Bayer CropScience

Document Title

Summary of the fate and behaviour in the environment for Fluoxastrobin

Data Requirements

EU Regulation 1107/2009 & EU Regulation 283/2013
Document MCA
Section 7: Fate and behaviour in the environment

According to the guidance document, SANCO 10181/2013, for preparing dossiers for the approval of a chemical active substance

Date

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[1] It is suggested that applicants adopt a similar approach to showing revisions and version history as outlined in SANCO/10180/2013 Chapter 4 How to revise an Assessment Report

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CA 7 FATE AND BEHAVIOUR IN THE ENVIRONMENT

As published in Commission Directive 2008/44/EC of 04th April 2008 and with an Entry into Force (EIF) date of 01st August 2008, the fungicide Fluoxastrobin was first included in Annex I to Commission Directive 91/414/EEC.

Now, with the aim to achieve European Re-Approval under Regulation 1107/2009, Bayer CropScience (BCS) provides this '**Supplementary Dossier**'. It contains only new data which were not submitted at the time of the Annex I inclusion of fluoxastrobin under Commission Directive 91/414/EEC and which were therefore not evaluated during the first European review.

In addition to submitting the above mentioned Supplementary Dossier, all studies relied upon under 91/414 and contained in the Draft Assessment Report and its Addenda are – for the convenience of the reviewers – included in what BCS calls '**Baseline Dossier**' (Document K level only).

In order to ease the reviewers' orientation on 'old' studies in the Baseline Dossier versus 'new' studies in the Supplementary Dossier, BCS has decided to apply the following basic principles:

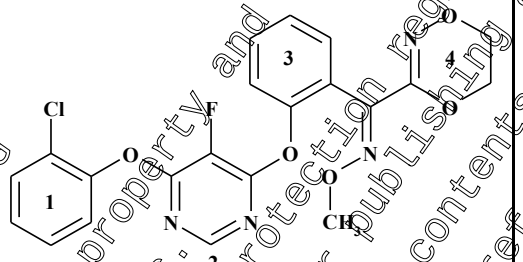
1. Conversion of the Document K part of the old EU dossier structure into the new structure (acc. to Commission Regulations 283/2013 and 284/2013 and linking the old studies to the new structure according to the cross-walk tables provided in Guidance Document SANCO/10181/2013 – rev. 2.1 of 13th May 2013).
2. On a case-by-case basis and where useful for the reader, old studies from the Baseline Dossier are occasionally summarised on the Document M level of the Supplementary Dossier; the text of those summaries is formatted in grey font colour.
3. For any referenced old study, its bibliographic information (e.g. author, year, document number) is formatted in grey font colour.
4. For any new study, its bibliographic information and its free flow summary text and table content is formatted in standard black font colour.

Where applicable, the formatting rules above apply to all dossier elements (e.g. MCA, MCP, JCA etc.).

According to the guidance of EFSA on the "Submission of scientific peer-reviewed open literature for the approval of pesticide active substances under Regulation (EC) No 1107/2009" (EFSA Journal 2011; 9(2):2092), literature for the active substance and its metabolites needs to be presented, covering the last 10 years prior to the submission of this Annex I renewal dossier. In relation to this section 7 no adequate scientific peer-reviewed open literature was identified which would need to be reported. There were no findings in the scientific peer-reviewed open literature for the active substance fluoxastrobin and its metabolites which might have a possible impact on an end-point or the risk assessments.

For substance codes, synonyms and abbreviations please refer to '*Document N3 - 'Substances and metabolites: structure, codes, synonyms – Fluoxastrobin*'.

Fluoxastrobin contains four ring moieties. The studies concerning the fate and behaviour of fluoxastrobin in the environment were conducted using three different radiolabel positions, [chlorophenyl-UL-^{14}C], [pyrimidine-2-^{14}C] and [methoxyiminotolyl-ring-UL-^{14}C]fluoxastrobin, as well as unlabelled fluoxastrobin.
The radiolabel positions are sufficient to define the route of degradation of fluoxastrobin. The structure of fluoxastrobin and the positions of the different radiolabels are as follows:

Structural formula of fluoxastrobin (HEC 5725, *E*-isomer): 1: ^{14}C-labeling position of the **ring 1-label** (short form used in this summary) = [chlorophenyl-UL^{14}C] 2: ^{14}C-labeling position of the **ring 2-label** (short form used in this summary) = [pyrimidine-2-^{14}C] 3: ^{14}C-labeling position of the **ring 3-label** (short form used in this summary) = [methoxyiminotolyl-ring-UL-^{14}C] 4: dioxazine ring	*E-isomer* 

A list of the environmental studies performed with fluoxastrobin and the radiolabel positions are summarised in the following table.

List of studies and used radiolabel positions:

Matrix	Study type	Label		
		1)	2)	3)
soil	aerobic metabolism		X	X
	anaerobic metabolism			X
	photolysis		X	X
	ads./des.			X
water	hydrolysis			X
	photolysis, ster. buffer	X		X
	photolysis, nat. water			X
	aerobic mineralisation surface water			X
	aerobic metabolism (wat/sed)			X
	anaerobic metabolism (wat/sed)			X

Labelling Strategy:

Fluoxastrobin exhibits a complex chemical structure with 4 ring-systems in a row. In order to address all transformation products/metabolites, the following labelling strategy was used:

Fluoxastrobin is stable due to hydrolysis. Therefore, the development and evaluation of pathways started with the aerobic soil metabolism studies. Both central ring systems (ring 2 and 3) were labelled in order to cover all possible metabolites.
In principle three different ways of formation of transformation products are possible:

a) Isomerisation of the E/Z isomers and/or rearrangement (due to photolysis)
b) Oxidation/reduction/derivatisation without changing the core structure
c) Cleavage of the ring systems

Soil:

In soil metabolism under aerobic conditions the metabolites were formed due to modification of the dioxazine moiety forming HEC 5725-amide *(M38)* or due to the cleavage of ring 1 and formation of HEC 5725-deschlorophenyl *(M48)* and 2-chlorophenol *(M82)*. 2-Chlorophenol was considered to be a well-known compound, which is well described in literature. Therefore, the chlorophenyl ring (ring 1) was not labelled.

The results and transformation of fluoxastrobin due to photolysis on soil surface is considered to be not predictable. This was the reason to perform the study with both core labels (ring 2 and 3) in order to cover all possible transformation products. Beside isomerisation no new metabolites were formed.

The anaerobic metabolism soil study did show similar pathway as under aerobic conditions and further degradation of to HEC 5725-carboxylic acid *(M40)* and HEC 5725-deschlorophenyl *(M48)*.

The amount of unknown metabolites was below 5% in all studies with exception of soil photolysis (sum of several unknowns max. 8.2%, none peak exceeded 4.5% AR (applied radioactivity)).

Therefore, in soil the entire pathway and all possible main metabolites are covered using the mentioned label positions.

Water:

The aqueous studies were performed with one label (ring 3) with the exception of photolysis in buffer, where two different labelled test substances (ring 3 and 1) were used.
Fluoxastrobin was stable in the hydrolysis and the aerobic mineralization in surface water studies. Therefore one label (core label ring 3) was sufficient.

In aerobic water / sediment studies the metabolic pattern was in principle the same as in the soil degradation studies. Metabolites were formed due to degradation of the dioxazine moiety (ring 4) (formation of HEC 5725-amide *(M38)* and HEC 5725-carboxylic acid *(M40)*) and cleavage of the chlorophenyl ring (ring 1), resulting in formation of HEC 5725-des-chlorophenyl *(M48)*. The chlorophenyl ring was not labelled separately because 2-chlorophenol *(M82)* was considered to be a well-known compound. The unknown metabolites were at maximum 3.1% AR.
In the anaerobic water/sediment study metabolites formed from the cleavage of the dioxazine ring (ring 4) (HEC 5725-amide *(M38)* and HEC 5725-carboxylic acid *(M40)*) were observed, only. The amount of unidentified metabolites did not exceed 2.6% AR.

In case of aqueous photolysis in sterile buffer solution two labels were used in order to cover all possible metabolites. Besides Z-isomer, HEC 5725-oxazepine *(M36)* and HEC5725-phenoxy-aminopyrimidine *(M56)*, a multitude of unknown compounds was formed, but none of the unidentified minor metabolites exceeded 5% AR.

The natural water photolysis (irradiated water/sediment) is regarded as supportive information. No degradation or transformation was observed beside the isomerisation. The unknown metabolites did not exceed 5.5% of AR.

Therefore, in water and water/sediment the entire pathway and all possible main metabolites are covered using the mentioned label positions.

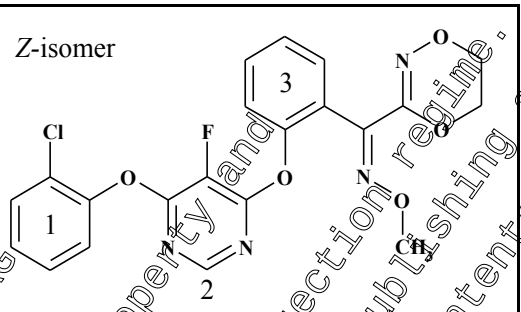
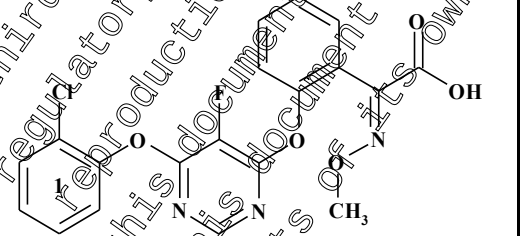
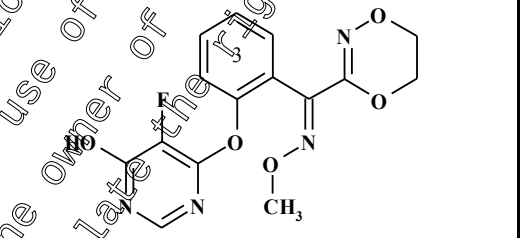
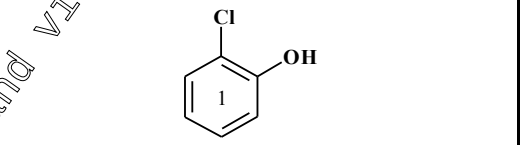
The results of the studies are summarized in the following sections CA 7.1 to CA 7.5.

The chemical structure of fluoxastrobin contains an oxime ether moiety. Due to the substitution pattern of that double bond *E*- and *Z*-isomers can be formed. The common name fluoxastrobin denotes the *E*-isomer. The technical grade active substance consists of minimum 96% of the E-isomer, whereas the *Z*-isomer is an impurity in the technical material with a specification limit of 2 mg/kg. The *Z*-isomer is biologically inactive in comparison to the *E*-isomer.
Isomerization of the double bond is a photoreaction, i.e. isomerization of the double bond is only possible under the influence of light. This reaction was shown to be reversible. The transformation will lead to an equilibrium state in which the *E*-isomer is the more stable and the energetically preferred isomer (ratio in aqueous solution about 10:1 = E / Z). Therefore, the sum of *E*- and *Z*-isomer (fluoxastrobin E+Z) is used for calculations as worst case assumption.

In the laboratory studies conducted under dark conditions with radiolabeled test substance the amount of *Z*-isomer was about 2 - 3% and the ratio of *E*/*Z*–isomer and did not change significantly in the course of the incubation, indicating a similar behaviour in the environment for both isomers.

Under irradiated conditions in the laboratory (soil and aqueous photolysis) the *Z*-isomer is formed with the maximum amount 22%. Under more realistic outdoor conditions (terrestrial field dissipation studies) a maximum of 12% is formed. The behaviour of the inactive *Z*-isomer in the environment is more favourable than the *E*-isomer because of comparable degradation rate and better sorption to soil.

In addition, soil degradation and adsorption studies were performed with the radiolabelled and unlabelled major degradation products HEC 5725-carboxylic acid (*M40*) and HEC 5725-*E*-des-chlorophenyl (*M48-E*). In case of 2-chlorophenol (*M82*) the adsorption was investigated with the UL-phenyl label. The degradation behaviour of the potentially formed 2-chlorophenol is known from literature and was addressed by worst case assumptions.

Structural formula of HEC 5725-*Z*-isomer (HEC 5725-*Z*-isomer): ^{14}C-labeling position of the **ring 1-label** (short form used in this summary) = [chlorophenyl-UL^{14}C] 2: ^{14}C-labeling position of the **ring 2-label** (short form used in this summary) = [pyrimidine-2-^{14}C] 3: ^{14}C-labeling position of the **ring 3-label** (short form used in this summary) = [methoxyiminotolyl-ring-UL-^{14}C]	*Z*-isomer 
Structural formula of HEC 5725-carboxylic acid (*M40*): 1: ^{14}C-labeling position of the **ring 1-label** (short form used in this summary) = [chlorophenyl-UL-^{14}C]HEC 5725-carboxylic acid	
Structural formula of HEC 5725-*E*-des-chlorophenyl (*M48-E*): 3: ^{14}C-labeling position of **the ring 3-label** (short form used in this summary) = [phenyl-UL-^{14}C] = [methoxyiminotolyl-ring-UL-^{14}C]	
Structural formula of 2-chlorophenol (*M82*): 1: ^{14}C-labeling position of the **phenyl-label** (short form used in this summary) = [phenyl-UL-^{14}C]	

In original reports study authors may have used different names or codes for degradation products of fluoxastrobin. In this summary a single name or a single code is used for each degradation product. A full list containing structural formula, various names, short forms, codes and occurrences of degradation products is provided in Document N3.

CA 7.1 Fate and behaviour in soil

Fluoxastrobin (*E*) is well degraded in soil to the major degradation products carbon dioxide, HEC 5725-carboxylic acid (*M40*), HEC 5725-*E*-des-chlorophenyl (*M48-E*) and 2-chlorophenol (*M82*), and non-extractable residues. In presence of light, the initial isomerisation of fluoxastrobin to fluoxastrobin-*Z*-isomer is observed without formation of major degradation products. No isomerisation was observed in other laboratory studies under dark conditions. Under typical conditions in the environment the degradation of fluoxastrobin in soil is driven by microbial degradation and

photodegradation plays only a minor role in the overall fate of fluoxastrobin. More details for the route and rates of degradation of fluoxastrobin and its major degradation products in soil are given in section CA 7.1.1 and section CA 7.1.2, respectively.

CA 7.1.1 Route of degradation in soil

The route of degradation of fluoxastrobin in soil was studied using two different radiolabel positions, ring 2- and ring 3-label. The studies have been performed in a number of soils in the laboratory. The maximum occurrences of degradation products in percentage of applied radioactivity (% AR), are given as means of duplicates and may slightly differ from the List of Endpoints (SANCO/3921/07-final, 2012).

CA 7.1.1.1 Aerobic degradation

The route of degradation of fluoxastrobin in soil under aerobic conditions in the laboratory was evaluated during the Annex I inclusion using two radiolabel positions, ring 2- and ring 3-label, and was accepted by the European Commission (SANCO/3921/07-final, 2012). Two studies are included in the baseline dossier. Summaries of these two studies were included in this supplementary dossier, since they are used for the risk assessment.

Author(s)	Year	Document No
[redacted]	2001	M-091500-01-1
[redacted]	2001	M-091507-01-1

No additional aerobic soil degradation studies are submitted within this supplementary dossier for the fluoxastrobin renewal of approval.

Report: KCA 7.1.1.1/01 [redacted]; 2001; M-091500-01-1
Title: Aerobic degradation of [methoxyiminotolyl-ring-UL-14C]HEC5725 in soil [redacted] LAXXa
Report No.: MR-230/01
Document No.: M-091500-01-1
Guideline(s): - US EPA, Subdivision N, Paragraph 162-1
- German BBA, Part IV, 5-1
EU 95/EC amending 91/414/EEC
SETAC-Europe Procedures, March 1995
Guideline deviation(s): not specified
GLP/GEP: yes

Ring 3 labelled fluoxastrobin was added in acetonitrile to stored soil (100 g dry weight equivalent in each subsample, 2 mm sieved) of [redacted] LAXXa soil, a sandy loam soil from [redacted] Germany (pH 7.0 in water, 1.8% OC) at a target concentration of 0.265 mg a.s./kg soil (representing a single application of the foliar EC product at the maximum recommended rate of 200 g/ha). It was noted that soil samples were taken from the field on 3 December 1997. Before the start of the study on 19 January 1998 the soil was air dried so that it could be sieved to 2 mm and then the soil was stored at 5 °C until the start of the experiment. Flasks containing the treated soil were fitted with traps for CO_2 and organic volatiles (soda lime trap and polyurethane foam plug respectively), with air exchange, then incubated at 20 °C in the dark for up to 120 days with soil maintained at 75% of 1/3 bar moisture content. The microbial activity of untreated soil was initially 385 mg microbial C/kg soil dry weight and 345 after 120 days whilst treated soils was 303 after 120 days indicating that the soil systems were biologically active during the period of the test.

At the intervals shown in Table 7.1.1.1- 1, radioactivity from duplicate soil samples were extracted with acetonitrile (organic extract) before hot extraction by boiling with methanol (hot extract). Further exhaustive extraction (hot extraction with acidified methanol) was undertaken. The remaining radioactivity in the soil was determined by combustion. Samples were analysed by TLC. The identity of the main metabolite HEC 5725-*E*-des-chlorophenyl (*M48*) was confirmed by LC-MS and LC-MS/MS. Radioactivity was determined in extracted liquid samples using LSC.

The limit of quantification of a single component in the extracts was 0.01% of the applied radioactivity corresponding to approximately 0.26 µg fluoxastrobin equivalents/kg soil.

$^{14}CO_2$ was quantified by means of LSC measurements. The polyurethane plug used to trap other volatiles was extracted with ethyl acetate and an aliquot of the extract was used for radioactivity determination using LSC. Solid samples i.e. filter papers and soil were combusted to determine their radioactive content.

Recoveries and characterisation of radioactivity are shown in Table 7.1.1.1-1.

Table 7.1.1.1- 1: Distribution of radioactivity following the aerobic soil degradation study using ring 3 labelled fluoxastrobin in [redacted] LUFA Speyer 2.2 soil maintained at 20 °C, 75% of 1/3 bar moisture content (% AR)

Soil Texture (USDA)	DAT	Extractable residues[a)]	Soil NER[b)]	Total soil	Volatiles $^{14}CO_2$	Volatiles Other volatiles	Total recovery
[redacted] sandy loam	0	95.5	3.1	98.6	n.m.	n.m.	98.6
	1	94.0	2.9	96.9	< 0.1	< 0.1	97.0
	3	89.4	9.1	98.5	< 0.1	< 0.1	98.5
	7	88.7	8.2	96.9	0.1	< 0.1	97.0
	14	78.0	18.7	96.7	0.3	< 0.1	97.0
	32	54.4	43.5	97.9	1.3	< 0.1	99.2
	62	33.6	60.0	93.6	3.8	< 0.1	97.3
	98	23.9	69.3	93.2	6.3	< 0.1	99.5
	120	21.2	71.0	92.2	7.2	< 0.1	99.3

DAT: Days after treatment; n.m. = not measured
a) extracted: organic extract + hot extract
b) not extracted: soil + filter

The amount of fluoxastrobin (sum of fluoxastrobin-*E*- and *Z*-isomers) decreased from 93.6% AR on DAT-0 to 7.1% AR at the end of the incubation time. The characterisation of extractable radioactivity is summarised in Table 7.1.1.1- 2. Four unknown minor metabolites were detected (referred to as metabolites 2, 3, 4 and 5). None of these metabolites exceeded 4.1% AR (using extracted values). Metabolite 4 was identified as HEC 5725-*E*-4-hydroxyphenyl using data from another soil metabolism study. No HEC 5725-carboxylic acid (*M40*) could be detected in this aerobic study.

The results for the distribution of the active substance and the degradation products are summarized in Table 7.1.1.1- 2.

Table 7.1.1.1- 2: Distribution of fluoxastrobin and degradation products after application of fluoxastrobin to soil [redacted] (% AR, mean of two values)

DAT	fluoxastrobin (*E*)	HEC 5725-*Z*-isomer	HEC 5725-*E*-des-chlorophenyl (*M48.1*)	Unknown minor metabolites[a)]
0	91.5	2.1	0.1	0.8
1	87.6	2.1	1.1	2.4
3	82.6	2.1	3.9	4.1
7	73.0	1.9	9.0	3.7
14	55.6	1.8	18.0	5.6
30	27.0	1.2	23.1	2.3
62	10.6	0.8	20.4	1.3
98	6.8	0.6	14.4	1.3
120	6.6	0.5	12.2	1.1

DAT: Days after treatment
a) sum of four unknown minor metabolites, none exceeded 4.1% of the applied radioactivity

Fluoxastrobin is calculated to have a DT_{50} of 26.8 days and a DT_{90} of 89 days using the program Model Maker assuming simple first order kinetics ($R^2 = 0.808$).

*****

Report: KCA 7.1.1.1/02 [redacted] R; [redacted]; 2001; M-091507-01-1
Title: Aerobic degradation and metabolism of [methoxyiminotolyl-ring-UL-14C]- and [pyrimidine-2-14C]HEC5725 in three soils
Report No.: MR-231/01
Document No.: M-091507-01-1
Guideline(s): - US EPA, Subdivision N, Paragraph 162-1
- German BBA, Part IV, 4-1
- EU 95/36/EC amending 91/414/EEC
- SETAC Europe Procedures, March 1995
Guideline deviation(s): not specified
GLP/GEP: yes

The aerobic degradation of fluoxastrobin was investigated in three soils ([redacted] a loamy sand, [redacted] a silt and [redacted] a silt loam according to USDA textural class). Ring 3 labelled fluoxastrobin (i.e. [methoxyiminotolyl-ring-UL-^{14}C] label) was tested with the 3 different soils whilst ring 2 labelled fluoxastrobin (i.e. [pyrimidine-2-^{14}C] label) was tested in the [redacted] and [redacted] soils. The characteristics of the three soils used are shown in Table 7.1.1.1- 1. Soils were sampled within one month of the experiment and air dried where necessary and sieved to a particle size of ≤ 2 mm and stored at ambient temperature. It is stated that the soil was treated at a target rate of 207 µg/100 g dry soil using active substance dissolved in acetonitrile.

A soil moisture corresponding to 75% of the 1/3 bar moisture for soil [redacted] and 40% of the maximum water holding capacity for soils [redacted] and [redacted] A II was used. The flasks containing 100 g dry soil equivalent were closed with a trap attachment which was permeable for oxygen and able to absorb developing CO_2 and other volatile metabolites (soda lime trap to collect CO_2 and polyurethane plug to adsorb volatile organic compounds) and incubated in the dark at 20 °C for either 120 or 365 days.

