).
- The following table gives flutolanil concentrations in course of time for the four incubation series.

Table B.8.2.1.2-5 Flutolanil (% of time zero flutolanil) in course of time

incubation conditions	**Sample Time (Days)**						
	0	1	2.96	6.95	13.9	21.0	30.0
non-sensitised dark	100	99.2	94.8	97.4	100	99.2	101
sensitised dark	100	97.7	96.4	101	98.5	98.7	101
non-sensitised exposed	100	97.4	98.4	97.1	98.2	93.5	91.9
sensitised exposed	100	92.3	68.3	67.0	67.0	62.4	60.6

Previous evaluation	Submitted for first approval, DAR 2005
RMS remark	Acceptable

Report:	**CA 7.2.1.2/02, Bashir,. M. (1991)**
Title:	Identification of Degradation Products of Flutolanil in an Aqueous Photosensitized System
Document No:	#38426 (E-3011)
Guidelines:	N-161-2
Testing laboratory:	ABC Laboratories, Inc., Missouri, USA
GLP:	Yes

Executive Summary

The photolytic degradation of flutolanil had been investigated in a previous study in buffer at pH 7 (CA 7.2.1.2/01) under both non-sensitized and sensitized photolytic conditions. Very slow degradation was observed under non-sensitized conditions. Significant degradation, however, was observed under sensitized conditions, but insufficient material was recovered to allow identification of the photoproducts. The objective of this study was to try to produce a large quantity of the photoproducts for identification purposes.

[Aniline-U-^{14}C] -flutolanil in pH7 tris (hydroxymethyl) aminomethane buffer containing 1% acetone was exposed to a xenon arc light source. The exposure period was for 14 days as a bulk of test solution (1200 ml) in which < 1% degradation occurred, with a further 14 days after division into smaller aliquots (70 ml). Flutolanil (77.1%) and three major polar zones (each of three zones 3.3 - 4.4% of total) were found to contain the majority of the radioactivity after the final 14 day exposure period. No single component of the remainder (including the origin material) represented more than 3% of the total radioactivity.

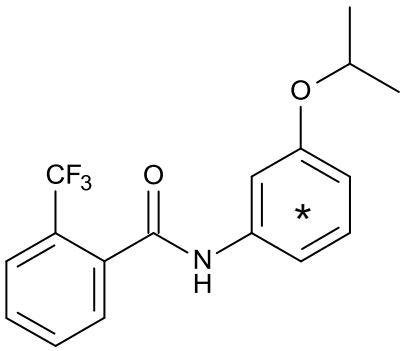
The three major zones were purified by a scheme involving solvent extraction, freeze-drying, solvent extraction of the resulting solid, open column chromatography and preparative TLC. Analytical TLC and HPLC found that these zones did not co-chromatograph with any known metabolite or environmental breakdown product from studies on other test systems.

Radio-LC/MS proved these zones to have mass spectra without any of the ions characteristic of either flutolanil or of the known environmental breakdown products. Spectra of these zones were consistent with artefacts formed by reaction of flutolanil with the acetone photosensitizer and the tris buffer. These products would not therefore be found in the environment.

I. MATERIALS AND METHODS

A. MATERIALS

1. Test material: [aniline-U-^{14}C]-flutolanil



* indicates position of ^{14}C radiolabel

Chemical name (IUPAC):	α,α,α-trifluoro-3'-isopropoxy-*o*-toluanilide
Specific activity:	7.27 µCi/mg
Lot or batch number:	CP-993
Radiochemical purity:	99.5%
CAS registry number:	66332-96-5
Stability of test compound:	Stable, determined within study
Application vehicle:	Acetone

B. STUDY DESIGN AND METHODS

1. In-life dates:

13 November 1989 – 26 January 1990

2. Test System

This study was performed in 0.05M pH 7 tris buffer. The buffer solution was prepared by adding 1 M hydrochloric acid solution to 10 L of a 0.05 M tris(hydroxymethyl) aminomethane to adjust the pH to 7.0. The buffer was sterilised by autoclaving.

Table B.8.2.1.2-6 Experimental design

Parameter			Description
Nature of light source			Xenon lamp
Emission wavelength spectrum			290 - 750 nm
Filters used			UV filter that cuts out wavelengths of <290 nm
Duration of the test			28 days
Test system			Irradiated sample, 1000 mL of sterile pH 7.0 buffer
Test concentration			4.29 µg/mL
Control conditions			Not applicable
Number of replicates		Irradiated	Duplicate
		Dark Controls	Not applicable
Test apparatus		Irradiated	Tubes exposed to the output of the Xenon lamp
		Dark Controls	Not applicable
Traps for CO_2 & organic volatiles			Not applicable
Test material application	Identity of solvent		1% Acetone
	Volume of application solution		12 mL in 1000 mL of buffer.
	Evaporation of application solvent		Not applicable
Experimental conditions		Temperature (°C)	25 ± 1 °C
		Continuous irradiation	Yes

Table B.8.2.1.2-7 Sampling

Parameter	Details
Sampling intervals for the parent/transformation products	The test solution was exposed to light but after 14 days, TLC showed that little degradation had occurred. One of the bottles was therefore divided into fourteen smaller (70 ml) samples and exposed for a further 14 days.
Sampling procedure	The test solution (20 ml), after the final 14 days of light exposure was extracted with hexane (1x10 ml, 2x5 ml), followed by water-saturated n-butanol (1x10 ml, 2x5 ml) at neutral pH and then water saturated n-butanol (1x10 ml, 2x5 ml) at acidic pH (pH 1). The replicates of each type of extract were combined, counted by LSC and analysed by TLC.

Description of analytical procedures

The combined extracts at the end of the photolysis experiment were purified by solvent extraction, freeze-drying, solvent extraction of the resulting solid, open column chromatography and preparative TLC. The purified extracts we then submitted to TLC and HPLC.

II. RESULTS AND DISCUSSION

Flutolanil (77.1%) and three major polar zones (each of three zones 3.3 - 4.4% of total) were found to contain the majority of the radioactivity after the final 14 day exposure period. No single component of the remainder (including the origin material) represented more than 3% of the total radioactivity.

The three major zones were purified by a scheme involving solvent extraction, freeze-drying, solvent extraction of the resulting solid, open column chromatography and preparative TLC. Analytical TLC and HPLC found that these zones did not co-chromatograph with any known metabolite or environmental breakdown product from studies on other test systems. Radio-LC/MS proved these zones to have mass spectra without any of the ions characteristic of either flutolanil or of the known environmental breakdown products. Spectra of these zones were consistent with artefacts formed by reaction of flutolanil with the acetone photosensitizer and the tris buffer.

III. CONCLUSIONS

Breakdown products from the photodegradation of flutolanil in an acetone sensitized, tris(hydroxymethyl) aminomethane buffer, (representing 3.3 to 4.4% after the final 14 days light exposure) were found to be artefacts from reaction of the flutolanil with acetone and the buffer. None of these degradates would therefore be formed on the exposure of flutolanil to sunlight in the natural environment.

Remarks RMS renewal

- Results of this evaluation are acceptable. No half lives are determined.

Previous evaluation	Submitted for the purpose of renewal
RMS remark	Acceptable

Report:	**CA 7.2.1.2/03, Tanaka, T. (2016)**
Title:	Photodegradation of Flutolanil in buffer solution
Document No:	LSRC-E15-152A (E-3056)
Guidelines:	OECD 316, OPPTS 835.2240
Testing laboratory:	Research Center Nihon Noyaku Co., Ltd, Osaka, Japan
GLP:	Yes

Executive Summary

Radioactive flutolanil labelled in the phenyl ring was applied to buffer solutions of pH 7 (<1% organic solvent acetonitrile). Buffer solutions were sterilised by filtration and incubation vessels by dry-heat sterilization.The pH, oxygen content and UV-Vis spectrum of the buffer were measured after sterilisation (pH 7.00; oxygen content 8.91 mg/L; UV_{max} at 200 nm, no absorbance from 250 nm onwards). The target concentration was 3.3 mg/L. The studies were performed in an Atlas SUNTEST apparatus equipped with xenon arc lamp and a UV filter to cut off wave lengths below 290 nm.

Test solutions were maintained at 25±1°C. A continuous light cycle was used during 24 days. Dark controls were run under the same conditions.

Duplicate irradiated samples were taken for analysis after 0, 3, 6, 9, 12, 18 and 24 days, and duplicate control samples after 0, 6, 12 and 24 days. Immediately after sampling, test vessels were connected through silicon tube to volatile traps consisting of ethylene glycol (one vessel) for organic volatiles and ethanolamine (two vessels) for CO_2. Volatile radioactivity was purged into the connected traps by bubbling N_2 gas for about 10 min. Radioactivity in test samples and traps was quantified using LSC and analysed by 2-D TLC, with confirmation of identity by HPLC. Compound identification was based on co-chromatography with unlabelled reference compounds.

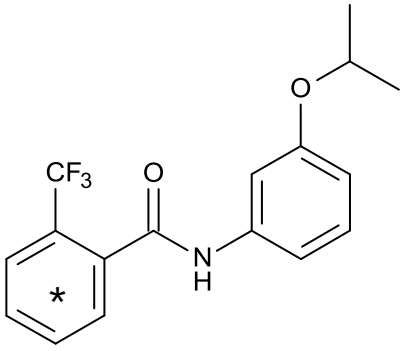
To confirm sterility of the test system, after the last sampling time a buffer solution prepared in the same way as the test samples was applied to a culture kit containing authentic medium with microbial indicator. No contamination was observed.

Recovery of radioactivity was in the range 96-102%. No radioactivity was detected in volatile traps (<0.1% AR). In irradiated samples, the mean level of flutolanil decreased from 100% on day 0 to 94% on day 24. The SFO DT50 was 235 days under test conditions. As no degradation of flutolanil was observed in dark controls, this represents also the DT50 for photolysis under test conditions. No metabolites were found at >5% AR. M-101 and M-102 were identified in irradiated samples at levels not exceeding 2.6% AR and 1.3% AR, respectively. The quantum yield of flutolanil was determined to be 0.00007829 using actinometry. At 30-50°N, estimated environmental photolysis half-lives in summer were in the range 476-701 days.

MATERIALS AND METHODS

A. MATERIALS

1. Test material: [phenyl-U-^{14}C]-flutolanil



* indicates position of ^{14}C radiolabel

Specific activity: 2.37 GBq/mmol
Lot or batch number: 0AE0002S-R
Radiochemical purity: ≥96.8%

B. STUDY DESIGN AND METHODS

1. In-life dates:

22 July 2015 – 18 September 2015

2. Test System

This study was performed in 0.05M pH 7.0 phosphate buffer. The buffer was sterilised by filtration through a 0.22 µm membrane filter. The pH, oxygen content and UV-Vis spectrum of the buffer were

measured after sterilisation (pH 7.00; oxygen content 8.91 mg/L; UV_{max} at 200 nm, no absorbance from 250 nm onwards). Glass vessels with quartz plates as covers (dry-heat sterilized at 180°C for 2 hours prior to use) were used with silicone rubber stopper for air inlet/outlet. An application solution of [phenyl-U-^{14}C]-flutolanil mixed with non-radiolabelled flutolanil (batch 1AE0012P, 99.6% pure) was prepared in acetonitrile. Test samples were prepared by addition of 40 µL of the application solution in acetonitrile solution into 8 mL of the phosphate buffer solution, giving a nominal concentration of 3.3 mg/L, which was less than half of the water solubility. The samples were incubated for 24 days under continuous irradiation with artificial sunlight in a SUNTEST unit, equipped with a xenon arc lamp and an optical UV filter blocking the wavelength <290 nm. The temperature was maintained at 24.5-25.0°C (mean 24.8°C. Intensity and spectral energy distribution of the light source were measured at the start and the end of the irradiation using a spectroradiometer. Average irradiance at 290-400 and 290-800 nm before and after the study was 36.73 and 481.25 W/m^2, respectively. It was reported that no prominent change was observed in the spectrum of the light source before and after the irradiation period (no individual data were shown). Dark control samples were wrapped with aluminum foil and kept in the same water bath as the irradiation samples.

Duplicate irradiated samples were taken for analysis after 0, 3, 6, 9, 12, 18 and 24 days, and duplicate control samples after 0, 6, 12 and 24 days. Immediately after sampling, test vessels were connected through silicon tube to volatile traps consisting of ethylene glycol (one vessel) for organic volatiles and ethanolamine (two vessels) for CO_2. Volatile radioactivity was purged into the connected traps by bubbling N_2 gas for about 10 min. Radioactivity in test samples and traps was quantified using LSC and analysed by 2-D TLC, with confirmation of identity by HPLC. Compound identification was based on co-chromatography with unlabelled reference compounds.

To confirm sterility of the test system, after the last sampling time a buffer solution prepared in the same way as the test samples was applied to a culture kit containing authentic medium with microbial indicator. No contamination was observed.

To determine the quantum yield for flutolanil in aqueous solutions, samples containing PNAP-PYR actinometer were irradiated under exactly the same condition as the test samples. Dark controls (test vessels with PNAP-PYR wrapped with aluminum foil) were incubated under the same condition as the irradiated solution. Samples were removed and analysed for PNAP by HPLC at the same time points as the study samples.

RESULTS AND DISCUSSION

The total recoveries and distribution of radioactivity are shown in Table B.8.2.1.2-7 and Table B.8.2.1.2-8. Identification and characterization of radioactivity is presented in
Table B.8.2.1.2-9 and Table B.8.2.1.2-10.

Please note the following: The results in Table B.8.2.1.2-9 and Table B.8.2.1.2-10 were reported as % AR, however, this contradicts with the results in Table B.8.2.1.2-7 and Table B.8.2.1.2-8. For example, on day 0, the aqueous extract contained on average 95.9% AR (Table B.8.2.1.2-7), but flutolanil was reported to represent on average 100% AR (Table B.8.2.1.2-9). Therefore the results in
Table B.8.2.1.2-9 and Table B.8.2.1.2-10 are assumed to represent the results for distribution of futolanil and metabolites determined by 2-D TLC, normalized to 100%, and uncorrected for the level of

radioactivity in the aqueous extract. This is considered acceptable in this case, for the following reasons: (a) No radioactivity was detected in other fractions than the aqueous extract; (b) Aqueous extracts were analysed directly (no work-up steps); (c) The recovery of radioactivity (equal to the radioactivity in extracts) showed very limited variation, which may be due to the error associated with the use of a small application volume (40 µL).

Recovery of radioactivity was in the range 96-102%. No radioactivity was detected in volatile traps (<0.1% AR). In irradiated samples, the mean level of flutolanil decreased from 100% on day 0 to 94% on day 24. The reported SFO DT50 based on mean replicate data was 235 days under test conditions (determined using Microsoft Excel®; R^2 0.93). As no degradation of flutolanil was observed in dark controls, this represents also the DT50 for photolysis under test conditions. No metabolites were found at >5% AR. M-101 and M-102 were identified in irradiated samples at levels not exceeding 2.6% AR and 1.3% AR, respectively.

The quantum yield of flutolanil was calculated using the formula (OECD 316, equation 20):

$$\Phi_{chem} = \Phi_{act}\left(\frac{k_{d(chem)}}{k_{d(act)}}\right)\left(\frac{\sum_{290}^{800}\epsilon_{\lambda(act)}\ I_{0\lambda(xenon)}}{\sum_{290}^{800}\epsilon_{\lambda(chem)}\ I_{0\lambda(xenon)}}\right)$$

where ϕ_{act}= quantum yield (for actinometer calculated as 0.0169 x conc[PYR]), act = actinometer, chem = test substance, $k_{d(chem)}$/kd($_{act)}$ = ratio of rate constants for degradation of test substance and actinometer, respectively (determined experimentally), ε = molar absorptivity (determined from UV spectrum of test substance and actinometer), $I_{0\lambda(xenon)}$ = incident light irradiance of filtered xenon arc lamp (measured by radiometer).

The quantum yield of flutolanil was determined to be 0.00007829.

The estimated half-life under natural sunlight in summer and winter was calculated by the following equation:

$$t_{1/2} = \ln 2 \ / \ k_{d(solar)}$$

$k_{d(solar)}$ (estimated rate constant) was the estimated photolysis rate constant calculated by the following equation (OECD 316, equation 12):

$$k_{d(solar)} = \frac{1}{2.3}\cdot\frac{D_{cell}}{l}\frac{k_{d(xenon)}\sum_{290}^{800}\epsilon_{\lambda}L_{\lambda}}{\sum_{290}^{800}\epsilon_{\lambda}I_{0\lambda(xenon)}}$$

where ε_λ is the molar absorption coefficient of the test substance ($M^{-1}cm^{-1}$) at wavelength λ; L_λ is the solar photon irradiance at 20, 30, 40 and 50°N latitude (mmol/cm^2/day) at wavelength λ; D_{cell} is the depth of irradiated system (cm) and l is the light pathlength (cm). Values for L_λ (solar photon irradiance at 20, 30, 40 and 50°N latitude at wavelength λ) were taken from OPPTS 835.2210. The half-life under natural sunlight are shown in

Table B.8.2.1.2-12. At 30-50°N, environmental photolysis half-lives in summer were in the range 476-701 days.

Table B.8.2.1.2-8 Distribution of radioactivity in irradiated samples pH 7 (% AR)

Fraction	Exposure (Day)						
	0	3	6	9	12	18	24
Water	94.1	98.8	102.4	95.5	98.6	97.8	95.6
	97.7	101.6	97.4	97.4	94.6	96.0	96.6
Organic volatile	NA[1)]	NA	NA	-[2)]	-	-	-
	NA	NA	NA	-	-	-	-
CO_2	NA	NA	NA	-	-	-	-
	NA	NA	NA	-	-	-	-

1) : Not applicable
2) : Not detected

Table B.8.2.1.2-9 Distribution of radioactivity in dark control samples pH 7 (% AR)

Fraction	Exposure (Day)			
	0	6	12	24
Water	94.1	101.1	97.0	99.3
	97.7	98.6	94.9	98.8
Organic volatile	NA[1)]	NA	NA	NA
	NA	NA	NA	NA
CO_2	NA	NA	NA	NA
	NA	NA	NA	NA

1) : Not applicable

Table B.8.2.1.2-10 Degradation and formation of metabolites in irradiated samples pH 7 (% AR)

Compounds	Exposure (Day)						
	0	3	6	9	12	18	24
Flutolanil	100.0	99.7	99.3	99.3	97.1	94.6	91.7
	100.0	99.8	99.2	99.2	95.8	95.3	96.0
M-101	-[1)]	0.2	0.4	0.5	1.3	2.3	3.5
	-	0.2	0.5	0.5	2.0	2.0	1.7
M-102	-	0.1	0.2	0.2	0.9	1.3	1.9
	-	-	0.3	0.2	1.2	0.7	0.8
Origin	-	-	-	-	-	1.4	2.2
	-	-	-	-	-	1.4	1.1
Sum of others [2)]	-	-	-	-	0.7	0.4	0.7
	-	-	-	-	0.9	0.5	0.4

1) : Not detected
2) : Sum of unknown radioactivity accounting to below 0.5% of AR for each component .

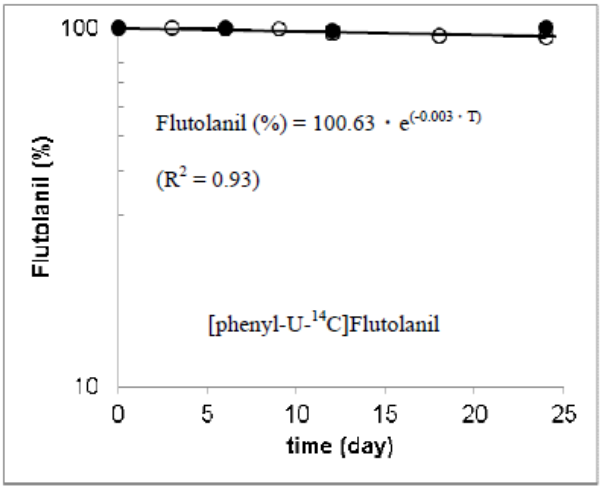
Table B.8.2.1.2-11 Degradation and formation of metabolites in dark control samples pH 7 (% AR)

Compounds	Exposure (Day)			
	0	6	12	24
Flutolanil	100.0 100.0	100.0 100.0	98.0 98.8	100.0 100.0
M-101	-[1)] -	- -	0.0 0.2	- -
M-102	- -	- -	0.0 0.4	- -
Origin	- -	- -	- -	- -
Sum of others [2)]	- -	- -	2.0 0.6	- -

1) : Not detected
2) : Sum of unknown radioactivity accounting to below 1.3% of AR for each component .

Table B.8.2.1.2-12 Estimated half-lives (day) under natural sunlight irradiation at 20°, 30°, 40°, 50°N latitude

20°N latitude	438.0 (Summer) 927.2 (Winter)
30°N latitude	476.0 (Summer) 1757.5 (Winter)
40°N latitude	559.1 (Summer) 4685.9 (Winter)
50°N latitude	701.0 (Summer) 20490.2 (Winter)



○ : irradiated sample, ● : dark control

Figure 8.2.1.2-1 First order fit for degradation of flutolanil in light exposed samples

CONCLUSIONS

The photolysis SFO half-life of flutolanil was 235 days under test conditions. No metabolites were found at >5% AR. The quantum yield of flutolanil was determined to be 0.00007829. At 30-50°N, environmental photolysis half-lives in summer were calculated to be in the range 476-701 days.

Remarks RMS renewal

- The reported SFO DT50 under test conditions determined using Microsoft Excel® based on the means of replicate data was 235 days. The DT50 value based on individual replicate data determined by the RMS using Microsoft Excel® was 231 days. This difference is considered to be negligible. The study was performed in agreement with OECD 316 and is acceptable.

B.8.2.2 Route and rate of biological degradation in aquatic systems

B.8.2.2.1 Ready biodegradability

Previous evaluation	Submitted for first approval, DAR 2005
RMS remark	Acceptable

Report:	**CA 7.2.2.1/01, Kitano, M. (1987)**
Title:	THE BIODEGRADABILITY TEST OF S-824
Document No:	E-3003
Guidelines:	OECD Test Guideline No.301 C
Testing Facility:	Chemical Biotesting Center, Chemicals Inspection & Testing Institute, Japan
GLP:	No

I. MATERIALS AND METHODS

A. MATERIALS

1.	**Test material:**	α,α,α-trifluoro-3'-isopropoxy-*o*-toluanilide
a.	**Lot/Batch #:**	No. S-824
	Purity:	99.3%
	Appearance	white crystals
	Stability of test compound	Shown to be stable under the conditions of the test

B. STUDY DESIGN AND METHODS

In-life dates:

12 April 1984 – 10 May 1984

The following test solutions were prepared: (a) water + test substance, (b) sludge + test substance, (c) sludge + aniline and (d) basal culture medium. Test solution (b) was set up in three vessels. Each test vessel contained 300 mL of the basal culture medium to which 30 mg of test substance was added. Test solutions (b), (c) and (d) were inoculated with 9 mg of the standard inoculum. The samples were incubated for 28 days at 25±1°C in darkness.

II. RESULTS AND DISCUSSION

Findings: The percentage degradation of aniline calculated by biochemical oxygen demand (BOD) was 53% after 7 days. The percentage biodegradation of the test substance after 28 days was 0%. Degradation of flutolanil measured by HPLC analysis was 3%.

III. CONCLUSIONS

Conclusion: Flutolanil was not biodegradable under the conditions of the test.

Remarks RMS renewal

No comments

B.8.2.2.2 Aerobic mineralisation in surface water

Previous evaluation	Submitted for the purpose of renewal
RMS remark	Acceptable

Report:	**CA 7.2.2.2/01, Dobson, R. & Cooper, J. (2016)**
Title:	[^{14}C]-Flutolanil: Aerobic Mineralisation in Surface Water
Document No:	XG/015/012
Guidelines:	OECD 309, April 2004
Testing Facility:	Battelle UK Ltd, Essex , UK
GLP:	Yes

Executive summary:

The aerobic mineralisation of [phenyl-U-^{14}C]-flutolanil was studied in one surface water system from Cassington Water under pelagic conditions at 20 ± 2ºC in the dark.