The metabolism experiment used ring 3 labelled fluoxastrobin and [redacted] soil stored under similar conditions to the main experiment. The soil was extracted with acetonitrile. The extracts were partitioned sequentially with ethyl acetate and dichloromethane. The extraction efficiency was confirmed by LS measurements. The extracted compounds were separated by TLC and purified using HPLC fractionation. The volume and amount of radioactivity was determined in the purified fractions and the structures of the fractions were elucidated using NMR, LC-MS and LC-MS/MS.

The other soil samples were extracted first with water then with acetonitrile (organic extract) which were bulked for analysis. An aliquot of extracted soil sample was additionally extracted using Accelerated Solvent Extraction (ASE) or hot extracts. The residual radioactivity in the soil was determined by combustion. Organic and ASE extracts were analysed by TLC.

The polyurethane plug was extracted with ethyl acetate and an aliquot was used to determine radioactivity content. $^{14}CO_2$ was determined as benzoic acid using the Grignard reaction.

The limit of quantification of a single component in the extracts was 0.1% AR corresponding to approximately 0.2 µg fluoxastrobin equivalents/kg soil. Recoveries and characterisation of the radioactivity are shown in Table 7.1.1.1- 4 to Table 7.1.1.1-7.

Table 7.1.1.1- 3: Soil characteristics

Soil characteristics	[redacted], Georgia, USA	[redacted] 4a, Germany	[redacted] A II, Germany
Textural class [USDA]	Loamy sand	Silt	Silt loam
pH in:			
Water	6.1	7.8	8.1
$CaCl_2$	-	7.2	7.3
Organic carbon (%)		2.62	0.86
Organic matter (%)	0.43	4.51	1.48
Cation exchange capacity (meq/100 g soil)	4.29	15	8
Water holding capacity (g water to 100g dry soil)	-	63.40	36.4
1/3 bar moisture (g water to 100g dry soil)	7.65	-	-
Particle density (g/ml)	2.59[a)]	2.60	2.55
Microbial biomass (mg microbial C/kg dry soil)			
Main experiment:			
day 0 without a.s. / with a.s.	88 / n.m.	687 / n.m.	237 / n.m.
day 120 without a.s. / with a.s.	n.m. / n.m.	567 / 565	238 / 234
day 182 without a.s. / with a.s.	ca. 60[b)] / ca. 4[b)]	n.m. / n.m.	n.m. / n.m.
day 365 without a.s. / with a.s.	19 / 19	n.m. / n.m.	n.m. / n.m.
Additional experiment:			
day 0 without a.s. / with a.s.	24 / n.m.	778 / n.m.	
day 120 without a.s. / with a.s.	n.m. / n.m.	729 / 699	
day 182 without a.s. / with a.s.	50 / 41	n.m. / n.m.	
day 365 without a.s. / with a.s.	33 / 29	n.m. / n.m.	

n.m. = not measured
a) bulk density
b) data must be interpreted with caution because the soil moisture was low

Table 7.1.1.1- 4: Radioactivity following aerobic soil degradation of ring 3 labelled fluoxastrobin (% AR)

Soil Texture (USDA)	DAT	Soil			Volatiles		Material balance
		Extractable residues[a)]	NER[b)]	Total soil	$^{14}CO_2$	Other volatiles	
[redacted] loamy sand (low microbial biomass)	0	97.0	3.0	100.0	n.m.	n.m.	100.0
	4	97.7	3.5	101.2	< 0.1	< 0.1	101.2
	8	99.7	4.5	104.3	< 0.1	< 0.1	104.3
	16	95.2	5.1	100.3	0.1	< 0.1	100.4
	30	93.6	8.5	102.1	0.6	< 0.1	102.7
	59	89.5	9.8	99.3	0.5	< 0.1	99.8
	91	85.5	13.4	98.9	0.7	< 0.1	99.5
	120	84.1	13.4	97.5	1.0	< 0.1	98.5
	182	80.8	18.1	98.9	1.6	< 0.1	100.5
	270	76.5	20.3	96.8	2.3	< 0.1	99.1
	365	74.5	24.5	99.0	3.1	< 0.1	102.0
[redacted] silt	0	97.9	2.1	100.0	n.m.	n.m.	100.0
	4	92.4	5.1	97.2	0.1	< 0.1	97.3
	8	88.2	11.7	97.9	0.3	< 0.1	98.2
	16	72.6	24.0	96.6	1.1	< 0.1	97.8
	30	52.5	41.0	93.5	3.0	< 0.1	96.4
	59	31.2	54.8	86.0	6.8	< 0.1	92.8
	91	26.3	55.0	81.3	10.0	< 0.1	91.3
	120	19.7	58.0	77.7	12.5	< 0.1	90.3
[redacted] A II silt loam	0	97.0	3.0	100.0	n.m.	n.m.	100.0
	4	95.5	3.1	98.5	< 0.1	< 0.1	98.5
	8	93.6	3.9	97.5	0.1	< 0.1	97.6
	16	89.0	6.7	95.7	0.3	< 0.1	96.0
	30	82.2	12.9	95.1	0.8	< 0.1	95.9
	59	67.2	22.0	89.2	2.3	< 0.1	91.5
	91	56.7	35.7	88.4	3.8	< 0.1	92.2
	120	46.0	39.2	85.2	5.9	< 0.1	91.1

DAT: Days after treatment; n.m. = not measured
a) extracted: organic extract + hot extract
b) not extracted: soil + filter

Table 7.1.1.1- 5: Radioactivity following aerobic soil degradation of ring 2 labelled fluoxastrobin (% AR)

Soil Texture (USDA)	DAT	Soil			Volatiles		Material balance
		Extractable residues[a)]	NER[b)]	Total soil	$^{14}CO_2$	Other volatiles	
[redacted]	0	98.9	1.3	100.0	n.m.	n.m.	100.0
loamy sand	7	98.7	3.6	102.3	0.2	< 0.1	102.5
	30	92.5	6.6	99.1	1.3	< 0.1	100.4
(low microbial	91	85.0	10.7	95.7	3.5	< 0.1	99.2
biomass)	120	85.3	11.6	96.9	4.0	< 0.1	100.9
	179	73.7	18.4	92.1	6.1	< 0.1	98.2
	270	67.0	23.6	90.6	9.0	< 0.1	99.6
	365	66.5	22.5	90.0	11.4	< 0.1	101.4
[redacted]	0	98.9	1.2	100.1	n.m.	n.m.	100.1
silt	7	89.8	8.7	98.5	1.6	< 0.1	100.1
	30	58.1	24.1	82.2	16.2	< 0.1	98.4
	91	28.2	34.8	63.0	34.1	< 0.1	97.1
	120	24.3	35.5	59.8	37.7	< 0.1	97.5

DAT: Das after treatment; n.m. = not measured
a) extracted: organic extract + hot extract
b) not extracted: soil + filter

Table 7.1.1.1- 6: Distribution of fluoxastrobin and degradation products after application of ring 3 labelled fluoxastrobin (% AR)

Soil Texture (USDA)	DAT	fluoxastrobin (*E*)	HEC 5725-*Z*-isomer	HEC 5725-*E*-hydroxyphenyl (*M02-E*)	HEC 5725-amide (*M38*)	HEC 5725-*E*-des-chlorophenyl (*M48-E*)	Unknown minor metabolites[a]
[redacted]	0	94.3	2.2	n.d.	n.d.	0.1	n.d.
loamy sand	4	90.0	2.2	2.6	0.1	2.5	0.1
	8	88.8	2.5	3.5	0.3	3.0	0.1
(low microbial	16	81.2	2.3	3.9	0.4	5.3	0.1
biomass)	30	75.4	3.3	4.0	0.4	9.1	0.3
	59	69.7	1.9	4.5	0.6	11.6	0.5
	91	64.3	1.5	4.0	0.6	14.7	0.8
	120	60.1	1.8	4.4	0.8	14.2	1.2
	182	53.6	1.4	4.2	1.3	16.0	2.0
	270	46.1	1.5	3.6	1.3	18.9	2.1
	365	42.7	1.5	4.0	1.2	17.4	2.1
[redacted]	0	94.1	2.2	0.1	< 0.1	0.1	n.d.
silt	4	72.6	1.8	3.1	0.4	13.5	0.2
	8	59.2	1.8	3.1	0.4	18.1	0.6
	16	35.6	1.7	2.0	1.0	29.5	0.8
	30	14.1	1.6	1.2	0.8	30.2	2.9
	59	5.6	0.6	0.5	0.3	20.0	2.4
	91	2.6	0.6	0.3	0.2	18.2	2.5
	120	3.4	0.5	0.4	0.3	20.7	2.4
[redacted] A II	0	93.1	2.2	n.d.	n.d.	n.d.	n.d.
silt loam	4	85.5	2.0	2.0	0.3	4.2	0.2
	8	80.1	2.2	3.2	0.8	6.3	0.3
	16	71.4	1.8	2.6	0.9	10.5	0.4
	30	50.0	1.2	2.0	1.3	15.0	1.6
	59	39.0	1.2	1.4	0.4	23.6	0.5
	91	23.5	0.9	0.9	0.4	28.4	1.2
	120	14.6	0.9	0.8	0.5	25.0	1.6

DAT: Days after treatment

a) - soil [redacted] sum of three unknown minor metabolites, none exceeded 2.1% AR
- soils [redacted] and [redacted] A II sum of five unknown minor metabolites, none exceeded 1.3% AR

Table 7.1.1.1- 7: Distribution of fluoxastrobin and degradation products after application of ring 2 labelled fluoxastrobin (% AR)

Soil Texture (USDA)	DAT	fluoxastrobin (*E*)	HEC 5725-*Z*-isomer	HEC 5725-*E*-hydroxyphenyl (*M02-E*)	HEC 5725-amide (*M38*)	HEC 5725-*E*-des-chlorophenyl (*M48-E*)	Unknown minor metabolites[a]
[redacted] loamy sand	0	94.0	2.8	0.3	0.8	0.3	n.d.
	7	90.1	2.7	1.7	1.1	2.3	n.d.
	30	80.4	2.2	1.4	1.1	5.6	0.4
	91	70.0	2.1	1.5	1.1	8.9	0.7
	120	68.8	2.2	1.9	1.0	8.6	0.8
	179	58.3	1.9	1.2	1.0	8.7	0.6
	270	51.0	2.2	1.0	0.9	8.9	0.7
	365	49.3	2.2	1.0	0.9	10.3	1.0
[redacted] silt	0	93.3	2.6	1.1	0.9	0.6	n.d.
	7	59.7	2.3	2.8	1.3	21.3	0.9
	30	16.7	1.1	0.8	1.0	37.2	2.1
	91	6.2	0.8	0.3	0.4	35.6	2.0
	120	4.7	0.7	0.4	0.3	13.4	2.3

DAT: Days after treatment
a) sum of two unknown minor metabolites, none exceeded 1.3% AR

Degradation kinetics were calculated using Model Maker assuming simple first order kinetics. The results are summarized in Table 7.1.1.1-8. It is noted that all studies were undertaken at 20°C with [redacted] soil at 75% 1/3 bar moisture content and the other two soils at 50% maximum water holding capacity.

Table 7.1.1.1- 8: Degradation of fluoxastrobin in aerobic soil samples at 20°C

	ring 2-label		ring 2-label		
	[redacted] loamy sand	[redacted] silt	[redacted] silt loam	[redacted] loamy sand	[redacted] silt
Rate constant, K (1/d)	0.00245	0.0573	0.0147	0.00195	0.0567
R^2	0.936	0.994	0.999	0.935	0.986
DT_{50} (days)	283	12.0	47.1	356	12.2
DT_{90} (days)	938	40.0	156	1180	40.6

The major metabolite in aerobic soil degradation was found to be HEC 5725-*E*-des-chlorophenyl (*M48*). HEC 5725-amide (*M38*) and HEC 5725-*E*-hydroxyphenyl (*M02*) were identified, however, the levels of these compounds did not exceed a maximum of 1.5% and 5% AR, respectively. None of the other non-identified minor metabolites detected were present at levels above 3% AR.

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CA 7.1.1.2 Anaerobic degradation

Due to the proposed use pattern of fluoxastrobin as a fungicide applied to cereals and vegetables, an anaerobic soil degradation study was not considered to be required. Therefore, no studies on the route and rate of degradation of fluoxastrobin in soil under anaerobic conditions were submitted for the Annex I inclusion. However, an anaerobic soil metabolism and degradation study of fluoxastrobin was performed in 2014 and is submitted within this supplementary dossier for the fluoxastrobin renewal approval.

Report:	KCA 7.1.1.2/01 [redacted],; [redacted]; 2014; M-486558-01-1
Title:	[Methoxyiminotolyl-ring-UL-14C]fluoxastrobin: Anaerobic degradation/metabolism in soil
Report No.:	EnSa-14-0419
Document No.:	M-486558-01-1
Guideline(s):	OECD Test Guideline No. 307, Aerobic and Anaerobic Transformation in Soil. (2002)
Guideline deviation(s):	not specified
GLP/GEP:	**yes**
Justification:	New data according to OECD 307

Executive Summary

The route and rate of degradation of ring 3 labelled fluoxastrobin were studied in one soil at 20 ± 2 °C in the dark in the laboratory under anaerobic conditions for 120 days following an aerobic incubation phase of 31 days (total study duration of 151 days):

Soil	Source	Texture (USDA)	pH[a]	OC [%]
[redacted]	[redacted], Germany	silt loam	6.3	3.1

a) pH value was derived from aqueous 0.01 M $CaCl_2$ suspension

A study application rate of 533 µg/kg soil dry weight was applied based on a maximum single field application rate of fluoxastrobin of 200 g/ha.

The mean material balance was 98.2% AR (range from 96.2 to 100.4% AR).

The maximum amount of carbon dioxide formed at the end of the aerobic incubation phase was 1.6% AR and remained at the same level during the anaerobic incubation phase. Formation of volatile organic compounds (VOC) during the aerobic and anaerobic incubation phase was insignificant as demonstrated by values of ≤ 0.1% AR at all sampling intervals.

Extractable residues decreased from 99.7% AR at DAT 0 to 68.5% AR at DASF-120.

Non-extractable residues (NER) increased during the aerobic incubation phase from DAT-0 to DAT-31 from 0.8 to 23.1% AR. During the following anaerobic incubation phase, NER further increased to 27.8% AR at DASF-93 and slightly declined to 26.1% AR until DASF-120.

Within the aerobic incubation phase, the amount of fluoxastrobin decreased from DAT-0 to DAT-31 from 99.2 to 56.7% AR. During the following anaerobic incubation phase, the amount of fluoxastrobin further decreased to 37.9% AR at DASF-120.

Two degradation products were identified with the following maximum occurrences: HEC 5725-des-chlorophenyl with 15.0% AR (aerobic, DAT-31) and 13.6% AR (anaerobic, DASF-7 and DASF-16) as well as HEC 5725-carboxylic acid with 16.9% AR (anaerobic, DASF-120) and 1.0% AR (aerobic, DAT-31). The total unidentified residues amounted to a maximum of 3.9% AR and no single component exceeded 1.5% AR at any sampling interval.

The experimental data could be well described by a single first order (SFO) kinetic model. The half-life of fluoxastrobin under anaerobic conditions was 195.4 days in the investigated soil.

I. MATERIALS AND METHODS

A. MATERIALS

1. Test Item

[methoxyiminotolyl-ring-UL-^{14}C]fluoxastrobin

Sample ID:	KML 9497
Specific Activity:	3.7 MBq/mg (100 µCi/mg)
Radiochemical Purity:	≥ 99%
Chemical Purity:	> 98%

2. Test Soil

One soil was used (see Table 7.1.1.2-1). The soil was taken from an agricultural use area. No plant protection products were used for the previous 5 years. The soil was sampled freshly from the field (upper horizon of 0 to 20 cm) and sieved to a particle size of ≤ 2 mm. Soil collection and handling were in accordance to ISO 10381-6.

Table 7.1.1.2- 1: Physico-chemical properties of test soil

Parameter		Results / Units
Soil Designation		[redacted] 4a
Geographic Location		
City		[redacted]
State		North-Rhine Westphalia
Country		Germany
GPS Coordinates		N 51° 04.013' E 007° 06.305'
Soil Series		no information available
Textural Class (USDA)		silt loam
Sand	[50 µm – 2 mm]	24%
Silt	[2 µm – 50 µm]	64%
Clay	[< 2 µm]	12%
pH (soil/$CaCl_2$ 1/2)		6.3
pH (soil/water 1/1)		6.5
pH (saturated paste)		6.5
pH (soil/1 N KCl)		6.0
Organic Carbon (combustion)		3.1%
Organic Matter[a)]		5.3%
Cation Exchange Capacity [meq/100 g]		13.4
Maximum Water Holding Capacity [g H_2O *ad* 100 g soil DW]		
maximum		66.7
at 0.1 bar (pF 2.0)		36.7%
Bulk Density (disturbed) [g/cm^3]		0.99
Microbial biomass (aerobic incubation phase) [mg microbial carbon per kg soil DW][b)]		
DAT-3 (BIO- / BIO+)		1356 / 1022
DAT-31 (BIO-)		1666
Microbial Viability (anaerobic incubation phase) [CFU/g soil DW][b)]		
DASF-120 (BIO-)		27000

a) % organic matter = % organic carbon x 1.724
b) BIO- samples were left untreated, BIO+ samples were applied with solvent of application solution (400 µL methanol/water 1/1 (*v/v*)).
CFU: colony forming units
DAT: days after treatment
DASF: days after soil flooding
DW: dry weight
GPS: global positioning system
USDA: United States Department of Agriculture

B. STUDY DESIGN

1. Experimental Conditions

The static test system for degradation in soil under anaerobic conditions consisted of Erlenmeyer glass flasks (volume e.g. 300 mL). For the aerobic incubation phase, each flask was fitted with a trap attachment (permeable for oxygen) containing soda lime for absorption of carbon dioxide and a polyurethane (PU) foam plug for adsorption of volatile organic compounds (VOC). For the anaerobic incubation phase, the trap attachments were replaced by sealable two-valve glass stoppers connected with air-tight plastic gas sampling bags for the collection of volatiles.

For preparation of the test systems, 100 g dry weight equivalents of the sieved soil were weighed into each flask. Soil moisture was adjusted to 50 ± 5% of the maximum water holding capacity (MWHC) for the individual test systems by addition of de-ionized water. The flasks were then fitted with trap attachments and equilibrated to study conditions for 5 days prior to application.

A study application rate of 533 µg/kg soil dry weight was applied based on a maximum single field application rate of fluoxastrobin of 200 g/ha.

The test item was applied dropwise onto the soil surface of the respective test systems in 400 µL methanol/water 1/1 (*v/v*) using a syringe. After application, the test vessels (except DAT-0 samples) were fitted with trap attachments.

The test systems were incubated in the dark for 31 days at 20 ± 2 °C and a soil moisture of 55 ± 5% MWHC in a walk-in climatic chamber.

31 days after treatment (DAT-31 corresponding to DASF-0), the soil was flooded with 150 mL oxygen-depleted water and set under an atmosphere of nitrogen. The trap attachments were replaced by air-tight plastic gas sampling bags. To ensure maintenance of oxygen-free conditions in the anaerobic incubation phase, the test systems were placed in a nitrogen-flooded box within the walk-in climatic chamber. The test systems were incubated in the dark under anaerobic conditions for 120 days at 20 ± 2 °C.

2. Sampling

Ten sampling intervals were distributed over the entire incubation period of 394 days (30 days under aerobic conditions and 364 days under anaerobic conditions). Duplicate samples were processed and analysed 0, 10, 17 and 31 days after treatment (DAT) in the aerobic incubation phase and 0, 3, 7, 16, 30, 65, 93, and 120 days after soil flooding (DASF) in the anaerobic incubation phase. Microbial soil biomass was determined in the aerobic incubation phase at study start (DAT-3) and end of the aerobic incubation phase. The amounts of anaerobic bacteria were determined at the end of the anaerobic incubation phase (DASF-120).

3. Analytical Procedures

Carbon dioxide absorbed by soda lime was liberated with 18% aqueous hydrochloric acid and trapped in a scintillation cocktail selective for binding of carbon dioxide using an air-tight assembly. The radioactivity content was determined by liquid scintillation counting (LSC).

The PU foam plugs of the trap attachments were extracted with ethyl acetate in an ultrasonic bath to desorb VOC. The radioactivity content was determined by LSC.

Volatiles collected by the gas sampling bag during the anaerobic incubation phase were slowly purged through a soda lime trap for absorption of carbon dioxide, then through a catalytic oven for oxidative combustion of VOC (e.g. methane), and its combustion exhaust through a scintillation cocktail selective for binding of carbon dioxide using an air-tight assembly. The radioactivity content was determined by LSC and the soda lime was further processed as described before for carbon dioxide.

At each sampling interval of the anaerobic incubation phase, pH, oxygen content and redox potential in the water and the redox potential in the soil were determined. Water and soil were separated by centrifugation and decantation. The entire soil of each test system was extracted three times at ambient temperature using a mechanical shaker and acetonitrile/water 4/1 (*v/v*). Furthermore, two accelerated extraction steps using a microwave with a magnetic stirrer were performed, first with acetonitrile/water 1/1 (*v/v*) at 70 °C and second with methanol/water 1/1 (*v/v*) at 70 °C. After each extraction step, extract and soil were separated by centrifugation (3480 x *g*) and decantation. The radioactivity content of the water, the combined ambient soil extracts and the microwave soil extracts was determined by LSC. Aliquots of the soil extracts were combined. Water and combined soil extracts were concentrated and analysed by reversed phase HPLC/radiodetection. The limit of detection (LOD) and limit of quantitation (LOQ) for HPLC/radiodetection analysis of the water and combined soil extracts were 0.6 and 1.8% AR, respectively.

The exhaustive extracted soils were air-dried, homogenized and non-extractable residues were determined by combustion/LSC.

Test item and degradation products were identified by HPLC-MS(/MS) including accurate mass determination.

The degradation kinetics of fluoxastrobin was determined according to FOCUS kinetics (2006) using the software KinGUI 2 with three different kinetic models: single first order, first order multi compartment and double first order in parallel. Model input datasets were the residual amounts found in each replicate test system at each sampling interval of the anaerobic incubation phase (DASF-0 to DASF-120). The best-fit kinetic model was selected on the basis of the chi^2 scaled-error criterion and on the basis of a visual assessment of the goodness of the fits. DT_{50} and DT_{90} values were calculated from the resulting kinetic parameters.