Study flasks were filled with 100 mL of natural water and treated with [phenyl-U-^{14}C]-flutolanil at nominal dose levels of 10 and 100 µg/L. All flasks were attached to an incubation system through which moistened air was passed and any volatiles formed were passed through a series of three liquid traps, the first containing ethylene glycol and the second and third containing 2M potassium hydroxide. Positive control flasks were treated with [phenyl-ring-U-^{14}C]-benzoic acid at a nominal dose rate of 10 µg/L. Solvent control flasks were also dosed with [^{14}C]-benzoic acid and a volume of organic solvent equivalent to the volume used in the [phenyl-U-^{14}C]-flutolanil dosed flasks. Sterile controls were filled with 100 mL of the test water, autoclave sterilized (15 min at 121°C) and treated at 10 and 100 µg/L [phenyl-U-14C]-labeled flutolanil in acetonitrile.

Duplicate flasks and their associated traps were removed at each sampling interval. Samples were taken at zero time and following 1, 7, 14, 28, 40, 60 and 90 days incubation. Sterile flasks were sampled at days 1 and 61.

At each sampling interval, the flasks and their associated traps were transferred to an extraction system, where inorganic carbon was driven out of the samples and into the KOH traps. Radioactivity in the water, flask rinses and trapping liquids was quantified by LSC. The water samples were analysed by direct HPLC.

The day 61 samples were proven to be sterile. The sterility of the day 1 samples could not be verified due to procedural errors. This has no effect on the validity of the study as the test item was essentially stable in both live and sterile replicates.

Measurements of pH and oxygen levels showed that the test water remained aerobic and within the environmentally relevant pH range throughout the study.

The positive control samples showed rapid mineralisation of the [14C]-benzoic acid with mean levels of 76.7% and 85.1% AR being recovered as $^{14}CO_2$ (sum of ethanolamine and KOH traps) after 7d and 14d of incubation respectively, thus demonstrating that the test water showed adequate levels of biological activity for use in the test.

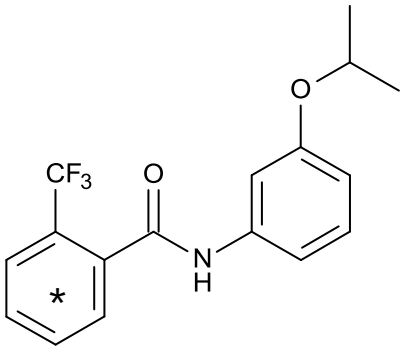
In 14C-flutolanil treated samples, mass balances of individual replicates were in the range 96.6-102% AR. Mean level of radioactivity in the water decreased from 100-101% AR to 96.7-97.2% AR after 97 days. Mineralisation to $^{14}CO_2$ was a minor pathway (mean level of radioactivity KOH traps at test termination 0.71% AR and 0.18% AR at 10 and 100 µg/L, respectively). The mean level of 14C-flutolanil in the water decreased from 100-101% AR at the start to 96.7-97.2% AR after 97 days. The water phase contained no metabolites >5% AR (only minor unidentified metabolites with a mean maximum level of 1.53% AR).

SFO DT50 values of flutolanil determined according to FOCUS Kinetics (2014) were >1000 days at both treatment rates.

MATERIALS AND METHODS

A. MATERIALS

1. Test material: [phenyl-U-^{14}C]-flutolanil



*Indicates position of the radiolabel

Lot or batch number: CFQ42127
Specific activity: 13.35 MBq/mg (360.8 µCi/mg, 4.37 GBq/mmol)
Radiochemical purity: 99.84%

2. Surface Water: The study was conducted using surface water collected from Cassington Water, Millfields, Derbyshire, UK. A summary of the physical and chemical properties of the surface water is provided in below.

Parameter	Value
Water Identity	Cassington Water
pH	8.24
5-d Biochemical Oxygen Demand (O_2/L)	<1 mg/L
Temperate at sampling (°C)	11.7
Hardness	11.7 mg eq $CaCO_3$/L
Conductivity	0.29 mmhos/cm
Total suspended solids	4 ppm
Total organic carbon	3.4 ppm
Dissolved organic carbon	3.2 ppm

B. STUDY DESIGN

In-life dates: 15 October 2015 – 24 February 2016

Experimental conditions

Stock solutions of [phenyl-U-14C]-labeled flutolanil in acetonitrile were prepared and aliquots (100 µL) added to 250 mL borosilicate glass conical flasks containing 100 mL of freshly sampled surface water (passed through a 100 µm sieve). Two concentrations were tested at nominal values of 10 µg/L (low rate) and 100 µg/L (high rate) of test substance. All flasks were attached to an incubation system through which moistened air was passed, at a rate that allowed sufficient aeration of the headspace to maintain aerobic conditions and carry any volatiles formed into the trapping system. Each flask was connected to a series of three liquid traps, the first containing ethylene glycol or ethanolamine and the second and third containing 2M potassium hydroxide. Following treatment, each flask was placed in a controlled temperature room maintained at 20 ± 2°C in the dark for up to 90 days.

Positive control flasks treated with [^{14}C]-benzoic acid in deionized water at a nominal dose rate of 10 µg/L were used as control items to verify that the test water showed a good level of biological activity.

Four solvent control flasks were treated with [^{14}C]-benzoic acid at a nominal dose rate of 10 µg/L with the same quantity of organic solvent (acetonitrile) used in the standard experiment.

Sterile controls to enable differentiation between biotic and abiotic degradation of the test item were prepared in 500 mL glass screw cap bottles. These were filled with 100 mL of the test water, loosely lidded, autoclave sterilized (15 min at 121°C) and treated at 10 and 100 µg/L [phenyl-U-14C]-labeled flutolanil in acetonitrile. No aeration or trapping system was used with the sterile controls. The incubation period was 61 days.

Flasks for monitoring test conditions were treated with non-radiolabelled flutolanil (two at each dose level, at 10 µg/L and 100 µg/L). They were incubated under the same conditions as the test samples and used to verify the pH, oxygen concentration and redox potential of the test systems during the incubation period.

Sampling

Two replicate flasks were removed for analysis following test substance application (zero time) and after 1, 7, 14, 28, 40, 60 and 90 days. Sterile flasks were sampled at days 1 and 61.

Description of analytical procedures

At each sampling interval, the flasks and their associated traps were transferred to an extraction system which used vacuum to draw air into the flasks and through the traps. Each flask was placed on a magnetic stirrer plate to ensure adequate mixing of the water. Once the flasks were attached to the system they were amended with 5 mL of acetonitrile (not used in flasks containing benzoic acid) and 2 mL of formic acid and closed immediately. The stirring rate was then increased and the samples left on the trapping system for four hours (fifteen minutes for day 1 flasks). This procedure served to drive inorganic carbon out of the samples and into the KOH traps. Radioactivity in the water, flask rinses and trapping liquids was quantified by LSC. The water samples were analysed by direct HPLC. HPLC column recovery for a representative sample was found to be quantitative with 93.9% of injected radioactivity being recovered post-column.

To confirm the sterility of the autoclave-sterilised replicates 50 µL aliquots were taken from each flask and applied to separate sterile nutrient agar plates. Sterility checks were performed in duplicate for each flask at each treatment level at the start of the study (day 1) and at the final sterile sampling point (day 61).

DT50 and DT90 values for the degradation of flutolanil in the water phase were determined following the recommendations of the FOCUS guidance document on degradation kinetics. An input data set for the modelling was derived from the individual data for each time-point. All data-points were weighted equally. For optimal goodness of fit, the initial value was also allowed to be estimated by the model. Time zero values for the test item content of the water were based on the recovered activity and the purity of the test item. The kinetic evaluations and the statistical calculations for the quality checks were implemented in the numerical software package CAKE 2. The models SFO and FOMC were evaluated.

RESULTS

The day 61 samples were proven to be sterile. The sterility of the day 1 samples could not be verified due to procedural errors. This has no effect on the validity of the study as the test item was essentially stable in both live and sterile replicates.

The temperature of the samples was maintained at 20 ± 2°C. The pH of the water in the reference flasks averaged 8.2 (range 7.1 to 8.8). The oxygen saturation of the water in the flasks averaged 8.6 mg/L (range 5.2-10.1 mg/L), while the redox potentials averaged +427 mV (range +357 to +488 mV). These results showed that the test water remained aerobic and within the environmentally relevant pH range throughout the study.

The positive control samples showed rapid mineralisation of the [14C]-benzoic acid with mean levels of 76.7% and 85.1% AR being recovered as $^{14}CO_2$ (sum of ethanolamine and KOH traps) after 7d and 14d of incubation respectively, thus demonstrating that the test water showed adequate levels of biological activity for use in the test.

In 14C-flutolanil treated samples, mass balances of individual replicates were in the range 96.6-102% AR. Mean level of radioactivity in the water decreased from 100-101% AR to 96.7-97.2% AR after 97

days. Mineralisation to $^{14}CO_2$ was a minor pathway (mean level of radioactivity KOH traps at test termination 0.71% AR and 0.18% AR at 10 and 100 µg/L, respectively). The mean level of 14C-flutolanil in the water decreased from 100-101% AR at the start to 96.7-97.2% AR after 97 days. The identity of 14C-flutolanil was confirmed in selected water samples by LC-MS.The water phase contained no metabolites >5% AR (only minor unidentified metabolites with a mean maximum level of 1.53% AR).

Table B.8.2.2.2-1 Recovery of Radioactivity in Carsington Water Replicates and Traps, 10 µg/L Dose Level (as % AR)

Sampling Point (days)	Sample ID	Water	Ethylene Glycol Trap	KOH Traps	Flask Rinse	Total Recovery
0	1	101.23	0.00	0.65		101.89
	2	101.00	0.00	0.63		101.63
Mean		**101.12**	**0.00**	**0.64**		**101.76**
1	3	98.28	0.01	0.62		98.90
	4	96.98	0.01	0.54	0.94	98.48
Mean		**97.63**	**0.01**	**0.58**	**0.94**	**98.69**
7	5	98.19	0.02	0.63		98.84
	6	99.47	0.01	0.63		100.10
Mean		**98.83**	**0.01**	**0.63**		**99.47**
14	7	98.40	0.00	0.75		99.15
	8	98.63	0.01	0.70		99.34
Mean		**98.52**	**0.00**	**0.72**		**99.24**
28	9	99.12	0.02	0.71		99.84
	10	97.31	0.00	0.65		97.96
Mean		**98.21**	**0.01**	**0.68**		**98.90**
40	11	99.21	0.03	0.74		99.97
	12	97.13	0.03	0.73		97.88
Mean		**98.17**	**0.03**	**0.73**		**98.93**
61	13	98.49	0.00	0.67		99.16
	14	97.62	0.01	0.71		98.34
Mean		**98.05**	**0.01**	**0.69**		**98.75**
97	15	96.28	0.00	0.73		97.01
	16	98.16	0.04	0.70		98.89
Mean		**97.22**	**0.02**	**0.71**		**97.95**

Table B.8.2.2.2-2 Recovery of Radioactivity in Carsington Water Replicates and Traps, 100 µg/L Dose Level (as % AR)

Sampling Point (days)	Sample ID	Water	Ethylene Glycol Trap	KOH Traps	Flask Rinse	Total Recovery
0	25	100.37	0.00	0.06		100.43
	26	99.92	0.00	0.05		99.97
Mean		**100.14**	**0.00**	**0.05**		**100.20**
1	27	98.91	0.00	0.06		98.98
	28	97.82	0.00	0.06	0.84	98.72
Mean		**98.37**	**0.00**	**0.06**	**0.84**	**98.85**
7	29	97.87	0.00	0.06		97.94
	30	97.81	0.00	0.07		97.87
Mean		**97.84**	**0.00**	**0.06**		**97.91**
14	31	98.00	0.00	0.08		98.09
	32	99.02	0.00	0.09		99.11
Mean		**98.51**	**0.00**	**0.08**		**98.60**
28	33	96.81	0.01	0.16		96.98
	34	97.32	0.01	0.13		97.46
Mean		**97.07**	**0.01**	**0.14**		**97.22**
40	35	97.33	0.01	0.11		97.45
	36	98.55	0.00	0.11		98.66
Mean		**97.94**	**0.00**	**0.11**		**98.06**
61	37	97.28	0.00	0.17		97.46
	38	97.25	0.00	0.17		97.42
Mean		**97.26**	**0.00**	**0.17**		**97.44**
97	39	96.47	0.00	0.17		96.64
	40	96.92	0.00	0.19		97.12
Mean		**96.69**	**0.00**	**0.18**		**96.88**

Table B.8.2.2.2-3 Recovery of Radioactivity in Carsington Water Positive Controls and Traps, 10 µg/L Dose Level (as % AR)

Sampling Point days)	Sample ID	Water	Ethanolamine Trap 1	2M KOH Trap 2	2M KOH Trap 3	MeCN flask Rinse	Total Recovery
7	57	9.26	67.88	0.22	0.20	6.87	84.44
7	58	11.77	84.61	0.23	0.23	2.07	98.91
Mean		**10.52**	**76.24**	**0.22**	**0.21**	**4.47**	**91.67**
14	59	5.33	85.49	0.22	0.24	1.14	92.42
14	60	7.79	83.86	0.23	0.22	1.35	93.46
Mean		**6.56**	**84.67**	**0.23**	**0.23**	**1.24**	**92.94**

Table B.8.2.2.2-4 Recovery of Radioactivity in Carsington Water Solvent Controls and Traps, 10 µg/L Dose Level (as % AR)

Sampling Point days)	Sample ID	Water	Ethanolamine Trap 1	2M KOH Trap 2	2M KOH Trap 3	MeCN flask Rinse	Total Recovery
7	65	8.63	81.90	0.22	0.22	1.85	92.83
7	66	11.28	80.46	0.23	0.22	4.52	96.71
Mean		**9.95**	**81.18**	**0.23**	**0.22**	**3.19**	**94.77**

Table B.8.2.2.2-5 Composition of Radioactivity in the Water-Phase of Replicates Treated with Flutolanil (10 µg/L Dose Level, as % AR by HPLC)

Time point (days)	Sample ID	Water	Parent
0	1	101.23	101.23
	2	101.00	101.00
Mean		**101.12**	**101.12**
1	3	98.28	98.28
	4	96.98	96.98
Mean		**97.63**	**97.63**
7	5	98.19	98.19
	6	99.47	99.47
Mean		**98.83**	**98.83**
14	7	98.40	98.40
	8	98.63	98.63
Mean		**98.52**	**98.52**
28	9	99.12	99.12
	10	97.31	97.31
Mean		**98.21**	**98.21**
40	11	99.21	99.21
	12	97.13	97.13
Mean		**98.17**	**98.17**
61	13	98.49	98.49
	14	97.62	97.62
Mean		**98.05**	**98.05**
97	15	96.28	96.28
	16	98.16	98.16
Mean		**97.22**	**97.22**

Table B.8.2.2.2-6 Composition of Radioactivity in the Water-Phase of Replicates Treated with Flutolanil (100 µg/L Dose Level, as % AR by HPLC)

Time point (days)	Sample ID	Water	Minor Metabolites <5% AR	Parent
0	25	100.37		100.37
	26	99.92		99.92
Mean		**100.14**		**100.14**
1	27	98.91		98.91
	28	97.82		97.82
Mean		**98.37**		**98.37**
7	29	97.87		97.87
	30	97.81		97.81
Mean		**97.84**		**97.84**
14	31	98.00		98.00
	32	99.02		99.02
Mean		**98.51**		**98.51**
28	33	96.81		96.81
	34	97.32		97.32
Mean		**97.07**		**97.07**
40	35	97.33	0.00	97.33
	36	98.55	1.15	97.40
Mean		**97.94**	**0.56**	**97.38**
61	37	97.28	0.89	96.38
	38	97.25	2.16	95.09
Mean		**97.26**	**1.53**	**95.74**
97	39	96.47	0.00	94.78
	40	96.92	0.32	94.90
Mean		**96.69**	**0.16**	**94.84**

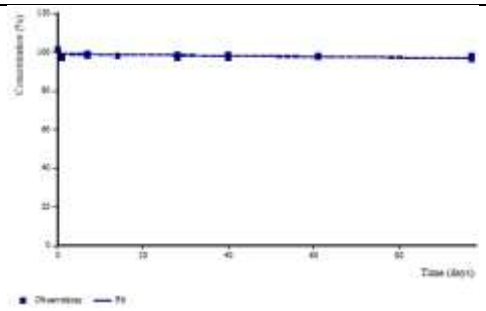
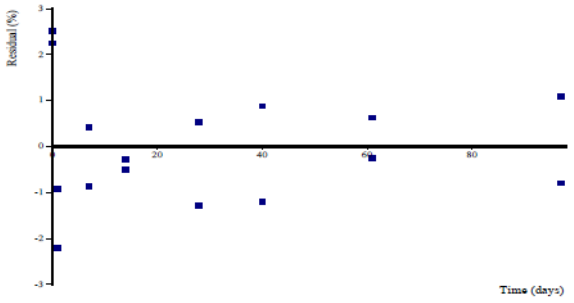
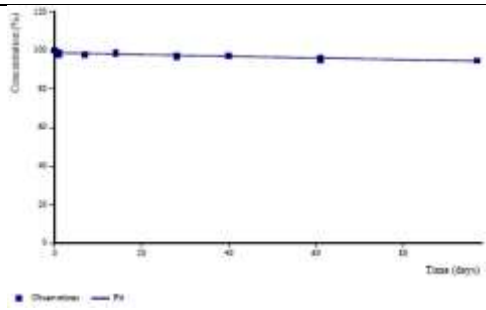
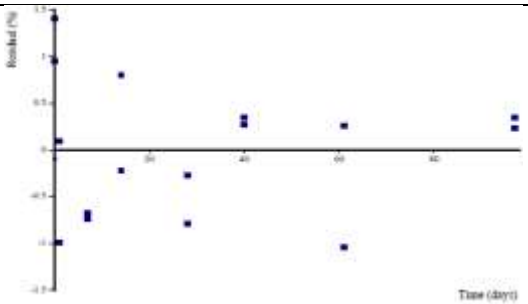
The reported SFO DT50 values with statistical parameters and the corresponding fits of modelled versus measured data and residuals fits are summarised in the tables below. FOMC showed no improvement over the SFO fit, and the 90th % confidence intervals for the FOMC parameters α and β included zero, hence the FOMC fit is not further considered. SFO DT50 values of flutolanil determined according to FOCUS Kinetics (2014) were >1000 days at both treatment rates.

Table B.8.2.2.2-7 SFO DT_{50} and DT_{90} values for flutolanil in aerobic aquatic systems

System	Kinetic model	DT_{50} (days)	DT_{90} (days)	Chi^2 (%)	Parameter confidence	Visual fit
10 µg/L	SFO	>1000	>1000	1.0	0.02698	Good
100 µg/L	SFO	>1000	>1000	1.0	1.36E-06	Good

Table B.8.2.2.2-8 SFO model fits

	10 µg/L	
Model	Visual Fit	Residuals plot

SFO		
	100 µg/L	
Model	Visual Fit	Residuals plot
SFO		

CONCLUSION

Flutolanil did not significantly mineralize (<1%) over the study duration in surface water treated with 14C-flutolanil at 10 and 100 µg/L, incubated under laboratory conditions in the dark at 20°C. The DT50 for flutolanil was >1000 days at both treatment rates. No metabolites were formed at >5% AR.

RMS remarks renewal

- Study acceptable. No comments

B.8.2.2.3 Water/sediment studies

Previous evaluation	Submitted for first approval, DAR 2005
RMS remark	Acceptable with remarks

Report:	**CA 7.2.2.3/01, Wyss-Benz, M. (1993)**
Title:	^{14}C-Flutolanil: Degradation and Metabolism in Two Aerobic Aquatic Systems
Document No:	R-3017
Guidelines:	BBA Guideline Part IV, No. 5-1, December 1990 Dutch Guidelines for the Registration of Pesticides, June 1991, Part G.2.
Testing Facility:	RCC UMWELTCHEMIE AG, ltingen, Switzerland
GLP:	Yes

Executive summary:

The route and rate of degradation of [^{14}C]-flutolanil has been investigated in two water-sediment systems incubated at 20 ± 2°C for a period of up to 105 days. The [^{14}C]-flutolanil used in the study was radiolabelled in the aniline ring [aniline-U-^{14}C]. The sediments and associated waters were collected from two natural systems in the Netherlands: Pond, Lienden, and Ditch, (Ijzendoorn).

Throughout the experiment, the flasks were maintained in the dark at 20 ± 2 °C whilst attached to an incubation system allowing air to be bubbled through the surface water and then through a system for trapping volatile degradates. The water/sediment systems were incubated for 35 days prior to

application of flutolanil to allow the systems to equilibrate. The redox potential of the sediment and water and the pH and dissolved oxygen content of the water was measured in control flasks, at regular intervals during the incubation.

Flutolanil was applied to the water surface at an application rate equivalent to an initial concentration of *ca* 0.087 mg/L in the water phase. At zero time (immediately after treatment) and at intervals of 0.25, 1, 2, 7, 14, 30, 61 and 105 days after treatment, duplicate flasks and their corresponding traps were removed from the incubation system. The water was decanted and the sediment extracted with mixtures of acetonitrile and acetonitrile : water.

The overall recovery of radioactivity was good, with mean recoveries of 97.6% and 98.3% of applied radioactivity (AR) for the Pond and Ditch systems respectively. All individual flask recoveries fell within the acceptable range of 90–110% (actual range 93.2 - 102.1% AR across both systems).

In the Pond system, dissipation to the sediment from the water phase was steady, with the radioactivity recovered declining from 95.4% AR (mean values) at time zero to 37.5% AR by day 105. In the Ditch system the dissipation was faster and recovery from the water phase declined from 97.8% AR at time zero to 14.1% AR by day 105.

Extractable radioactivity in the sediment from the Pond and Ditch systems increased to reach a maximum of 37.2% AR and 72.0% AR at day 30 respectively, both systems then decreased to 24.7% and 64.0% by day 105 respectively.

Unextractable radioactivity accounted for 25.4% AR and 14.7% AR at day 105. The non-extractable radioactivity was mainly bound to the humin fraction of the sediments.

Chromatographic analysis showed that, flutolanil declined in the Pond system, from 99.7% AR at time zero to 44.7% AR on day 105. Flutolanil in the Ditch system declined from 100.9% AR at time zero to 71.9% AR by day 105.

Two minor metabolites M-4 (α,α,α-trifluoro-3'-hydroxy-*o*-toluanilide) and M-11 (2-[3'-(α,α,α-trifluoro-*o*-toluamido)phenoxy]propionic acid) were observed in the water sediment systems. M-4 reached a maximum of 5.2% AR after 61 days in the water phase of the Pond system, but did not exceed 5% on two consecutive timepoints. M-11 reached a maximum of 6.9% AR after 105 days in the water phase of the Pond system, exceeding 5% AR on the final two timepoints. In the water phase of the Ditch system the metabolites did not exceed 2% AR throughout the study. In sediment both M-4 and M-11 remained < 2% AR in both Pond and Ditch sediments throughout the study.

Flutolanil was identified based on its retention time against certified reference compounds during TLC analysis.

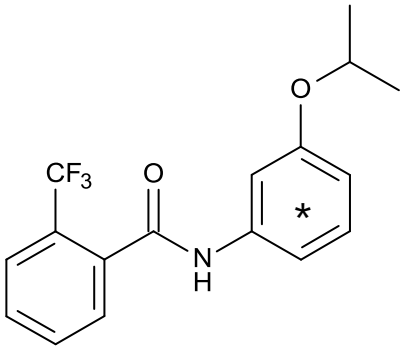
The dissipation of flutolanil in the total system was evaluated according to a first order kinetic model. In the total system (water plus sediment), degradation DT_{50} values for flutolanil were calculated to be 90 days in the Pond system and 244 days in the Ditch system. Corresponding, total system DT_{90} values of 299 days for the Pond system and 811 days for the Ditch system were also calculated.