II. RESULTS AND DISCUSSION

Results indicated that the anticipated standardized conditions were maintained in the aerobic and anaerobic incubation phase, and that the soil was microbially active over the duration of the laboratory study. Anaerobic bacteria plate count assays performed at study end confirmed the establishment of an anaerobic microflora in the test systems.

The pH values in water of the anaerobic incubation phase ranged from 8.8 to 7.2.

Oxygen contents in the water decreased from a maximum concentration of 4.7 mg/L at DASF-0 to ≤ 1.4 mg/L from DASF-3 onwards demonstrating the shift from aerobic to anaerobic conditions.

Redox potential measurements indicated reducing conditions in the water and soil from DASF-30 and DASF-16, respectively, onwards.

A. DATA

Table 7.1.1.2- 2: Degradation of fluoxastrobin in soil [redacted] under anaerobic conditions (mean values and SD expressed as % AR)

Compound		Sampling Intervals											
	DAT	0	10	17	31	31	34	38	47	61	96	124	151
	DASF	N/A				0	3	7	16	30	65	93	120
fluoxastrobin	Mean	99.2	83.8	77.9	56.7	59.9	56.5	56.1	55.0	56.2	48.5	41.0	37.9
	SD	± 0.0	± 0.3	± 1.7	± 4.8	± 0.6	± 0.3	± 1.1	± 0.8	± 0.1	± 0.1	± 0.6	± 0.4
HEC5725-*E*-des-chlorophenyl	Mean	n.d.	6.2	6.4	15.0	11.3	13.4	13.6	13.6	12.5	10.2	10.2	8.7
	SD		± 0.0	± 1.6	± 3.8	± 0.4	± 0.5	± 0.5	± 0.1	± 0.4	± 0.2	± 0.3	± 0.0
HEC5725-carboxylic acid	Mean	n.d.	0.7	< LOD	1.0	< LOD	1.0	0.8	< LOD	1.3	3.1	12.5	16.9
	SD		± 0.0		± 0.1		± 0.1	± 0.1		± 0.2	± 0.5	± 0.1	± 0.7
Sum of Unid./Diff. Residues	Mean	< LOD	1.0	2.3	< LOD	0.9	0.8	0.9	0.7	0.7	1.9	2.4	3.9
	SD		± 0.1	± 1.2		± 0.0	± 0.1	± 0.0	± 0.0	± 0.1	± 0.4	± 0.2	± 0.3
Total Extractable Residues[a)]	Mean	99.2	91.7	86.9	73.1	72.5	71.7	71.4	69.6	70.7	68.5	66.0	67.3
	SD	± 0.0	± 0.2	± 0.9	± 1.6	± 0.7	± 0.0	± 0.5	± 0.4	± 0.1	± 0.2	± 0.4	± 0.0
Carbon Dioxide[b)] (Sum Aerobic and Anaerobic)	Mean	n.a.	0.3	0.7	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
	SD		± 0.0	± 0.1	± 0.0	± 0.0	± 0.0	± 0.0	± 0.0	± 0.0	± 0.0	± 0.0	± 0.0
Volatile Organic Compounds[b)] (Sum Aerobic and Anaerobic)	Mean	n.a.	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	SD		± 0.0	± 0.0	± 0.0	± 0.0	± 0.0	± 0.0	± 0.0	± 0.0	± 0.0	± 0.0	± 0.0
Non-Extractable Residues[b)]	Mean	0.8	6.6	11.5	23.0	23.3	24.2	24.7	26.3	25.6	25.6	27.8	26.1
	SD	± 0.0	± 0.1	± 0.9	± 0.7	± 0.3	± 0.5	± 0.6	± 0.2	± 0.2	± 0.2	± 0.0	± 0.2
Total Recovery[a)]	Mean	100.0	98.6	99.0	97.8	97.4	97.5	97.7	97.6	97.9	95.8	95.5	95.0
	SD	± 0.0	± 0.2	± 0.0	± 0.9	± 0.4	± 0.5	± 0.1	± 0.2	± 0.3	± 0.3	± 0.4	± 0.2

n.d.: not detected, n.a.: not analysed, DAT: days after treatment, DASF: days after soil flooding, SD: standard deviation
a) Difference to Material Balance values due to rounding errors as well as clean up and chromatographic losses
b) Values taken from Material Balance

B. MATERIAL BALANCE

Mean material balance was 98.2% of applied radioactivity [% AR] (range from 96.2 to 100.4% AR). The complete material balances found at all sampling intervals demonstrated that there was no significant loss of radioactivity dissipated from the test systems or during sample processing.

C. EXTRACTABLE AND NON-EXTRACTABLE RESIDUES

Extractable residues decreased from 99.7% AR at study start (DAT-0) to approximately 68.5% AR from DASF-120 onwards. Non-extractable residues increased from 0.8% AR at DAT-0 to 27.8% AR at DASF-93 and slightly declined to 26.1% AR until DASF-120.

D. VOLATILES

The maximum amount of carbon dioxide was 1.6% AR at DAT-31 in the aerobic incubation phase and remained constant in the anaerobic incubation phase until 120 days after soil flooding (DASF). Formation of volatile organic compounds was insignificant as demonstrated by values of ≤ 0.1% AR at all sampling intervals.

E. DEGRADATION OF PARENT COMPOUND

The amount of fluoxastrobin decreased in the aerobic incubation phase from DAT-0 to DAT-31 from 99.2 to 56.7% AR. During the following anaerobic incubation phase, the amount of fluoxastrobin further decreased to 37.9% AR at DASF-120.

Two degradation products were identified: HEC 5725-E-des-chlorophenyl with a maximum occurrence of 13.6% AR after flooding and HEC 5725-carboxylic acid with a maximum amount of 16.9% AR after flooding. The total unidentified residues amounted to a maximum of 3.9% AR and no single component exceeded 1.5% AR at any sampling interval. The proposed degradation pathway of fluoxastrobin in soil under anaerobic conditions is shown in

The degradation of fluoxastrobin in the anaerobic incubation phase followed single first order (SFO) kinetics according to the lowest chi^2 error values and visual assessments. Table 7.1.1.2- 3 summarizes the best-fit results of the DT_{50} and DT_{90} calculations.

Table 7.1.1.2- 3: Degradation kinetics of fluoxastrobin in soil [redacted] under anaerobic conditions according to FOCUS (best fit)

Best-Fit Kinetic Model[a)]	DT_{50} [days]	DT_{90} [days]	Chi^2 Error [%]	Visual Assessment[b)]
SFO	195.4	649.3	2.6	+

a) SFO: single first order
b) visual assessment: + = good

III. CONCLUSIONS

Fluoxastrobin was rapidly moderately degraded in soil under anaerobic conditions following an aerobic incubation phase in the dark in the laboratory.

The calculated best fit half-life was between 195.4 days.

Two degradation products were identified with the following maximum occurrences: HEC 5725-*E*-des-chlorophenyl with 13.6% AR and HEC 5725-carboxylic acid with 16.9% AR after flooding.

Fluoxastrobin will be moderately degraded in soil under anaerobic conditions following an aerobic incubation phase. Formation of significant amounts of non-extractable residues indicates a participation of fluoxastrobin in the natural carbon cycle of soil.

Therefore, fluoxastrobin and its degradation products are not expected to have a potential for accumulation in the environment.

CA 7.1.1.3 Soil photolysis

The route of degradation of fluoxastrobin in soil under photolytic conditions in the laboratory was evaluated during the Annex I inclusion using two radiolabel positions, ring 2- and ring 3-label, and was accepted by the European Commission (SANCO/3921/07-final, 2012). No new study was performed for renewal. The following study is included in the baseline dossier and has been included in this supplementary dossier, since it has been used for the risk assessment.

Author(s)	Year	Document No
[redacted]	2001	M-091513-01-1

Report: KCA 7.1.1.3/01 [redacted]; 2001; M-091513-01-1
Title: [HEC5725]: Photolysis of HEC5725 on soil surface
Report No.: MR-347/00
Document No.: M-091513-01-1
Guideline(s):
- EU 95/36/EC amending 91/414/EEC
- SETAC Europe Procedures, March 1995
- US EPA Subdivision N, Paragraph 161-3US EPA, Subdivision N, Paragraph 162-1

Guideline deviation(s): not applicable
GLP/GEP: **yes**

Samples of [redacted] sandy loam soil (2 mm sieved, 3.0 g dry weight) were dried at 105 °C and then placed onto plates to give a thin layer (ca. 3 mm depth). In the present ring 3 labelled fluoxastrobin or ring 2 labelled fluoxastrobin (equivalent to 1.3 mg a.s./kg) was added in acetonitrile to each soil plate. The mainly used ring 2 labelled fluoxastrobin (equivalent to 1.3 mg a.s./kg). All plates were maintained at 75% of 1/3 bar moisture at 20 °C in flasks fitted with traps for CO_2 and organic volatiles (soda lime and polyurethane foam respectively). Replicate flasks were either kept in the dark or exposed continuously to an artificial light source simulating natural sunlight (xenon chamber wavelength in range 300 - 3000 nm) for 15 days. It is stated that the average intensity of the Suntest Unit was 783 W/m^2 therefore 6.37 hours in the unit equated to one solar summer day (June) in Phoenix 118A (33 N). Also 4.11 hours in the unit is stated to equate to one solar summer day (June) in Athens Greece (38°N). The maximum experimental exposure period of 15 days was quoted as corresponding to 365 solar summer days in Phoenix and 87 solar summer days in Athens.

Duplicate samples were taken for each treatment at DAT-0 and five representative time points. Radioactivity from soil samples was extracted with acetonitrile then with acetonitrile/water before quantification by LSC and analysis by TLC. $^{14}CO_2$ was identified as the amount of radioactivity trapped in the soda lime. Radioactivity in trapping solutions was quantified by LSC. The parent compound and metabolites were identified by co-chromatography. As no major metabolites were found no further characterisation was undertaken. Unextracted radioactivity was quantified by combustion and LSC. The LOD was reported to be 0.12% AR with a LOQ of 0.27% AR (i.e.3.5 µg fluoxastrobin equivalents/kg).

Characterisation of the radiolabelled fractions was as outlined in Table 7.1.1.3- 1.

Table 7.1.1.3- 1: Distribution of radioactivity after application of fluoxastrobin to a thin layer of soil which was then kept either under artificial light or in the dark (% AR)

Test	Label	Condi-tions	DAT	Fluoxa-strobin *(E)*	HEC 5725-*Z*-isomer	Unknown metabolites [a]	$^{14}CO_2$	Org. volatiles	Extrac-table residues	NER	Total
Pre-test	Ring 3	Irradiated	0	92.6	2.7	1.9	n.m.	n.m.	100.0	n.m.	100.0
			3	70.4	9.6	5.8	0.9	0.1	87.4	7.6	95.0
			7	61.3	13.6	6.3	1.9	n.d.	83.4	8.3	91.8
			15	48.9	17.1	7.9	4.1	< 0.1	77.9	10.3	93.0
	Ring 2		0	93.5	2.5	n.d.	n.m.	n.m.	100.0	n.m.	100.0
			3	66.9	11.6	6.4	1.1	< 0.1	86.5	7.0	94.0
			7	61.0	14.1	7.8	2.2	< 0.1	85.1	8.0	93.8
			15	56.8	16.4	8.0	2.3	< 0.1	85.0	8.6	95.9
Main Test	Ring 2	Irradiated	0[b]	95.4	2.4	n.d.	n.m.	n.m.	93.8	2.7	96.5
			1	76.5	13.7	2.8	0.1	n.d.	91.4	5.9	97.3
			3	69.4	16.6	4.0	0.3	n.d.	91.1	4.6	96.0
			6	59.6	20.7	5.8	1.0	n.d.	87.3	6.8	95.1
			10	62.0	19.4	5.6	1.1	n.d.	88.0	7.0	97.1
			15	51.0	22.2	8.2	4.1	n.d.	85.1	8.3	96.8
		Dark	0.0	95.4	2.4	n.d.	n.m.	n.m.	n.m.	n.m.	100.0
			0.042	89.3	4.1	n.m.	n.m.	n.m.	93.8	2.7	96.5
			1	88.4	2.2	2.0	< 0.1	n.d.	92.7	4.4	97.1
			3	86.4	2.4	2.2	< 0.1	n.d.	91.5	5.3	96.9
			6	87.2	2.7	1.5	< 0.1	n.d.	91.4	7.6	99.0
			10	85.0	2.2	1.4	< 0.1	n.d.	89.6	8.3	97.9
			15	83.4	2.2	1.5	< 0.1	n.d.	88.6	8.1	96.7

DAT: Days after treatment; n.m. = not measured; n.d. = < LOD of 1%
a) sum of six unknown minor metabolites, none exceeded 4.5% of the applied radioactivity
b) exposure time 0 days = non-irradiated samples processed after about 1 hour

After 15 days of irradiation, the *Z*-isomer of fluoxastrobin accounted for a mean of 51.0% and 83.4% AR from illuminated and dark control samples respectively. Whilst the *Z*-isomer of fluoxastrobin accounted for 22.2 and 2.2% AR from irradiated and dark controls respectively. The pre-test identified five minor photoproducts from irradiated samples using the ring 3 labelled fluoxastrobin whilst 6 minor photoproducts were identified for the ring 2 labelled fluoxastrobin, although none accounted for more than 4% AR.

DT_{50} values were calculated using linear regression. The conversion of the *E*-isomer to the *Z*-isomer of fluoxastrobin was accelerated in the light compared to the samples kept in the dark. The photolysis kinetics calculated are shown in Table 7.1.1.3- 2. This table also calculates the relationship between the continuous irradiation in the test and the equivalent number of solar summer days under intensive solar conditions in Phoenix, AZ (USA).

Table 7.1.1.3- 2: Photolysis kinetics for radioactive labelled fluoxastrobin

	Pre-test (irradiated samples) ring 3 labelled fluoxastrobin		ring 2 labelled fluoxastrobin		Main test (ring 2 labelled fluoxastrobin) Irradiated		Dark	
	E	*E+Z*	*E*	*E+Z*	*E*	*E+Z*	*E*	*E+Z*
No. data pairs	4	4	4	4	6	6	7	
Rate constant [day^{-1}]	0.0394	0.0222	0.0283	0.0150	0.0339	0.00162	0.0060	0.00594
DT_{50} (days)	17.6	31.2	24.5	46.3	20.5	42.8	114.6	116
r^2	0.97	0.95	0.84	0.79	0.90	0.93	0.80	0.80
DT_{50} expressed as solar summer days in Phoenix	66	118	92	174	77	161	N/A	N/A

The data show that light enhances the conversion of the *E*-isomer of fluoxastrobin to the *Z*-isomer with increased mineralisation to carbon dioxide when compared to the dark samples. However, the overall effect of light on degradation in the environment is likely to be low as the DT_{50} of the sum of the *E+Z* isomers (118 to 174 Phoenix solar summer days) is not that different to the range extrapolated for the dark controls (DT_{50} of 115 and 117 days).

No additional soil photolysis studies are submitted within this supplementary dossier for the fluoxastrobin renewal of approval.

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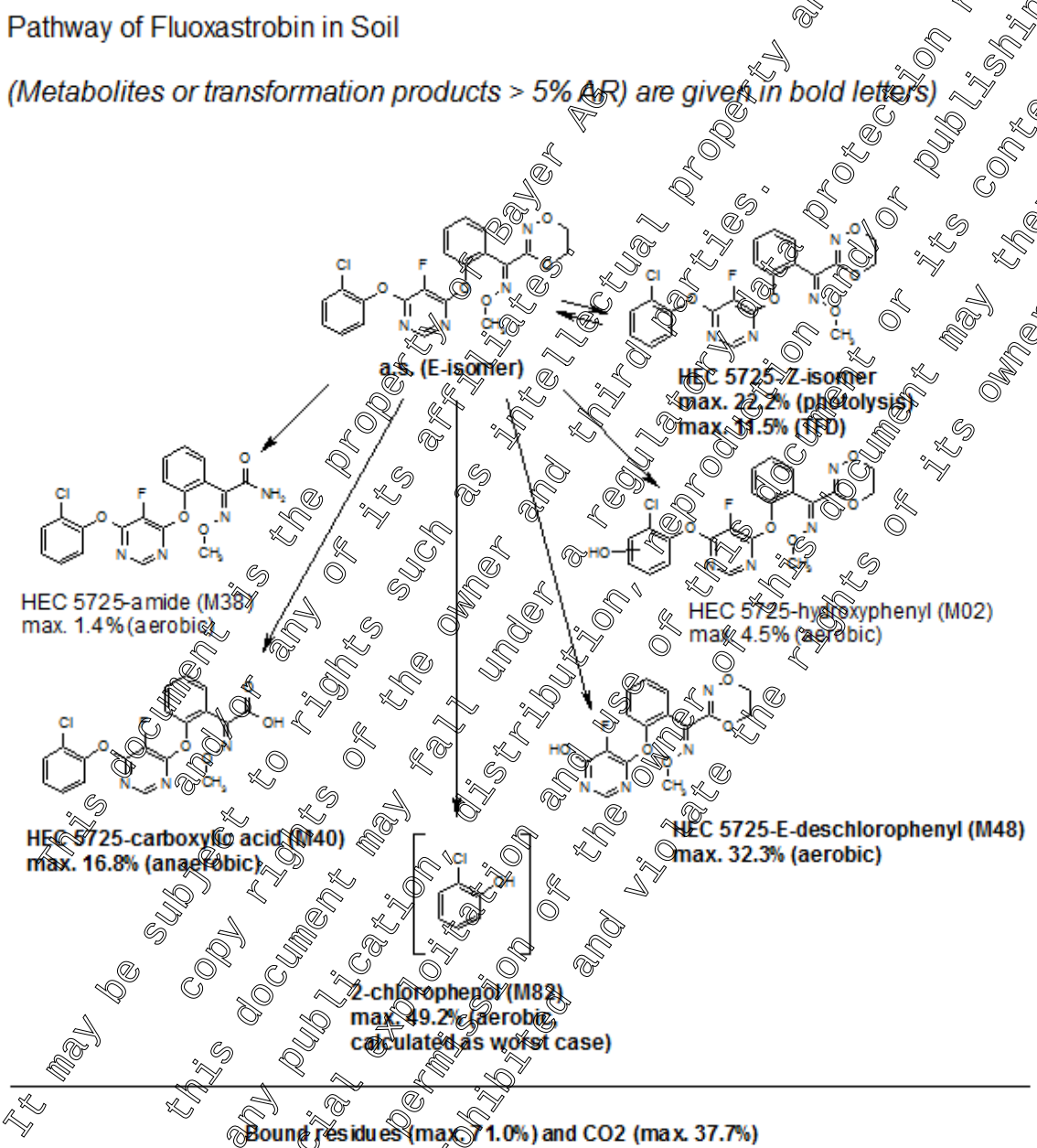
Overall summary of route of degradation in soil

Under <u>aerobic</u> conditions in the dark in the laboratory, fluoxastrobin (*E*) was degraded to carbon dioxide with a range of 3.1 to 12.5% AR for the ring 3-label and a maximum amount of 37.7% AR for the ring 2-label. Besides the formation of carbon dioxide, HEC 5725-*E*-des-chlorophenyl (*M48-E*) was identified as the single major degradation product with a maximum amount of 32.2% AR. Actual amount of 2-chlorophenol formed was not measured in any of the studies (chlorophenol ring was not ^{14}C-labelled in the laboratory studies). As a result of the cleavage of the molecule 2-chlorophenol will be released at an expected worst case maximum amount of 49.2% (see EFSA addendum on fate and behaviour; 26 July 2005). Non-extractable residues (NER) ranged from 24.5 to 71.0% AR for the ring 3-label from 23.5 to 35.5% AR for the ring 2-label.

Under <u>anaerobic</u> conditions in soil after flooding two degradation products, HEC 5725-*E*-des-chlorophenyl and HEC 5725-carboxylic acid, were observed with maximum amounts of 13.6% AR and 16.9% AR, respectively.

Under <u>photolytic</u> conditions in the laboratory fluoxastrobin (*E*) was isomerized to the *Z*-isomer (HEC5725-*Z*-isomer) with a maximum amount of 22.2% AR. No major degradation products were observed in the photodegradation study. Formation of carbon dioxide increased in comparison to dark controls and reached maximum amounts of 4.4 and 4.8% AR for the ring 2- and ring 3-label, respectively. NER reached maximum amounts of 8.6 and 10.3% AR for the ring 2- and ring 3-label, respectively.

The proposed overall degradation pathway of fluoxastrobin in soil including the maximum occurrences of the metabolites observed in soil is as follows (major degradation products > 5% AR in bold letters):



CA 7.1.2 Rate of degradation in soil

Fluoxastrobin was well degraded in soil under aerobic conditions in the laboratory as well as under field conditions. Under anaerobic conditions in the laboratory fluoxastrobin was moderately degraded. The kinetic models and DT_{50} values in soil of fluoxastrobin and its major degradation products used for modelling purpose and trigger evaluation (best-fit) as well as the formation fractions in soil for major degradation products are summarized in sections CA 7.1.2.1 and CA 7.1.2.2.

Modelling input values for the calculation of predicted environmental concentrations (PECs) of fluoxastrobin and its major degradation products in soil (PEC_{soil}), groundwater (PEC_{gw}) and surface water (PEC_{sw}) were derived from studies and kinetic evaluations (according to FOCUS kinetics (2006)) summarized in sections CA 7.1.1, CA 7.1.2 and CA 7.2, and are submitted within this supplementary dossier. The DT_{50} values, maximum occurrences and formation fractions in soil and aquatic systems of fluoxastrobin and its major degradation products used as modelling input values for the calculation of PECs are summarized in Table 7.1.2- 1 to Table 7.1.2- 3.