In conclusion, in both water/sediment systems, flutolanil was found to dissipate from the water phase to the sediment. Flutolanil was slowly degraded to form two known metabolites, M4, (α,α,α-trifluoro-3'-hydroxy-o-toluanilide) at 6.8% AR, and M11, (2-[3'-(α,α,α--trifluoro-o-toluamido)phenoxy]propionic acid) at 8.3% AR.

I. MATERIALS AND METHODS

A. MATERIALS

1. Test material: [aniline-U-^{14}C]-flutolanil



*Indicates position of the [^{14}C] radiolabel

Chemical name (IUPAC): α,α,α-trifluoro-3'-isopropoxy-*o*-toluanilide

CAS registry number: 66332-96-5

Lot or batch number: CP-1412

Specific activity: 73.5 µCi/mg (2.72 MBq/mg), 23.8 mCi/mmol (879 M Bq/mmol)

Radiochemical purity: >99.6%

Stability of test compound: Shown to be stable under the conditions of the test

2. Water/Sediment: The water/sediment systems were freshly collected from sources at Lienden, Ommeren, Netherlands and Ijzendoorn, Echteld, Netherlands see table below. Prior to use, each test water and sediment was sieved through a 0.2 mm and 2 mm mesh sieve respectively. The sediment and water were placed into incubation flasks within 8 days of sampling

Table B.8.2.2.3-1 Physicochemical Parameters of the Water/Sediment Systems

Sediment Parameter	**Pond**		**Ditch**	
Geographic Location	Lienden, Ommeren, Netherlands		Ijzendoorn, Echteld, Netherlands	
Texture Class	Loamy sand		Silt loam	
% Sand	84.6		22.6	
% Silt	11.1		51.1	
% Clay	4.3		26.3	
pH (KCl)	7.25		6.71	
P-total (g/kg sediment)	0.210		0.827	
N-total (g/kg sediment)	0.39		2.93	
% Total Organic Carbon	0.15		2.09	
Soil Biomass Initial (mg/g dry wt.) Final	68.21 111.06		310.84 117.94	
CEC (meq/100 g)	24.2		154.5	
Water Parameter	Pond		Ditch	
pH	8.27		7.17	
Temperature (°C)	17		17	
Phosphorus (mg/L)	0.05		0.07	
TOC (ppm)	9.8		4.9	
Hardness (°dH)	13		15	
Oxygen concentration (mg/L) at initiation:	8.2		6.3	
Redox potential (mV)	Initial	Final	Initial	Final
water	192	211	211	217
Sediment	-137	-70	-256	-108

B. STUDY DESIGN AND METHODS

1. In-life dates:

08 June 1993 – 05 November 1993

Parameter		Description
Duration of test		105 days
Water/sediment condition		Freshly sampled, sediment sieved (≤ 2 mm), entire water/sediment systems pre-incubated under test conditions for 35 days prior to treatment.
Target application rate		20.0 kg / ha
Concentration in test system	Nominal	80 µg per flask; equivalent to initial concentration of 42.4 mg per flask
	Measured	46.3 µg per flask, 87.3 µg/L
Number of replications		Two
Test apparatus		Water sediment flasks containing sediment and natural water
Weight of sediment per vessel (to give *ca* 3 cm depth)		*ca* 187.5 g ode for Pond *ca* 88.0 g ode for Ditch
Volume of natural water per vessel (to give *ca* 15 cm total depth)		*ca* 530 mL
Test material application	Identity of solvent	Acetonitrile
	Volume of application solution	200 µL
	Application method	Hamilton syringe
Traps for CO_2 and organic volatiles		One ethylene glycol trap and one sodium hydroxide trap.
Is there any indication of the test material absorbing to the walls of the test apparatus?		No
Experimental conditions	Temperature	20 ± 2°C
	Lighting	Dark

Table B.8.2.2.3-2 Sampling

Parameter	Details,
Sampling intervals for the parent/transformation products	Non-sterile flasks 0, 0.25, 1, 2, 7, 14, 30, 61 and 105 days. Sterile flasks 0, 7, 30 and 105 days
Sampling procedure	The water and sediment layers were separated by pipetting of the water layer. Any water remaining in the sediment was thereafter treated as sediment. The radioactivity in the water layer was quantified by LSC. After removal of the water phase, the sediment was exhaustively extracted sequentially with combinations of the following solvents acetonitrile, methanol, acetonitrile / water (9:1 *v/v*) and methanol/water (1:1 *v/v*). The radioactivity in the sediment extracts was quantified by LSC. Unextractable radioactivity in the sediment was determined by combustion/LSC. Further characterisation of the non-extractable radioactivity in the 105 day samples was performed by organic matter fractionation of extracted sediment samples.
Collection of CO_2 and other volatiles	Volume of solutions measured and radioactivity quantified by LSC at sampling or around every two weeks of the study.
Measurement of sediment water parameters	Control flask monitored for redox potential, pH and O_2 at each sampling.

3. Description of analytical procedures.

The water samples following partition with organic solvents were concentrated and samples radioassayed using LSC and analysed by TLC (co-chromatography with unlabelled compounds) to determine the levels of parent and significant degradates in each sample. The sediment extracts samples radioassayed using LSC and analysed by TLC.

The radioactivity in the sodium hydroxide traps was characterised to be $^{14}CO_2$ by $BaCO_3$ precipitation, which indicated the mineralisation of flutolanil.

II. RESULTS AND DISCUSSION

A. MASS BALANCE

Material balance for the Pond system was 97.6 ± 2.7% AR. Material balance for the Ditch was 98.3 ± 3.2% AR. A summary of the recoveries at each sampling time interval are provided in Table B.8.2.2.3-3 and Table B.8.2.2.3-4.

Bound and Extractable Residues

For the 105 DAT timepoint, sediment post extraction was subjected to soil organic matter fractionation into humic acids, fulvic acids and humin fractions. The results indicated that the majority of the non-extractable radioactivity was associated with the humin fraction: 12.5% and 6.5% of the applied radioactivity for the Pond and Ditch systems, respectively. The recoveries and distribution of radioactivity from humic substance fractionation are shown in Table B.8.2.2.3-5.

The amount of radiolabelled material in the water layer generally decreased over the course of the study from a maximum of 95.4% AR to a minimum of 37.5% AR in the Pond system and from a maximum of 97.8% AR to a minimum of 14.1% AR in the Ditch system.

The radioactivity in the sediment was approximately 5.9% AR at Day 0 for the Pond system and approximately 4.3% AR for the Ditch system, then gradually increased throughout the rest of the study for both systems to reach a maximum 78.4% AR in the Pond system. Non-extractable residues slowly increased during the study, reaching a maximum of 26.3% AR in the Pond system 15.1% AR in the Ditch system. Throughout the study, evolved radioactivity, either as $^{14}CO_2$ or organic volatiles, accounted for <6.0% AR in both systems.

The amount of flutolanil in the Pond and Ditch systems (i.e., water plus sediment) decreased from a maximum of 99.7% and 100.9% AR at Day 0 to a minimum of 44.7% and 71.9% AR at study termination, respectively.

Two transformation products were identified in the water sediment systems, the metabolites M-4 (α,α,α-trifluoro-3'-hydroxy-*o*-toluanilide) and M-11 (2-[3'-(α,α,α--trifluoro-*o*-toluamido)phenoxy]propionic acid). M-4 was observed as a minor metabolite in the water phase of the Pond system, reaching a

maximum of 5.2% AR after 61 days, but did not exceed 5% on two consecutive timepoints. M-11 reached a maximum of 6.9% AR after 105 days in the water phase of the Pond system, exceeding 5% AR at the final two timepoints. In the water phase of the Ditch system the metabolites did not exceed 2% AR throughout the study. Both M-4 and M-11 remained < 2% AR in both Pond and Ditch sediments throughout the study. Overall the metabolites reached maxima of 6.8% AR and 8.3% AR in the Pond system.

Throughout the study the sterile flasks behaved similarly to the non-sterile flasks except lower levels of $^{14}CO_2$ were seen thus demonstrating the sterility of the flasks.

Table B.8.2.2.3-3 Recovery of the applied radioactivity in pond water/sediment system (as % applied radioactivity)

Sample	**Incubation time (days)**								
	0	**0.25**	**1**	**2**	**7**	**14**	**30**	**61**	**105**
Overlying water	95.4	97.3	92.4	79.9	73.5	60.2	54.4	45.5	37.5
Sediment	5.9	2.8	3.6	18.2	25.2	38.4	42.9	46.7	50.6
Volatiles $^{14}CO_2$	n.p.	<0.1	<0.1	<0.1	<0.1	0.2	0.6	2.7	5.2
TOTAL	101.3	100.1	95.9	98.1	98.7	98.7	97.9	94.8	93.2
Mean ± sd	97.6 ± 2.7								

n.p.: Not performed

Table B.8.2.2.3-4 Recovery of the applied radioactivity in ditch water/sediment system (as % applied radioactivity)

Sample	**Incubation time (days)**								
	0	**0.25**	**1**	**2**	**7**	**14**	**30**	**61**	**105**
Overlying water	97.8	98.2	93.5	72.4	38.2	30.6	18.2	15.5	14.1
Sediment	4.3	3.2	2.2	25.2	60.5	65.8	78.9	80.6	78.4
Volatiles $^{14}CO_2$	n.p.	<0.1	<0.1	<0.1	0.2	0.4	1.2	2.6	3.7
TOTAL	102.1	101.4	95.6	97.6	98.9	96.7	98.2	98.6	96.1
Mean ± sd	98.3 ± 2.3								

n.p.: Not performed

Table B.8.2.2.3-5 Humic substance fractionation (as % applied radioactivity)

Humic substance fraction	**% of applied radioactivity**	
	Pond	**Ditch**
Fulvic acid	10.0	3.8
Humic acid	2.0	1.7
Humin	12.6	6.3
Total	24.6	11.8

B. FINDINGS

A summary of the distribution of the residues expressed as % of applied radioactivity at each sampling time is provided in the tables below.

Table B.8.2.2.3-6 Biotransformation of flutolanil, expressed as percentage of applied radioactivity, in Pond water/sediment system, Lienden

Compound	Matrix	Sampling times (days)								
		0	**0.25**	**1**	**2**	**7**	**14**	**30**	**61**	**105**
Flutolanil	Water	95.2	96.8	91.9	79.3	72.4	55.8	48.8	32.5	24.5
	Sediment	4.5	0.0	0.0	16.5	22.5	32.0	34.0	23.4	20.2
	System	99.7	96.8	91.9	95.8	94.9	87.8	82.8	55.9	44.7
M-4	Water	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	2.1	**5.2**	**3.9**
	Sediment	<0.1	n.d.	n.d.	n.d.	n.d.	n.d.	0.7	1.6	1.7
	System	<0.1	n.d.	n.d.	n.d.	<0.1	n.d.	2.8	**6.8**	**5.6**
M-11	Water	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	1.8	**5.4**	**6.9**
	Sediment	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	1.4
	System	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	1.8	**5.5**	**8.3**
Unknowns	Water	n.d.	n.d.	n.d.	n.d.	n.d.	2.4	0.7	1.0	0.9
	Sediment	0.1	n.d.	n.d.	0.2	0.1	1.2	0.9	2.1	1.0
	System	<0.1	n.d.	n.d.	0.2	<0.1	3.6	1.6	3.1	1.9
Volatiles $^{14}CO_2$		n.p.	<0.1	<0.1	<0.1	<0.1	0.2	0.6	2.7	5.2
Non resolved radioactivity		0.2	2.5	3.1	1.4	1.1	2.0	1.1	1.2	1.3
Non extracted radioactivity		1.3	0.8	1.0	0.8	2.7	5.2	7.3	19.7	26.3
TOTAL		101.3	100.1	95.9	98.1	98.7	98.7	97.9	94.8	93.2

n.d. Not detected

Table B.8.2.2.3-7 Biotransformation of flutolanil, expressed as percentage of applied radioactivity, in Ditch water/sediment system, Ijzendoorn

Compound	Matrix	Sampling times (days)								
		0	**0.25**	**1**	**2**	**7**	**14**	**30**	**61**	**105**
Flutolanil	Water	97.5	97.8	91.2	71.9	37.4	29.0	16.3	12.8	11.1
	Sediment	3.4	n.d.	n.d.	22.4	53.7	61.4	68.7	65.7	60.8
	System	100.9	97.8	91.2	94.3	91.0	90.4	85.0	78.4	71.9
M-4	Water	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.2	1.3	1.0
	Sediment	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.5	1.4	1.3
	System	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.7	2.8	2.4
M-11	Water	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.7	0.9	1.5
	Sediment	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.3
	System	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.8	0.9	1.8
Unknowns	Water	n.d.	n.d.	1.7	n.d.	n.d.	0.2	0.5	0.2	0.3
	Sediment	n.d.	n.d.	n.d.	0.7	1.6	0.7	2.3	1.0	0.7
	System	n.d.	n.d.	1.7	0.7	1.6	0.9	2.7	1.2	1.1
Volatiles $^{14}CO_2$		n.p.	<0.1	<0.1	<0.1	0.2	0.4	1.2	2.6	3.7
Non resolved radioactivity		0.3	3.0	2.2	1.7	0.9	1.4	0.4	0.3	0.2
Non extracted radioactivity		0.9	0.7	0.6	1.0	5.2	3.8	7.5	12.6	15.1
TOTAL		102.1	101.4	95.6	97.5	98.8	96.7	98.2	98.7	96.1

n.d. Not detected

III. CONCLUSIONS

Study results indicate that flutolanil degrades slowly in aerobic aquatic system maintained under dark conditions. In the total system (water plus sediment), degradation DT_{50} values for flutolanil were calculated to be 90 days in the Pond system and 244 days in the Ditch system. Corresponding, total system DT_{90} values of 299 days for the Pond system and 811 days for the Ditch system were also calculated. Two minor metabolites M-4, (α,α,α-trifluoro-3'-hydroxy-*o*-toluanilide) and M-11, (2-[3'-(α,α,α-trifluoro-*o*-toluamido)phenoxy]propionic acid) were observed in the water sediment systems.

Remarks RMS renewal

- Analytical results are considered acceptable. Half-lives need to be recalculated using currently accepted methods. For a kinetic analysis of the data from this study, please refer to study CA 7.2.2.3/03, Hardy, I.A.J., & Jastrzebski, N. (2016b).
- M4 appeared on two consecutive timepoints at >5% AR for water+sediment (=system) and M11 was measured at two timepoints at >5% AR for water and system. It is not clear from the Regulation whether the water or the system maximum observed is the relevant parameter, and therefore M4 is taken into consideration in the risk assessment as a worst-case. Concluding, the metabolites M4 and M11 are both considered major.

Previous evaluation	Submitted for the purpose of renewal
RMS remark	Acceptable

Report:	**CA 7.2.2.3/02, Simmonds, M. & Adams, A. (2016)**
Title:	[^{14}C]-Flutolanil: Route and Rate of degradation in Two Water/Sediment Systems at 20 ± 2°C
Document No:	XG/15/013
Guidelines:	OECD 308 (2002), EPA 835.4300 (2008)
Testing Facility:	Battelle UK Ltd, Essex , UK
GLP:	Yes

Executive summary:

The route and rate of degradation of [^{14}C]-flutolanil radiolabelled in the phenyl ring has been investigated in two water-sediment systems incubated in the dark at 20±2°C for a period of up to 98 days. The sediments and associated waters were collected from two natural systems: Calwich Abbey Lake, Calwich, Staffordshire and Swiss Lake, Chatsworth, Derbyshire.

Approximately 43 g oven-dried equivalent of Calwich Abbey sediment or 115 g oven-dried equivalent of Swiss Lake sediment (each sieved to 2 mm) along with *ca* 336 mL (Calwich) or *ca* 307 mL (Swiss) of the associated water, was dispensed into 600 mL glass flask. All flasks were attached to an incubation system through which moistened air was bubbled, at a rate that allowed aeration of the water without disturbance of the sediment water interface.

Each flask was connected to a series of three traps, the first containing ethylene glycol and the second and third containing 2 *M* potassium hydroxide. The water/sediment systems were incubated at 20 ± 2°C in the dark for 25-26 days of acclimatization, until there was complete phase separation and the oxygen levels, pH and redox potentials had been established. At the end of acclimatization, the water-sediment systems were each treated with 200 µL of [14C]-flutolanil treatment solution in acetonitrile (treatment rate 0.21 mg/L). Following treatment the flasks were kept in the dark at 20 ± 2°C throughout the course of the study (up to 98 days).

Duplicate flasks and their associated traps were removed at each sampling interval. Samples were taken at 0 hour and following 3, 7, 14, 29, 59 and 98 days of incubation. The water and sediment layers were separated by decanting of the water layer. After removal of the water phase, the sediment was extracted with acetonitrile / water (4:1 *v/v*) + 0.1% ascorbic acid twice followed by acetonitrile: 0.1 N Hydrochloric Acid (4:1 *v/v*) + 0.1% ascorbic acid and acetonitrile / 1N Hydrochloric Acid (4:1 *v/v*) + 0.1% ascorbic acid. The radioactivity in the water layer, sediment extracts and trapping liquids was

quantified by LSC. Unextractable radioactivity in the sediment was determined by combustion/LSC. The water samples and sediment extracts were analysed by direct reversed phase HPLC (co-chromatography with unlabelled compounds) to determine the levels of parent and degradates.
The water conditions (pH, oxygen and redox potential) were measured in separate treated flasks throughout the duration of the study. Throughout the incubation period the pH of the sediment remained between 6.2 and 7.3 for both sediments (average pH of 7.1 for Calwich Abbey and 6.7 for Swiss Lake) and the water phase between 5.5 and 8.7 (average pH of 8.2 for Calwich Abbey and 7.4 for Swiss Lake). The redox potentials indicated that the water phases remained aerobic and the sediment layers anaerobic throughout the study. The oxygen content of the water phases ranged from 7.0 to 10.8 mg/L throughout the study.
Mass balances of individual replicates were in the range 90.9-104.3% AR. Formation of volatile products was insignificant (<0.4% AR trapped after 98 days incubation in both systems). Radioactivity in water decreased from 93.0-95.1% AR on day 0 to 25.6-52.6% AR on day 98. Radioactivity in sediment increased from 8.0-8.8% AR on day 0 to 41.2-65.1% AR on day 98. Non-extractable residues reached maximum levels after 59 days of 1.2-3.2% AR, declining to ≤0.1% AR at study end (day 98).

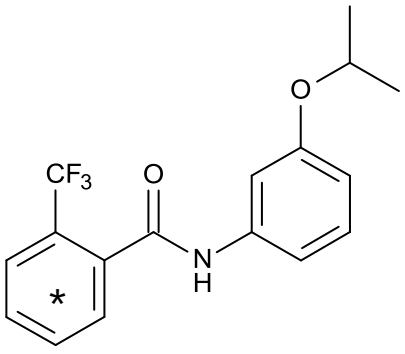
Flutolanil levels in the water phase decreased from 93.0-95.1% AR on day 0 to 20.4-47.2% AR on day 98, whilst those in sediment increased from 7.5-8.1% AR on day 0 to 37.9-61.2% AR on day 98. In the total systems of Calwich Abbey and Swiss Lake, Flutolanil decreased from 101.1-102.6% AR on day 0 to 81.6-85.1% AR on day 98. In the total systems of Calwich Abbey and Swiss Lake, 2-trifluoromethyl-benzamide (M-101), M4 and M11 were detected, but never exceeded 2.1% AR, 2.6% AR and 0.8% AR, respectively, whilst total unknowns were always ≤2.4% AR.

For a kinetic analysis of the data from this study, please refer to study CA 7.2.2.3/03.

MATERIALS AND METHODS

A. MATERIALS

1. Test material: [phenyl-U-^{14}C]-flutolanil



*Indicates position of the [^{14}C] radiolabel

Lot or batch number: CFQ42127

Specific activity: 118 mCi/mmol; 4370 MBq/mmol; 13.3 MBq/mg

Radiochemical purity: 100.0%

2. Water/Sediment: The water/sediment systems were freshly collected from sources at Calwich Abbey, Staffordshire, UK and Swiss Lake, Chatsworth, Derbyshire, UK, see table below. Prior to use, test water was sieved through a 212 µm sieve and sediment through a 2 mm mesh sieve. The sediment and water were stored at approximately 4°C in the dark for about a week prior to use.

Table B.8.2.2.3-8 Physicochemical Parameters of the Water/Sediment Systems

Sediment Parameter	**Calwich Abbey Battelle Soil ID - 15/049**		**Swiss Lake Battelle Soil ID - 15/056**	
Geographic Location	Calwich Abbey, Calwich, Staffordshire, UK		Swiss Lake, Chatsworth, Derbyshire, UK	
OS Map Reference	OSGB-SK 127431		OSGB-SK 27177 69993	
Texture Class	Silt Loam		Sand	
% Sand	33		93	
% Silt	51		3	
% Clay	16		4	
pH (1:1 soil:water ratio)	7.1		6.0	
pH (0.01M $CaCl_2$) 1:2 ratio	7.0		5.7	
% Organic Carbon	5.2		0.54	
Soil Biomass[(A)] Initial (µg/g dry wt.) Final	224 210		41.7 86.6	
CEC (meq/100 g)	11.2		3.2	
Water Parameter	**Calwich Abbey**		**Swiss Lake**	
pH	7.5		6.8	
TOC (ppm)	7.5		9.3	
DOC (ppm)	5.7		8.0	
Oxygen concentration (mg/L) at initiation:	7.3		9.2	
Redox potential (mV)	Initial	Final	Initial	Final
water	79.5	147.2	207.8	189.9
Sediment	-71.4	47.8	-31.4	-12.1

(A) Determined using the fumigation/extraction method

B. STUDY DESIGN AND METHODS

1. In-life dates:

11 August 2015 – 04 February 2016

Approximately 43 g oven-dried equivalent of Calwich Abbey sediment or 115 g oven-dried equivalent of Swiss Lake sediment (each sieved to 2 mm) along with *ca* 336 mL (Calwich) or *ca* 307 mL (Swiss) of the associated water, was dispensed into 600 mL glass flask. The flasks were allowed to acclimatize under study conditions for 25-26 days prior to application of the test item. Ratios of approximately 1:4 v/v (based upon sediment depth: water depth) were obtained for all samples of both systems. A sediment layer of *ca* 3 cm depth was established and then water was added to give a column height of about 12 cm above the sediment. All flasks were attached to an incubation system through which moistened air was bubbled, at a rate that allowed aeration of the water without disturbance of the sediment water interface.

Each flask was connected to a series of three traps, the first containing ethylene glycol and the second and third containing 2 *M* potassium hydroxide. The water/sediment systems were incubated at 20 ± 2°C in the dark until there was complete phase separation and the oxygen levels, pH and redox potentials had been established. At the end of acclimatization, the water-sediment systems were each treated with 200 µL of [14C]-flutolanil treatment solution in acetonitrile (treatment rate 0.21 mg/L). Following treatment the flasks were kept in the dark at 20 ± 2°C throughout the course of the study (up to 98 days).

Duplicate flasks and their associated traps were removed at each sampling interval. Samples were taken at 0 hour and following 3, 7, 14, 29, 59 and 98 days of incubation. The water and sediment layers were separated by decanting of the water layer. After removal of the water phase, the sediment was extracted with acetonitrile / water (4:1 *v/v*) + 0.1% ascorbic acid twice followed by acetonitrile: 0.1 N Hydrochloric Acid (4:1 *v/v*) + 0.1% ascorbic acid and acetonitrile / 1N Hydrochloric Acid (4:1 *v/v*) + 0.1% ascorbic acid. The radioactivity in the water layer, sediment extracts and trapping liquids was quantified by LSC. Unextractable radioactivity in the sediment was determined by combustion/LSC. The water samples and sediment extracts were analysed by direct reversed phase HPLC (co-chromatography with unlabelled compounds) to determine the levels of parent and degradates (LOD for HPLC 0.02% AR). HPLC column recoveries were acceptable for representative samples of water and sediment extracts, with 91.9-100.4% of injected radioactivity being recovered post-column.