Table 7.1.2- 1: DT_{50} values and maximum occurrences in soil of fluoxastrobin and its major degradation products used as modelling input values for calculation of PEC_{soil}

Modelling Input Parameter	Endpoint	Comment
fluoxastrobin (E+Z)		
DT_{50} in soil [days]	$DT_{50\ fast\ phase}$ = 39.81 d, $DT_{50\ slow\ phase}$ = 237.9 d, g = 0.4996	Simple PEC_{soil} calculations, with an Excel spread sheet, typically are carried out considering the worst-case DT_{50} and / or DT_{90} of these evaluations. Therefore, PEC_{soil} calculations were carried out assuming a DFOP dissipation model (worst-case field, non-normalised) using the parameters k_{fast} = 0.01741 1/d, k_{slow} = 0.002913 1/d, g = 0.4996
maximum occurrence in soil [%]	100	worst case
HEC 5725-carboxylic acid (*M40*)		
DT_{50} in soil [days]	28.6	worst case lab
maximum occurrence in soil [%]	16.9	anaerobic
HEC 5725-*E*-des-chlorophenyl (*M48-E*))		
DT_{50} in soil [days]	95.6	apparent field decline, non-normalised
maximum occurrence in soil [%]	32.2	
2-Chlorophenol (*M82*)		
DT_{50} in soil [days]	23.0	worst-case half-life used for predictive calculations according to the recommendation given by EFSA (EFSA, 2007)
maximum occurrence in soil [%]	49.1	theoretical estimation was given by EFSA (European Commission, 2007) (p. 72)

Table 7.1.2- 2: DT_{50} values and formation fraction in soil of fluoxastrobin and its major degradation products used as modelling input values for calculation of PEC_{gw}

Modelling Input Parameter	Endpoint	Comment
fluoxastrobin (E+Z)		
DT_{50} in soil [days]	38.9	geom. lab + field, normalised
HEC 5725-Z-Isomer		
DT_{50} in soil [days]	63.8	geom. field apparent decline, normalised. PECs are calculated based on sum of E+Z isomer
HEC 5725-carboxylic acid (*M40*)		
DT_{50} in soil [days]	170	geom. lab aerob
FF fluoxastrobin → HEC 5725-carboxylic acid	1	
HEC 5725-*E*-des-chlorophenyl *(M48-E)*		
DT_{50} in soil [days]	56.7	(geom. lab + field, normalised)
FF fluoxastrobin → HEC 5725-*E*-des-chlorophenyl	0.5145	
2-Chlorophenol (*M82*)		
DT_{50} in soil [days]	23.0	worst-case half-life used for predictive calculations according to the recommendation given by EFSA (EFSA, 2007)
FF fluoxastrobin → 2-Chlorophenol	1	worst-case

Table 7.1.2- 3: DT_{50} values and maximum occurrences in soil and aquatic systems of fluoxastrobin and its major degradation products used as modelling input values for calculation of PEC_{sw}

Modelling Input Parameter	Endpoint	Comment
fluoxastrobin (E+Z)		
DT_{50} in soil [days]	38.9	geom. lab + field, norm
$DisT_{50}$ in water [days]	16.0	geomean
$DisT_{50}$ in sediment [days]	313	geomean
$DegT_{50}$ in total water/sediment system [days]	238	geomean
max. occurrence in sediment [%]	73.7	
HEC 5725-carboxylic acid (*M40*)		
DT_{50} in soil [days]	17.0	geomean lab aerob
max. occurrence in soil [%]	16.9	anaerobic
$DisT_{50}$ in water [days]	-	not fully reliable, not usable
$DisT_{50}$ in sediment [days]	64.9	
$DegT_{50}$ in total water/sediment system [days]	67.9	
max. occurrence in total water [%]	5.9	
max. occurrence in total sediment [%]	5.8	
max. occurrence in total water/sediment system [%]	10.6	
Formation fraction in total water-sediment [%]	0.4841	
HEC 5725-*E*-des-chlorophenyl *(M48-E)*		
DT_{50} in soil [days]	56.7	geom. lab + field, norm
max. occurrence in soil [%]	32.2	
DT_{50} in water [days]	1000	default (not evaluable, not sufficient data points)
DT_{50} in sediment [days]	1000	default (not evaluable, not sufficient data points)
DT_{50} in total water/sediment system [days]	1000	default (not fully reliable, mathematically not significantly different from 0; not usable)
max. occurrence in total water [%]	19.9	
max. occurrence in total sediment [%]	2.4	
max. occurrence in total water/sediment system [%]	18.3	
Formation fraction in total water-sediment [%]	0.51 (max)	
2-Chlorophenol (*M82*)		
DT_{50} in soil [days]	23	worst case lab
max. occurrence in soil [%]	49.2	(theoretical estimation by EFSA, p. 72 EuropeanCommission, 2007)
DT_{50} in water [days]	1000	default
DT_{50} in sediment [days]	1000	default
DT_{50} in total water/sediment system [days]	1000	default
max. occurrence in total water/sediment system [%]	0.01	p. 82 (EuropeanCommission, 2007)

CA 7.1.2.1 Laboratory studies

The degradation rates of fluoxastrobin and its major degradation products in soil were studied using two different radiolabel positions for the parent compound, ring 2- and ring 3-label, and unlabelled HEC 5725-carboxylic acid. The degradation rate of 2-chlorophenol was not investigated in a study but can be addressed using data from literature. The studies have been performed in a number of soils in

the dark in the laboratory at a temperature of 20 °C. The kinetic models and DT_{50} values used for modelling purpose (non-normalised) and trigger evaluation (best-fit) are summarized at the end of section CA 7.1.2. The DT_{50} and DT_{90} values for trigger evaluation (best-fit) were taken from study reports and may slightly differ from the List of Endpoints (SANCO/3921/07-final, 2012), as new evaluations were performed within the course of this re-approval process.

CA 7.1.2.1.1 Aerobic degradation of the active substance

The degradation rate of fluoxastrobin in soil under aerobic conditions in the dark in the laboratory was evaluated during the Annex I inclusion using two radiolabel positions, ring 2- and ring 3-label, and was accepted by the European Commission (SANCO/3921/07-final, 2012). The following studies are included in the baseline dossier:

Author(s)	Year	Document No
[redacted]	2001	M-091500-01-1
[redacted]	2001	M-091507-01-1

Short summaries of the two studies which are included in the baseline dossier are given in section CA 7.1.1.1.

Report: KCA 7.1.2.1.1/01 [redacted]; 2001; M-091500-01-1
Title: Aerobic degradation of [methoxyiminotolyl-ring-UL-14C]HEC5725 in soil [redacted] AXX
Report No.: MR-230/01
Document No.: M-091500-01-1
Guideline(s): - US EPA, Subdivision N, Paragraph 162-1
- German BBA, Part IV, 4-1
- EU 95/36/EC amending 91/414/EEC
- SETAC-Europe Procedures, March 1995
Guideline deviation(s): not specified
GLP/GEP: **yes**

Report: KCA 7.1.2.1.1/02 [redacted]; 2001; M-091507-01-1
Title: Aerobic degradation and metabolism of [methoxyiminotolyl-ring-UL-14C]- and [pyrimidine-2-14C]HEC5725 in three soils
Report No.: MR-231/01
Document No.: M-091507-01-1
Guideline(s): - US EPA, Subdivision N, Paragraph 162-1
- German BBA, Part IV, 4-1
- EU 95/36/EC amending 91/414/EEC
- SETAC-Europe Procedures, March 1995
Guideline deviation(s): not specified
GLP/GEP: **yes**

No additional studies are submitted within this supplementary dossier for the fluoxastrobin renewal of approval. However, updated kinetic evaluations of the degradation behaviour of fluoxastrobin in soil under aerobic conditions in the dark in the laboratory have been performed according to FOCUS kinetics (2006, 2014) to derive kinetic parameters suitable for modelling purpose and environmental risk assessment. A summary of the degradation rates of fluoxastrobin and its major degradation products in soil in the laboratory is given at the end of this section.

New kinetic evaluation submitted for Annex I Renewal

Justification for including this study in the Annex I Renewal Dossier: The objective of this study is a kinetic evaluation of the aerobic soil metabolism studies of fluoxastrobin (CA 7.1.2.1.1), included in the baseline dossier and its major degradation product HEC 5725-des-chlorophenyl (*M48*) (CA 7.1.2.1.2 also included in the baseline dossier). The evaluation was conducted to derive kinetic parameters according to EFSA Guidance 2014 and FOCUS Guidance 2014.

Report:	KCA 7.1.2.1.1/05[redacted]; 2015; M-534472-01-1
Title:	Kinetic evaluation of aerobic laboratory soil degradation of fluoxastrobin according to FOCUS kinetics using KinGui 2.1
Report No.:	Ensa-15-0132
Document No.:	M-534472-01-1
Guideline(s):	- EFSA, 2014: 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, European Food Safety Authority (EFSA), Parma, Italy. EFSA Journal 2014;12(5):3662 - FOCUS, 2006: Guidance Document on Estimating Persistence and Degradation Kinetics from Environmental Fate Studies on Pesticides in EU Registration. Report of the FOCUS Work Group on Degradation Kinetics. EC Document Reference Sanco/10058/2005, v.2.0, June 2006 - FOCUS, 2014: Generic guidance for Estimating Persistence and Degradation Kinetics from Environmental Fate Studies on Pesticides in EU Registration, Version: 4.1; Date: 18 December 2014 - OECD, 1995: Final report of the OECD workshop on selection of soils/sediments, TG95.25, Belgirate, Italy, 18-20 January 1995 - OECD, 2002: OECD Guideline for the testing of chemicals - Aerobic and anaerobic transformation in soil. OECD 307, adopted 24th April 2002
Guideline deviation(s):	not applicable
GLP/GEP:	**no**

Kinetic analysis of the degradation of fluoxastrobin and its major degradation product HEC 5725-des-chlorophenyl (M48-E) for trigger and modelling endpoints

Executive Summary

The soil degradation of fluoxastrobin (HEC 5725, *E*+ *Z*-isomers) and its metabolite HEC 5725-*E*-des-chlorophenyl (*M48-E*) has been investigated under aerobic laboratory conditions in 2 studies, with 4 soils (20 °C) and 2 different radioactive labels: ring 3-label (all soils) and ring 2-label (soil [redacted], [redacted]) (CA 7.1.2.1.1). The conditions varied in soil type, soil moisture (40% MWHC or 75% of 1/3 bar) and application rate (200, 600 g a.s./ha).

A kinetic modelling analysis of residue data of fluoxastrobin (*E*+*Z*) and HEC 5725-*E*-des-chlorophenyl (*M48-E*) was conducted using the software tool KinGui 2.1, implementing the IRLS error model (Iteratively reweighted least square). The identification of the appropriate kinetic model followed the recommendations given by FOCUS (2006, 2014b) based on a detailed statistical analysis including visual assessment, χ^2 statistic, significance t-test and correlation analysis. In case of modelling purpose, especially the distinction for residues > 10% (DFOP, HS) or < 10% (FOMC) of applied substance at study end, has been taken into account. In doubt, the simplest model, as e.g. SFO, has been chosen.

In general, a very good overall model fit was reached, with the proposed metabolic pathway including parent and metabolite. Aerobic lab soil $DegT_{50}$ values proposed for the best or appropriate fit for modelling as well as trigger purpose according to FOCUS kinetics are summarised in Table 7.1.2.1.1- 1 and Table 7.1.2.1.1- 2

In addition, the apparent dissipation of HEC 5725-*E*-des-chlorophenyl (*M48-E*) in soil was evaluated, conservatively, starting from the observed maximum onwards until end of the study.

In general, the experimental study conditions lead to the following restrictions. Typically, the biomass or microbial carbon content during a study should be above 1% of the total organic carbon (TOC criterion) (FOCUS, 2006; OECD, 1995, 2002). In case of USA soil [redacted], the microbial carbon content was partly below this 1% criterion (ring 3-label > 120 d, ring 2-label at study begin). This reflects a relatively weak biological activity, not fully representative for agricultural soils and especially not fully appropriate for kinetic evaluations (FOCUS, 2006). Therefore, the [redacted] trial with ring 2-label was not taken into account for this kinetic evaluation and with ring 3-label was evaluated until 120 d. In addition, the trial was characterised with a very low organic carbon content of 0.25% and carried out under relatively dry conditions (5.76 g water / 100 g soil).

The part concerning the major degradation product HEC 5725-*E*-des-chlorophenyl (*M48-E*) is reported in section CA 7.1.2.1.2 of this document.

Table 7.1.2.1.1- 1: Trigger endpoints of fluoxastrobin (E+Z), lab degradation

Study	Soil	Kinetic type[a)]	DT_{50} [days]
[redacted] (2001) M-091500-01-1	[redacted] AXXa, ring 3-label	DFOP	17.9
[redacted] (2001) M-091507-01-1 [b)]	[redacted], ring 3-label	DFOP	215
	[redacted] ring 2-label	*DFOP*	*10.5*
	[redacted], ring 3-label	*DFOP*	*11.0*
	[redacted] AII, ring 3-label	SFO	46.2
Maximum			**215**

a) SFO: Single first order, DFOP: Double first order in parallel
b) [redacted] soil included in mean only once, with its geomean.

Table 7.1.2.1.1- 2: Modelling endpoints of fluoxastrobin (E+Z), lab degradation

Study	Soil	Kinetic type[a)]	DT_{50} [days] non-norm.	DT_{50} [days] norm.[b)]
[redacted] (2001) M-091500-01-1	[redacted] AXXa, ring 3-label	FOMC	21.6	21.6
[redacted] (2001) M-091507-01-1 [c)]	[redacted], ring 3-label	DFOP	280	150
	[redacted], ring 2-label	*FOMC*	*18.4*	*17.5*
	[redacted], ring 3-label	*FOMC*	*15.0*	*14.3*
	[redacted], geomean			15.8
	[redacted] AII, ring 3-label	SFO	46.2	30.8
Geometric mean				**35.5[c)]**
Maximum				**150**

a) SFO: Single first order, FOMC: First order multi compartment, DT50 recalc = DT90 / 3.32, DFOP: Double first order in parallel, DT50 of slow phase
b) normalised to 20 °C and pF 2
c) [redacted] soil included in mean only once, with its geomean.

I. METHODS

Soil residue data from the aerobic soil degradation studies (M-091500-01-1 and M-091507-01-1) (Baseline Dossier, CA 7.1.2.1.1) were used. In these studies, the degradation of fluoxastrobin was studied in soil [redacted] AXXa (sandy loam), soil [redacted] AII (silt loam), soil [redacted] (loamy sand) and soil [redacted] (silt) under aerobic conditions in the dark in the laboratory at 20 °C. The conditions varied in soil type, soil moisture (40% MWHC or 75% of 1/3 bar) and application rate (200, 600 g a.s./ha).

The kinetic analysis was performed according to FOCUS kinetics (2006, 2014) using the software KinGUI 2.1 with four different kinetic models: Single First-Order (SFO) and the bi-exponential models FOMC (First-Order Multi-Compartment model), DFOP (double first order parallel) and HS (Hockey-stick).
Calculation of DT_{50} / DT_{90} values: A half-life is defined as the time taken for 50% of substance to disappear/dissipate from a compartment following single first-order kinetics, whereas DT_{50} and DT_{90} values are not strictly connected to a first order kinetics. In this report half-lives, DT_{50} and DT_{90} values are calculated from the appropriate rate constant k as $DT_{50} = \ln(2)/k$ and $DT_{90} = \ln(10)/k$, respectively.

Normalisation of fitted DT_{50} values (modelling endpoints): Conditions like temperature and moisture are assumed to keep steady in the laboratory, but they can differ from the so called "standard" conditions as they are required for DT_{50} values as input parameter in models. Therefore, the modelling DT_{50} values were corrected to pF2 and an ambient temperature of 20 °C. According to EFSA (2008), Q_{10} was set to 2.58 and T_{ref} was set to 20 °C.

II. RESULTS AND DISCUSSION

Trigger endpoints and modelling endpoints for fluoxastrobin and its metabolite were derived following the procedure described in FOCUS (2006, 2014) and EFSA (2014). For modelling endpoints additionally a normalisation to reference conditions according to FOCUS groundwater (2014) assumptions was performed.
The trigger endpoints and statistical parameters for fluoxastrobin are given in Table 7.1.2.1.1- 3. A summary of the best fits of the trigger endpoints of fluoxastrobin is given in Table 7.1.2.1.1- 1 in the Executive Summary.
The non-normalised modelling endpoints and statistical parameters for fluoxastrobin are given in Table 7.1.2.1.1- 4. The modelling DT_{50} values were corrected to pF2 and an ambient temperature of 20°C. Calculated correction factors for all trials are given in Table 7.1.2.1.1- 5. A summary of the most appropriate non-normalised modelling endpoints and the corresponding normalised modelling endpoints are given in Table 7.1.2.1.1- 2 in the Executive Summary.

Table 7.1.2.1.1- 3: **Trigger endpoints and statistical parameters of fluoxastrobin (E+Z), lab degradation,** best fits highlighted in **bold letters**

Method of calculation [a]	Fitted parameters	χ^2 [%]	t-test k_{fast} / k_{slow}	Visual fit [b]	$DegT_{50}$ [days]	$DegT_{90}$ [days]
[redacted] (2001) (M-091500-01-1, CA 7.1.2.1.1						
[redacted] **AXXa (ring 3-label)**						
SFO	M_0: 94.78 k: 0.03692	4.64	< 0.001	o	18.77	62.36
FOMC	M_0: 95.13 α: 5.569 β: 140.1	3.94		o	18.57	71.76
DFOP	M_0: 95.52 k_1: 0.0425 k_2: 2.33E-14 g: 0.9407	2.85	< 0.001 / 0.5	++	**17.85**	**73.94**
[redacted] (2001) (M-091507-01-1 CA 7.1.2.1.1)						
[redacted] **(ring 3-label)**						
SFO	M_0: 94.23 k: 0.004328	3.22	0.001	-	160.2	532.1
FOMC	M_0: 98.03 α: 0.1826 β: 11.81	1.64		+	513.6	> 1000
DFOP	M_0: 97.08 k_1: 0.0680 k_2: 0.00248 g: 0.1477	0.88	< 0.001	+	**215**	**863.9**
HS	M_0: 96.34 k_1: 0.08475 k_2: 0.002884 t_b: 20.6 d	0.93	< 0.001	+	200.4	758.5
[redacted] **(ring 2-label)**						
SFO	M_0: 98.78 k: 0.06373	8.76	< 0.001	-	10.88	36.13
FOMC	M_0: 99.34 α: 1.560020 β: 18.049204	4.86		+	10.1	60.92
DFOP	M_0: 98.94 k_1: 0.0780 k_2: 0.006446 g: 0.8788	0.48	< 0.001	++	**10.53**	**53.15**

a) SFO: Single first order, FOMC: First order multi compartment, DFOP: Double first order in parallel, HS: Hockey stick

b) Visual fit: + = good, o = moderate, - = poor

Table 7.1.2.1.1- 3 *(cont.):* **Trigger endpoints and statistical endpoints of fluoxastrobin (E+Z), lab degradation,**
best fits highlighted in **bold letters**

Method of calculation [a]	Fitted parameters	χ^2 [%]	t-test k_{fast} / k_{slow}	Visual fit [b]	$DegT_{50}$ [days]	$DegT_{90}$ [days]
[redacted] (2001) M-091507-01-1, CA 7.1.2.1.1						
[redacted] (ring 3-label)						
SFO	M_0: 97.56 k: 0.060816	5.60	< 0.001	o	11.4	37.86
FOMC	M_0: 98.57 α: 2.617173 β: 35.259682	4.50		+	10.69	49.73
DFOP	M_0: 98.00 k_1: 0.0701 k_2: 0.006029 g: 0.9202	2.62	< 0.001 0.186	+	**11.01**	**45.02**
[redacted] AII (ring 3-label)						
SFO	M_0: 94.98 k: 0.01499	1.79	< 0.001	+	**46.24**	**153.6**
FOMC	M_0: 95.26 α: 19.04 β: 1228	1.87		+	45.51	157.8
DFOP	M_0: 96.72 k_1: 12.62 k_2: 0.01456 g: 0.0277	0.81	< 0.001	+	44.97	155.5
HS	M_0: 96.87 k_1: 1.930 k_2: 0.01452 t_b: 0.0217 d	0.78	< 0.001	+	44.86	155.7

a) SFO: Single first order, FOMC: First order multi compartment, DFOP: Double first order in parallel, HS: Hockey stick.
b) Visual fit: + = good, o = moderate, - = poor

Table 7.1.2.1.1- 4: Modelling endpoints and statistical parameters of fluoxastrobin (E+Z), lab degradation (non-normalised)
best fits highlighted in **bold letters**

Method of calculation	Fitted parameters	χ^2 [%]	t-test k_{fast} / k_{slow}	Visual fit [b]	DegT50 [a] [days]
[redacted] (2001), M-091500-01-1, CA 7.1.2.1.1					
[redacted] **AXXa (ring 3-label)**					
SFO	M_0: 94.78 k: 0.03692	4.64	< 0.001	o	18.77
FOMC	M_0: 95.13 α: 5.569 β: 140.1	3.94		o	**21.61**
DFOP	M_0: 95.52 k_1: 0.0425 k_2: 2.33E-14 g: 0.9407	2.85	0.001 0.5	++	3E+13
[redacted] (2001), M-091507-01-1, CA 7.1.2.1.1					
[redacted] **(ring 3-label)**					
SFO	M_0: 94.23 k: 0.004328	3.22	0.001	-	160.2
FOMC	M_0: 98.03 α: 0.1826 β: 11.81	2.14		+	na
DFOP	M_0: 97.08 k_1: 0.0680 k_2: 0.00248 g: 0.1477	0.88	< 0.001	+	**279.5**
HS	M_0: 96.34 k_1: 0.008475 k_2: 0.002884 t_b: 20.6 d	0.93	< 0.001	+	240.3
[redacted] **(ring 2-label)**					
SFO	M_0: 98.78 k: 0.06373	8.76	< 0.001	-	10.88
FOMC	M_0: 99.34 α: 1.360020 β: 18.049204	4.86		+	**18.35**
DFOP	M_0: 98.94 k_1: 0.0780 k_2: 0.006446 g: 0.8788	0.48	< 0.001	++	107.5

SFO: Single first order, FOMC: First order multi compartment, DFOP: Double first order in parallel,
HS: Hockey stick,
na: not available, not appropriate
a) for modelling: FOMC: $DT_{50\ recalc} = DT_{90,\ FOMC} / 3.32$;
DFOP or HS: DT_{50} of slow phase
b) Visual fit: + = good, o = moderate, - = poor

Table 7.1.2.1.1- 4 *(cont.):* **Modelling endpoints and statistical parameters of fluoxastrobin, lab degradation (non-normalised)**
best fits highlighted in **bold letters**

Method of calculation	Fitted parameters	χ^2 [%]	t-test k_{fast} / k_{slow}	Visual fit [b]	$DegT_{50}$ [a] [days]	
[redacted] (2001), M-091507-01-1, CA 7.1.2.1.1						
[redacted] (ring 3-label)						
SFO	M_0: 97.56 k: 0.060816	5.60	< 0.001	o	11.40	
FOMC	M_0: 98.57 α: 2.617173 β: 35.259682	4.50		+	**14.98**	
DFOP	M_0: 98.00 k_1: 0.0701 k_2: 0.006029 g: 0.9202	2.63	0.001 0.186	+	15.0	
[redacted] AII (ring 3-label)						
SFO	M_0: 94.98 k: 0.01499	1.79	< 0.001	+	**46.24**	
FOMC	M_0: 95.23 α: 19.04 β: 1228	1.87		+	47.53	
DFOP	M_0: 96.72 k_1: 12.62 k_2: 0.01456 g: 0.0377	0.81	< 0.001	+	47.61	
HS	M_0: 96.87 k_1: 1.930 k_2: 0.01452 t_b: 0.0217 d	0.78	0.001	+	47.74	

SFO: Single first order, FOMC: First order multi compartment, DFOP: Double first order in parallel,
HS: Hockey stick
na: not available, not appropriate
a) for modelling: FOMC: $DT_{50,ecalc} = DT_{90,FOMC} / 3.32$
DFOP or HS: DT_{50} of slow phase
b) Visual fit: + = good, o = moderate, - = poor

Table 7.1.2.1.1- 5: Calculated correction factors for temperature and moisture normalisation for all trials

Soil	Temperature Study [°C]	Moisture exp. MWHC g/100g ds	Moisture exp. study g/100g ds	Moisture at FC / pF 2 [b] g/100g ds	Correction factor (moist. + temp. f. DT_{50})
[redacted] (2001) (M-091500-01-1, CA 7.1.2.1.1)					
[redacted] AXXa	20	29.1 [a]	21.8	19	1
[redacted] (2001) (M-091507-01-1, CA 7.1.2.1.1)					
[redacted]	20	7.68 [a]	5.76	14	0.5370
[redacted] 4a	20	63.1	25.24	27	0.9539
[redacted] AII	20	36.4	14.56	26	0.6664

a) experimental moisture at pF 2.5
b) estimations for classified soils taken from FOCUS report (FOCUS, 2000); field capacity defined to be water content at pF 2 (10 kPa)

III. CONCLUSIONS

The $DegT_{50}$ values (trigger endpoints) for fluoxastrobin range from 10.5 to 215 days.
The non-normalised modelling endpoints range from 15.0 to 280 days. The normalised (20 °C, pF2) modelling endpoints range from 15.8 to 150 days with a geometric mean of 35.5 days. The derived degradation rates are considered appropriate as input for modelling purposes.