RESULTS

The water conditions (pH, oxygen and redox potential) were measured in separate treated flasks throughout the duration of the study. Throughout the incubation period the pH of the sediment remained between 6.2 and 7.3 for both sediments (average pH of 7.1 for Calwich Abbey and 6.7 for Swiss Lake) and the water phase between 5.5 and 8.7 (average pH of 8.2 for Calwich Abbey and 7.4 for Swiss Lake). The redox potentials indicated that the water phases remained aerobic and the sediment layers anaerobic throughout the study. The oxygen content of the water phases ranged from 7.0 to 10.8 mg/L throughout the study.

The total recoveries and distribution of radioactivity in test systems treated with 14C-flutolanil are shown in the tables below. The identification and characterization of radioactivity in the water, sediment and test systems treated with 14C-flutolanil is presented below the recoveries. Unless indicated differently, in the summary below % AR represents replicate means.

Mass balances of individual replicates were in the range 90.9-104.3% AR. Formation of volatile products was insignificant (<0.4% AR trapped after 98 days incubation in both systems). Radioactivity in water decreased from 93.0-95.1% AR on day 0 to 25.6-52.6% AR on day 98. Radioactivity in sediment increased from 8.0-8.8% AR on day 0 to 41.2-65.1% AR on day 98. Non-extractable residues reached maximum levels after 59 days of 1.2-3.2% AR, declining to ≤0.1% AR at study end (day 98).

Flutolanil levels in the water phase decreased from 93.0-95.1% AR on day 0 to 20.4-47.2% AR on day 98, whilst those in sediment increased from 7.5-8.1% AR on day 0 to 37.9-61.2% AR on day 98. The identity of 14C-flutolanil was confirmed in selected water and sediment samples by LC-MS. In the total systems of Calwich Abbey and Swiss Lake, Flutolanil decreased from 101.1-102.6% AR on day 0 to 81.6-85.1% AR on day 98. In the total systems of Calwich Abbey and Swiss Lake, 2-trifluoromethyl-benzamide (M-101), M4 and M11 were detected, but never exceeded 2.1% AR, 2.6% AR and 0.8% AR, respectively, whilst total unknowns were always ≤2.4% AR.

For a kinetic analysis of the data from this study, please refer to study CA 7.2.2.3/03.

Table B.8.2.2.3-9 Recovery of the applied radioactivity in Calwich Abbey (silt loam) water/sediment system (as % AR)

Incubation (days)	Vessel Number	Overlying Water	Sediment			Volatiles*		Total
			Extracts	NER	Total	KOH	EG	
0	CA-1	94.6	6.8	0.8	7.6	n/a	n/a	102.2
	CA-2	91.5	9.3	0.7	10.0	n/a	n/a	101.5
Average	-	**93.0**	**8.1**	**0.8**	8.8	**n/a**	**n/a**	**101.8**
3	CA-3	95.9	4.5	0.1	4.5	<0.1	<0.1	100.5
	CA-4	80.4	18.3	0.2	18.5	<0.1	<0.0	98.9
Average	-	**88.2**	**11.4**	**0.1**	11.5	**<0.1**	**<0.1**	**99.7**
7	CA-5	86.6	9.2	0.1	9.3	<0.1	<0.1	95.9
	CA-6	91.9	3.5	0.1	3.6	<0.1	<0.1	95.5
Average	-	**89.3**	**6.3**	**0.1**	6.4	**<0.1**	**<0.1**	**95.7**
14	CA-7	68.4	29.6	0.7	30.3	<0.1	<0.1	98.8
	CA-8	81.0	18.4	0.3	18.7	<0.1	<0.1	99.7
Average	-	**74.7**	**24.0**	**0.5**	24.5	**<0.1**	**<0.1**	**99.3**
29	CA-9	42.8	53.9	1.4	55.3	<0.1	<0.1	98.1
	CA-10	69.7	26.5	0.4	26.9	<0.1	<0.1	96.6
Average	-	**56.2**	**40.2**	**0.9**	41.1	**<0.1**	**<0.1**	**97.4**
59	CA-11	40.4	53.0	3.1	56.1	0.2	<0.1	96.6
	CA-12	34.5	58.3	3.3	61.6	0.1	<0.1	96.3
Average	-	**37.5**	**55.6**	**3.2**	58.8	**0.2**	**<0.1**	**96.5**
98	CA-13	24.0	66.3	0.1	66.4	0.4	<0.1	90.9
	CA-14	27.2	63.8	0.1	63.8	0.3	<0.1	91.4
Average	-	**25.6**	**65.0**	**0.1**	65.1	**0.4**	**<0.1**	**91.1**
					Overall Mean Recovery			**97.3**

* Potassium Hydroxide (KOH), Ethylene Glycol (EG)
n/a volatile traps not required at time zero
NER= Non-extractable residue.

Table B.8.2.2.3-10 Recovery of the applied radioactivity in Swiss Lake (sand) water/sediment system (as % AR)

Incubation (days)	Vessel Number	Overlying Water	Sediment			Volatiles*		Total
			Extracts	NER	Total	KOH	EG	
0	SL-33	93.6	7.8	0.4	8.2	n/a	n/a	101.8
	SL-34	96.6	7.3	0.4	7.7	n/a	n/a	104.3
Average	-	**95.1**	**7.5**	**0.4**	8.0	**n/a**	**n/a**	**103.0**
3	SL-35	99.0	2.0	<0.1	2.0	<0.1	<0.1	101.0
	SL-36	100.1	1.2	<0.1	1.2	<0.1	<0.1	101.3
Average	-	**99.5**	**1.6**	**<0.1**	1.6	**<0.1**	**<0.1**	**101.2**
7	SL-37	92.8	1.9	<0.1	1.9	<0.1	<0.1	94.8
	SL-38	92.9	2.7	<0.1	2.7	<0.1	<0.1	95.6
Average	-	**92.8**	**2.3**	**<0.1**	2.3	**<0.1**	**<0.1**	**95.2**
14	SL-39	82.7	17.4	0.2	17.6	<0.1	<0.1	100.3
	SL-40	95.6	5.5	<0.1	5.5	<0.1	<0.1	101.2
Average	-	**89.1**	**11.5**	**0.2**	11.7	**<0.1**	**<0.1**	**100.7**
29	SL-41	62.3	34.2	0.9	35.1	<0.1	<0.1	97.5
	SL-42	82.2	17.6	0.1	17.8	<0.1	<0.1	100.0
Average	-	**72.3**	**25.9**	**0.5**	26.4	**<0.1**	**<0.1**	**98.8**
59	SL-43	56.6	38.5	1.5	40.0	0.1	<0.1	96.8
	SL-44	46.5	45.4	0.9	46.3	0.1	<0.1	92.9
Average	-	**51.6**	**42.0**	**1.2**	43.1	**0.1**	**<0.1**	**94.9**
98	SL-45	55.5	39.2	<0.1	39.2	0.3	0.1	95.1
	SL-46	49.7	43.2	<0.1	43.2	0.2	0.1	93.1
Average	-	**52.6**	**41.2**	**<0.1**	41.2	**0.2**	**0.1**	**94.1**
					Overall Mean Recovery			**98.3**

* Potassium Hydroxide (KOH), Ethylene Glycol (EG)
n/a volatile traps not required at time zero
NER= Non-extractable residue.

Table B.8.2.2.3-11 Composition of Radioactivity in the Water Phase of the Calwich Abbey System (as % AR, by HPLC)

Incubation Time	Flask No	% of Applied Radioactivity	Flutolanil	2-(TFM) Benzamide (M-101)	M4	M11	*Total Unknowns	Total peaks
0 hour	CA-01	94.6	94.6	0.0	0.0	0.0	0.0	94.6
	CA-02	91.5	91.5	0.0	0.0	0.0	0.0	91.5
Mean		**93.0**	**93.0**	**0.0**	**0.0**	**0.0**	**0.0**	93.0
Day 3	CA-03	95.9	95.9	0.0	0.0	0.0	0.0	95.9
	CA-04	80.4	80.4	0.0	0.0	0.0	0.0	80.4
Mean		**88.2**	**88.2**	**0.0**	**0.0**	**0.0**	**0.0**	88.2
Day 7	CA-05	86.6	86.6	0.0	0.0	0.0	0.0	86.6
	CA-06	92.0	89.5	0.0	0.0	0.0	2.4	92.0
Mean		**89.3**	**88.1**	**0.0**	**0.0**	**0.0**	**1.2**	89.3
Day 14	CA-07	68.4	66.8	1.2	0.0	0.0	0.4	68.4
	CA-08	81.0	80.6	0.0	0.0	0.0	0.4	81.0
Mean		**74.7**	**73.7**	**0.6**	**0.0**	**0.0**	**0.4**	74.7
Day 29	CA-09	42.8	38.9	0.6	1.0	0.6	1.7	42.8
	CA-10	69.7	68.4	0.5	0.0	0.2	0.6	69.7
Mean		**56.2**	**53.6**	**0.6**	**0.5**	**0.4**	**1.2**	56.2
Day 59	CA-11	40.4	37.2	1.1	0.5	0.6	0.9	40.4
	CA-12	34.5	32.2	0.9	0.5	0.2	0.8	34.5
Mean		**37.5**	**34.7**	**1.0**	**0.5**	**0.4**	**0.9**	37.5
Day 98	CA-13	24.0	19.3	1.7	0.7	0.8	1.5	24.0
	CA-14	27.2	21.4	2.3	0.6	0.6	2.3	27.2
Mean		**25.6**	**20.4**	**2.0**	**0.6**	**0.7**	**1.9**	25.6

* No single unknown component was seen at levels greater than 2.28% AR in any individual sample.

The named components, with the exception of Flutolonil, have not been confirmed by MS, however, they were shown to co-chromatograph with supplied reference standards.

Table B.8.2.2.3-12 Composition of Radioactivity in the Sediment Phase of the Calwich Abbey System (as % AR, by HPLC)

Incubation Time	Flask No	% of Applied Radioactivity	Flutolanil	2-(TFM) Benzamide	M4	M11	*Total Unknowns	Total peaks
0 hour	CA-01	6.8	6.8	0.0	0.0	0.0	0.0	6.8
	CA-02	9.3	9.3	0.0	0.0	0.0	0.0	9.3
Mean		**8.1**	**8.1**	**0.0**	**0.0**	**0.0**	**0.0**	**8.1**
Day 3	CA-03	3.7	3.7	0.0	0.0	0.0	0.0	3.7
	CA-04	17.0	17.0	0.0	0.0	0.0	0.0	17.0
Mean		**10.4**	**10.4**	**0.0**	**0.0**	**0.0**	**0.0**	**10.4**
Day 7	CA-05	8.4	8.4	0.0	0.0	0.0	0.0	8.4
	CA-06	3.2	3.2	0.0	0.0	0.0	0.0	3.2
Mean		**5.8**	**5.8**	**0.0**	**0.0**	**0.0**	**0.0**	**5.8**
Day 14	CA-07	26.8	26.7	0.0	0.0	0.0	0.1	26.8
	CA-08	16.7	16.7	0.0	0.0	0.0	0.0	16.7
Mean		**21.8**	**21.7**	**0.0**	**0.0**	**0.0**	**0.1**	**21.8**
Day 30	CA-09	49.1	48.5	0.0	0.4	0.0	0.3	49.2
	CA-10	24.0	24.0	0.0	0.0	0.0	0.0	24.0
Mean		**36.6**	**36.3**	**0.0**	**0.2**	**0.0**	**0.1**	**36.6**
Day 60	CA-11	51.4	50.7	0.2	0.3	0.1	0.2	51.4
	CA-12	56.4	55.6	0.2	0.4	0.0	0.2	56.4
Mean		**53.9**	**53.1**	**0.2**	**0.3**	**0.0**	**0.2**	**53.9**
Day 100	CA-13	63.6	62.7	0.0	0.7	0.2	0.0	63.6
	CA-14	61.5	59.7	0.0	0.9	0.0	0.9	61.5
Mean		**62.6**	**61.2**	**0.0**	**0.8**	**0.1**	**0.5**	**62.6**

* No single unknown component was seen at levels greater than 0.56% AR in any individual sample.

The named components, with the exception of Flutolonil, have not been confirmed by MS, however, they were shown to co-chromatograph with supplied reference standards.

Table B.8.2.2.3-13 Composition of Radioactivity in the Total Calwich Abbey System (as % AR, by HPLC)

Incubation Time	Flask No	% of Applied Radioactivity	Flutolanil	2-(TFM) Benzamide (M-101)	M4	M11	*Total Unknowns	Total peaks
0 hour	CA-01	101.4	101.4	0.0	0.0	0.0	0.0	101.4
	CA-02	100.8	100.8	0.0	0.0	0.0	0.0	100.8
Mean		**101.1**	**101.1**	**0.0**	**0.0**	**0.0**	**0.0**	**101.1**
Day 3	CA-03	99.7	99.7	0.0	0.0	0.0	0.0	99.7
	CA-04	97.4	97.4	0.0	0.0	0.0	0.0	97.4
Mean		**98.5**	**98.5**	**0.0**	**0.0**	**0.0**	**0.0**	**98.5**
Day 7	CA-05	95.0	95.0	0.0	0.0	0.0	0.0	95.0
	CA-06	95.1	92.7	0.0	0.0	0.0	2.4	95.1
Mean		**95.1**	**93.8**	**0.0**	**0.0**	**0.0**	**1.2**	**95.0**
Day 14	CA-07	95.3	93.5	1.2	0.0	0.0	0.5	95.3
	CA-08	97.7	97.4	0.0	0.0	0.0	0.4	97.7
Mean		**96.5**	**95.4**	**0.6**	**0.0**	**0.0**	**0.5**	**96.5**
Day 29	CA-09	91.9	87.4	0.6	1.4	0.6	2.0	91.9
	CA-10	93.7	92.4	0.5	0.0	0.2	0.6	93.7
Mean		**92.8**	**89.9**	**0.6**	**0.7**	**0.4**	**1.3**	**92.8**
Day 59	CA-11	91.8	87.9	1.3	0.8	0.7	1.1	91.8
	CA-12	90.9	87.7	1.1	0.9	0.2	1.0	90.9
Mean		**91.4**	**87.8**	**1.2**	**0.9**	**0.4**	**1.1**	**91.4**
Day 98	CA-13	87.7	82.0	1.7	1.4	1.0	1.5	87.7
	CA-14	88.7	81.1	2.3	1.5	0.6	3.2	88.7
Mean		**88.2**	**81.6**	**2.0**	**1.4**	**0.8**	**2.3**	**88.2**

* No single unknown component was seen at levels greater than 2.85% AR in any individual sample.

The named components, with the exception of Flutolonil, have not been confirmed by MS, however, they were shown to co-chromatograph with supplied reference standards.

Table B.8.2.2.3-14 Composition of Radioactivity in the Water Phase of the Swiss Lake System (as % AR, by HPLC)

Incubation Time	Flask No	% of Applied Radioactivity	Flutolanil	2-(TFM) Benzamide (M-101)	M4	M11	*Total Unknowns	Total peaks
0 hour	SL-33	93.6	93.6	0.0	0.0	0.0	0.0	93.6
	SL-34	96.6	96.6	0.0	0.0	0.0	0.0	96.6
Mean		**95.1**	**95.1**	**0.0**	**0.0**	**0.0**	**0.0**	**95.1**
Day 3	SL-35	99.0	99.0	0.0	0.0	0.0	0.0	99.0
	SL-36	100.1	100.1	0.0	0.0	0.0	0.0	100.1
Mean		**99.5**	**99.5**	**0.0**	**0.0**	**0.0**	**0.0**	**99.5**
Day 7	SL-37	92.8	92.7	0.0	0.0	0.0	0.2	92.8
	SL-38	92.9	92.5	0.0	0.4	0.0	0.0	92.9
Mean		**92.8**	**92.6**	**0.0**	**0.2**	**0.0**	**0.1**	**92.8**
Day 14	SL-39	82.7	79.8	0.8	0.8	0.0	1.3	82.7
	SL-40	95.6	95.6	0.0	0.0	0.0	0.0	95.6
Mean		**89.1**	**87.7**	**0.4**	**0.4**	**0.0**	**0.7**	**89.1**
Day 29	SL-41	62.3	55.6	3.5	1.1	0.3	1.8	62.3
	SL-42	82.2	81.1	0.4	0.5	0.0	0.2	82.2
Mean		**72.3**	**68.3**	**2.0**	**0.8**	**0.1**	**1.0**	**72.3**
Day 59	SL-43	56.6	51.7	1.0	2.3	0.4	1.3	56.6
	SL-44	46.5	42.3	1.3	1.7	0.2	1.1	46.5
Mean		**51.6**	**47.0**	**1.2**	**2.0**	**0.3**	**1.2**	**51.6**
Day 98	SL-45	55.5	50.2	1.4	1.3	0.6	2.0	55.5
	SL-46	49.7	44.3	0.6	1.8	0.6	2.4	49.7
Mean		**52.6**	**47.2**	**1.0**	**1.5**	**0.6**	**2.2**	**52.6**

* No single unknown component was seen at levels greater than 2.39 % AR in any individual sample.

The named components, with the exception of Flutolonil, have not been confirmed by MS, however, they were shown to co-chromatograph with supplied reference standards.

Table B.8.2.2.3-15 Composition of Radioactivity in the Sediment Phase of the Swiss Lake System (as % AR, by HPLC)

Incubation Time	Flask No	% of Applied Radioactivity	Flutolanil	2-(TFM) Benzamide (M-101)	M4	M11	*Total Unknowns	Total peaks
0 hour	SL-33	7.8	7.8	0.0	0.0	0.0	0.0	7.8
	SL-34	7.3	7.3	0.0	0.0	0.0	0.0	7.3
Mean		**7.5**	**7.5**	**0.0**	**0.0**	**0.0**	**0.0**	**7.5**
Day 3	SL-35	1.8	1.8	0.0	0.0	0.0	0.0	1.8
	SL-36	1.1	1.1	0.0	0.0	0.0	0.0	1.1
Mean		**1.5**	**1.5**	**0.0**	**0.0**	**0.0**	**0.0**	**1.5**
Day 7	SL-37	1.7	1.7	0.0	0.0	0.0	0.0	1.7
	SL-38	2.4	2.4	0.0	0.0	0.0	0.0	2.4
Mean		**2.1**	**2.1**	**0.0**	**0.0**	**0.0**	**0.0**	**2.1**
Day 14	SL-39	15.4	15.4	0.0	0.0	0.0	0.0	15.4
	SL-40	5.0	5.0	0.0	0.0	0.0	0.0	5.0
Mean		**10.2**	**10.2**	**0.0**	**0.0**	**0.0**	**0.0**	**10.2**
Day 29	SL-41	29.9	28.9	0.2	0.2	0.0	0.7	29.9
	SL-42	15.9	15.9	0.0	0.0	0.0	0.0	15.9
Mean		**22.9**	**22.4**	**0.1**	**0.1**	**0.0**	**0.4**	**22.9**
Day 59	SL-43	36.6	35.8	0.0	0.6	0.0	0.3	36.6
	SL-44	43.5	41.9	0.1	0.8	0.0	0.7	43.5
Mean		**40.1**	**38.8**	**0.1**	**0.7**	**0.0**	**0.5**	**40.1**
Day 98	SL-45	36.7	36.3	0.1	0.1	0.0	0.1	36.7
	SL-46	40.3	39.4	0.0	0.6	0.0	0.3	40.3
Mean		**38.5**	**37.9**	**0.1**	**0.3**	**0.0**	**0.2**	**38.5**

* No single unknown component was seen at levels greater than 0.36 % AR in any individual sample.

The named components, with the exception of Flutolonil, have not been confirmed by MS, however, they were shown to co-chromatograph with supplied reference standards.

Table B.8.2.2.3-16 Composition of Radioactivity in the Total Swiss Lake System (as % AR, by HPLC)

Incubation Time	Flask No	% of Applied Radioactivity	Flutolanil	2-(TFM) Benzamide (M-101)	M4	M11	*Total Unknowns	Total peaks
0 hour	SL-33	101.3	101.3	0.0	0.0	0.0	0.0	101.3
	SL-34	103.9	103.9	0.0	0.0	0.0	0.0	103.9
Mean		**102.6**	**102.6**	**0.0**	**0.0**	**0.0**	**0.0**	**102.6**
Day 3	SL-35	100.8	100.8	0.0	0.0	0.0	0.0	100.8
	SL-36	101.2	101.2	0.0	0.0	0.0	0.0	101.2
Mean		**101.0**	**101.0**	**0.0**	**0.0**	**0.0**	**0.0**	**101.0**
Day 7	SL-37	94.6	94.4	0.0	0.0	0.0	0.2	94.6
	SL-38	95.3	94.9	0.0	0.4	0.0	0.0	95.3
Mean		**94.9**	**94.7**	**0.0**	**0.2**	**0.0**	**0.1**	**94.9**
Day 14	SL-39	98.1	95.2	0.8	0.8	0.0	1.3	98.1
	SL-40	100.5	100.5	0.0	0.0	0.0	0.0	100.5
Mean		**99.3**	**97.9**	**0.4**	**0.4**	**0.0**	**0.7**	**99.3**
Day 29	SL-41	92.3	84.5	3.7	1.3	0.3	2.5	92.3
	SL-42	98.1	96.9	0.4	0.5	0.0	0.2	98.1
Mean		**95.2**	**90.7**	**2.1**	**0.9**	**0.1**	**1.4**	**95.2**
Day 59	SL-43	93.3	87.5	1.0	2.9	0.4	1.5	93.3
	SL-44	90.0	84.2	1.5	2.4	0.2	1.7	90.0
Mean		**91.7**	**85.8**	**1.2**	**2.6**	**0.3**	**1.6**	**91.6**
Day 98	SL-45	92.2	86.5	1.5	1.4	0.6	2.1	92.2
	SL-46	90.0	83.7	0.6	2.4	0.6	2.7	90.0
Mean		**91.1**	**85.1**	**1.0**	**1.9**	**0.6**	**2.4**	**91.1**

* No single unknown component was seen at levels greater than 2.66 % AR in any individual sample.

The named components, with the exception of Flutolonil, have not been confirmed by MS, however, they were shown to co-chromatograph with supplied reference standards.

CONCLUSIONS

Flutolanil levels in the water phase decreased from 93.0-95.1% AR on day 0 to 20.4-47.2% AR on day 98, whilst those in sediment increased from 7.5-8.1% AR on day 0 to 37.9-61.2% AR on day 98. In the total systems of Calwich Abbey and Swiss Lake, Flutolanil decreased from 101.1-102.6% AR on day 0 to 81.6-85.1% AR on day 98. No significant metabolites (>5% AR) were observed in either system. No significant quantities of bound residues (<3.2% AR) or volatiles (<0.4% AR) were observed throughout the duration of the study.

For a kinetic analysis of the data from this study, please refer to study CA 7.2.2.3/03, Hardy, I.A.J., & Jastrzebski, N. (2016b).

Previous evaluation	Submitted for the purpose of renewal
RMS remark	Acceptable

Report:	**KCA 7.2.2.3/03, Hardy, I.A.J., Agostini F. & Jastrzebski, N. (2016d)**
Title:	Flutolanil: Kinetic Modelling Analysis of Data from Water-Sediment Studies
Document No:	XG/15/023J
Guidelines:	FOCUS (2006). "Guidance Document on Estimating Persistence and Degradation Kinetics from Environmental Fate Studies on Pesticides in EU Registration". Report of the FOCUS Working Group on Degradation Kinetics. EC Document Reference Sanco/10058/2005 version 2.0
GLP	No

Executive Summary:

The aim of this study was to evaluate water sediment degradation data for flutolanil to derive DT_{50} values for modelling purposes and DT_{50} and DT_{90} values for comparison with triggers according to FOCUS kinetics guidance.

The fate of flutolanil in aquatic sediment systems has been investigated in four different water sediment systems [Simmonds & Adams (2016) and Wyss-Benz (1993)] . In the studies the degradation of flutolanil was evaluated following application to four different water-sediment systems. The systems were incubated under aerobic conditions in the laboratory and maintained in dark conditions at a temperature of 20°C.

Kinetic modelling evaluations CAKE 3.2 showed that statistically valid results could be derived according to FOCUS Kinetics acceptance criteria. Trigger DT50 values for whole system, water and sediment were in the range 88.7-413, 4.49-50.4 and 91.9-1000 days, respectively, and trigger DT90 values were in the range 295-1480, 86.2->10000 and 305-3320 days, respectively. The whole system modelling endpoint DT_{50} values derived for flutolanil are summarised below:

Phase	**Study**	**Sample**	**Derivation of DT_{50}**	**DT_{50} (days)**
Total System	Simmonds & Adams (2016)	Calwich Abbey	SFO	346
		Swiss Lake	SFO	354
	Wyss-Benz (1993)	Pond	SFO	88.7
		Ditch	SFO	233
Geometric mean				**224**

MATERIALS AND METHODS

The experimental data generated in two aerobic aquatic–sediment studies [Simmonds & Adams (2016) and Wyss-Benz (1993)] was re-evaluated according to the FOCUS guidance document on degradation kinetics (2014) using the software CAKE. The aim of this evaluation was to conduct a kinetic modelling analysis of flutolanil data from aquatic sediment studies in order to derive trigger and unnormalised modelling endpoint DT_{50} values for use in subsequent exposure assessments.

The datasets evaluated for each of the water sediment systems are provided in the tables below. The values of the applied substance in the water phase and the total system at time t = 0 were set to the value of the total mass balance at this time point multiplied by the radiochemical purity (100.0% and 99.6% in the studies by Simmonds & Adams (2016) and Wyss-Benz (1993), respectively.

In the first instance, the data were directly fitted in CAKE [2016] un-weighted with the complete data set and unconstrained initial concentration (M0). Confidence in the resulting parameters has been assessed visually using a three-point scale (Poor = unacceptable fit; Acceptable = the fitted curve describes the trend of the data points, residuals may show some deviation from random distribution but it is not significant; Good = the fitted curve closely follows all the data points, residuals are randomly distributed). Confidence in the resulting parameters has been assessed statistically from the confidence intervals for the α and β parameters of the first order multicompartment (FOMC) model or probability values for a t-test of the rate parameters for the single first order (SFO), dual first order in parallel (DFOP) and hockey stick (HS) models. Parameter estimates with a significance level greater than 95% are acceptable and, if greater than 90%, may be accepted where the visual fit is acceptable or good. Where significance levels are less than 90%, the fits are not considered acceptable.The χ^2 error% parameter has been used to determine goodness of fit and where two models are an appropriate to fit the data, the choice of best fit has been based on the lowest value of this parameter.

All datasets were evaluated against FOCUS Kinetics criteria based on visual assessment, minimum chi^2 error of <15%, t-test parameter significance ≥95% and 90^{th} confidence interval of α and β parameters of FOMC should not include zero.

Table B.8.2.2.3-17 Summary of flutolanil processed residue data used in the kinetic evaluations for the Calwich Abbey and Swiss Lake systems

Time (days)	Flutolanil (% applied radioactivity)			
	Calwich Abbey		Swiss Lake	
	Total System	Water	Total System	Water
0	102.2	102.2	101.8	101.8
0	101.5	101.5	104.3	104.3
3	99.7	95.9	100.8	99.0
3	97.4	80.4	101.2	100.1
7	95.0	86.6	94.4	92.7
7	92.7	89.5	94.9	92.5
14	93.5	66.8	95.2	79.8
14	97.4	80.6	100.5	95.6
29	87.4	38.9	84.5	55.6
29	92.4	68.4	96.9	81.1
59	87.9	37.2	87.5	51.7
59	87.7	32.2	84.2	42.3
98	82.0	19.3	86.5	50.2
98	81.1	21.4	83.7	44.3

Note: sediment data not modelled, no decline apparent in sediment.

Table B.8.2.2.3-18 Summary of flutolanil processed residue data used in the kinetic evaluations for the pond and ditch system

Time (days)	Flutolanil (% applied radioactivity)					
	Pond			Ditch		
	Total System	Water	Sediment [a]	Total System	Water	Sediment [a]
0	103.5	103.5	-	101.1	101.1	-
0	98.2	98.2	-	102.2	102.2	-
0.25	97.1	97.1	-	98.7	96.7	-
0.25	98.5	96.5	-	98.9	98.9	-
1	91.0	91.0	-	92.5	92.5	-
1	92.7	92.7	-	89.9	89.9	-
2	94.8	76.3	-	94.0	75.1	-
2	98.8	82.3	-	94.5	68.6	-
7	94.8	70.9	-	92.1	31.7	-
7	94.9	73.9	-	89.9	39.0	-
14	87.5	58.9	-	91.2	31.7	-
14	88.0	52.7	-	89.5	26.3	-
30	83.9	48.3	35.8	84.2	18.2	67.9
30	81.7	49.3	32.4	85.8	16.4	69.4
61	53.9	32.1	21.8	78.9	12.9	66.0
61	57.8	32.9	24.9	77.9	12.6	65.3
105	46.6	25.2	21.4	73.5	11.4	62.1
105	42.8	23.8	19.0	70.3	10.8	59.5

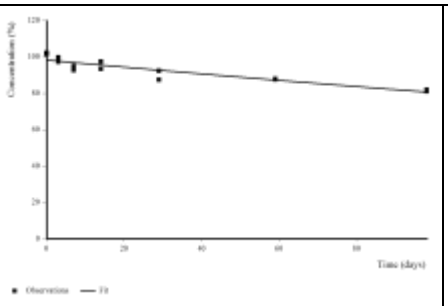
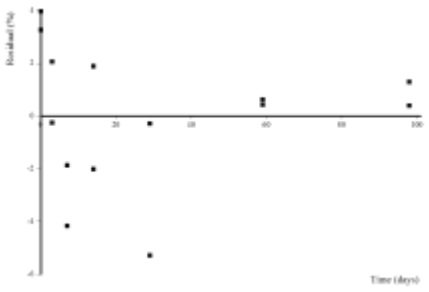
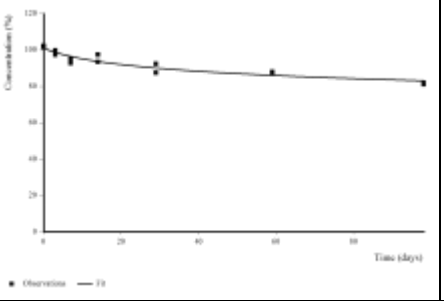
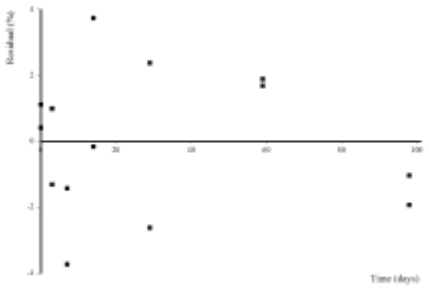
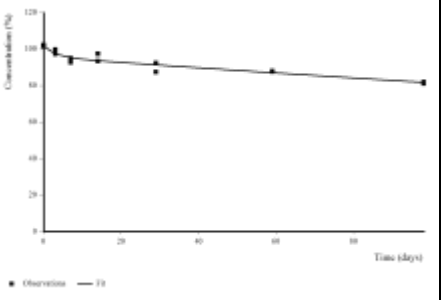
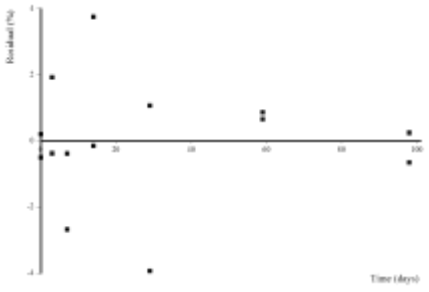
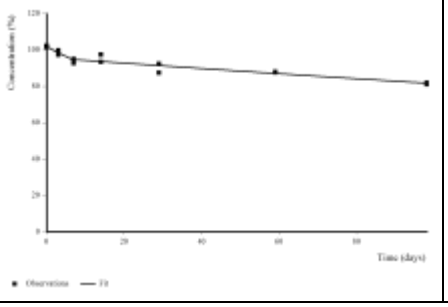
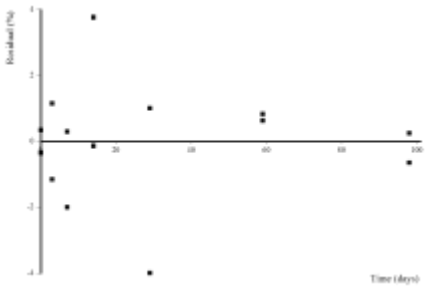
[a] *data plotted from maximum to simulate decline only*

RESULTS

The trigger and non-normalised modelling endpoints DT_{50} values for flutolanil are shown graphically in the tables below.

Table B.8.2.2.3-19 Graphical summary Calwich Abbey – Total System (Simmonds & Adams, 2016)

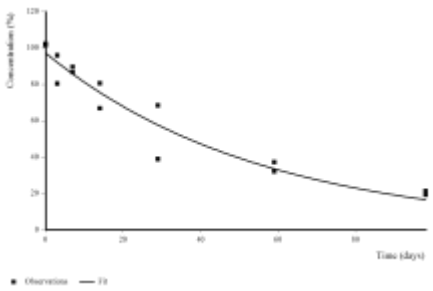
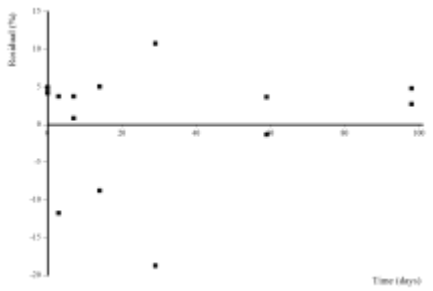
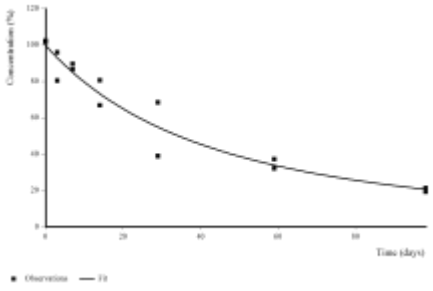
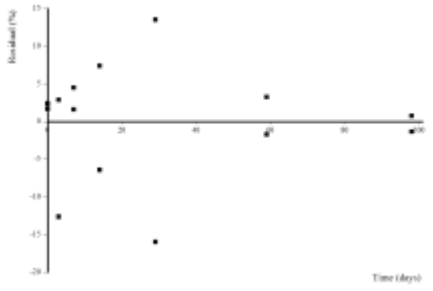
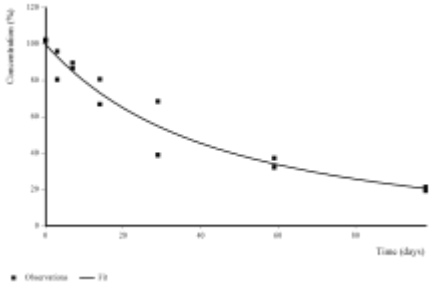
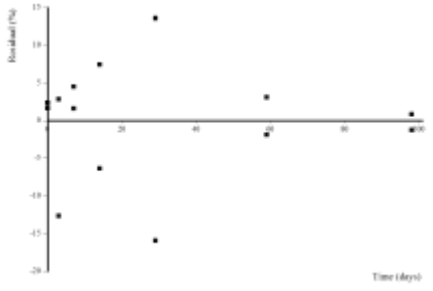
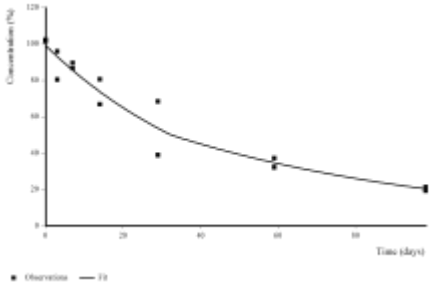
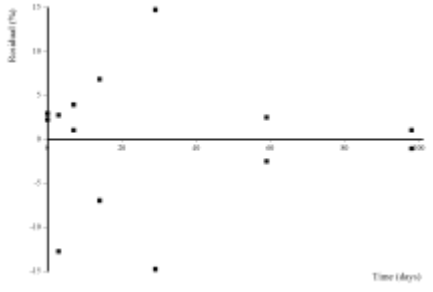
Sample (Study reference)	Calwich Abbey – Total System (Simmonds & Adams, 2016)			
Model	SFO	FOMC	DFOP	HS
Visual Fit	Good	Good	Good	Good
Residuals (visual)	Good	Good	Good	Good
χ^2 error (%)	1.83	1.39	1.15	1.01
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.002005 σ: 2.53 x 10^{-4} p (k): 2.04 x 10^{-6}	α: 0.07713 σ: 0.02392 95th %ile CI does not contain 0 β: 8.293 σ: 6.867 90th %ile CI contains 0	k_1: 0.3021 σ: 0.2353 p (k_1): 0.1141 k_2: 0.001606 σ: 2.76 x 10^{-4} p (k_2): 8.37 x 10^{-5} g: 0.0619 σ: 0.01941	k_1: 0.01098 σ: 0.006632 p (k_1): 0.06441 k_2: 0.001616 σ: 2.18 x 10^{-4} p (k_2): 1.14 x 10^{-5} tb: 6.565 σ: 3.917
Trigger DT_{50} (days)	346	>10000	392	**391**
Trigger DT_{90} (days)	1150	>10000	1390	**1390**
FOCUS decision step (Trigger)	SFO acceptable; compare with FOMC	FOMC better than SFO but β not robust, compare with DFOP & HS	DFOP better than FOMC but k_1 not robust; compare with HS	HS better than DFOP$^{(A)}$; HS selected as best fit
Modelling DT_{50} (days)	**346**			
FOCUS decision step (Modelling)	SFO acceptable acceptable; SFO DT_{50} selected			
Visual Fit	Residuals plot		Visual Fit	

SFO		
FOMC		
DFOP		
HS		

(A) The hinge point t_b was 6.6 days leaving only 4 data points for the estimation of k_1. Therefore the parameter k_1 is considered acceptable, although its p-value (0.06441) is slightly higher than 0.05.

Table B.8.2.2.3-20 Graphical summary Calwich Abbey – Water (Simmonds & Adams, 2016)

Sample (Study reference)	Calwich Abbey – Water (Simmonds & Adams, 2016)			
Model	SFO	FOMC	DFOP	HS
Visual Fit	Good	Good	Good	Good
Residuals (visual)	Good	Good	Good	Good
χ^2 error (%)	4.01	3.11	3.42	3.34
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.01805 σ: 0.002132 p (k): 1.05 x 10^{-6}	α: 2.126 σ: 2.153 90th %ile CI contains 0 β: 89.2 σ: 114.9 90th %ile CI contains 0	k_1: 0.04251 σ: 0.1052 p (k_1): 0.3474 k_2: 0.01119 σ: 0.02309 p (k_2): 0.3193 g: 0.4028 σ: 1.489	k_1: 0.0212 σ: 0.004041 p (k_1): 1.88 x 10^{-4} k_2: 0.01368 σ: 0.00892 p (k_2): 0.07801$^{(A)}$ tb: 32.4 σ: 49.98

Trigger DT_{50} (days)	38.4	34.4	34.4	**32.9**
Trigger DT_{90} (days)	128	174	160	**151**
FOCUS decision step (Trigger)	SFO acceptable; compare with FOMC	FOMC better than SFO but statistically unreliable; compare with DFOP & HS	DFOP better than FOMC but statistically unreliable; compare with HS	HS better than DFOP(A); HS selected as best fit
Modelling DT_{50} (days)	**38.4**			
FOCUS decision step (Modelling)	SFO acceptable; SFO DT_{50} selected			
Visual Fit	Residuals plot		Visual Fit	
SFO				
FOMC				
DFOP				
HS				

(A) The hinge point t_b was 32.4 days leaving only 4 data points for the estimation of k_2. Therefore the parameter k_2 is considered acceptable, although its p-value (0.07801) is slightly higher than 0.05.

Table B.8.2.2.3-21 Graphical summary Swiss Lake – Total System (Simmonds & Adams, 2016)

Sample (Study reference)	Swiss Lake – Total System (Simmonds & Adams, 2016)			
Model	SFO	FOMC	DFOP	HS
Visual Fit	Good	Good	Good	Good
Residuals (visual)	Good	Good	Good	Good
χ^2 error (%)	2.43	1.61	1.77	1.92
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.00196 σ: 3.89 x 10^{-4} p (k): 1.46 x 10^{-4}	α: 0.07087 σ: 0.03093 95th %ile CI does not contain 0 β: 6.214 σ: 7.842 90th %ile CI contains 0	k_1: 0.03519 σ: 0.06069 p (k_1): 0.2874 k_2: 2.98 x 10^{-10} σ: 0.003131 p (k_2): 0.5 g: 0.1761 σ: 0.2756	k_1: 0.01138 σ: 0.004649 p (k_1): 0.01719 k_2: 0.001513 σ: 4.16 x 10^{-4} p (k_2): 0.002269 tb: 6.989 σ: 0.4735
Trigger DT_{50} (days)	354	>10,000	>10,000	**413**
Trigger DT_{90} (days)	1180	>10,000	>10,000	**1480**
FOCUS decision step (Trigger)	SFO acceptable; compare with FOMC	FOMC better than SFO but statistically unreliable; compare with DFOP & HS	DFOP k_1 and k_2 not robust; compare with HS	HS slightly higher X^2 error term than FOMC but statistically robust; HS selected as best fit
Modelling DT_{50} (days)	**354**			
FOCUS decision step (Modelling)	SFO acceptable; SFO DT_{50} selected			
Visual Fit	Residuals plot		Visual Fit	

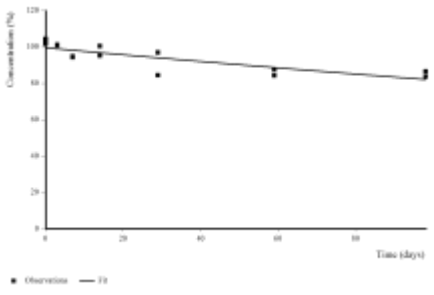
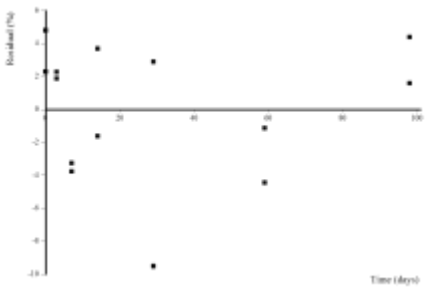
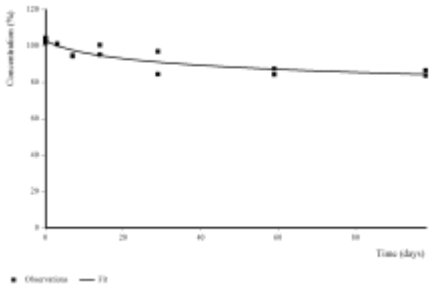
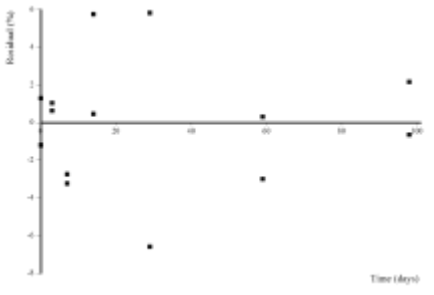
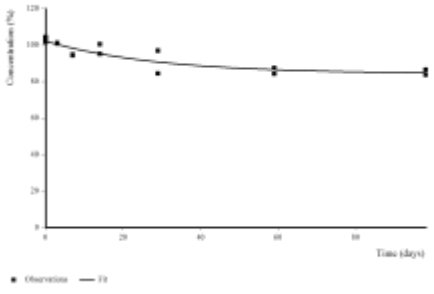
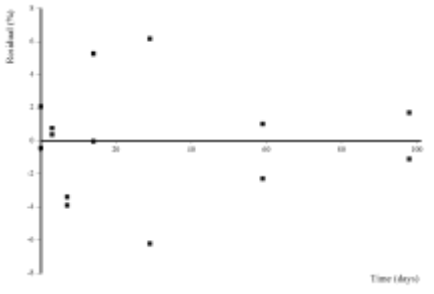
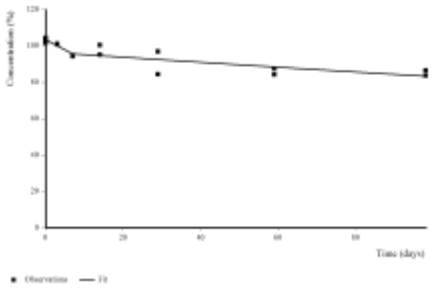
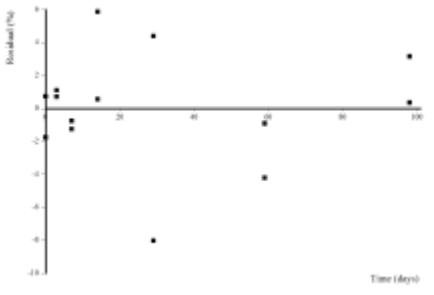
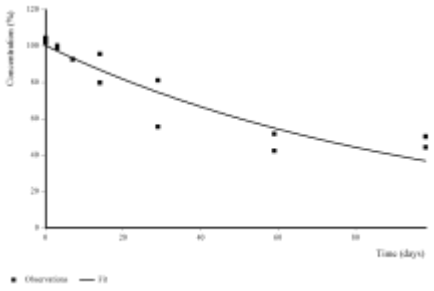
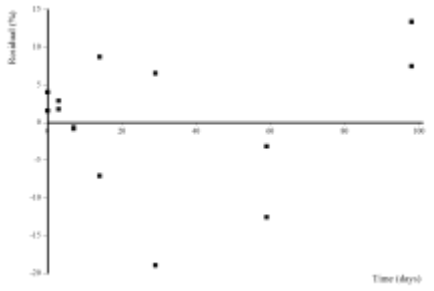
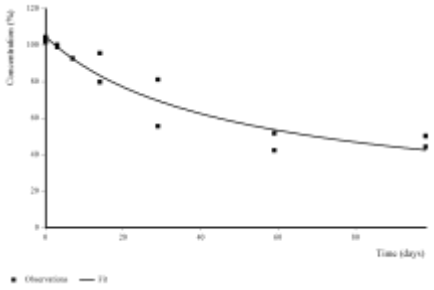
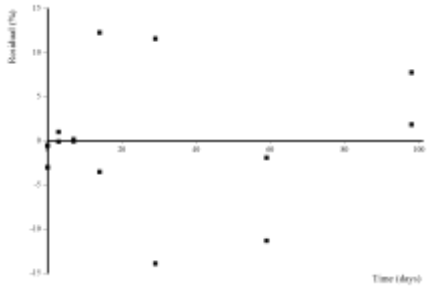
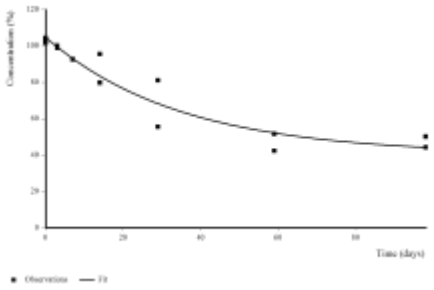
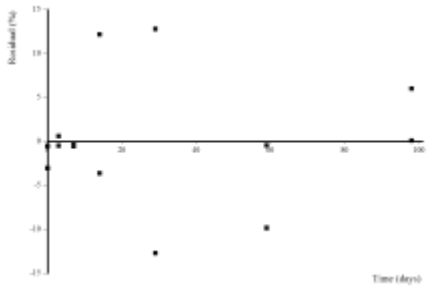
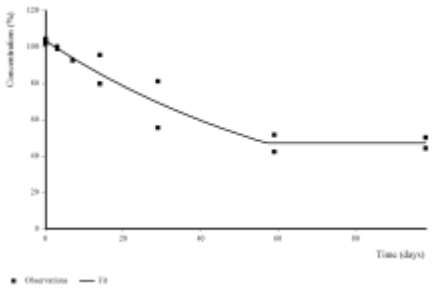
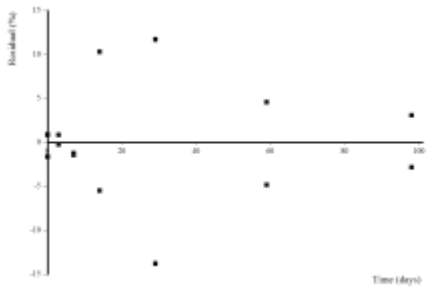
SFO		
FOMC		
DFOP		
HS		

Table B.8.2.2.3-22 Graphical summary Swiss Lake – Water (Simmonds & Adams, 2016)

Sample (Study reference)	Swiss Lake – Water (Simmonds & Adams, 2016)			
Model	SFO	FOMC	DFOP	HS
Visual Fit	Acceptable	Good	Good	Good
Residuals (visual)	Acceptable	Good	Good	Good
χ^2 error (%)	5.76	3.97	3.48	1.37
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.01022 σ: 0.0014 p (k): 4.75 x 10^{-6}	α: 0.6669 σ: 0.4105 90th %ile CI contains 0 β: 34.06 σ: 34.39 90th %ile CI contains 0	k_1: 0.02883 σ: 0.04048 p (k_1): 0.2463 k_2: 6.86 x 10^{-10} σ: 0.01924 p (k_2): 0.5 g: 0.6147 σ: 0.8925	k_1: 0.01376 σ: 0.002741 p (k_1): 2.61 x 10^{-4} k_2: 2.23 x 10^{-9} σ: 0.003976 p (k_2): 0.5$^{(A)}$ tb: 57.11 σ: 12.89

Trigger DT_{50} (days)	67.8	62.2	58.2	**50.4**
Trigger DT_{90} (days)	225	1040	>10000	**>10000**
FOCUS decision step (Trigger)	SFO acceptable; compare with FOMC	FOMC better than SFO but statistically unreliable; compare with DFOP & HS	DFOP k_1 and k_2 not robust; compare with HS	HS better than FOMC and DFOP(A); HS selected as best fit
Modelling DT_{50} (days)	**67.8**			
FOCUS decision step (Modelling)	SFO acceptable; SFO DT_{50} selected			
Visual Fit	Residuals plot		Visual Fit	
SFO				
FOMC				
DFOP				
HS				

(A) Parameter k_2 had p=0.5, however, the lack of statistical significance for k_2 is associated with the very low parameter value for k_2 of $2.23x10^{-9}$ day^{-1}, hence essentially zero. Although k_2 is not statistically significant, the lack of degradation implied by k_2 =$2.23x10^{-9}$ day^{-1} is confirmed by visual inspection of the HS graph of fitted versus measured data (no degradation apparent during last two sampling points), hence k_2 =$2.23x10^{-9}$ day^{-1} is considered a realistic estimate, and its lack of statistical significance does not invalidate the HS fit.