CA 7.1.2.1.2 Aerobic degradation of metabolites, breakdown and reaction products

The degradation rate of the major degradation products HEC 5725-carboxylic acid (*M40*) and HEC 5725-E-des-chlorophenyl (*M48-E*) and 2-chlorophenol (*M82*) in soil under aerobic conditions in the dark in the laboratory was evaluated during the Annex I inclusion and was accepted by the European Commission (SANCO/3921/07-final, 2012). The following studies are included in the baseline dossier:

Author(s)	Year	Document No
HEC 5725-des-chlorophenyl *(M48)*		
[redacted]	2001	M-091500-01-1
[redacted]	2001	M-091507-01-1
HEC 5725-carboxylic acid *(M40)*		
[redacted]	2002	M-033798-01-1
2-Chorophenol *(M82)*		
[redacted]	1980	M-063778-01-1
[redacted]	1961	M-063760-01-1
[redacted]	1987	M-064556-01-1
[redacted]	2001	M-063783-01-1
[redacted]	1954	M-063817-01-1
[redacted]	1988	M-063808-01-1
[redacted]	1992	M-065729-01-1

- **HEC 5725-des-chlorophenyl *(M48)***

Short summaries of the two studies which are included in the baseline dossier are given in section CA 7.1.1.1.

Report:	KCA 7.1.2.1.2/02 [redacted] C; [redacted]; 2001; M-091500-01-1
Title:	Aerobic degradation of [methoxyiminotolyl-ring-UL-14C]HEC5725 in soil [redacted] AXXa
Report No.:	MR-230/01
Document No.:	M-091500-01-1
Guideline(s):	- US EPA, Subdivision N, Paragraph 162-1 - German BBA, Part IV, 4-1 - EU 95/36/EC amending 91/414/EEC - SETAC-Europe Procedures, March 1995
Guideline deviation(s):	not specified
GLP/GEP:	**yes**

Report:	KCA 7.1.2.1.2/03 [redacted] C; [redacted]; 2001; M-091507-01-1
Title:	Aerobic degradation and metabolism of [methoxyiminotolyl-ring-UL-14C] and [pyrimidine-2-14C]HEC5725 in three soils
Report No.:	MR-231/01
Document No.:	M-091507-01-1
Guideline(s):	- US EPA, Subdivision N, Paragraph 162-1 - German BBA, Part IV, 4-1 - EU 95/36/EC amending 91/414/EEC - SETAC-Europe Procedures, March 1995
Guideline deviation(s):	not specified
GLP/GEP:	**yes**

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- **HEC 5725-carboxylic acid *(M40)***

Report:	KCA 7.1.2.1.2/01 [redacted]; 2002; M-033798-01-1
Title:	[HEC 5725-carboxylic acid]-Degradation of HEC5725-carboxylic acid (HEC7180) in three soils under aerobic conditions
Report No.:	MR-523/01
Document No.:	M-033798-01-1
Guideline(s):	- US EPA, Subdivision N, Section 162-1 - German BBA, Part IV, 4-1 - EU 95/36/EC amending 91/414/EEC - SETAC-Europe Procedures, March 1995
Guideline deviation(s):	The test was performed based on the requirements of European Guidelines. The soil moisture corresponded to 50% of maximum water holding capacity. This was different to the US-EPA Pesticide Assessment Guidelines, which required a moisture of 75% of 1/3 bar moisture. The degradation of the test substance was determined, only. The formation of metabolites was not investigated.
GLP/GEP:	**yes**

The biotransformation of unlabelled HEC 5725-carboxylic acid (*M40*) was studied in three different soils. The soils, a silt loam ([redacted] A III, Germany, pH 7.4 in water and OC 0.83%), a sandy loam ([redacted] AXXa, Germany, pH 7.2 in water and OC 1.02%) and a silt ([redacted]

[redacted] 4a, Germany, pH 7.6 in water and OC 2.11%) were incubated for a maximum of 62 days under aerobic conditions in the dark at 20 °C. The soil moisture was adjusted to 50% of the maximum water holding capacity. The application rate of the investigated metabolite was about 57 g/ha, which was about 8 µg HEC 5725-carboxylic acid per 100 g of soil as dry matter. This equates to 2.5% of the parent application rate being converted to the metabolite HEC 5725-carboxylic acid. The level used in the study is therefore considered to be a worst case high level as the anaerobic water sediment study [redacted], 2002 (CA 7.2.2.3) showed 21% of applied fluoxastrobin being transformed to HEC 5725-carboxylic acid (*M40*) in the entire water sediment system after 360 days under strict anaerobic conditions.

Soil samples were extracted with acetonitrile/water. The extracted amount of HEC 5725-carboxylic acid (*M40*) was determined by LC-MS/MS. The analysis method was stated to be Method 00211 ([redacted] 2001, MCA Section 4). The LOQ for the method was 5 µg/kg (0.25% of initial) for the *E* and *Z*-isomer of HEC 5725-carboxylic acid. The LOD was stated to be about 2 µg/kg. Procedural recoveries at 5 µg/kg were 84 - 101% fluoxastrobin *E*-isomer; 85 - 99% fluoxastrobin *Z*-isomer; 100% HEC 5725-*E*-des-chlorophenyl (*M48-E*) and 87 - 130% for HEC 5725-carboxylic acid (*M40* (*E*/*Z*).

The recovery was 103.7% (mean of DAT 0) of the applied amount of HEC 5725-carboxylic acid *(M40)*. The degradation of HEC 5725-carboxylic acid *(M40)* in soil is summarized in Table 7.1.2.1.2- 1.

Table 7.1.2.1.2- 1: Levels of HEC 5725-carboxylic acid (*M40*) found in the aerobic degradation study (µg/kg)

DAT	[redacted] A III	[redacted] AXXa	[redacted] 4a
0	78.62	72.44	85.32
1	78.13	68.21	78.92
3	70.2	57.31	71.32
7	66.18	50.57	54.27
14	47.45	46.1	36.53
29	---	---	14.3
30	35.32	---	---
37	---	31.13	---
44	16.41	21.36	2.5
62	9.69	11.59	0

DAT: Days after treatment

The first order dissipation rates are set out in Table 7.1.2.1.2- 2. [Rapporteur checked using Timme excel sheet which showed all soils to have first order degradation $r^2 = 0.99$ for first 2 soils but Timme only gave r^2 of 0.73 for third soil but plot did not appear correct – applicant's plot using Model Maker appeared more accurate therefore values below are considered acceptable.]

Table 7.1.2.1.2- 2: Degradation of HEC 5725-carboxylic acid (*M40*) in three soils (first order kinetic)

	Soil		
	[redacted] A III	[redacted] AXXa	[redacted] 4a
	silt loam	sandy loam	silt
DT_{50} (days)	31.6	25.1	10.9
DT_{90} (days)	71.7	83.4	36.1
r^2	0.989	0.972	0.998

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- **2-Chlorophenol *(M82)***

The degradation of 2-chlorophenol (M82) in soil is not addressed by any guideline study but with some studies published in the open scientific literature. The studies have been assessed by EFSA in the Final Addendum to the Draft Assessment Report (DAR)[1] to estimate soil DT_{50} of 2-chlorophenol based on the summaries provided in the DAR. These DT_{50} values are summarised in the following table.

Table 7.1.2.1.2- 3: DT_{50} values of 2-chlorophenol (*M82*) in soil under aerobic conditions

	Soil					
	[redacted] County	[redacted]	[redacted]	Mississippi	Texas	Arith. mean
Annex Point / Reference No	KCA 7.1.2.1.2 /04	KCA 7.1.2.1.2/05		KCA 7.1.2.1.2 /10		
DT_{50} (days)	0.6	7	23[1]	2.2	1.7	7.9

[1] wort case estimations reported

Report: KCA 7.1.2.1.2/04 [redacted], 1980, M-063778-01-1
Title: Microbial and non-biological decomposition of chlorophenols and phenol in soil
Report No.: MO-02-015073
Document No.: M-063778-01-1
Guideline(s): none
Guideline deviation(s): --
GLP/GEP: **no**

The aerobic and anaerobic degradation of phenol and selected chlorophenols were investigated in a clay loam soil with no added nutrients. The clay loam soil was obtained from the surface 15 cm of an uncultivated grassland site in [redacted] County, Ontario. The soil was passed through a 2 mm sieve and stored at 4 °C for week prior to experimentation when it was removed and allowed to equilibrate at 23 °C. Some samples were rendered sterile by autoclaving 3 times at 121 °C for 20 minutes. The pH of the non-sterile soil was 7.1 and had a moisture content of 16% (*w/w*) measured gravimetrically. The pH of the sterile soil was 7.1 and its moisture content 16% (*w/w*).

2-chlorophenol (described as ortho-chlorophenol) was one of the phenolic compounds tested in the experiments. 2-chlorophenol was added to the soil dissolved in aqueous ethanol solution (less than 10% of 95% ethanol). The soil (10 g wet weight) was treated to give an initial concentration of 100 µg/ml wet weight or 119.05 µg/ml dry weight soil. Aerobic and anaerobic (using oxygen free N_2 gas) flasks sealed with serum caps were incubated at 23 °C with some flasks kept in the dark. Soils were extracted with 95% ethanol with recoveries at time 0 of more than 80%. The representative UV wavelengths of the compounds were used for identification purposes.

After 1.5 days 2-chlorophenol was reported to have undergone 100% decomposition in aerobic non-sterile soil. The minimum time for more than 70% degradation in aerobic non-sterile soil was stated to be 0.5-1.0 days. In the aerobic sterile soil 67% degradation of 2-chlorophenol was reported after 40 days. Anaerobic non-sterile soil showed 78% degradation after 80 days whilst anaerobic sterile soil showed 8% degradation after 80 days. There was no significant difference in degradation of 2-chlorophenol incubated aerobically and anaerobically in sterile soil in the dark and in the light.

[1] Final Addendum to the Draft Assessment Report (DAR) - public version -
Initial risk assessment provided by the rapporteur Member State United Kingdom for the new active substance FLUOXASTROBIN as referred to in Article 8(1) of Council Directive 91/414/EEC
Volume 3, Annex B, B.8, Addendum prepared by EFSA on 26 July, 2005

2-chlorophenol was shown to be rapidly degraded by aerobic soil micro-organisms with no significant lag phase. The apparent decrease in 2-chlorophenol in anaerobic conditions could not be attributed to volatilisation or photolysis and could therefore result from autooxidation and or adsorption to soil organic matter. [The study noted that ortho-chlorophenyl and para-chlorophenyl were degraded much more rapidly by micro-organisms than meta-chlorophenyl.]

The Rapporteur notes that the study although not standard was reported in reasonable detail and showed an acceptable level of recovery for 2-chlorophenol.

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An evaluation of this report was performed in the Final Addendum to the Draft Assessment Report (DAR)[1]: Laboratory study. Aerobic degradation, no half life is reported but it is stated that 70 % of 2-chlorophenol or more is degraded in a minimum time of 0.01 d. In the worst case (1 d) this would correspond to a first order DT_{50} = 0.6 d (calculated by EFSA).

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Report: KCA 7.1.2.1.2/05 [redacted], 1961, M-063760-01-1
Title: Effect of chemical structure on microbial decomposition of aromatic herbicides
Report No.: MO-01-015671
Document No.: M-063760-01-1
Guideline(s): none
Guideline deviation(s): --
GLP/GEP: no

The aerobic degradation of various organic compounds including 2-chlorophenol was investigated for soil incubated in mineral nutrient medium. After sterilisation the test compounds (at concentrations of 10 - 100 ppm) were added to the solution plus 4 g aliquot of freshly sampled soil. The soils used to investigate chlorophenol degradation were [redacted] silt loam and [redacted] silt loam. After regular intervals aliquots removed from the flasks were centrifuged to remove soil particles and the absorbance of the solution compared to distilled water with correction for absorbance seen in the soil/medium without the test compound. **Complete disappearance (i.e. 75 - 90% decrease in absorbance) of 2-chlorophenol was seen after 14 days in the [redacted] soil and after 47 days in the [redacted] soil.** [The experiment showed that degradation of compounds with the halogen in the meta position to the phenolic hydroxyl were degraded more slowly than other positions for the halogen.]

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An evaluation of this report was performed in the Final Addendum to the Draft Assessment Report (DAR)[1]: Laboratory study. No half life is reported. Complete disappearance (i.e. 75-90 % decrease) was seen after 14 d for [redacted] soil and after 47 d in the [redacted] soil. This would correspond to DT50 between 4.37 d and 7.00 d for [redacted] soil and between 14.69 d and 23 d for [redacted] soil (calculated by EFSA).

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[1] Final Addendum to the Draft Assessment Report (DAR) - public version -
Initial risk assessment provided by the rapporteur Member State United Kingdom for the new active substance FLUOXASTROBIN as referred to in Article 8(1) of Council Directive 91/414/EEC
Volume 3, Annex B, B.8, Addendum prepared by EFSA on 26 July, 2005

Report:	KCA 7.1.2.1.2/06 [redacted],; [redacted]; 1987; M-064556-01-1
Title:	Biodegradation of chlorinated phenols in subsurface soils
Report No.:	MO-02-015854
Document No.:	M-064556-01-1
Guideline(s):	none
Guideline deviation(s):	--
GLP/GEP:	**no**

The biodegradation rates of 2-chlorophenol and other phenolic compounds were investigated in subsurface saturated and unsaturated soils. Soil and groundwater samples were obtained from sites near [redacted], Pennsylvania and [redacted], Virginia. Soil from Pennsylvania was taken from a depth of approx. 4 m (unsaturated zone) and was the lower part of a silty sand layer. Soil from the Virginia site came from depths of 4.5 m (unsaturated) and 31 m (saturated). Virginia soil was composed of alternating layers of sand and silty clay down to depth of 34 m. Soils were all shown to contain extensive microbial populations. Pennsylvania sub-surface water was aerobic with high nitrate levels, while the Virginia groundwater was characterised by low oxygen and nitrate levels. The pH of both groundwaters were near 4.6. Soil/groundwater microcosms were created using about 10 g soil to which sterile groundwater and a phenolic compound was added (soil/groundwater ratio 1:1). Aqueous samples were removed from the microcosm at set time points after each sampling the microcosms were vortex mixed and stored in the dark at a temperature of 10 °C until the next sampling. The biologically active microcosms were anaerobic after the first 2-3 days of incubation. Control microcosms using sterilised soil were used to check the level of sorption of the compounds to the soil.

Samples were analysed by gas-liquid chromatography with FID. Minimum detection limits ranged from 0.01 - 0.05 mg/l. Biodegradation rates varied with soil type. No sorption of 2-chlorophenol to soil was seen in the sterile soil microcosms. Biodegradation of 2-chlorophenol in the unsaturated soils lead to half-lives of about 9 – 13 days according to the degradation graph presented (least squares). The fastest degradation was seen in the Pennsylvania unsaturated soil microcosm whose groundwater was initially aerobic and containing high nitrate level. Biodegradation was lowest in the Virginia saturated soil (having lower microbial population than Virginia unsaturated soil) where an initial concentration of 50 mg/l of 2-chlorophenol was reduced to less than 20 mg/l in 45 days. Increased equilibrium concentrations were shown to yield higher degradation rates. The degradation of the compounds appeared to be first order under anaerobic, low temperature conditions.

The paper concluded that 2-chlorophenol equilibrium concentrations of up to 2000 mg/l were shown to be biodegraded in 2 months or less.

Report:	KCA 7.1.2.1.2/07 [redacted],; [redacted]; [redacted]; [redacted]; 2001; M-063783-01-1
Title:	Study of the degradation of the herbicides 2,4-D and MCPA at different depths in contaminated agricultural soil
Report No.:	MO-02-015675
Document No.:	M-063783-01-1
Guideline(s):	none
Guideline deviation(s):	--
GLP/GEP:	**no**

The degradation of 2,4-D and MCPA and their metabolites including 2-chlorophenol was investigated in field soil in an uncontaminated area of [redacted], Spain. The soil was alkaline and clayey and contained little organic matter. The properties of the soil at different depths were as shown below.

depth (cm)	clay (%)	sand (%)	silt (%)	pH	organic matter [%]
0-10	47	33	20	8.08	0.9
10-20	60	13	27	8.14	1.0
20-30	57	13	30	8.15	1.1
30-40	60	13	27	8.22	1.2

A plot of 12 m^2 was treated with spray solutions of 2,4-D and MCPA as the amine salts. The soil was subjected to no agricultural practice. Samples over time taken from different designated sampling areas were air-dried at room temperature for 24 hours, ground, sifted to 2mm and frozen at -20°C prior to analysis. The soil temperature over the 50 day study was 18 – 25 °C, with 6-13 hours sunlight per day with additional irrigation of the soil when the soil moisture fell below 12% *w/w*. Both 2,4-D and MCPA were added to the soil plot at approximately 80 mg/kg soil. Continuous extraction and pre-concentration of phenols from the soil was undertaken. The method of analysis was shown to have a LOD for 2-chlorophenol of 30 µg/kg and precision RSD of 5.8%.

2-chlorophenol was identified as one of 6 metabolites during the degradation of 2,4-D and MCPA. The rapporteur could not elucidate a DT_{50} for the degradation of the metabolite 2-chlorophenol from the paper however, it was clear that following formation after 2 days, 2-chlorophenol levels peaked between 5 and 11 days and dropped below the level of detection after 15 days in the surface horizon of soil (0 – 10 cm).

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Report: KCA 7.1.2.1.2/08 [redacted]; 1954; M-063817-01-1
Title: Preliminary observations on the decomposition of chlorophenols in soil
Report No.: MO-02-075682
Document No.: M-063817-01-1
Guideline(s): none
Guideline deviation(s): --
GLP/GEP: no

The degradation of chlorophenols was investigated in soil percolation experiments. Chlorophenols in tap water with or without the addition of 10% stock mineral solutions were allowed to percolate through columns of soil crumbs (1 – 2 mm). Most experiments used Rothamsted allotment soil (light clay, pH 6.8). Chlorophenol concentrations were estimated using the method of Redman, Weith and Brock: dilution with water, HCl and a known excess of N/10 KBr-$KbrO_3$ mixture added. The mixture was allowed to stand for 2 minutes, 7% KI solution was added and the liberated iodine was titrated with N/10 sodium thiosulphate solution using starch as internal indicator.

2-chlorophenol (referred to as o-chlorophenol) was percolated in a mineral solution through Rothamstead soil. The first percolation showed a decline of 2-chlorophenol from 25 to 10 mg in 10 days. Later percolations showed faster declines. Degradation of 2-chlorophenol when percolated through sterilised soil was about half the rate of that in un-sterilised soil. Addition of 0.1% sodium azide did not alter the rate of degradation of 2-chlorophenol in the percolator system.

The Rapporteur notes that no details of the temperature in the percolator during the experiment are provided.

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Report:	KCA 7.1.2.1.2/09[redacted]; [redacted]; 1988; M-063808-01-1
Title:	Toxicity and bioaccumulation of chlorophenols in earthworms in relation to bioavailability in soil
Report No.:	Lit. 5358
Document No.:	M-063808-01-1
Guideline(s):	--
Guideline deviation(s):	--
GLP/GEP:	**no**

The paper investigated the acute toxicity of five chlorophenols including 3-chlorophenol to two earthworm species. The two sandy soils used were [redacted] soil (pH 5.6 in 1 N KCl, 6.1% OM, 2.4% clay and CEC of 10 meq/100 g and [redacted] soil (pH 4.8 in 1 N KCl, 3.7% OM, 1.4% clay and CEC 6.6 meq/100 g. Soils were collected from the top 20 cm of agricultural fields, sieved, air dried and stored till use. Chemicals were mixed homogenously through the soils (3-chlorophenol dissolved in water with addition of a few drops of ethanol). The moisture content of the soils was raised to 16% *w/w*. Glass jars were incubated at the optimum temperatures for the two species of worms i.e. 23 and 15 °C. Soil samples were acidified and extracted with toluene. The toluene was then extracted with a K_2CO_3 solution. Chlorophenols were acetylated by addition of acetic anhydride and petroleum ether to this extract. The acetates obtained were analysed by GLC with ECD. The paper gives DT_{50} values for 3-chlorophenol in the 2 soils as 2.1, 2.6 days at 15 °C and at 23 °C 5.4 days at 23 °C.

The Rapporteur notes, however, that DT50 values for chlorophenols with the halogen at different positions on the ring cannot be extrapolated. However, it has been shown that the meta position (i.e. 3-chlorophenol) is usually more resistant to degradation than the ortho position (i.e. 2-chlorophenol) therefore it would be expected that 2-chlorophenol would show more rapid degradation than seen in this experiment for 3-chlorophenol.

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Report:	KCA 7.1.2.1.2/10[redacted]; [redacted]; 1992; M-065729-01-1
Title:	Loss of organics chemicals in soil: pure compound treatability studies
Report No.:	MCC92-016089
Document No.:	M-065729-01-1
Guideline(s):	none
Guideline deviation(s):	-
GLP/GEP:	**no**

Various organic chemicals were screened to determine their loss rates from an acidic soil and a slightly basic soil in aerobic laboratory batch microcosms. The acid soil from Mississippi was a sandy loam soil (pH 4.8, CEC 6.15 meq/100 g and 0.84% OC) whilst the slightly basic soil from Texas was a sandy silt loam (pH 7.8, CEC 10.8 meq/100 g and 3.25% OC). Both soils had active microbial populations typical of agricultural soils. Following collection soils were air-dried, sieved and stored at 4 °C in the dark. No sterile controls were used therefore loss of the chemicals may be due to biodegradation, chemical degradation, hydrolysis and volatilisation although previous experience with the soils indicates that the majority of loss is due to biodegradation. The soil was maintained at a moisture content of about 50% field capacity. The soils had not had previous exposure to industrial chemicals or wastes and did not receive any pre-treatment. Samples were incubated at 20 °C in the dark. Extraction of phenolic compounds was done with methylene chloride. Concentrated methylene chloride extracts were analysed by capillary-column GC using method 8040 (US EPA, 1986). Pre-screening determined acceptable levels for the addition of the chemicals whereby insignificant inhibition of soil microorganisms would occur. 2-chlorophenol was added at 400 mg/kg soil to the basic soil and at 300 mg/kg soil to the acid soil. Recovery efficiencies for 2-chlorophenol were 23% in

the basic soil and 25% in the acid soil, reported concentrations therefore include a correction factor for efficiency. The first order DT_{50} for 2-chlorophenol was calculated to be 7.2 days (r^2 = 0.95, 95% confidence intervals 6.3 - 8.7) in acid soil and 1.7 days (r^2 = 0.98, 95% confidence intervals 1.5-1.9) in the basic soil. [Data in the paper indicated that the DT_{50} for chlorophenols with the chlorine substituted in the meta-position (i.e. 3-chlorophenol) had greater half-lives than substitution in the ortho or para positions.]

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Updated kinetic evaluations of the degradation behaviours of major degradation products in soil under aerobic conditions in the dark in the laboratory have been performed according to FOCUS kinetics (2006) to derive kinetic parameters suitable for modelling purpose and environmental risk assessment. A summary of the degradation rates of fluoxastrobin and its major degradation products in soil in the laboratory is given at the end of section CA 7.1.2.

New kinetic evaluation submitted for Annex I Renewal

Justification for including this study in the Annex I Renewal Dossier: The objective of this study is a kinetic evaluation of the aerobic soil metabolism studies of fluoxastrobin (CA 7.1.2.1.1 included in the baseline dossier) and its major degradation product HEC 5725-des-chlorophenyl (*M48*) (CA 7.1.2.1.2 also included in the baseline dossier). The evaluation was conducted to derive kinetic parameters according to EFSA Guidance 2014 and FOCUS Guidance 2014.

Report:	KCA 7.1.2.1.2/11 [redacted],; [redacted]; 2015; M-534472-01-1
Title:	Kinetic evaluation of aerobic laboratory soil degradation of fluoxastrobin according to FOCUS kinetics using KinGui 2.1
Report No.:	Ensa-15-0132
Document No.:	M-534472-01-1
Guideline(s):	- EFSA, 2014: 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, European Food Safety Authority (EFSA), Parma, Italy, EFSA Journal 2014;12(5):3662 - FOCUS, 2006: Guidance Document on Estimating Persistence and Degradation Kinetics from Environmental Fate Studies on Pesticides in EU Registration. Report of the FOCUS Work Group on Degradation Kinetics. EC Document Reference Sanco/10058/2005, v.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; Date: 18 December 2014 - OECD, 1995: Final report of the OECD workshop on selection of soils/sediments, TG95.25, Belgirate, Italy, 18-20 January 1995 - OECD, 2002: OECD Guideline for the testing of chemicals - Aerobic and anaerobic transformation in soil. OECD 307, adopted 24th April 2002
Guideline deviation(s):	not applicable
GLP/GEP:	**no**

Executive Summary

The purpose of this study was to estimate normalised (20 °C, pF2) degradation times (DT_{50}) for use in model simulations of environmental exposure (modelling endpoints) and to estimate trigger endpoints (trigger endpoints) for fluoxastrobin and its major degradation product HEC 5725-E-des-chlorophenyl (*M48-E*).

The present report comprises the evaluation of the data according to the most recent FOCUS Kinetics report (FOCUS, 2014). Degradation parameters were fitted with the software KinGUI 2.1.
Four kinetic models, Single First-Order (SFO) and the bi-exponential models FOMC (First-Order Multi-Compartment model), DFOP (double first order parallel) and HS (Hockey-stick) are assumed to adequately describe the degradation of the applied substance in laboratory trials (FOCUS, 2014 and EFSA, 2014).

For HEC 5725-*E*-des-chlorophenyl (*M48-E*) the kinetic evaluations are based on the soil degradation of fluoxastrobin laboratory degradation studies (CA 7.1.2.1.1).

In addition, the apparent dissipation of HEC5725-*E*-des-chlorophenyl (*M48*) in soil was evaluated, conservatively, starting from the observed maximum onwards until end of the study.

The DT_{50} values (trigger endpoints) for HEC 5725-des-chlorophenyl (*M48*) range from 45.7 to 206 days,. The non-normalised modelling endpoints range from 43.6 to 206 days. The normalised (20 °C, pF2) modelling endpoints range from 41.6 to 111 days with a geometric mean of 62.0 days. The derived degradation rates are considered appropriate as input for modelling purposes. The data are summarised in Table 7.1.2.1.2- 4 and Table 7.1.2.1.2- 5 .

Table 7.1.2.1.2- 4: Trigger endpoints of HEC 5725-*E*-des-chlorophenyl (*M48-E*), lab degradation

Study	Soil	Kinetic type [a] parent	SFO DT_{50} [days] metabolite
[redacted] (2001) M-091500-01-1	[redacted] AXXa, ring 3-label	DFOP	53.5
[redacted] (2001) M-091507-01-1	[redacted] ring 3-label	DFOP	206
	[redacted] ring 2-label	*DFOP*	*49.0*
	[redacted], ring 3-label	*DFOP*	*42.7*
	[redacted], geomean		45.7
	[redacted] AH, ring 3-label	SFO	101
Maximum			**206**

a) SFO: Single first order, DFOP: Double first order in parallel
b) [redacted] soil included in mean only once, with its geomean

Table 7.1.2.1.2- 5: Modelling endpoints of HEC 5725-*E*-des-chlorophenyl (*M48-E*), lab degradation

Study	Soil	Kinetic type [a)] parent	SFO DT_{50} [days] metabolite non-norm.	norm.[b)]
[redacted] (2001) M-091500-01-1	[redacted] AXXa, ring 3-label	FOMC	48.0	48.0
[redacted] (2001) M-091507-01-1	[redacted], ring 3-label	DFOP	206	111
	[redacted], *ring 2-label*	*FOMC*	*46.3*	*44.1*
	[redacted], *ring 3-label*	*FOMC*	*41.1*	*39.2*
	[redacted], geomean		43.6	41.6
	[redacted] AII, ring 3-label	SFO	101	67.0
Geometric mean				**62.1** [c)]
Maximum				**111**

a) SFO: Single first order, FOMC: First order multi compartment, DFOP: Double first order in parallel
b) normalised to 20°C and pF2
c) [redacted] soil included in mean only once, with its geomean.

I. METHODS

Soil residue data from the aerobic soil degradation studies of fluoxastrobin (CA 7.1.2.1.1) were used. In these studies, the degradation of fluoxastrobin was studied in soil [redacted] AXXa (sandy loam), soil [redacted] AII (silt loam), soil [redacted] (loamy sand) and soil [redacted] (silt) under aerobic conditions in the dark in the laboratory at 20 °C. The conditions varied in soil type, soil moisture (40% MWHC or 75% of 1/3 bar) and application rate (200, 600 g a.s./ha).

The metabolite HEC 5725-*E*-des-chlorophenyl (*M48-E*) was fitted together with the parent compound, to describe best its total degradation pathways. Detailed information on the kinetic analysis is given in the corresponding chapter of the parent compound in section CA 7.1.2.1.1.

In addition, the apparent dissipation of HEC5725-*E*-des-chlorophenyl (*M48-E*) in soil was evaluated, conservatively, starting from the observed maximum onwards until end of the study.

II. RESULTS AND DISCUSSION

The trigger endpoints and statistical parameters for HEC 5725-*E*-des-chlorophenyl (*M48*) are given in Table 7.1.2.1.2- 6. A summary of the best fits of the trigger endpoints of HEC 5725-*E*-des-chlorophenyl (*M48-E*) is given in Table 7.1.2.1.2- 9 in the Executive Summary.
The non-normalised modelling endpoints and statistical parameters for HEC 5725-*E*-des-chlorophenyl (*M48-E*) are given in Table 7.1.2.1.2- 6. The modelling DT_{50} values were corrected to pF2 and an ambient temperature of 20°C. Calculated correction factors for all trials are given in Table 7.1.2.1.1- 5 in the chapter of the parent compound. A summary of the best fits non-normalised modelling endpoints and the corresponding normalised modelling endpoints are given in Table 7.1.2.1.2- 10 in the Executive Summary.

Table 7.1.2.1.2- 6: Estimated SFO degradation rates of HEC 5725-*E*-des-chlorophenyl (*M48-E*) for <u>trigger</u> purpose, lab degradation, in pathway fit
based on **fluoxastrobin** studies

model for parent	k_{M48} [1/d]	$DegT_{50\ M48}$ [days]	DT_{90} [days]	t-test	ε of χ^2-test [%]	formation fraction $f_{Fxa-M48}$	visual fit
[redacted] **(2001)**	(M-091500-01-1, CA 7.1.2.1.1)						
[redacted] **AXXa (ring 3-label)**							
DFOP	0.01295	53.5	117.7	< 0.001	3.71	0.4326	+
[redacted] **(2001)**	M-091507-01-1, CA 7.1.2.1.1)						
[redacted] **(ring 3-label)**							
DFOP	0.003361	206.2	685.1	0.0166	1.06	0.5210	+
[redacted] **(ring 2-label)**							
DFOP	0.01416	48.95	162.6	< 0.001	6.49	0.5468	+
[redacted] **(ring 3-label)**							
DFOP	0.016237	42.69	141.8	< 0.001	7.06	0.5269	+
[redacted] **AII (ring 3-label)**							
SFO	0.006892	100.6	334.1	< 0.001	5.73	0.5372	+

visual acceptability: + good, o medium, - bad

Table 7.1.2.1.2- 7: Estimated <u>SFO</u> degradation rates of HEC 5725-*E*-des-chlorophenyl (*M48-E*) for <u>modelling purpose, lab degradation, in pathway fit, (non-normalised)</u>
based on **fluoxastrobin** studies

model for parent	k_{M48} 1/d	$DegT_{50\ M48}$ d	t-test	ε of χ^2-test %	formation fraction $f_{Fxa-M48}$	visual fit
[redacted] **(2001)**	M-091500-01-1, CA 7.1.2.1.1					
[redacted] **AXXa (ring 3-label)**						
FOMC	0.01444	48.00	< 0.001	4.01	0.4539	+
[redacted] **(2001)**	M-091507-01-1, CA 7.1.2.1.1					
[redacted] **(ring 3-label)**						
DFOP	0.003361	206.2	0.0166	1.06	0.5210	+
[redacted] **(ring 2-label)**						
FOMC	0.0149871	46.25	< 0.001	4.80	0.5603	+
[redacted] **(ring 3-label)**						
FOMC	0.016857	41.12	< 0.001	6.20	0.5312	+
[redacted] **AII (ring 3-label)**						
SFO	0.006892	100.6	< 0.001	5.73	0.5372	+

visual acceptability: + good, o medium, - bad

The apparent dissipation of HEC 5725-*E*-des-chlorophenyl (*M48-E*) in soil was evaluated, conservatively, starting from the observed maximum onwards until end of the study.

Only in 2 soils, at least 4 data points have been available from the maximum onwards: [redacted] AXXa, and [redacted] ring 3-label.

The visual assessment, χ^2 test and t-test in both soils did result in an appropriate fit, assuming an SFO decay. Based on the good visual assessment and the low number of data points, bi-phasic models have been considered not to lead to any improvement and where therefore not taken into account.

In general, it has to be noted that apparent dissipation half-lives of a metabolite give a very conservative description of its degradation behaviour and are mainly useful in cases, where no proper degradation rates can be fitted in pathway fits. Results of the evaluation of the apparent dissipation of HEC 5725-*E*-des-chlorophenyl (*M48-E*) are shown in Table 7.1.2.1.2- 8.

Table 7.1.2.1.2- 8: Estimated SFO dissipation rates of HEC5725-*E*-des-chlorophenyl (*M48-E*) in aerobic lab studies from maximum onwards, for modelling or trigger purpose; not moisture normalised

kinetic model	M_0 [%]	k_{slow} [1/d]	t-test k_{slow}	$DisT_{50}$ initial [days]	$DisT_{90}$ initial [days]	$DisT_{50}$ modelling [days]	χ^2-test error [%]	visual fit
[redacted] (2001) M-091500-01-1, CA 7.1.2.1.1								
[redacted] AXXa								
SFO t, m	23.73	0.00701	< 0.001	**98.89**	328.5	**98.89**	3.948	+
[redacted] (2001) M-091507-01-1, CA 7.1.2.1.1								
[redacted] (ring 3-label)								
SFO t, m	29.68	0.01118	< 0.001	**61.97**	205.9	**61.97**	4.131	+

visual acceptability: + good, o medium, - bad
t best fit model for trigger evaluation
m best approach for modelling purpose

III. CONCLUSIONS

The $DegT_{50}$ values (trigger endpoints) for HEC 5725-des-chlorophenyl (*M48-E*) range from 45.7 to 206 days,.

The non-normalised modelling endpoints range from 43.6 to 206 days. The normalised (20 °C, pF2) modelling endpoints range from 41.6 to 111 days with a geometric mean of 62.1 days. The derived degradation rates are considered appropriate as input for modelling purposes.

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New kinetic evaluation submitted for Annex I Renewal

Justification for including this study in the Annex I Renewal Dossier: The objective of this study is a kinetic evaluation of the aerobic soil metabolism study of HEC 5725-carboxylic acid (*M40*) (CA 7.1.2.1.2, included in the baseline dossier. The evaluation was conducted to derive kinetic parameters according to EFSA Guidance 2014 and FOCUS Guidance 2014.

Report:	KCA 7.1.2.1.2/12 [redacted]; [redacted]; 2015; M-534569-01-1
Title:	Kinetic evaluation of aerobic laboratory soil degradation of HEC5725-carboxylic acid according to FOCUS kinetics using KinGui 2.1
Report No.:	EnSa-15-0328
Document No.:	M-534569-01-1
Guideline(s):	- EFSA, 2014: 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, European Food Safety Authority (EFSA), Parma, Italy, EFSA Journal 2014;12(5):3662 - FOCUS, 2006: Guidance Document on Estimating Persistence and Degradation Kinetics from Environmental Fate Studies on Pesticides in EU Registration. Report of the FOCUS Work Group on Degradation Kinetics, EC Document Reference Sanco/10058/2005, v.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, Date: 18 December 2014
Guideline deviation(s):	none
GLP/GEP:	**no**
Justification:	New data / guideline requirement: Kinetic analysis of the degradation of major degradation product HEC 5725-carboxylic acid for trigger and modelling purpose

Executive Summary

A kinetic analysis of soil residue data from the aerobic soil degradation study M-033798-01-1 was performed according to FOCUS kinetics (2006) to derive half-lives (DT_{50}) for HEC 5725-carboxylic acid (*M40*), a degradation product of fluoxastrobin, which are suitable for model simulations of environmental exposure (modelling endpoints) and to estimate trigger endpoints (trigger endpoints). The kinetic evaluation was performed with the software KinGUI 2. In this evaluation, the initial soil concentration was free fitted together with the degradation rate, based on the IRLS error model (Iteratively reweighted least square).

Single first order was the most appropriate kinetic model for modelling and trigger purpose for the degradation of HEC 5725-carboxylic acid (*M40*) in soils [redacted] AIII and [redacted] 4a and double first order in parallel/hockey-stick for soil [redacted] AXXa under aerobic conditions in the dark in the laboratory at 20°C and 50% of the maximum water holding capacity.

The DT_{50} values (trigger endpoints) for HEC 5725-carboxylic acid (*M40*) range from 10.9 to 21.9 days. The non-normalised modelling endpoints range from 10.9 to 28.6 days. The normalised (20°C, pF2) modelling endpoints range from 10.9 to 26.7 days with a geometric mean of 17.0 days. The derived degradation rates are considered appropriate as input for modelling purposes.

Table 7.1.2.1.2- 9: Trigger endpoints of HEC 5725-carboxylic acid (*M40*), lab degradation

Study	Soil	Kinetic Type [a)]	DT_{50} [days]
[redacted]. (2002) M-033798-01-1	[redacted] AIII	SFO	20.7
	[redacted] AXXa	DFOP	21.9
	[redacted] 4a	SFO	10.9
Maximum			**21.9**

a) SFO: Single first order, DFOP: Double first order in parallel

Table 7.1.2.1.2- 10: Modelling endpoints of HEC 5725-carboxylic acid (*M40*), lab degradation

Study	Soil	Kinetic type [a)]	DT_{50} [days] non-norm.	DT_{50} [days] norm. [b)]
[redacted]. (2002) M-033798-01-1	[redacted] AIII	SFO	21.66	16.9
	[redacted] AXXa	HS, slow phase	28.64	26.7
	[redacted] 4a	SFO	10.91	10.9
Geometric mean				**17.0**

a) SFO: Single first order, HS: Hockey-stick
b) normalised to 20 °C and pF2

I. METHODS

Soil residue data from the aerobic soil degradation study M-033798-01-1 were used. In this study, the degradation of HEC 5725-carboxylic acid (*M40*), a degradation product of fluoxastrobin, was studied in soil [redacted] AIII (silt loam), soil [redacted] AXXa (sandy loam) and soil [redacted] (silt) under aerobic conditions in the dark in the laboratory for 62 days at 20 °C and 50% of the maximum water holding capacity.

The degradation kinetics was determined according to FOCUS kinetics (2006) using the software KinGUI 2 with four different kinetic models: single first order (SFO), first order multi compartment (FOMC), hockey-stick (double first order sequential, HS) and double first order in parallel (DFOP). Model input datasets were the residual amounts found in each replicate test system at each sampling interval.

Calculation of DT_{50} / DT_{90} values: A half-life is defined as the time taken for 50% of substance to disappear/dissipate from a compartment following single first-order kinetics, whereas DT_{50} and DT_{90} values are not strictly connected to a first order kinetics. In this report half-lives, DT_{50} and DT_{90} values are calculated from the appropriate rate constant k as $DT_{50} = \ln(2)/k$ and $DT_{90} = \ln(10)/k$, respectively.

Normalisation of fitted DT_{50} values (modelling endpoints): Conditions like temperature and moisture are assumed to keep steady in the laboratory, but they can differ from the so called "standard" conditions as they are required for DT_{50} values as input parameter in models. Therefore, the modelling DT_{50} values were corrected to pF2 and an ambient temperature of 20°C. According to EFSA (2008), Q_{10} was set to 2.58 and T_{ref} was set to 20°C.

II. RESULTS

Single first order was the most appropriate kinetic model for modelling and trigger purpose for the degradation of HEC 5725-carboxylic acid (*M40*) in soils [redacted] AIII and [redacted] 4a. For the degradation of HEC 5725-carboxylic acid (*M40*) in soil [redacted] AXXa, double first order in parallel and hockey-stick were the most appropriate kinetic model for modelling and trigger purpose, respectively.

The trigger endpoints and statistical parameters for HEC 5725-carboxylic acid (*M40*) are given in Table 7.1.2.1.2- 11. A summary of the best fits of the trigger endpoints of HEC 5725-carboxylic acid (*M40*) is given in Table 7.1.2.1.2- 9 in the Executive Summary.
The non-normalised modelling endpoints and statistical parameters for HEC 5725-carboxylic acid (*M40*) are given in Table 7.1.2.1.2- 12. The modelling DT$_{50}$ values were corrected to pF2 and an ambient temperature of 20 °C. Calculated correction factors for all trials are given in Table 7.1.2.1.2- 11. A summary of the best fits non-normalised modelling endpoints and the corresponding normalised modelling endpoints are given in Table 7.1.2.1.2- 10 in the Executive Summary.