Table B.8.2.2.3-23 Graphical summary Pond – Total System (Wyss-Benz, 1993)

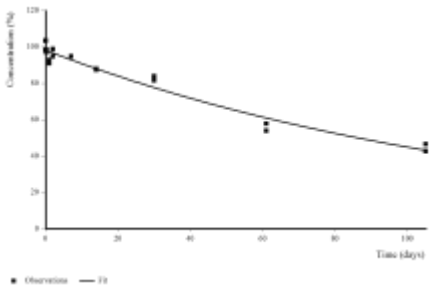
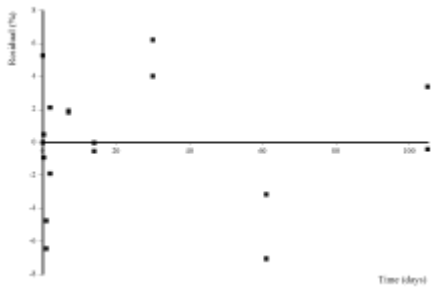
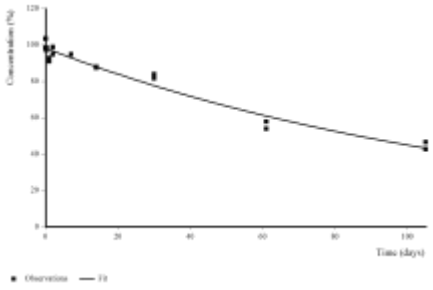
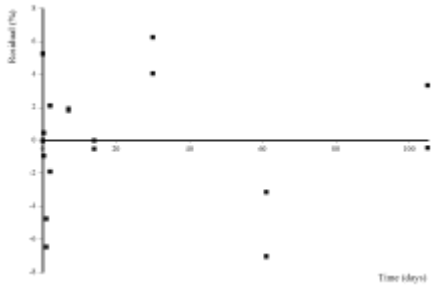
Sample (Study reference)	Pond – Total System (Wyss-Benz, 1993)	
Model	SFO	FOMC
Visual Fit	Good	Good
Residuals (visual)	Good	Good
χ^2 error (%)	3.13	3.31
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.007819 σ: 4.78 x 10^{-4} p (k): 1.04 x 10^{-11}	α: 79.62 σ: 546.5 90th %ile CI contains 0 β: 10100 σ: 70100 90th %ile CI contains 0
Trigger DT_{50} (days)	**88.7**	88.7
Trigger DT_{90} (days)	**295**	298
FOCUS decision step (Trigger)	SFO acceptable; compare with FOMC	SFO better than FOMC; SFO selected as best fit
Modelling DT_{50} (days)	**88.7**	
FOCUS decision step (Modelling)	SFO acceptable; SFO DT_{50} selected	
Visual Fit	Residuals plot	Visual Fit
SFO		
FOMC		

Table B.8.2.2.3-24 Graphical summary Pond – Water (Wyss-Benz, 1993)

Sample (Study reference)	Pond – Water (Wyss-Benz, 1993)			
Model	SFO	FOMC	DFOP	HS
Visual Fit	Poor	Good	Good	Good
Residuals (visual)	Poor	Good	Good	Good
χ^2 error (%)	9.93	4.10	3.96	4.79
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.01849 σ: 0.002431 p (k): 5.28 x 10^{-7}	α: 0.4305 σ: 0.06271 95th %ile CI does not contain 0 β: 5.531 σ: 1.869 90th %ile CI does not contain 0	k_1: 0.2726 σ: 0.08622 p (k_1): 0.003464 k_2: 0.01053 σ: 0.001343 p (k_2): 8.65 x 10^{-7} g: 0.3281 σ: 0.03912	k_1: 0.0472 σ: 0.007445 p (k_1): 9.15 x 10^{-6} k_2: 0.00983 σ: 0.00146 p (k_2): 4.78 x 10^{-6} tb: 10.98 σ: 2.358
Trigger DT_{50} (days)	37.5	22.2	**28.1**	28.8
Trigger DT_{90} (days)	125	1160	**181**	193
FOCUS decision step (Trigger)	SFO not acceptable; proceed with FOMC	FOMC better than SFO; compare with DFOP & HS	DFOP acceptable; compare with HS	DFOP better than HS; DFOP selected as best fit
Modelling DT_{50} (days)			**65.8**	
FOCUS decision step (Modelling)	SFO poor fit; 10% of initial concentration not reached; fit HS and DFOP		DFOP acceptable and better than HS; DFOP k_2 selected as DT_{50}	

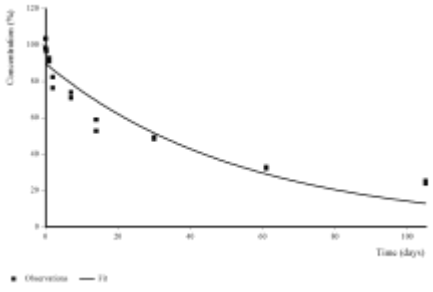
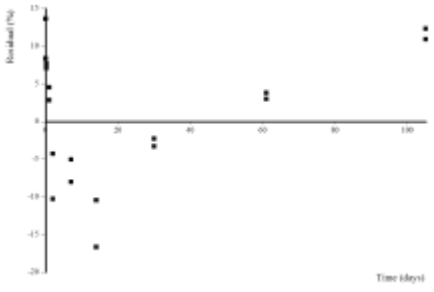
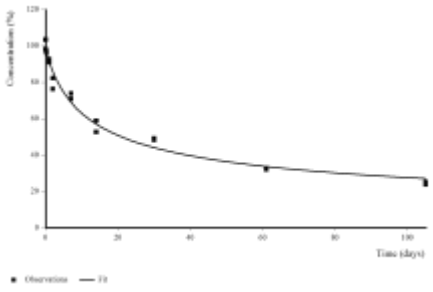
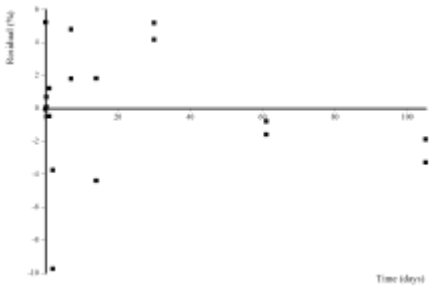
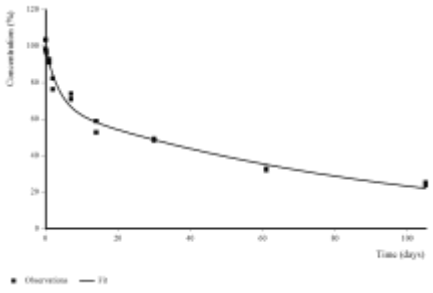
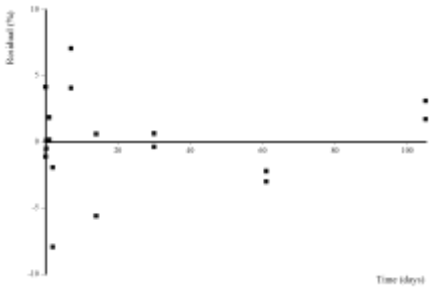
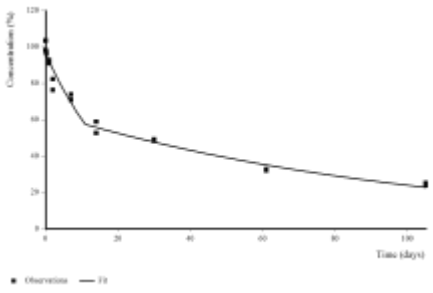
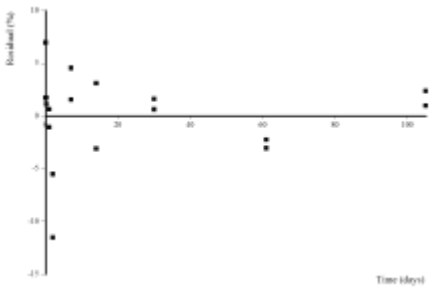
Visual Fit	Residuals plot	Visual Fit
SFO		
FOMC		
DFOP		
HS		

Table B.8.2.2.3-25 Graphical summary Pond – Sediment (Wyss-Benz, 1993)

Sample (Study reference)	Pond – Sediment (Wyss-Benz, 1993)	
Model	SFO	FOMC
Visual Fit	Acceptable	Good
Residuals (visual)	Acceptable	Good
χ^2 error (%)	6.53	Not calculated
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.007542 σ: 0.001686 p (k): 0.005528	α: 0.1788 σ: 0.1561 90th %ile CI contains 0 β: 4.24 σ: 10.27 90th %ile CI contains 0
Trigger DT_{50} (days)	**91.9**	200
Trigger DT_{90} (days)	**305**	>10,000
FOCUS decision	SFO acceptable; compare with	SFO better than FOMC; SFO

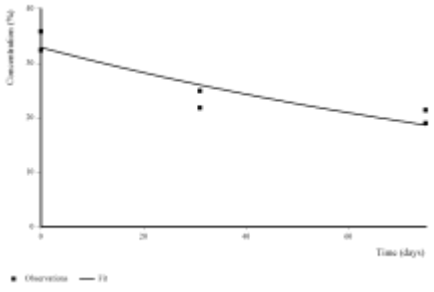
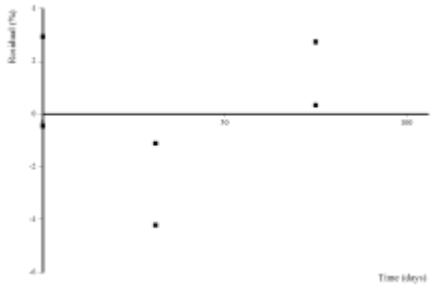
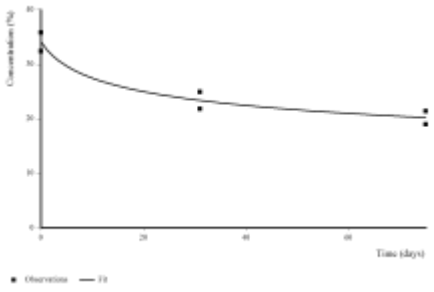
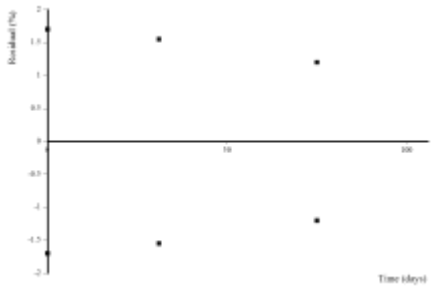
step (Trigger)	FOMC	selected as best fit
Modelling DT_{50} (days)	**91.9**	
FOCUS decision step (Modelling)	SFO acceptable; SFO DT_{50} selected	
Visual Fit	Residuals plot	Visual Fit
SFO		
FOMC		

Table B.8.2.2.3-26 Graphical summary Ditch – Total System (Wyss-Benz, 1993)

Sample (Study reference)	Ditch – Total System (Wyss-Benz, 1993)			
Model	SFO	FOMC	DFOP	HS
Visual Fit	Good	Good	Good	Good
Residuals (visual)	Good	Good	Good	Good
χ^2 error (%)	2.75	2.41	1.21	1.01
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.002976 σ: 3.06 x 10-4 p (k): 2.00 x 10^{-8}	α: 0.1566 σ: 0.06077 95th %ile CI does not contain 0 β: 19.62 σ: 15.06 90th %ile CI contains 0	k_1: 2.493 σ: 1.034 p (k_1): 0.01512 k_2: 0.002541 σ: 1.73 x 10^{-4} p (k_2): 3.40x10^{-10} g: 0.09115 σ: 0.01214	k_1: 0.1134 σ: 0.06125 p (k_1): 0.04272 k_2: 0.002547 σ: 1.48 x 10^{-4} p (k_2): 4.07x10^{-11} tb: 0.8205 σ: 0.3959
Trigger DT_{50} (days)	233	1620	235	**236**
Trigger DT_{90} (days)	774	>10,000	869	**868**
FOCUS decision step (Trigger)	SFO acceptable; compare with FOMC	FOMC better than SFO but statistically unreliable; compare with DFOP & HS	DFOP better than FOMC; compare with HS	HS better than DFOP; HS selected as best fit
Modelling DT_{50} (days)	**233**			
FOCUS decision step (Modelling)	SFO acceptable; SFO DT_{50} selected			

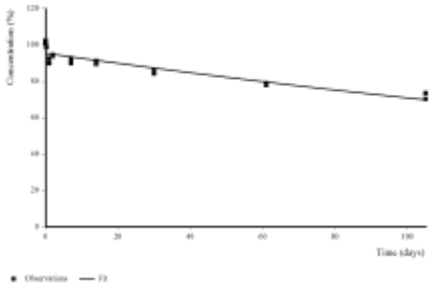
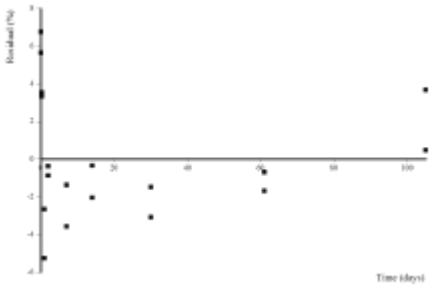
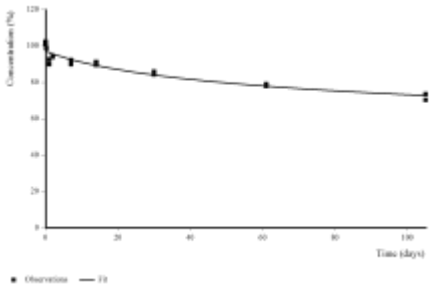
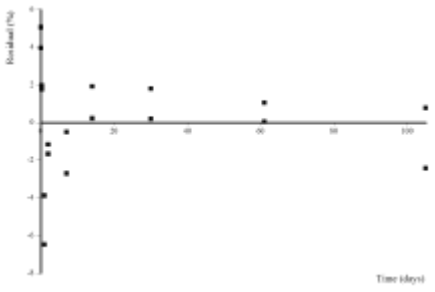
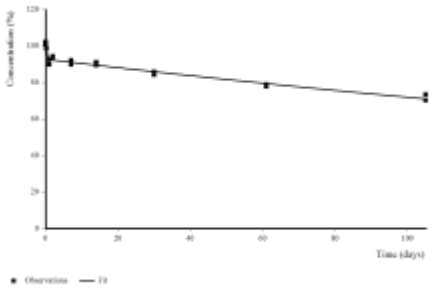
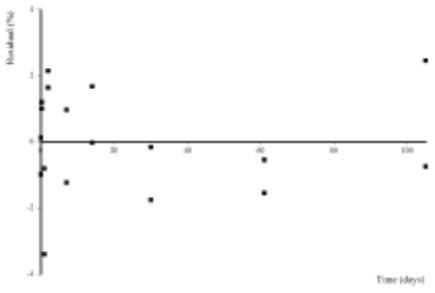
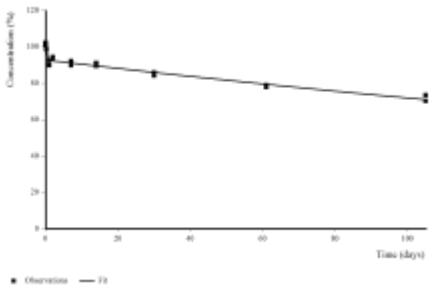
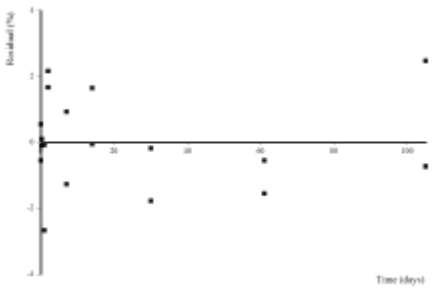
Visual Fit	Residuals plot	Visual Fit
SFO		
FOMC		
DFOP		
HS		

Table B.8.2.2.3-27 Graphical summary Ditch – Water (Wyss-Benz, 1993)

Sample (Study reference)	Ditch – Water (Wyss-Benz, 1993)			
Model	SFO	FOMC	DFOP	HS
Visual Fit	Poor	Good	Good	Good
Residuals (visual)	Poor	Good	Good	Good
χ^2 error (%)	13.7	6.13	4.54	4.46
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.111 σ: 0.01624 p (k): 2.01 x 10^{-6}	α: 0.7444 σ: 0.1094 95th %ile CI does not contain 0 β: 2.972 σ: 0.8938 95th %ile CI does not contain 0	k_1: 0.2391 σ: 0.03063 p (k_1): 9.12 x 10^{-7} k_2: 0.009302 σ: 0.00324 p (k_2): 0.006165 g: 0.7556	k_1: 0.1545 σ: 0.01029 p (k_1): 2.51x10^{-10} k_2: 0.01295 σ: 0.003053 p (k_2): 4.10 x 10^{-4} tb: 8.379

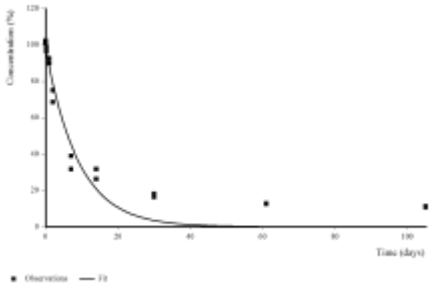
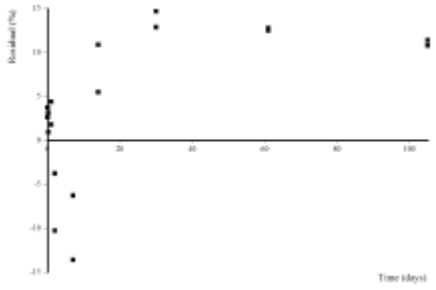
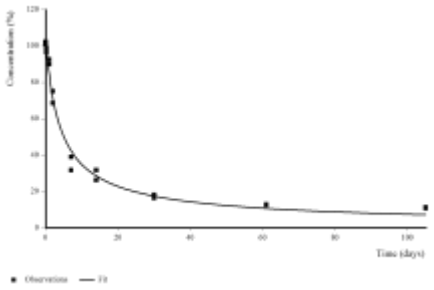
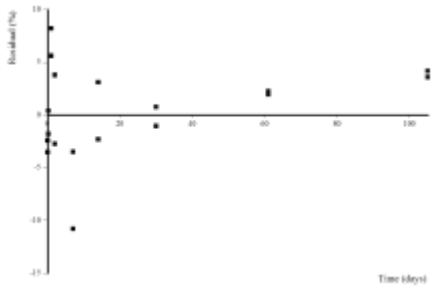
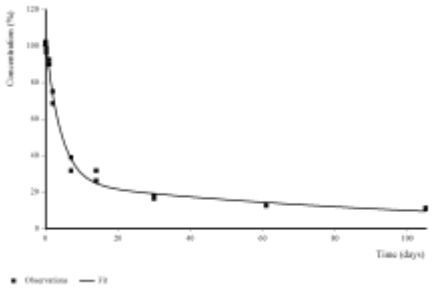
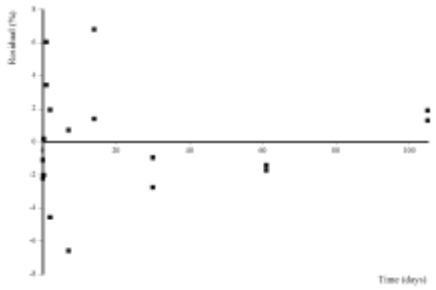
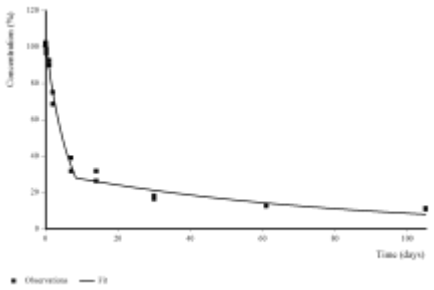
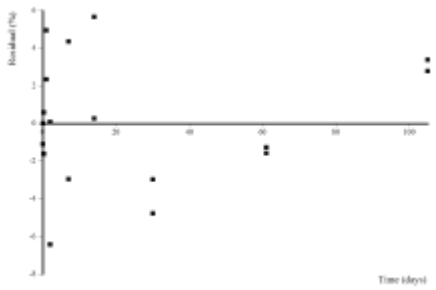
			σ: 0.03755	σ: 0.8792
Trigger DT_{50} (days)	6.25	4.57	4.38	**4.49**
Trigger DT_{90} (days)	20.8	62.6	96.1	**86.2**
FOCUS decision step (Trigger)	SFO poor fit; compare with FOMC	FOMC acceptable; compare with DFOP & HS	DFOP better than FOMC; compare with HS	HS better than DFOP; HS selected as best fit
Modelling DT_{50} (days)				**53.5**
FOCUS decision step (Modelling)	SFO poor fit; 10% of initial concentration not reached; fit DFOP & HS		DFOP acceptable; compare with HS	HS better than DFOP; HS k_2 DT_{50} selected
Visual Fit	Residuals plot		Visual Fit	
SFO				
FOMC				
DFOP				
HS				