Table 7.1.2.1.2- 11: <u>Trigger</u> endpoints and statistical parameters of HEC 5725-carboxylic acid (*M40*), lab degradation
best fits highlighted in **bold letters**

Kinetic model [a]	Fitted parameters	χ^2 error [%]	t-test k_{slow}	Visual fit [b]	DT_{50} [days]	DT_{90} [days]
[redacted] **(2002)** (CA 7.1.2.1.2)						
[redacted] **AIII**						
SFO	M_0: 104.2 k: 0.03201	4.306	< 0.001	+	**21.66**	**71.94**
FOMC	M_0: 104.2 α: 8031 β: 2509	4.593	< 0.001	+	21.66	71.95
DFOP	M_0: 104.2 k_1: 0.03202 k_2: 0.03201 g: 0.000	4.961	0.001	-	21.66	71.94
HS	M_0: 104.2 k_1: 0.03715 k_2: 0.03201 tb: < 0.001	4.961	< 0.001	-	21.66	71.94
[redacted] **AXXa**						
SFO	M_0: 90.8 k: 0.02834	6.197	< 0.001	o	24.46	81.24
FOMC	M_0: 93.0 α: 1.6622 β: 40.7394	6.167	< 0.185	-	21.08	122.1
DFOP	M_0: 96.0 k_1: 0.55206 k_2: 0.02385 g: 0.15686	3.220	< 0.001	+	**21.91**	**89.38**
HS	M_0: 96.0 k_1: 0.07664 k_2: 0.02421 tb: 3.00001	3.248	< 0.001	+	22.14	88.63
[redacted]						
SFO	M_0: 112.2 k: 0.06354	2.689	< 0.001	+	**10.91**	**36.24**
FOMC	M_0: 112.2 α: 16260 β: 255900	2.842	< 0.001	+	10.91	36.24
DFOP	M_0: 112.2 k_1: 0.06354 k_2: 0.00000 g: 1.00000	3.031	0.5	+	10.91	36.24
HS	M_0: 111.8 k_1: 0.06150 k_2: 0.1025 tb: 28.97	1.483	< 0.001	+	11.27	34.06

a) SFO: Single first order, FOMC: First order multi compartment, DFOP: Double first order in parallel, HS: Hockey-stick
b) Visual fit: + = good, o = moderate, - = poor

Table 7.1.2.1.2- 12: <u>Modelling</u> endpoints and statistical parameters of HEC 5725-carboxylic acid (*M40*), lab degradation (non-normalised)
best fits highlighted in **bold letters**

Kinetic model [a]	Fitted parameters	χ^2 error [%]	t-test k_{slow}	Visual fit [b]	DT_{50} [a] [days]
[redacted] **(2002)** (CA 7.1.2.1.2)					
[redacted] **AIII**					
SFO	M_0: 104.2 k: 0.03201	4.306	< 0.001	+	**21.66**
FOMC	M_0: 104.2 α: 8031 β: 2509	4.593	< 0.001	+	21.67
DFOP	M_0: 104.2 k_1: 0.03202 k_2: 0.03201 g: 0.000	4.961	< 0.001	+	21.65
HS	M_0: 104.2 k_1: 0.03215 k_2: 0.03201 tb: ~0.001	4.961	< 0.001	+	21.65
[redacted] **AXXa**					
SFO	M_0: 90.8 k: 0.02834	6.197	< 0.001	o	24.46
FOMC	M_0: 93.0 α: 1.6622 β: 40.7394	6.167	< 0.185		36.76
DFOP	M_0: 96.0 k_1: ~0.55206 k_2: 0.02385 g: 0.15686	3.920	< 0.001	+	29.06
HS	M_0: 96.0 k_1: 0.07604 k_2: 0.02421 tb: 3.00001	3.248	< 0.001	+	**28.64**
[redacted]					
SFO	M_0: 112.2 k: 0.06354	2.689	< 0.001	+	**10.91**
FOMC	M_0: 112.2 α: 16260 β: 255900	2.842	< 0.001	+	10.92
DFOP	M_0: 112.2 k_1: 0.06354 k_2: ~ 0 g: 1.00000	3.031	0.5	+	10.91 [c]
HS	M_0: 111.8 k_1: 0.06150 k_2: 0.1025 tb: 28.97	1.483	< 0.001	+	6.76

SFO: Single first order, FOMC: First order multi compartment, DFOP: Double first order in parallel, HS: Hockey stick

a) for modelling: FOMC: $DT_{50\ recalc} = DT_{90,\ FOMC} / 3.32$;
DFOP or HS: DT_{50} of slow phase
~ not significantly different from 0, t-test > 5 %

b) Visual fit: + = good, o = moderate, - = poor

c) DT_{50} mod based on k_{fast}, as g_{fast} is 1

Table 7.1.2.1.2- 13: Calculated correction factors for temperature and moisture normalisation for all trials

Soil	Temperature Study [°C]	Moisture exp. MWHC g/100g ds	Moisture exp. study g/100g ds	Moisture at FC / pF 2 [a] g/100g ds	Correction factor (moist. + temp. f. DT_{50})
[redacted] **(2002)** (CA 7.1.2.1.2)					
[redacted] AIII	20	36.4	18.2	26	0.7791
[redacted] AXXa	20	34.42	17.21	19	0.9331
[redacted]	20	63.1	31.55	27	1

a) estimations for classified soils taken from FOCUS report (FOCUS, 2000); field capacity defined to be water content at pF 2 (10 kPa)

III. CONCLUSIONS

The DT_{50} values (trigger endpoints) for HEC 5725-carboxylic acid (*M40*) range from 10.91 to 21.91 days.
The non-normalised modelling endpoints range from 10.91 to 28.64 days. The normalised (20°C, pF2) modelling endpoints range from 10.91 to 26.72 days with a geometric mean of 17.01 days. The derived degradation rates are considered appropriate as input for modelling purposes.

CA 7.1.2.1.3 Anaerobic degradation of the active substance

Due to the proposed use pattern of fluoxastrobin as a fungicide applied to cereals, an anaerobic soil degradation study was not considered to be required. Therefore no studies on the route and rate of degradation of fluoxastrobin in soil under anaerobic conditions were submitted for the Annex I inclusion. However an anaerobic soil metabolism and degradation study of fluoxastrobin was performed in 2014 and is submitted within this supplementary dossier for the fluoxastrobin renewal approval (M-486558-01-1, CA 7.1.1.1.2).

New study submitted for Annex I Renewal
Justification for including this study in the Annex I Renewal Dossier: This study was conducted to cover metabolism and degradation of fluoxastrobin in soil under anaerobic conditions. A full study summary is included in Section CA 7.1.1.1.2 .

Executive Summary
The degradation data as reported in this study were kinetically evaluated. The experimental data could be well described by a single first order (SFO) kinetic model. The half-life of fluoxastrobin under anaerobic conditions was 195 days in the investigated soil.

I. MATERIALS AND METHODS

Details on the study conduct and its results are summarized under (CA 7.1.1.1.2). Nonlinear regression analysis was used to determine the kinetic parameters (KinGUI 2), and linear regression analysis was used to determine the radioactivity detector response.
For the evaluation of the data three different kinetic models (Single First Order Model (SFO), First Order Multi Compartment Model) FOMC) and Double First Order in Parallel Model (DFOP)) were tested in order to determine the best-fit kinetic model. The best-fit kinetic model was selected on the basis of the chi² scaled-error criterion and on the basis of a visual assessment of the goodness of the fits. DT_{50} and DT_{90} values were calculated from the resulting kinetic parameters.

II. RESULTS AND DISCUSSION

The SFO, FOMC and DFOP models were used to fit the observed degradation of fluoxastrobin in the anaerobic soil metabolism study.
The degradation of fluoxastrobin followed single first order (SFO) kinetics based on chi^2 error values and visual assessments of fits.
The chi^2 scaled-error statistic for the SFO model was 2.6%, with calculated DT_{50} and DT_{90} values of 195 and 649 days, respectively. The chi^2 scaled-error statistic for the FOMC model was 2.7%, with calculated DT_{50} and DT_{90} values of 196 and 649 days, respectively. The chi^2 scaled-error statistic for the DFOP model was 2.9%, with calculated DT_{50} and DT_{90} values of 195 and 649 days, respectively. The SFO, FOMC and DFOP kinetic end-points are summarized in Table 7.1.2.1.3- 1.

Table 7.1.2.1.3- 1: Summary of the kinetic evaluation (for trigger values according to FOCUS) of the degradation of fluoxastrobin under anaerobic conditions

Soil (Texture (USDA))	Kinetic Model[a,b)]	DT_{50} [days]	DT_{90} [days]	Chi^2 error [%]	Visual Assessment[c)]
[redacted] 4a (silt loam)	**SFO**	**195**	**649**	**2.6**	+
	FOMC	196	649	2.7	+
	DFOP	195	649	2.9	+

a) SFO: Single first order, FOMC: First order multi compartment, DFOP: Double first order in parallel
b) Best fits highlighted in **bold** letters
c) Visual Assessment: + = good, o = moderate, - = poor

III. CONCLUSIONS

Fluoxastrobin is moderately degraded in soil under anaerobic conditions following an aerobic incubation phase. Formation of significant amounts of non-extractable residues indicates a participation of fluoxastrobin in the natural carbon cycle of soil. Therefore, fluoxastrobin and its degradation products are not expected to have a potential for accumulation in the environment.

CA 7.1.2.1.4 Anaerobic degradation of metabolites, breakdown and reaction products

New study submitted for Annex I Renewal
Justification for including this study in the Annex I Renewal Dossier: This study was conducted to cover metabolism and degradation of fluoxastrobin in soil under anaerobic conditions.

A full summary is included in Section CA 7.1.1.2 M-486558-01-1.

The route and rate of degradation of [methoxyiminotolyl-ring-UL-^{14}C]fluoxastrobin was studied in one soil under anaerobic conditions. Two degradation products were identified with the following maximum occurrences: HEC 5725-des-chlorophenyl with 13.6% AR and HEC 5725-carboxylic acid with 16.9% AR.

No information on the degradation rate of both metabolites in anaerobic soil was evaluated. A conservative, default estimate for the half-life of HEC 5725-*E*-des-chlorophenyl and HEC 5725-carboxylic acid under anaerobic conditions in soil can be assumed to be 1000 days.

CA 7.1.2.2 Field studies

The dissipation and degradation of fluoxastrobin under field conditions were studied at eight sites in Germany, United Kingdom, France, Spain and Italy using unlabelled fluoxastrobin formulated as EC 100. Half of the trials were conducted without vegetation, while the other half of the trials were cropped with spring barley in the first and grass in the second year. The trial locations are characterised by different soil types and climates.

The kinetic models and DT_{50} values used for modelling purpose (normalised to 20 °C and field capacity) and best-fit evaluation are summarized at the end of section CA 7.1.2.

CA 7.1.2.2.1 Soil dissipation studies

The dissipation and degradation of fluoxastrobin in soil under field conditions were evaluated during the Annex I inclusion using unlabelled fluoxastrobin formulated as EC 100, and were accepted by the European Commission (SANCO/3921/07-final, 2012). The following study is included in the baseline dossier:

Annex Point / Reference No	Author(s)	Year	Document No
KCA 7.1.2.2.1	[redacted]	2001	M-136670-01-1

A soil dissipation study was conducted. A short summary of the field study is given below.

Report: KCA 7.1.2.2.1/01 [redacted], 2001, M-136670-01-1
Title: Dissipation of HEC 5725 (100 EC) in soil under field conditions (France, Germany, Great Britain, Italy)
Report No.: RA-2047/98
Document No.: M-136670-01-1
Guideline(s): - Commission Directive 95/36/EC of 14 July 1995 amending Council Directive 91/414/EEC
- ECPA Guidance Document on Field Soil Dissipation Studies, D/97/NM/2047 of August 1997
- SETAC-Europe: Procedures for Assessing the Environmental Fate and Ecotoxicity of Pesticides, March 1995 SETAC guidelines (1995)
Guideline deviation(s): -
GLP/GEP: yes

Soil dissipation studies with fluoxastrobin (HEC 5725 100 EC formulation) were carried out to investigate the dissipation behaviour of fluoxastrobin in soil under field conditions. Eight trials were located in typical agricultural regions of northern Europe (Germany, Great Britain and France) and southern Europe (France and Italy). Half of the trials were conducted without vegetation, while the other half of the trials were cropped with spring barley in the first and grass in the second years. The trial locations were characterised by different soil types and climates.
Weather data were submitted. The trial plots had no history of strobilurin pesticide use.

A single spray application of fluoxastrobin (as HEC 5725 100 EC formulation) was carried out to bare soil. In the case of the cropped trials, the application was done immediately after sowing of the spring barley. Application details are outlined in Table 7.1.2.2.1- 1. As applications were to bare soil, this represented a 2- to 3-fold overdose in terms of soil exposure as compared to practical conditions when foliar interception will occur. Therefore the trial design represented a worst case scenario.

Soil samples were taken as summarized in Table 7.1.2.2.1- 1. Samples were frozen and stored for up to 27 months before analysis. A freezer stability report demonstrating stability of residues in soil after

14 months of storage was submitted (CA 7.1.2.2.2**Error! Reference source not found.**). Soil samples were analysed for the *E*- and *Z*-isomer of fluoxastrobin (HEC5725) and its metabolites HEC 5725-carboxylic acid (*M40*) and HEC 5725-*E*-des-chlorophenyl (*M48-E*) according to method 00611 by [redacted] (2001, see MCA Section 4). Soil metabolism studies showed that the *Z*-isomer of the metabolite HEC 5725-des-chlorophenyl (*M48*) was only seen in very small amounts. However as the *E*/*Z* ratio of HEC5725 carboxylic acid reference substance changes during the extraction process recovery rates and concentrations of both isomers were calculated as the sum of both isomers. Soil samples were extracted with a mixture of acetonitrile/water. Identification and quantification of the active substance and the metabolites were done by HPLC MS/MS detection. Statistical interpretation and graphical representation of the degradation behaviour of both fluoxastrobin isomers were done according to simple first order kinetics using the program package Model Maker.

The mean recoveries of the method, which were determined at fortification levels of 5 to 200 µg/kg, were 101% for fluoxastrobin-*E*-isomer (RSD = 7.1%), 98.9% for HEC 5725-*Z*-Isomer (RSD = 8.4%), 88.6% for HEC 5725-carboxylic acid (*M40*) (RSD = 14.3%) and 100% for HEC 5725-*E*-des-chlorophenyl (*M48-E*) (RSD= 4.6%). The limit of quantification (LOQ) was 5 µg/kg for all analytes. The limit of detection (LOD) was stated to be 2 µg/kg for all compounds. Based on an application rate of 200 g a.s./ha, which is 13.5 µg a.s./kg soil (soil layer 10 cm, soil density 1.5 g/cm^3), the LOD for the metabolites is about 15% of the applied amount of fluoxastrobin and the LOQ is about 4% of the applied amount of fluoxastrobin. The mean procedural recoveries during analysis of samples, which were determined at 5 and 50 µg/kg, were 100% for fluoxastrobin-*E*-isomer, 101% for HEC 5725-*Z*-Isomer, 95.2% for HEC 5725-carboxylic acid (*M40*) and 98.9% for HEC 5725-*E*-des-chlorophenyl (*M48-E*).

Residues of the parent were found only in the 0 – 10 cm soil layer in samples collected up to 745 days after application. Residues of HEC 5725-*E*/*Z*-carboxylic acid (*M40*) were not detected in any soil layer (< 2 µg/kg). HEC 5725-*E*-des-chlorophenyl (*M48-E*) was found in the 0 – 10 cm soil layer in samples collected up to 480 days after application. In three samples (R812404, day 204; R812439, day 13; R812447, day 130) the metabolite was also found in the 10 – 20 cm soil layer below the LOQ. Maximum residues (up to 8.75 µg/kg dry soil) appeared after 99 – 258 days and dissipated to < 2 µg/kg after 199 – 614 days.

Table 7.1.2.2.1- 1: Summary of soil dissipation of fluoxastrobin in 8 field trials

Trial No.	Location/soil properties/plot size/bare or cropped	Application dates	No cores per sample core Ø/depth (cm)	DAA (days)	Residue fluoxastrobin (total E/Z isomer) (mg/kg) 0-10 cm depth. Levels of Z isomer above LOQ shown in brackets	Residue HEC5725-E-des-chlorophenyl (M48) (mg/kg) 0-10 cm depth	Comments
R812390	[redacted], Germany Silt loam pH 6.25 OC 0.97% CEC 15 meq Ba/100g dry soil MC 37.5 g/100g dry soil Plot 225m² Soil left bare.	8 May 1998	10 control samples 20 treated samples At day 0 – 5/10cm Other sampling dates – 4.8-5/50 cm.	0 12 28 55 89 140 194 258 375 479 614 733	0.138 0.0589 0.0503 0.0172 0.0128 < LOQ 0.0334 0.0123 n.d. n.d. n.d. n.d.	n.d. n.d. n.d. <LOQ 0.00754 <LOQ 0.00663 0.00875 <LOQ < LOQ n.d. n.d.	The metabolite HEC5725-E/Z carboxylic acid (M40) was not detected.
R812404	[redacted], UK Sandy clay loam pH 7.56 OC 1.34% CEC 24 meq Ba/100g dry soil MC 41.7 g/100g dry soil Plot 310 m² Soil left bare.	28 April 1998	10 control samples 20 treated samples At day 0 – 5/10cm Other sampling dates – 4.8-5/50 cm.	0 14 28 56 135 204 273 356 486 583 745	0.144 0.115 0.112 0.0939 (16.3% Z) 0.0874 (11.26% Z) 0.0505 (8.7% Z) 0.0355 0.0352 0.0312 0.0136 0.0102 0.00705	n.d. n.d. n.d. <LOQ 0.00805 <LOQ <LOQ n.d. n.d. n.d. n.d.	The metabolite HEC5725-E/Z carboxylic acid (M40) was not detected.
R812412	[redacted] France (North) Silt loam pH 7.18 OC 0.88% CEC 9 meq Ba/100g dry soil MC 43.6 g/100g dry soil Plot size 360 m² Soil left bare.	19 May 1998	10 control samples 20 treated samples At day 0 – 5/10cm Other sampling dates – 4.8-5/50 cm.	0 15 28 53 91 136 199 276 364 480 602 731	0.158 0.0896 (13.8% Z) 0.0779 (16.1% Z) 0.0696 (18% Z) 0.0608 (17.9% Z) 0.0458 (18.8% Z) 0.0287 0.0229 0.0202 0.00585 n.d. <LOQ	n.d. n.d. <LOQ <LOQ <LOQ <LOQ n.d. n.d. n.d. <LOQ n.d. n.d.	The metabolite HEC5725-E/Z carboxylic acid (M40) was not detected.
R812420	[redacted], UK Sandy clay loam pH 7.56 OC 1.34% CEC 24 meq Ba/100g dry soil MC 41.7 g/100g dry soil Plot size 310 m² Cropped.	28 April 1998	10 control samples 20 treated samples At day 0 – 5/10cm Other sampling dates – 4.8-5/50 cm.	0 14 28 56 135 204 273 356 486 583 745	0.150 0.134 0.126 0.0871 (8.2% Z) 0.0866 (9% Z) 0.0498 0.0326 0.0249 0.0225 0.00884 0.0068 0.00744	n.d. n.d. n.d. <LOQ 0.00667 0.00424 <LOQ n.d. <LOQ n.d. n.d. n.d.	The metabolite HEC5725-E/Z carboxylic acid (M40) was not detected.

cont.

Table 7.1.2.2.1- 1: Summary of soil dissipation of fluoxastrobin in 8 field trials
(cont.)

Trial No.	Location/soil properties/plot size/bare or cropped	Application dates	No cores per sample core Ø/depth (cm)	DAA (days)	Residue fluoxastrobin (total E/Z isomer) (mg/kg) 0-10 cm depth. Levels of Z isomer above LOQ shown in brackets	Residue HEC5725-E-des-chlorophenyl (M48) (mg/kg) 0-10 cm depth	Comments
R812439	[redacted] France (North) Silt pH 7.06 OC 0.81% CEC 13 meq Ba/100g dry soil MC 46.4 g/100g dry soil Plot 360 m² Cropped.	18 May 1998	10 control samples 20 treated samples At day 0 – 5/10cm Other sampling dates – 4.8-5/50 cm. (One of the 20 collected soils cores was broken at T09.)	0 15 28 53 91 136 199 276 364 480 601 731	0.123 0.0785 (11.1% Z) 0.0787 (12.9% Z) 0.0744 (12.2% Z) 0.0442 (11.4% Z) <LOQ <LOQ 0.0288 0.0268 0.0226 0.00335 <LOQ <LOQ	n.d. n.d. <LOQ <LOQ <LOQ n.d. n.d. <LOQ <LOQ n.d.	The metabolite HEC5725-E/Z carboxylic acid (M40) was not detected.
R812447	[redacted], Italy Sandy loam pH 7.56 OC 0.48 CEC 13 meq Ba/100g dry soil MC 39 g/100g dry soil Plot 960 m² Cropped.	28 April 1998	10 control samples 20 treated samples At day 0 – 5/10cm Other sampling dates – 4.95/50 cm.	0 14 28 56 90 135 199 269 479 601 730	0.138 0.0842 (16.2% Z) 0.0766 (15.3% Z) 0.0851 (16.3% Z) 0.067 (13.9% Z) 0.0434 (15.8% Z) 0.027 0.035 0.0138 0.0040 n.d. n.d.	n.d. n.d. <LOQ <LOQ <LOQ n.d. n.d. n.d. n.d. n.d. n.d.	The metabolite HEC5725-E/Z carboxylic acid (M40) was not detected.
R812455	[redacted] France (South) Silt loam pH 7.5 OC 0.85 CEC 10 meq Ba/100g dry soil MC 38 g/100g dry soil Plot 350 m² Cropped	25 March 1998	10 control samples 20 treated samples At day 0 – 5/10cm Other sampling dates – 4.8-5/50 cm.	0 15 28 56 90 135 201 268 355 483 594 729	0.013 0.0618 (18.6% Z) 0.0473 (15.3% Z) 0.0435 (16.7% Z) 0.0511 (18.6% Z) 0.0369 (19% Z) 0.021 0.017 0.0154 0.0068 <LOQ <LOQ	n.d. n.d. <LOQ n.d. <LOQ <LOQ <LOQ <LOQ n.d. n.d. n.d. n.d.	The metabolite HEC5725-E/Z carboxylic acid (M40) was not detected.
R814202	[redacted], Germany. Sandy loam pH 6.32 OC 0.89 CEC 16 meq Ba/100g dry soil MC 29.6 g/100g dry soil Plot 2[illegible] m² Bare	23 April 1998	10 control samples 20 treated samples At day 0 – 5/10cm Other sampling dates – 4.8-5/50 cm.	0 14 26 56 140 208 264 362 474 600 725	0.127 0.110 (13.9% Z) 0.0752 (13.3% Z) 0.0577 (17.12% Z) 0.0300 (21.97% Z) 0.0141 0.0105 0.0118 0.0102 <LOQ n.d. n.d.	n.d. n.d. n.d. <LOQ <LOQ <LOQ n.d. n.d. n.d. n.d. n.d. n.d.	The metabolite HEC5725-E/Z carboxylic acid (M40) was not detected.

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No additional studies are submitted within this supplementary dossier for the fluoxastrobin renewal of approval. However, updated kinetic evaluations of the degradation behaviour of fluoxastrobin in soil under field conditions have been performed according to EFSA Guidance (2014) and FOCUS Guidance (2014) to derive kinetic parameters suitable for modelling purpose and environmental risk assessment. They are summarized under CA 7.1.2.2.1. An overall summary of the degradation rates of fluoxastrobin and its major degradation products in soil is given at the end of section CA 7.1.2.