Table B.8.2.2.3-28 Graphical summary Ditch – Sediment (Wyss-Benz, 1993)

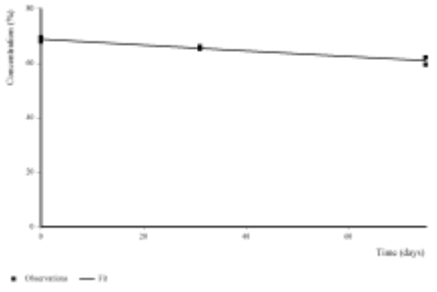
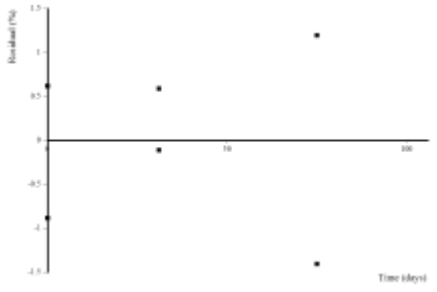
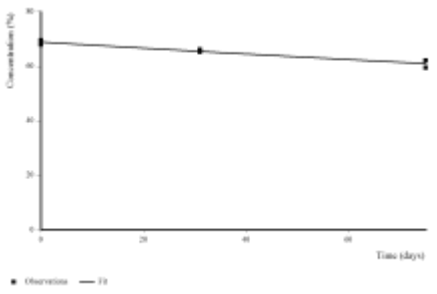
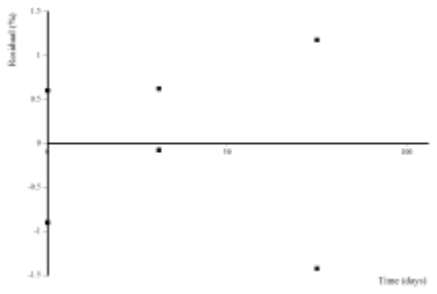
Sample (Study reference)	Ditch – Sediment (Wyss-Benz, 1993)	
Model	SFO	FOMC
Visual Fit	Good	Good
Residuals (visual)	Good	Good
χ^2 error (%)	0.23	Not calculated
Rate Parameters: estimate / standard error / probability (trigger:0.05)	k: 0.001622 σ: 2.29 x 10^{-4} p (k): 0.001054	α: 2.308 σ: 1.435 90th %ile CI contains 0 β: 1390 σ: 853.5 90th %ile CI contains 0
Trigger DT_{50} (days)	**427**	486
Trigger DT_{90} (days)	**1420**	2370
FOCUS decision step (Trigger)	SFO acceptable; compare with FOMC	SFO better than FOMC; SFO selected as best fit
Modelling DT_{50} (days)	**427**	
FOCUS decision step (Modelling)	SFO acceptable; SFO DT_{50} selected	
Visual Fit	Residuals plot	Visual Fit
SFO		
FOMC		

Table B.8.2.2.3-29 Flutolanil modelling endpoint DT_{50} values

Phase	**Study**	**Sample**	**Derivation of DT_{50}**	**DT_{50} (days)**
Total System	Simmonds & Adams (2016)	Calwich Abbey	SFO	346
		Swiss Lake	SFO	354
	Wyss-Benz (1993)	Pond	SFO	88.7
		Ditch	SFO	233
Geometric mean				**224**
Water	Simmonds & Adams (2016)	Calwich Abbey	SFO	38.4
		Swiss Lake	SFO	67.8

	Wyss-Benz (1993)	Pond	DFOP k_2	65.8
		Ditch	HS k_2	53.5
Geometric mean				**55.0**
Sediment	Simmonds & Adams (2016)	Calwich Abbey	Conservative default	1000
		Swiss Lake	Conservative default	1000
	Wyss-Benz (1993)	Pond	SFO	91.9
		Ditch	SFO	427
Geometric mean				**445**

Table B.8.2.2.3-30 Flutolanil trigger endpoint DT_{50} and DT_{90} values

Phase	Study	Sample	Kinetic	DT_{50} (days)	DT_{90} (days)
Total system	Simmonds & Adams (2016)	Calwich Abbey	HS	391	1390
		Swiss Lake	HS	413	1480
	Wyss-Benz (1993)	Pond	SFO	88.7	295
		Ditch	HS	236	868
Water	Simmonds & Adams (2016)	Calwich Abbey	HS	32.9	151
		Swiss Lake	HS	50.4	>10000
	Wyss-Benz (1993)	Pond	DFOP	28.1	181
		Ditch	HS	4.49	86.2
Sediment	Simmonds & Adams (2016)	Calwich Abbey	-[b]	1000	3320 [a]
		Swiss Lake	-[b]	1000	3320 [a]
	Wyss-Benz (1993)	Pond	SFO	91.9	305
		Ditch	SFO	427	1420

[a] DT_{50} multiplied by 3.32
[b] No decline apparent, conservative default

CONCLUSIONS

Kinetic modelling analysis according to FOCUS Kinetics of the data from four aquatic sediment systems treated with flutolanil provided acceptable model fits, giving a geometric mean total system $DegT_{50}$ value of 224 days. Trigger DT50 values for whole system, water and sediment were in the range 88.7-413, 4.49-50.4 and 91.9-1000 days, respectively, and trigger DT90 values were in the range 295-1480, 86.2->10000 and 305-3320 days, respectively.

RMS remarks renewal

1. A few discrepancies were noted between the reported levels of flutolanil in the water and sediment of the pond and ditch system and those used for modelling. These discrepancies were probably due to the poor resolution of the data in the report of the study by Wyss-Benz (1993). Discrepancies noted were: pond sediment day 30 replicate A: 35.8% AR instead of 35.6% AR; pond sediment day 61 replicate A: 21.8% AR instead of 21.6% AR; ditch water day 7 replicate A: 31.7% AR instead of 38.7 or 36.7% AR; ditch sediment day 0 replicate A: 3.8% AR instead of 3.6% AR). The discrepancies were generally minor and are considered to be of a negligible impact on the modelling results.
2. For the sake of completeness, the reported modelling endpoints for sediment and water were included in this summary. It should be taken into account however, that the modelling endpoints for sediment and water include not only degradation, but also other processes (e.g., in case of

modelling endpoints for water, dissipation from the water phase due to adsorption to sediment; in case of modelling endpoints for sediment, back partitioning to the water phase). Hence, as the kinetic calculations for water and sediment did not follow the methodology for determining DegT50/DegT90 values (which would require a level PII analysis), the whole system values are selected as modelling endpoints for use in FOCUSsw exposure assessments.

B.8.2.2.4 Microcosm studies

A microcosm study is an optional higher tier study which is not required for flutolanil.

B.8.2.2.5 Irradiated water/sediment studies

An irradiated water sediment study is an optional higher tier study which is not required for flutolanil.

B.8.2.3 Degradation in the saturated zone

Two studies with both labels are available addressing this subject. They are summarised and filed in B.8.1.1.2 (Supplementary studies - anaerobic degradation). The treated soil samples were incubated first under aerobic conditions and thereafter converted to anaerobic conditions.

In summary, during the aerobic phase the same results were obtained as in the degradation studies under aerobic conditions. The DT_{50} values obtained were >250 days. After flooding the soil, only very low degradation of flutolanil was observed. This degradation was assumed to be the result of microbial metabolism rather than hydrolysis (pH about 7).

B.8.2.4 Information on impact on water treatment procedures

Nihon Nohyaku notes that no agreed guidance exists for assessing the effects of water treatment processes on residues that may occur in drinking water nor is there a data requirement in Regulations 283/2013 and 284/2013.

The potential formation of harmful substances from water treatment processes such as chlorination, ozonation or UV radiation is applicable to any organic chemical in raw water and is not specific to pesticides.

Ground and surface water FOCUS scenarios are set up to estimate the potential movement of a pesticide in very conservative conditions and, as such, the predicted concentrations are most likely significant overestimates of concentrations at the drinking water abstraction point. The surface water concentrations are modelled for a ditch at the edge of a field and any residues, if present, will be significantly diluted once they reach the main streams and rivers. Further dissipation and degradation will occur in the stream and river systems before reaching any potential abstraction point. Groundwater concentrations in the FOCUS models are predicted for 1 m soil depth and they will be further diluted should any reach a groundwater aquifer used for drinking water.

Considering the proposed use of the representative EU formulation of flutolanil according to “Good Agricultural Practice”, the maximum concentrations of flutolanil and its metabolites, predicted from the FOCUS scenarios and assuming reasonable dilution factors, entering water treatment are expected to be such that any hypothetical degradates that could be produced would only arise at concentrations

well below the appropriate threshold of toxicological concern[1],[2] (45 mg/L for general toxicity, 0.075 mg/L if they have a genotoxicity alert, and 20% of each if they were also found in the diet[3]).

Input trace levels of flutolanil and its metabolites in water abstracted for drinking are expected to be significantly reduced due to the initial aeration, flocculation and filtration processes. Subsequent oxidation/sterilisation procedures are expected to further reduce these concentrations. Any further degradates produced as a consequence will only occur at extremely low levels where exposure would not cause any concern, and these in turn will also be subject to further removal processes.

Notifier therefore concludes that, considering the low predicted concentrations in ground and surface water, drinking water treatment of flutolanil and its metabolites is not expected to produce degradates of toxicological hazard at levels where exposure could cause any risk in drinking water.

B.8.3 Fate and behaviour in air

B.8.3.1 Route and rate of degradation in air

Previous evaluation	Submitted for first approval, DAR 2005
RMS remark	Acceptable

Report:	**CA 7.3.1/01, van der Gaauw, A. (2000)**
Title:	Estimation of the photo-degradation of flutolanil by photo-oxidation in air Model Calculation according to Atkinson
Document No:	C010509 (PC-3030)
Guidelines:	None
Testing Facility:	RCC Ltd, Itingen, Switzerland
GLP:	Yes

Executive Summary:

The computer programme AOPWIN Ver 1.70 (Syracuse Research Corporation, Syracuse N.Y.) was used to estimate the rate constant for the atmospheric reaction between photochemically produced hydroxyl radicals and flutolanil. The bimolecular rate constant k_{OH} was estimated as 149.374 x 10^{-12} cm^3 $molecule^{-1}$ sec^{-1} at 25 °C resulting in a DT_{50} for flutolanil of 0.072 days when a 12 hour day and 0.036 days when a 24 hour day is considered.

I. MATERIALS AND METHODS

1. In-life dates:

22 September 2000 – 29 September 2000

[1] EFSA Scientific Committee; Scientific Opinion on exploring options for providing advice about possible human health risks based on the concept of Threshold of Toxicological Concern (TTC). *EFSA Journal* 2012; 10(7):2750 [103 pp.] doi:10.2903/j.efsa.2012.2750

[2] Kroes R, Renwick A G, Cheeseman M A, Kleiner J, Mangelsdorf I, Piersma A, Schilter B, Schlatter J, van Schothorst F, Vos J G, Wurtzen G, 2004. Structure-based thresholds of toxicological concern (TTC): guidance for application to substances present at low levels in the diet. *Food and Chemical Toxicology* 42: 65-83

[3] WHO 2011 Guidelines for Drinking-Water Quality, 4th Ed, 564 pp.

The computer programme AOPWIN Ver 1.70 (Syracuse Research Corporation, Syracuse N.Y.) was used to estimate the rate constant for the atmospheric reaction between photochemically produced hydroxyl radicals and flutolanil. The programme sums estimated individual bimolecular rate constants for reaction of hydroxyl radicals with functional groups and structural features within the molecule to give an estimated rate constant for the whole molecule. Inputs in this study included the chemical structure of flutolanil (SMILES notation), an assumed concentration of 137.206 x 10^{-12} cm^3 photochemically produced during a 12 hour-photophase/day (based on published data), and temperature/solar light intensity typically found at sea level. Rates of reaction of flutolanil with atmospheric ozone were assumed to be slow relative to those with hydroxyl ions.

II. RESULTS AND DISCUSSION

The bimolecular rate constant k_{OH} was estimated as 149.374 x 10^{-12} cm^3 $molecule^{-1}$ sec^{-1} at 25 °C resulting in a DT_{50} for flutolanil of 0.072 days when a 12 hour day and 0.036 days when a 24 hour day is considered.

III. CONCLUSIONS

Based on the short chemical lifetime, accumulation of flutolanil in the air is not to be expected.

RMS remarks renewal

- No comment, study still acceptable

B.8.3.2 Transport via air

The vapour pressure of flutolanil is 4.1 x 10-7 Pa, which is well below the triggers for volatilisation of 10-5 Pa from plants and 10-4 Pa from soil. Transport via air is not a relevant route of exposure. There are no major metabolites to volatilise and there is no risk of long-range transport.

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B.8.3.3 Local and global effects

The potential for local effects from use of flutolanil is considered in risk assessments performed following its use under field conditions in particular by considering factors like spray drift. The combination of exposure assessments with potential effects measured in soil and surface water do thus cover the environmental compartments of interest. In contrast and since there is no aerial application envisaged, air is not a compartment regarded to be major compartment of potential for flutolanil occurrence following its intended use in the field.

The setting of global effects like contributions to global warming potential (GWP), ozone depleting potential (OPD), photochemical ozone creation potential (POCP) would require a high probability for the molecule assessed to evaporate and thus occur in the gas phase. This probability can be expressed by the volatility in terms of the vapour pressure (and the Henry constant). The very low potential of flutolanil residues to occur in the atmosphere has been addressed before under CA 7.3.2.

Any accumulation in the troposphere would require high volumes of active substance applied and a significant volatility combined with persistence in the gas phase. An acidification potential (AP) would

require the generation of acidifying gases like sulfur dioxide or nitrogen oxides in a free form. An eutrophication potential (EP) would require the generation of ammonia or phosphorous compounds acting as nutrients

B.8.4 Definition of the residue

Please refer to Volume 1.

B.8.5 Monitoring data concerning fate and behaviour of the active substance, metabolites, degradation and reaction products

Flutolanil groundwater monitoring data

Two publications of groundwater monitoring in the United Kingdom and the Netherlands which include monitoring for flutolanil have been included in this submission. Both publications confirm a low risk to groundwater from flutolanil.

Previous evaluation	Submitted for the purpose of renewal
RMS remark	Acceptable

Report:	**CA 7.5/01, Stuart, M. et al. (2011)**
Title:	Emerging contaminants in groundwater
Journal	British Geological Survey, Groundwater Science Programme, Open Report OR/11/013
GLP:	Yes

A review of the types of organic micropollutants which can be found in the aqueous environment was conducted by British Geological Survey. Organic micropollutants include nanomaterials, pharmaceuticals, industrial additives and by-products, personal care products and fragrances, water treatment by-products, flame/fire retardants and surfactants, hormones, caffeine and nicotine metabolites as well as pesticides.

The report summarised a large set of analyses collected by the Environmental Agency on organic micropollutants in groundwater from England and Wales. It was reported there are currently around 3300 groundwater quality monitoring sites across England and Wales. The dataset analysed by the British Geological Survey contained 17,694 entries from 10,301 samples collected from 3963 monitoring sites. Of these sites, a number of 2644 had at least one analysis. Data were recorded from 1992 up to 2009. Out of this dataset only two detects for flutolanil were listed.

RMS remarks renewal

- The interpretation of the above findings for flutolanil in groundwater in the UK is hampered by the lack of information on the use of flutolanil in areas where groundwater wells that were sampled were located. It is unclear whether flutolanil was included in the residue method of all analyses.
- The maximum observed concentration was 0.17 µg/L. However, the depth of this measurement is unknown.

Previous evaluation	Submitted for the purpose of renewal

RMS remark	Acceptable

Report:	**CA 7.5/02, Schipper, P. et al. (2008)**
Title:	Pesticides in groundwater and drinking water wells: overview of the situation in the Netherlands
Journal	Water Science and Technology, 57.8 (p1277-1286)
GLP:	No (publication)

A national groundwater monitoring program was conducted in the Netherlands in 2006. A total of 771 monitoring wells were selected based on land use and geohydrology. In total 154 shallow groundwater samples (< 7 m below soil surface) and 547 deeper groundwater samples (> 7 m below soil surface) were considered. Most samples were analyzed for approximately 70 substances. When considering all samples excluding those taken in the province of South-Holland, pesticides were found in 143 samples of shallow groundwater and 181 samples of deeper groundwater. Out of this dataset only one finding of flutolanil in shallow groundwater (measured concentration >0.1 µg/L) and one finding of flutolanil in deeper groundwater (measured concentration >LOD but <0.1 µg/L) were listed.

Remarks RMS renewal

- The interpretation of the above findings for flutolanil in groundwater in the Netherlands is hampered by the lack of information on the use of flutolanil in areas where groundwater wells that were sampled were located.

Flutolanil surface water monitoring data

Flutolanil was observed in Dutch surface water (most recent data is from 2014). The number of observations in the surface water are presented in the table below. An authorisation threshold of 23.3 µg/L is available (0.1*NOECfish). No annual average environmental quality standard (AA-EQS) or maximum acceptable concentration- environmental quality standard (MAC-EQS) are available for flutolanil. The MPC (maximum permitted concentration) for flutolanil is 22 µg/L.

Table B.8.2.2.5-1 Monitoring data in Dutch surface water for flutolanil (from www.pesticidesatlas.nl, version 3)

Total no of locations (2014)	***n* > authorisation threshold**	***n* > EQS**		
		MAC-EQS	**AA-EQS**	**MPC (ad-hoc/indicative)**
321*	0	N.A.	N.A.	0

* The total number of measurements is 2132 in 2014.

RMS remarks renewal

- Pesticide Atlas includes a statistical correlation analysis between concentrations, threshold exceedance and land use, which may indicate probable relationships. In this version also the correlation analysis of land use with the environmental quality standards (EQS) of the Water Framework Directive (WFD) is included. Data from the Pesticide Atlas are used to evaluate potential exceedances of the authorisation threshold and environmental quality standards

(MKN in Dutch, data source http://www.rivm.nl/rvs/Normen). These environmental quality standards consist either of the harmonised WFD thresholds derived according to the Fraunhofer methodology (AA-EQS and MAC-EQS) or of an MPC value (which is usually derived on the basis of outdated guidance).

- RMS checked the 2015 data and confirmed that there are no indications for flutolanil to be found in the surface water in values above the ecotoxicological thresholds.

Flutolanil air monitoring data

No data is available. Based on the short chemical lifetime, accumulation of flutolanil in the air is not to be expected.

B.8.6 References relied on

B.8.6.1 Scientific peer reviewed literature

In accordance with Article 7, Paragraph 1(m) of Commission Implementing Regulation (EU) No. 844/2012, this review presents the summaries and results of scientific literature as referred in Article 8 (5) of Regulation (EC) No. 1107/2009.

Article 8 (5) of Regulation (EC) No. 1107/2009 requires that the summary dossier submitted to support the approval of an active substance shall include scientific and peer-reviewed open literature, as determined by the Authority, on the active substance and its relevant metabolites dealing with the side-effects on health, the environment and non-target species and published within the last 10 years before the date of submission of the dossier.

B.8.6.1.1 Notifier literature review report

Reference	**CA 9/04: Oddy, A (2016)**
Title:	Flutolanil: Literature review report for environmental fate data
Report No	XG/15/024-04
Guidelines	EFSA, 2011
GLP	No
Published	No

Executive summary

This report summarises the search for published information on Flutolanil and its metabolites. The search covered the period of January 2006 to July 2016 and returned 417 publications. After a rapid screening assessment, 409 articles were considered not relevant and were excluded from the review.

After a second assessment involving a more detailed review of the abstracts and full documents, 8 publications were selected as relevant or unclear. The full relevance criteria applied in this detailed assessment are provided in the Literature Review Report. Reliability assessments were conducted for studies not excluded after this detailed assessment and those considered reliable and provided data for establishing or challenging the risk assessment are included in the dossier in Document M-CA7.

I. MATERIALS AND METHODS

Search methods

STN was chosen as the provider of a comprehensive collection of relevant scientific databases for the literature search. These databases cover all aspects of the requirements mentioned by the EFSA Guidance document. In addition to the STN databases, the “open source” database HSDB (as part of the NLM TOXNET) has been used as another important source of scientific peer-reviewed open literature.

The individual STN databases included in the search are detailed in the table below.

AGRICOLA	ENERGY	INSPEC
BIOSIS	EMBASE	MEDLINE

CABA	ESBIOBASE	PASCAL
CEABA-VTB	FROSTI	PQSCITECH
COMPENDEX	FSTA	SCISEARCH
CSNB	HCAPLUS	TOXCENTER
DDFU	HCIN	

A multi-concept search was performed using chemical names, common names and CAS numbers, where available, in conjunction with keywords. Trade names of products were also used in search

The detailed search queries are presented in the full report (Document K-CA7).

The dates the searches were conducted are:
Date of search:18 July 2016
Date span of the search: January 2006 - July 2016

The initial findings were evaluated in a rapid screening assessment to determine their relevance. All articles were assessed based on three categories;
1. Irrelevant,

- Duplicates of references that had not been screened out by the database software.
- None of the keywords were cited in the title or abstract.
- Subject matter of the citation was clearly not relevant to e-fate & behaviour properties.
- Citations of non-peer reviewed publications or conference proceedings.
- Test conditions not in line with EU data requirements
- Exposure/risk assessment not relevant to EU conditions
- Citation of regulatory assessments.

2. Unclear
3. Relevant using broad relevance criteria shown below.

The full text of articles considered as Unclear or Relevant were assessed again in detail against specific relevance criteria into two categories; 1. Irrelevant or 2. These criteria are presented in the table below.

Data requirements(s)	Criteria for relevance
Route and rate of degradation in soil: Laboratory Studies with parent and metabolites CA 7.1.1 Route of degradation CA 7.1.1.1 Aerobic degradation CA 7.1.1.2 Anaerobic degradation	Well defined test material (including purity/content) Soil(s) must be agricultural and relevant for the EU e.g. from temperate zone, no extreme characteristics (e.g. meets the criteria in OECD 307) Soil collection, preparation and storage did not differ significantly from recommended protocols Test soils had not previously been exposed to the test material or structural analogues. Experimental conditions did not differ significantly from recommended protocols e.g. temperature and moisture Application rate is within the range of the proposed use and can be

CA 7.1.2 Rate of degradation CA 7.1.2.1.1 Aerobic degradation- parent CA 7.1.2.1.2 Aerobic degradation - metabolite CA 7.1.2.1.3 Anaerobic degradation - parent CA 7.1.2.1.4 Anaerobic degradation - metabolite	verified from the data (time zero samples) Sufficient number of samples taken to determine kinetics (minimum 5) Extraction system was appropriate e.g. avoidance of excessive or inadequate methods Analytical method well described, LOD/LOQ at appropriate level Mass balance or recovery for radiolabelled and unlabelled studies respectively is adequate to support the conclusions, e.g. >90%. Analytical method appears robust with suitable reproducibility and supports the conclusions made e.g. for unlabelled studies are suitable blank controls included Identification of 'new' metabolites is robust with appropriate details of method used Anaerobic conditions are verified by measurement
Route and rate of degradation in soil: Field Studies with parent and metabolites CA 7.1.2.2.1 Soil dissipation studies CA 7.1.2.2.2 Soil accumulation studies	In addition to criteria under laboratory route and rate: Field site(s) must be geoclimatically relevant for the EU Adequate weather data available to verify relevance of study Application technique relevant to proposed use (foliar, ST granule etc) Sufficient sampling detail and description of sample handling prior to analysis Initial and procedural recoveries are adequate to support the conclusions, e.g. 70-120%.
CA 7.1.1.3 Soil photolysis	In addition to criteria under laboratory route and rate: Light source was suitable with details of spectrum and intensity available Dark control included and reported
Mobility studies- parent and metabolites CA 7.1.3 Adsorption, desorption CA 7.1.4.1 Column leaching studies	Well defined test material (including purity/content) Soil(s) must be agricultural and relevant for EU e.g. from temperate zone, no extreme characteristics (e.g. meets the criteria in OECD 106) Soil collection, preparation and storage did not differ significantly from recommended protocols Test soils had not previously been exposed to the test material or structural analogues. Experimental conditions did not differ significantly from recommended protocols Application rate is appropriate to the proposed use and can be verified from the data Sufficient number of samples taken to determine isotherm (if done). Stability of the test item in the system was demonstrated Extraction system was appropriate e.g. avoidance of excessive or inadequate methods Mass balance or recovery for radiolabelled and unlabelled studies respectively is adequate to support the conclusions, e.g. >90% Analytical method well described, LOD/LOQ at appropriate level

	Analytical method appears robust with suitable reproducibility and supports the conclusions
CA 7.1.4.2 Lysimeter studies	In addition to criteria under laboratory route and rate: Field site(s) must be geo-climatically relevant for the EU Adequate weather data available to verify relevance of study. Combined rainfall/irrigation sufficient to meet guideline requirements Minimum 1 m depth soil monolith Study continued for sufficient years to support the conclusions
CA 7.1.4.3 Field leaching studies	In addition to criteria under laboratory route and rate: Field site(s) must be geo-climatically relevant for the EU Adequate weather data and groundwater data (depth, direction) available to verify the validity of study Installation and operation of lysimeters and/or wells and samplers follows recommended protocols Study continued for sufficient years to support the conclusions
Fate & behaviour in water and sediment CA 7.2.1.1 Hydrolytic degradation	Well defined test material (including purity/content) Experimental conditions should not differ significantly from recommended protocols Application rate is within an acceptable the range (e.g. consider solubility) and can be verified from the data (time zero samples) Sufficient number of samples taken to determine kinetics (minimum 5) Analytical method well described, LOD/LOQ at appropriate level Mass balance or recovery for radiolabelled and unlabelled studies respectively is adequate to support the conclusions, e.g. >90%. Analytical method appears robust with suitable reproducibility and supports the conclusions made e.g. for unlabelled studies are suitable blank controls included Identification of 'new' metabolites is robust with appropriate details of method used
CA 7.2.1.2 Direct photolysis CA 7.2.1.3 Indirect photolysis	In addition to criteria under hydrolytic degradation: Light source was suitable with details of spectrum and intensity available Dark control included and reported
Route & rate of biological degradation in aquatic systems CA 7.2.2.1 Ready biodegradability CA 7.2.2.2 Aerobic mineralisation CA 7.2.2.3 Water/sediment study CA 7.2.2.4 Irradiated water/sediment	Well defined test material (including purity/content) Water(s) and sediment(s) must be from an agricultural area and relevant for the EU e.g. from temperate zone, no extreme characteristics (e.g. meets the criteria in OECD 308) Water/sediment collection, preparation and storage do not differ significantly from recommended protocols Experimental conditions do not differ significantly from recommended protocols e.g. temperature and aeration Application rate is within the range of the proposed use and can be verified from the data (time zero samples)

study	Sufficient number of samples taken to determine kinetics (minimum 5) Extraction system was appropriate e.g. avoidance of excessive or inadequate methods Analytical method well described, LOD/LOQ at appropriate level Analytical method appears robust with suitable reproducibility and supports the conclusions made e.g. for unlabelled studies are suitable blank controls included Mass balance or recovery for radiolabelled and unlabelled studies respectively is adequate to support the conclusions, e.g. >90% Identification of 'new' metabolites is robust with appropriate details of method used Anaerobic conditions are verified by measurement
CA 7.2.3 Degradation in the saturated zone	For laboratory studies refer to criteria under laboratory route and rate Field site(s) must be geo-climatically relevant for the EU Adequate site characterisation data available e.g. soils, geology, hydrology Installation of samplers e.g. wells, lysimeters follows recommended protocols Analytical method well described, LOD/LOQ at appropriate level Analytical method appears robust with suitable reproducibility and supports the conclusions made e.g. for unlabelled studies are suitable blank controls included
Fate and behaviour in air: CA 7.3.1 Route and rate of degradation	Experimental conditions or calculations differ significantly from recommended protocols Analytical method well described, LOD/LOQ at appropriate level Analytical method appears robust with suitable reproducibility and supports the conclusions made e.g. for unlabelled studies are suitable blank controls included

Articles that were considered Relevant were then assessed for reliability. Articles classified as Relevant and Reliable are summarised in Document M-CA7 and the full text of the article is available in Document K-CA7.

II. RESULTS AND DISCUSSION

Out of a total of 417 articles identified in the search, a total of 8 articles were considered as relevant or of unclear relevance. After a detailed review of the full text of these article, a total of 0 articles were considered relevant and reliable and providing information that may establish or challenge the risk assessment of flutolanil or its metabolites. The table below gives an overview of the search statistics.

Data requirement(s) captured in the search	**Number (Initial Search)**
Total number of *summary records* retrieved after *all** searches of peer-reviewed literature (excluding duplicates)	417

Number of *summary records* excluded from the search results after rapid assessment for relevance	409
Total number of *full-text* documents assessed in detail	8
Number of *studies* excluded from further consideration after detailed assessment for relevance	8
Number of *studies* not excluded for relevance after detailed assessment (i.e. relevant studies and studies of unclear relevance)	0

List of studies excluded after detailed review of the full text

Author(s)	Year	Title	Source	Reason for exclusion
Anasco NC, Koyama J, Uno S	2010	Pesticide residues in coastal waters affected by rice paddy effluents temporarily stored in a wastewater reservoir in southern Japan.	Archives of environmental contamination and toxicology, (2010 Feb) Vol. 58, No. 2, pp. 35260. Electronic Publication Date: 17 Jul 2009 Journal code:	Not relevant for environmental fate. Subject matter of publication is the monitoring of coastal waters in Japan. Not relevant to the EU.
Moreno-Gonzalez R, Campillo J A, Leon V M	2015	Influence of an intensive agricultural drainage basin on the seasonal distribution of organic pollutants in seawater from a Mediterranean coastal lagoon (Mar Menor, SE Spain).	Marine pollution bulletin, (2013 Dec 15) Vol. 77, No. 1-2, pp. 400-11. Electronic Publication Date: 15 Oct 2013 Journal code: 0260231. E-ISSN:	Not relevant for environmental fate. Subject matter of publication is the monitoring of seawater from a coastal lagoon.
Rice Pamela J Horgan Brian P; Rittenhouse Jennifer L	2010	Evaluation of core cultivation practices to reduce ecological risk of pesticides in runoff from *Agrostis palustris.*	Environmental toxicology and chemistry / SETAC, (2010 Jun) Vol. 29, No. 6, pp. 1215-23. Journal code:	Not relevant for environmental fate. Subject matter of publication is the ecological risk from runoff.
Rice Pamela J Horgan Brian P; Rittenhouse Jennifer L	2010	Pesticide transport with runoff from creeping bentgrass turf: Relationship of pesticide properties to mass transport.	Environmental toxicology and chemistry / SETAC, (2010 Jun) Vol. 29, No. 6, pp. 1209-14. Journal code:	Not relevant for environmental fate. Subject matter of publication is the ecological risk from runoff.
Anasco Nathaniel Uno Seiichi; Koyama Jiro; Matsuoka Tatsuro; Kuwahara	2010	Assessment of pesticide residues in freshwater areas affected by rice paddy effluents in Southern Japan.	Environmental monitoring and assessment, (2010 Jan) Vol. 160, No. 1-4, pp. 371-83. Journal code:	Not relevant for environmental fate. Subject matter of publication is the monitoring of fresh waters in Japan. Not relevant to the EU.
Tanabe Akiko Kawata Kuniaki	2009	Daily variation of pesticides in surface water of a small river flowing through paddy field area.	Bulletin of environmental contamination and toxicology, (2009 Jun) Vol. 82, No. 6, pp. 70510. Electronic	Not relevant for environmental fate. Subject matter of publication is the monitoring of paddy fields in Japan. Not relevant to the EU.

Tsuda T Nakamura T; Inoue A; Tanaka K	2009	Pesticides in water and sediment from littoral area of Lake Biwa.	Bulletin of environmental contamination and toxicology, (2009 Jun) Vol. 82, No. 6, pp. 683-9. Electronic	Not relevant for environmental fate. Subject matter of publication is the monitoring of water from a lake in Japan. Not relevant to the EU.
Narushima, Terukazu; Sato, Takehiko; Goto, Yusuke; Takahashi,	2014	Pesticides in River and Tap Water in a Rice Production Area of Niigata, Japan	Water, Air, & Soil Pollution, (2014) Vol. 225, No. 12, pp. 1-16. CODEN: WAPLAC. ISSN: 0049-6979.	Not relevant for environmental fate. Subject matter of publication is the monitoring of water in Japan. Not relevant to the EU.

III. CONCLUSION

A literature review was conducted for environmental fate data on flutolanil and its metabolites in accordance with current EFSA guidance. A total of 8 articles were identified as being relevant or of unclear relevance.

After a detail review of the full text of these articles a total of 0 articles were considered as relevant and reliable and providing information that may establish or challenge the risk assessment of flutolanil or its metabolites.

B.8.6.1.2 RMS comments on literature search

In general, the search is adequate and has been conducted in line with the EFSA Guidance. The search queries that were used are acceptable.

It should be noted that only STN databases were used for the search queries.
RMS requests notifier to include searches with (proquest) dialog databases. For a suggestion of the proquest dialog database selection, please refer to the table below.

The search criteria are well defined and well documented. However, the 8 publications that were selected as relevant (or unclear) should be included in the summary file.
RMS requests notifier to add a summary/abstract for RMS and other member states to evaluate the relevance of the 8 relevant (or unclear) publications.
The arguments for non-inclusion are well documented.

Suggested databases to include in the search queries

PROQUEST DIALOG DATABASES
AGRICOLA
AGRIS
Aqualine
Aquatic Science & Fisheries Abstracts (ASFA)
BIOSIS® Toxicology
BIOSIS Previews®
CAB ABSTRACTS

Embase®
Environment Abstracts
Foodline®: SCIENCE
FSTA®
GEOBASE
GeoRef
MEDLINE®
Meteorological & Geoastrophysical Abstracts
PASCAL
Pollution Abstracts
Toxfile®
Toxicology Abstracts
TOXLINE
Water Resources Abstracts

B.8.6.2 Reference list

Reference	Author	Year	Title Testing facility Report No. GLP [Y/N] Published [Y/N]	Vertebrate Study [Y/N]	Data Protection claimed [Y/N]	Justification	Owner
CA 7.1.1.1-01	Morgenroth, U.	1993	^{14}C-Flutolanil: Degradation in four soils incubated under aerobic conditions RCC UMWELTCHEMIE AG, Switzerland Report: R-3018 GLP: Yes Published: No	N	N	-	Nihon Nohyaku Co. Ltd
CA 7.1.1.1-02	Swason, M.	1996	Aerobic soil metabolism of ^{14}C-Flutolanil Battelle Columbus Operations, USA Report: A55786/W70 (E-3026) GLP: Yes Published: No	N	N	-	Nihon Nohyaku Co. Ltd
CA 7.1.1.1-03	Yoshizane, T	2015	Aerobic soil metabolism of ^{14}C-Flutolanil Nihon Noyaku Co., Ltd, Japan Report: LRSC-M15-111A (E-3055) GLP: Yes Published: No	N	Y	Article 59(1) & (2) of Regulation (EC) 1107/2009 applies	Nihon Nohyaku Co. Ltd

Reference	Author	Year	Title Testing facility Report No. GLP [Y/N] Published [Y/N]	Vertebrate Study [Y/N]	Data Protection claimed [Y/N]	Justification	Owner
CA 7.1.1.1-04	Yoshizane, T	2013	Aerobic soil metabolism study of [Phenyl-U-^{14}C] Flutolanil Nihon Noyaku Co., Ltd, Japan Report: LRSC-M13-008A (E-3050) GLP: Yes Published: No	N	Y	Article 59(1) & (2) of Regulation (EC) 1107/2009 applies	Nihon Nohyaku Co. Ltd
CA 7.1.1.1-05	Aizawa, H.	1982	Decomposition Test of Flutolanil in Soil Mitsubishi-Kasei Institute, Japan Report: 56-076-(3) (E-3002) GLP: No Published: No	N	N	-	Nihon Nohyaku Co. Ltd
CA 7.1.1.1/06	Daly, D	1991b	Soil/Sediment Adsorption-Desorption of Soil Incorporated 14C-Flutolanil Following Aerobic Aging ABC Laboratories, Inc, USA 37793 (E-3014) GLP: Yes Published: No	N	N	-	Nihon Nohyaku Co. Ltd
CA 7.1.1.2-01	Mallipudi, N. & Cooke, L.	2013	Anaerobic Soil Metabolism of [^{14}C] Flutolanil Eurofins Product Safety Labs, USA Report: SR20130114A (E-3049) GLP: Yes Published: No	N	Y	Article 59(1) & (2) of Regulation (EC) 1107/2009 applies	Nihon Nohyaku Co. Ltd
CA 7.1.1.2-02	Roohi, A.	2016	[^{14}C]-Flutolanil: Route and Rate of Degradation in Soil under Anaerobic Conditions at 20°C Battelle UK Ltd, UK Report: XG/15/007 GLP: Yes Published: No	N	Y	Article 59(1) & (2) of Regulation (EC) 1107/2009 applies	Nihon Nohyaku Co. Ltd

Reference	Author	Year	Title Testing facility Report No. GLP [Y/N] Published [Y/N]	Vertebrate Study [Y/N]	Data Protection claimed [Y/N]	Justification	Owner
CA 7.1.1.2/03	Daly, D	1991	Anaerobic Aquatic Metabolism of 14C-Flutolanil ABC Laboratories, Inc. USA 36762 (E-3013) GLP: Yes Published: No	N	N	-	Nihon Nohyaku Co. Ltd
CA 7.1.1.3-01	Cooper, J and Moore, H	2016	[^{14}C]-Flutolanil: Soil Photolysis Battelle UK Ltd, UK Report: XG/15/008 GLP: Yes Published: No	N	Y	Article 59(1) & (2) of Regulation (EC) 1107/2009 applies	Nihon Nohyaku Co. Ltd
CA 7.1.1.3-02	Carpenter, M	1991	Determination of the Photolysis Rate of Flutolanil on the Surface of Soil Analytical Bio-Chemistry Laboratories, USA Report: 38480 (E3022) GLP: Yes Published: No	N	N	-	Nihon Nohyaku Co. Ltd
CA 7.1.2.1.1-01	Völkl, S.	2001	Degradation of [^{14}C]-Flutolanil in one soil incubated under aerobic conditions at 10°C RCC Umweltchemie AG, Switzerland Report: C017049 (E-3031) GLP: Yes Published: No	N	N	-	Nihon Nohyaku Co. Ltd
CA 7.1.2.1.1-02	Hardy, I., Agostini, F. & Jastrzebski, N.	2016a	Flutolanil: Kinetic Modelling Analysis of Data from Aerobic Soil Metabolism Studies Battelle UK Ltd, UK Report: XG/15/023D GLP: Yes Published: No	N	N	-	Nihon Nohyaku Co. Ltd

Reference	Author	Year	Title Testing facility Report No. GLP [Y/N] Published [Y/N]	Vertebrate Study [Y/N]	Data Protection claimed [Y/N]	Justification	Owner
CA 7.1.2.2.1-01	Wicks, R.	1999	FLUTOLANIL: Field Soil Dissipation Study after Soil and Seed Potato Treatment in Northern Europe Rhône-Poulenc Agriculture, UK Report: 202274 (E-3027) GLP: Yes Published: No	N	N	-	Nihon Nohyaku Co. Ltd
CA 7.1.2.2.1-02	Ginzburg, N & Hardy, I.	2007	Field soil dissipation of flutolanil in a typical potato growing area following one application of Flutolanil 40SC under field conditions (the Netherlands – season 2005) Battelle Geneva Research Centre, Switzerland Report: FA-26-05-01, (E-3042) GLP: Yes Published: No	N	N	-	Nihon Nohyaku Co. Ltd
CA 7.1.2.2.1-03	Castro, L.	1994	Dissipation of Flutolanil on Bare Soil Following Application of Flutolanil 50WP, USA, 1989 NOR-AM Chemical Company, USA Report: E-3018 GLP: Yes Published: No	N	N	-	Nihon Nohyaku Co. Ltd

Reference	Author	Year	Title Testing facility Report No. GLP [Y/N] Published [Y/N]	Vertebrate Study [Y/N]	Data Protection claimed [Y/N]	Justification	Owner
CA 7.1.2.2.1-04	Hardy, I., Agostini, F. & Jastrzebski, N.	2016b	Flutolanil: Kinetic Modelling Analysis of Data from Field Soil Dissipation Studies Conducted in Europe Normalised to 20ºC and pF2 (Spray Application Trials) Battelle UK Ltd, UK Report: XG/15/023A GLP: No Published: No	N	N	-	Nihon Nohyaku Co. Ltd
CA 7.1.2.2.1-05	Hardy, I., Agostini, F. & Jastrzebski, N.	2016c	Flutolanil: Kinetic Modelling Analysis of Data from Field Soil Dissipation Studies Conducted in Europe Battelle UK Ltd, UK Report: XG/15/023B GLP: No Published: No	N	N	-	Nihon Nohyaku Co. Ltd
CA 7.1.2.2.1-06	Hardy, I. & Jastrzebski, N.	2016a	Flutolanil: Kinetic Modelling Analysis of Data from Field Soil Dissipation Studies Conducted in Europe Normalised to 20ºC and pF2 (Tuber Application Trials) Battelle UK Ltd, UK Report: XG/15/023C GLP: No Published: No	N	N	-	Nihon Nohyaku Co. Ltd

Reference	Author	Year	Title Testing facility Report No. GLP [Y/N] Published [Y/N]	Vertebrate Study [Y/N]	Data Protection claimed [Y/N]	Justification	Owner
CA 7.1.2.2.2-01	Castro, L.	1993	Long-term Field Dissipation of Flutolanil Under Conditions of Peanut Cultivation Initiated 1989, USA NOR-AM Chemical Company, USA Report: E-3023 GLP: Yes Published: No	N	N	-	Nihon Nohyaku Co. Ltd
CA 7.1.3.1.1-01	Daly, D.	1987	Soil/Sediment Adsorption-Desorption with ^{14}C-Flutolanil Analytical Bio-Chemistry Laboratories, USA Report: #35398 (E3015) GLP: Yes Published: No	N	N	-	Nihon Nohyaku Co. Ltd
CA 7.1.3.1.1-02	Williams, M.	1992a	Soil/Sediment Adsorption-Desorption with ^{14}C-Flutolanil Analytical Bio-Chemistry Laboratories, USA Report: #40130 (E-3019) GLP: Yes Published: No	N	N	-	Nihon Nohyaku Co. Ltd
CA 7.1.3.1.2-01	Williams, M.	1992b	Soil/Sediment Adsorption-Desorption with ^{14}C-Desisopropylflutolanil Analytical Bio-Chemistry Laboratories, USA Report: #40410 (E3020) GLP: Yes Published: No	N	N	-	Nihon Nohyaku Co. Ltd

Reference	Author	Year	Title Testing facility Report No. GLP [Y/N] Published [Y/N]	Vertebrate Study [Y/N]	Data Protection claimed [Y/N]	Justification	Owner
CA 7.1.4.1.1-01	Ellgehausen E.	1986	Leaching Characteristics of MONCUT (Flutolanil) in Three Soils RCC UMWELTCHEMIE AG, Switzerland Report: #066330 (E-3005) GLP: Yes Published: No	N	N	-	Nihon Nohyaku Co. Ltd
CA 7.2.1.1-01	Daly D., & Ediger K.	1987	Hydrolysis of ^{14}C-Flutolanil as a Function of pH at 25°C Analytical Bio-Chemistry Laboratories, USA Report: 35399 (E-3016) GLP: Yes Published: No	N	N	-	Nihon Nohyaku Co. Ltd
CA 7.2.1.1-02	O'Connell, C and Adams, A	2015	[^{14}C]-Flutolanil: Aqueous Hydrolysis as a Function of pH Battelle UK Ltd, UK Report: XG/15/010 GLP: Yes Published: No	N	Y	Article 59(1) & (2) of Regulation (EC) 1107/2009 applies	Nihon Nohyaku Co. Ltd
CA 7.2.1.2-01	Carpenter, M. & Fennessey, M.	1991	Determination of Photodegradation of ^{14}C-Flutolanil in Aqueous Solution Analytical Bio-Chemistry Laboratories, USA Report: #35176R (E-3010) GLP: Yes Published: No	N	N	-	Nihon Nohyaku Co. Ltd

Reference	Author	Year	Title Testing facility Report No. GLP [Y/N] Published [Y/N]	Vertebrate Study [Y/N]	Data Protection claimed [Y/N]	Justification	Owner
CA 7.2.1.2-02	Bashir, M.	1991	Identification of Degradation Products of Flutolanil in an Aqueous Photosensitized System Analytical Bio-Chemistry Laboratories, USA Report: #38426 (E-3011) GLP: Yes Published: No	N	N	-	Nihon Nohyaku Co. Ltd
CA 7.2.1.2-03	Tsuneyuki, T.	2016	Photodegradation of Flutolanil in buffer solution Research Center Nihon Noyaku Co., Ltd, Japan Report: LSRC-E15-152A (E-3056eu) GLP: Yes Published: No	N	Y	Article 59(1) & (2) of Regulation (EC) 1107/2009 applies	Nihon Nohyaku Co. Ltd
CA 7.2.2.1-01	Kitano, M.	1987	The Biodegradability Test of S-824 Chemical Biotesting Center, Japan Report: E-3003 GLP: No Published: No	N	N	-	Nihon Nohyaku Co. Ltd
CA 7.2.2.2-01	Dobson, R. & Cooper, J.	2016	[^{14}C]-Flutolanil: Aerobic Mineralisation in Surface Water Battelle UK Ltd, UK Report: XG/15/012 GLP: Yes Published: No	N	Y	Article 59(1) & (2) of Regulation (EC) 1107/2009 applies	Nihon Nohyaku Co. Ltd
CA 7.2.2.3-01	Wyss-Benz, M.	1993	^{14}C-Flutolanil: Degradation and Metabolism in Two Aerobic Aquatic Systems RCC UMWELTCHEMIE AG, Switzerland Report: R-3017 GLP: Yes Published: No	N	N	-	Nihon Nohyaku Co. Ltd

Reference	Author	Year	Title Testing facility Report No. GLP [Y/N] Published [Y/N]	Vertebrate Study [Y/N]	Data Protection claimed [Y/N]	Justification	Owner
CA 7.2.2.3-02	Adams, A. and Simmonds, M.	2016	[^{14}C]-: Route and Rate of degradation in Two Water/Sediment Systems at 20 ± 2°C Battelle UK Ltd, UK Report: XG/15/013 GLP: Yes Published: No	N	Y	Article 59(1) & (2) of Regulation (EC) 1107/2009 applies	Nihon Nohyaku Co. Ltd
CA 7.2.2.3-03	Hardy, I., Agostini, F. & Jastrzebski, N.	2016 d	Flutolanil: Kinetic Modelling Analysis of Data from Water-Sediment Studies Battelle UK Ltd, UK Report: XG/15/023J GLP: No Published: No	N	N	-	Nihon Nohyaku Co. Ltd
CA 7.3.1-01	Van der Gaauw, A	2000	Estimation of the photo-degradation of flutolanil by photo-oxidation in air. Model Calculation according to Atkinson RCC Ltd, Switzerland C010509 (PC-3030) GLP: No Published: No	N	N	-	Nihon Nohyaku Co. Ltd
CA 7.5/01	Stuart, M *et al*	2011	Emerging contaminants in groundwater British Geological Survey, Groundwater Science Programme. Open Report OR/11/013 GLP: No Published: Yes	N	N	-	-

Reference	Author	Year	Title Testing facility Report No. GLP [Y/N] Published [Y/N]	Vertebrate Study [Y/N]	Data Protection claimed [Y/N]	Justification	Owner
CA 7.5/02	Schipper, P *et al*	2008	Pesticides in groundwater and drinking water wells: overview of the situation in the Netherlands Water Science and Technology 57.8, p1277-1286 GLP: No Published: Yes	N	N	-	-