New kinetic evaluation submitted for Annex I renewal

Justification for including this study in the Annex I Renewal Dossier: The objective of this study is to estimate dissipation times (DT_{50}) of fluoxastrobin (*E*- and *Z*-isomer summed) at study conditions (CA 7.1.2.2.1, included in the Baseline Dossier) for trigger evaluation. The evaluation was conducted to derive kinetic parameters according to FOCUS Guidance 2014).

Report:	KCA 7.1.2.2.1/05 [redacted]; 2015; M-534457-01-1
Title:	Kinetic evaluation of a field dissipation study with fluoxastrobin in Europe according to FOCUS kinetics for trigger purpose using KinGui 2.1 - E + Z-isomer summed
Report No.:	Ensa-15-0367
Document No.:	M-534457-01-1
Guideline(s):	- EFSA, 2014: 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, European Food Safety Authority (EFSA), Parma, Italy, EFSA Journal 2014;12(5):3662 - FOCUS, 2006: Guidance Document on Estimating Persistence and Degradation Kinetics from Environmental Fate Studies on Pesticides in EU Registration. Report of the FOCUS Work Group on Degradation Kinetics. EC Document Reference Sanco/10058/2005, v.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, Date: 18 December 2014
Guideline deviation(s):	not applicable
GLP/GEP:	**no**
Justification:	New data / guideline requirement: Kinetic analysis of the degradation of fluoxastrobin for trigger evaluation

Executive Summary

The purpose of this study was to estimate dissipation times (DT_{50}) at study conditions for use as trigger endpoint. The dissipation of fluoxastrobin and the metabolite HEC 5725-*E*-des-chlorophenyl (*M48-E*) in agricultural soils under natural field conditions was investigated in eight trials in Europe ([redacted], 2001, CA 7.1.2.2.1, included in the baseline dossier). The kinetic evaluation was performed according to the guidance given by the FOCUS Kinetics report (FOCUS, 2014). Degradation parameters were fitted with the software KinGUI 2.1.

Three kinetic models, Single First-Order (SFO) and the bi-exponential models FOMC (First-Order Multi-Compartment model) and DFOP (double first order parallel) are assumed to adequately describe the dissipation of the applied substance in field trials (FOCUS, 2014). The fit of the metabolite HEC 5725-*E*-des-chlorophenyl (*M48*) in combination with the parent fit, seemed not to be appropriate for trigger purpose. However, a conservative, apparent field decline DT_{50} could be evaluated.

The DT_{50} values for fluoxastrobin and HEC 5725-*E*-des-chlorophenyl (*M48-E*) are shown in the tables below. DT_{50} values (trigger endpoints) ranged from 11.5 to 91.7 days for fluoxastrobin. For HEC 5725-*E*-des-chlorophenyl (*M48-E*) the conservative apparent field decline DT_{50} values were 93.5 and 95.6 days. The kinetic parameters determined for the dissipation under realistic field conditions are considered appropriate as trigger endpoints.

Table 7.1.2.2.1- 2: Trigger endpoints (field dissipation $DisT_{50}$) of fluoxastrobin (E+Z)

Study	Location	Kinetic model [a]	$DisT_{50}$ initial [days]
[redacted] (2001) M-136670-01-1	[redacted] (Germany)	FOMC	11.53
	[redacted] (Germany)	DFOP	44.36
	[redacted] R812404 (UK)	DFOP	86.41
	[redacted] R812420 (UK)	FOMC	**91.66**
	[redacted] R812412 (France)	DFOP	28.79
	[redacted] R812439 (France)	DFOP	76.41
	[redacted] (France)	DFOP	25.05
	[redacted] (Italy)	DFOP	82.75

a) SFO: Single first order, FOMC: First order multi compartment, DFOP: Double first order in parallel

Table 7.1.2.2.1- 3: Estimated apparent field decline of HEC 5725-*E*-des-chlorophenyl (*M48-E*) for trigger purpose from maximum

Study	Location	Kinetic model [a]	DT_{50} actual [days]
[redacted] (2001) M-136670-01-1	[redacted] R812404 (UK)	SFO	93.47
	[redacted] R812420 (UK)	SFO	95.57

a) SFO: Single first order, FOMC: First order multi compartment, DFOP: Double first order in parallel

I. METHODS

The behaviour of fluoxastrobin under field conditions was investigated in one terrestrial field soil dissipation study encompassing eight trial sites located throughout Europe (France, Germany, Italy and UK, [redacted] 2001). All trials which were considered in the evaluation (Baseline dossier, CA 7.1.2.2.1) were used. The field dissipation trials were carried out at eight sites across Europe in order to cover different representative agro-climatic regions. Each test site received a single application at a nominal application rate of the active substance of 200 g/ha. Application was made on bare soil. At 4 trials, the soil was maintained bare; at the other 4 trials spring barley was sown shortly before application, followed by grass after the first season.

The kinetic analysis was performed according to FOCUS kinetics (2014) using the software KinGUI 2 with four different kinetic models: Single First-Order (SFO) and the bi-exponential models FOMC (First-Order Multi-Compartment model) and DFOP (double first order parallel).

The fit of the metabolite HEC 5725-*E*-des-chlorophenyl (*M48-E*) in combination with the parent fit, seemed not to be appropriate for trigger purpose. However, a conservative, apparent field decline DT_{50} could be evaluated.

Calculation of DT_{50} / DT_{90} values: A half-life is defined as the time taken for 50% of substance to disappear/dissipate from a compartment following single first-order kinetics, whereas DT_{50} and DT_{90} values are not strictly connected to a first order kinetics. In this report half-lives, DT_{50} and DT_{90} values are calculated from the appropriate rate constant k as $DT_{50} = \ln(2)/k$ and $DT_{90} = \ln(10)/k$, respectively.

For trigger endpoints, all residue data beginning from DAT-0 are used and the day length is not normalised to standard conditions.

II. RESULTS AND DISCUSSION

Trigger endpoints for fluoxastrobin and HEC 5725-*E*-des-chlorophenyl (*M48-E*) were derived following the procedure described in FOCUS (2014). An overview of the trigger endpoints is given in Table 7.1.2.2.1- 2 and Table 7.1.2.2.1- 3 in the Executive Summary. The trigger endpoints and statistical parameters for fluoxastrobin and HEC 5725-*E*-des-chlorophenyl (*M48-E*) are given in Table 7.1.2.2.1- 4 and Table 7.1.2.2.1- 6.

Table 7.1.2.2.1- 4: **<u>Trigger</u> endpoints (field $DisT_{50}$) and statistical parameters of fluoxastrobin (E+Z-isomer)**
best fits highlighted in **bold letters**

Type of kinetics [a]	Fitted parameters	χ^2 error [%]	t-test k_{fast} / k_{slow}	Visual fit [b]	$DisT_{50}$ [days]	$DisT_{90}$ [days]
[redacted] - R812390 (Germany)						
SFO	M_0: 131.9 k: 0.03898	26.89	< 0.001	- o	17.78	59.08
FOMC	M_0: 137.2 α: 1.098 β: 13.10	15.76	< 0.028	++	**11.53**	**93.55**
DFOP	M_0: 137.5 k_1: 3.362 x 10^6 k_2: 0.02071 g: 0.4164	15.65	< 0.001	+	7.465	85.17
[redacted] - R814202(Germany)						
SFO	M_0: 126.3 k: 0.01384	14.02	< 0.001	-	50.08	166.4
FOMC	M_0: 128.9 α: 2.1961 β: 119.0612	11.29	< 0.005	+	44.19	220.7
DFOP	M_0: 128.6 k_1: 0.01937 k_2: 0.002739 g: 0.8344	10.59	< 0.001 / 0.046	+	**44.36**	**225.2**
[redacted] - R812404 (UK)						
SFO	M_0: 146.8 k: 0.006007	13.21	< 0.001	o	115.39	383.3
FOMC	M_0: 154.6 α: 1.366 β: 133.3	9.794	< 0.009	+	88.15	586.3
DFOP	M_0: 154.8 k_1: 0.01741 k_2: 0.002913 g: 0.4996	9.994	0.067 / 0.002	++	**86.41**	**<u>552.8</u>**
[redacted] - R812420 (UK)						
SFO	M_0: 142.1 k: 0.00661	9.645	< 0.001	o	104.9	348.3
FOMC	M_0: 145.8 α: 2.504 β: 287.4	8.084	< 0.021	+	**<u>91.66</u>**	**433.5**
DFOP	M_0: 145.2 k_1: 0.01011 k_2: 0.002315 g: 0.745466	8.631	0.004 / 0.159	+	92.72	443.4

cont.

Table 7.1.2.2.1- 4: **Trigger endpoints (field $DisT_{50}$) and statistical parameters of fluoxastrobin (E+Z-isomer)**
(cont.) best fits highlighted in **bold letters**

Type of kinetics [a]	Fitted parameters	χ^2 error [%]	t-test k_{fast} / k_{slow}	Visual fit [b]	$DisT_{50}$ [days]	$DisT_{90}$ [days]
[redacted] - R812412 (France)						
SFO	M_0: 134 k: 0.009118	25.65	< 0.001	-	76.02	252.5
FOMC	M_0: 156.4 α: 0.55652 β: 11.83601	15.03	< 0.009	-	29.29	729.6
DFOP	M_0: 158 k_1: 1.715 k_2: 0.004690 g: 0.4277	5.306	< 0.001	+	**28.79**	**371.9**
[redacted] - R812439 (France)						
SFO	M_0: 110 k: 0.006798	16.23	< 0.001	o	102	338.7
FOMC	M_0: 118.7 α: 1.0900 β: 76.3518	12.94	< 0.007	o	67.86	555
DFOP	M_0: 123.5 k_1: 1.787 k_2: 0.004882 g: 0.2739	8.564	< 0.001	+	**76.41**	**406.1**
[redacted] - R812455 (France)						
SFO	M_0: 112.7 k: 0.009893	28.05	< 0.001	-	70.06	232.7
FOMC	M_0: 130.2 α: 0.58965 β: 12.80785	16.18	< 0.006	-	28.69	623.1
DFOP	M_0: 131.5 k_1: 1.791 k_2: 0.00472 g: 0.4372	10.23	< 0.001	+	**25.05**	**366**
[redacted] - R812447 (Italy)						
SFO	M_0: 127.6 k: 0.007075	11.7	< 0.001	o	97.98	325.5
FOMC	M_0: 130.8 α: 3.0745 β: 539.9619	11.55	0.025 / 0.054	o -	85.97	379
DFOP	M_0: 138 k_1: 1.780 k_2: 0.005834 g: 0.1898	7.093	< 0.001	+	**82.75**	**358.6**

a) SFO: Single first order, FOMC: First order multi compartment, DFOP: Double first order in parallel
b) Visual fit: + = good, o = moderate, - = poor

The metabolite HEC 5725-*E*-des-chlorophenyl (*M48-E*) was detected in 3 field trials only above the LOQ.

In these cases, the metabolite HEC 5725-*E*-des-chlorophenyl was fitted together with the parent compound, to describe best its total degradation pathways in the field.

The best fit model for trigger purpose of the parent was chosen, and the corresponding SFO degradation rates and formation fractions for the metabolite were considered here.

It has to be noted, that the observed residue data have been very close to the limit of detection LOD or quantification LOQ.

Based on the relatively low residue findings, few data points > LOQ and scattering data the χ^2 test error exceed considerably 15% in all trials.

Nevertheless, the 15% threshold value for the scaled error « should not be employed as absolute cut-off criteria, as this value is strictly appropriate only for optimal experimental conditions. It might be that the error to pass the χ^2 test is higher than 15%, but the model fit still represents a reasonable description of the degradation behaviour. Especially at field data evaluations or for metabolites it may be justified to accept larger values. A reason for this is the large inherent variability of field residue data (scattered data points).

For metabolites, only a SFO fit was tested. However, assuming a bi-phasic decay should not improve the fit, as the dissipation curve seems not to be bi-phasic. Moreover, the overall (non-normalised) formation and dissipation was not described sufficiently well.

Table 7.1.2.2.1- 5: Estimated SFO field degradation of HEC 5725-*E*-des-chlorophenyl (*M48-E*), for trigger purpose, based on best fit of parent; not temperature or moisture normalised

Model for parent	Fitted parameters	χ^2 error [%]	t-test	Visual fit [b)]	DT_{50} [days]	DT_{90} [days]
[redacted] - R812390 (Germany)						
FOMC	k: 0.001346 ff: 0.0666	*51.96*	0.031	-	515.0 [c)]	> 1000 [c)]
[redacted] - R812404 (UK)						
DFOP	k: 0.008490 ff: 0.1446	*52.9*	0.007	o -	81.64 [c)]	271.2 [c)]
[redacted] - R812420 (UK)						
FOMC	k: 0.009717 ff: 0.1565	*56.6*	0.003	o -	71.34 [c)]	237.0 [c)]

a) SFO: Single first order, FOMC: First order multi compartment, DFOP: Double first order in parallel
b) Visual fit: + = good, o = moderate, - = poor
c) not fully reliable, mathematically not significantly different from 0; not usable

The fit of the metabolite HEC5725-*E*-des-chlorophenyl (*M48-E*) in combination with the parent fit, seemed not to be appropriate for trigger purpose. However, a conservative, apparent field decline DT_{50} could be evaluated

Table 7.1.2.2.1- 6: Fitted parameters of apparent field decline of HEC 5725-*E*-des-chlorophenyl (*M48-E*), for <u>trigger purpose,</u> <u>not</u> temperature or moisture <u>normalised</u>

Kinetic model [a]	Fitted parameters	χ^2 error [%]	t-test	Visual fit [b]	DT_{50} [days]	DT_{90} [days]
[redacted] - R812404 (UK)						
SFO	k: 0.5485	34.11	0.007	o	93.47	310.5
[redacted] - R812420 (UK)						
SFO	k: 0.5669	13.21	0.0025	+	95.57	317.5

a) SFO: Single first order
b) Visual fit: + = good, o = moderate, - = poor

III. CONCLUSIONS

DT_{50} values (trigger endpoints) ranged from 11.5 to 91.7 days for fluoxastrobin (E+Z). For HEC 5725-*E*-des-chlorophenyl (*M48-E*) the conservative apparent field decline DT_{50}-values were 93.5 and 95.6 days. The kinetic parameters determined for the dissipation under realistic field conditions are considered appropriate as trigger endpoints.

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New kinetic evaluation submitted for Annex I renewal

Justification for including this study in the Annex I Renewal Dossier: The objective of this study is to estimate dissipation times (DT_{50}) of fluoxastrobin (*E*- and *Z*-isomer summed) at field conditions (CA 7.1.2.2.1, included in the baseline dossier) for use as modelling endpoint. The evaluation was conducted to derive kinetic parameters according to FOCUS Guidance 2014).

Report:	KCA 7.1.2.2.1/06 [redacted]; [redacted]; 2015; M-534453-01-1
Title:	Kinetic evaluation of field dissipation studies of fluoxastrobin in Europe according to FOCUS kinetics and EFSA TFD guidance for modelling purpose using KinGui 2.1 - E + Z-isomer summed
Report No.:	Ensa-15-0309
Document No.:	M-534453-01-1
Guideline(s):	- EFSA, 2007: Scientific Opinion of the Panel on Plant Protection Products and their Residues on a request from EFSA related to the default Q10 value used to describe the temperature effect on transformation rates of pesticides in soil. EFSA Journal, 622, 1-32 - EFSA, 2014: 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. European Food Safety Authority (EFSA), Parma, Italy, EFSA Journal 2014;12(5):3662 - FOCUS, 2000: FOCUS groundwater scenarios in the EU plant protection product review process. Report of the FOCUS Groundwater Scenarios Workgroup. EC Document Reference Sanco/321/2000 rev.2 - FOCUS, 2006: Guidance Document on Estimating Persistence and Degradation Kinetics from Environmental Fate Studies on Pesticides in EU Registration. Report of the FOCUS Work Group on Degradation Kinetics. EC Document Reference Sanco/10058/2005, v.2.0, June 2006 - FOCUS, 2009: Assessing Potential for Movement of Active Substances and their Metabolites to Ground Water in the EU. Final report of the Ground Water Working Group of FOCUS (FOrum for the Co-ordination of pesticide fate models and theri USe). vers. 1, 13. June 2009. EC Document Reference SANCO/13144/2010, v1 - FOCUS, 2014: Generic guidance for Estimating Persistence and Degradation Kinetics from Environmental Fate Studies on Pesticides in EU Registration, Version 1.1; Date: 18 December 2014
Guideline deviation(s):	not applicable
GLP/GEP:	**no**
Justification:	New data; guideline requirement Kinetic analysis of the degradation of fluoxastrobin for modelling endpoints

Executive Summary

Normalised (20 °C, 100% field capacity) degradation $DT_{50\ matrix}$ values of fluoxastrobin (*E*- and *Z*-isomers summarised as parent) and its metabolite HEC 5725-*E*-des-chlorophenyl (*M48-E*) in the soil matrix under European field conditions (CA 7.1.2.2.1) were derived for modelling purpose according to FOCUS kinetics (FOCUS, 2006, 2014) and the EFSA guidance on field dissipation studies (EFSA, 2014). Processes potentially occurring at the soil surface, e.g. photodegradation, volatilisation, during the field study should be eliminated to result finally in a $DT_{50\ matrix}$ representing the degradation in the soil matrix or bulk. Only bare soil field trials have been taken into account.

Simulated (with PEARL) daily soil temperatures and moisture contents were used to normalise the evaluated parameters to reference conditions according to FOCUS groundwater assumptions (Arrhenius equation, Q_{10} = 2.58; [redacted] equation, pF2) (FOCUS, 2009, 2014). The residue data together with the transformed times (transformed time approach, time step normalisation) were kinetically and statistically evaluated, based on the procedure explained by FOCUS kinetics, using KinGUI 2.1.

Three kinetic models, Single First-Order (SFO) and the bi-exponential models DFOP (Double First Order Parallel) and Hockey-Stick (HS) are assumed to adequately describe the dissipation of the applied substance in field trials (FOCUS, 2014 and EFSA, 2014). Selection of the most appropriate kinetic model was based on a detailed statistical analysis including visual assessment, χ^2 statistics, and significance t-test.

Following the EFSA decision tree on field dissipation studies (EFSA, 2014), an appropriate description of soil matrix degradation of fluoxastrobin could be given using an SFO fit for 3 sites and a HS fit for 1 site. The fit of the metabolite HEC 5725-*E*-des-chlorophenyl (*M48-E*) in combination with the parent fit, seemed not to be appropriate for modelling purpose. However, a conservative apparent field decline DT_{50} could be evaluated.

Normalised $DegT_{50}$ values (modelling endpoints) for fluoxastrobin (E+Z) ranged from 19.6 to 69.1 days, with a geometric mean of 42.7 days. The normalised kinetic parameters determined for the dissipation under realistic field conditions are considered appropriate as input for modelling purposes. The DT_{50} values for fluoxastrobin derived by the evaluation of the field trials are shown in Table 7.1.2.2.1- 7.

The conservative apparent field decline DT_{50} value of HEC 5725-*E*-des-chlorophenyl (*M48-E*) (normalised, modelling endpoint) was 39.5 days (see Table 7.1.2.2.1- 8).

Table 7.1.2.2.1- 7: Estimated field matrix degradation of fluoxastrobin (*E+Z* isomer) for modelling purpose, normalised to 20 °C, 100% field capacity, Q_{10} = 2.58

Study	Location	Kinetic type [a]	$DegT_{50}$ [b] [days]
[redacted] (2001)	[redacted] (Germany)	HS	**19.61**
	[redacted] (Germany)	SFO	**36.33**
	[redacted] - R812404 (UK)	SFO	**69.13**
	[redacted] - R812412 (France)	SFO	**67.24**
Geometric mean			**42.66**

a) SFO: Single first order, HS: Hockey stick
b) Normalised using a Q10 of 2.58 and [redacted] equation coefficient of 0.7, values are DegT50matrix

Table 7.1.2.2.1- 8: Estimated apparent field decline of HEC5725-*E*-des-chlorophenyl (*M48-E*) for modelling purpose from maximum; 20 °C, 100% FC

Study	Location	Kinetic type [a]	$DegT_{50}$ [b] [days]
[redacted] (2001)	[redacted] - R812404 (UK)	SFO	39.54
Geometric mean			

a) SFO: Single first order, HS: Hockey stick
b) Normalised using a Q10 of 2.58 and [redacted] equation coefficient of 0.7, values are $DegT_{50}$matrix

I. METHODS

The behaviour of fluoxastrobin under field conditions was investigated in one terrestrial field soil dissipation study, encompassing eight trial sites located throughout Europe (France, Germany, Italy and UK, [redacted], 2001, CA 7.1.2.2.1). Only bare soil field trials have been taken into account. The field dissipation trials were carried out at eight sites (six geographic locations) across Europe in order to cover different representative agro-climatic regions. Each test site received a single application at a nominal application rate of 200 g/ha fluoxastrobin in spring. Application was made on bare soil. At 4 trials, the soil was maintained bare; at the other 4 trials spring barley was sown shortly before

application, followed by grass after the first season.
The present report comprises the evaluation of the data according to the most recent EFSA guidance for evaluating field dissipation studies (EFSA, 2014). The kinetic evaluation was also performed according to the guidance given by the FOCUS Kinetics report (FOCUS, 2014).

Because daily soil temperature and moisture data, which are necessary to normalise the degradation parameters were not measured on-field, corresponding values were generated by employing a suitable simulation model. Necessary driving variables for such a model are rainfall and other climatic data to calculate evapotranspiration. Soil moisture and temperature for the normalisation of the modelling endpoints were calculated with FOCUS PEARL 4.4.4. Degradation parameters were fitted with the software KinGUI 2.1.

Three kinetic models, Single First-Order (SFO) and the bi-exponential models DFOP (Double First Order Parallel) and Hockey-Stick (HS) are assumed to adequately describe the dissipation of the applied substance in field trials (FOCUS, 2014 and EFSA, 2014).
The fit of the metabolite HEC 5725-*E*-des-chlorophenyl (*M48-E*) in combination with the parent fit, seemed not to be appropriate for modelling purpose. However, a conservative, apparent field decline DT_{50} could be evaluated.

In the attempt to separate soil surface degradation processes, as photodegradation, volatilisation, from bulk soil degradation, an important threshold to start a kinetic evaluation might be the time, when at least 10 mm precipitation (+ irrigation) have been fallen (EFSA, 2014). Then, it is assumed that the active substance is sufficiently deep washed into the soil matrix. Thus, in case of an SFO fit, residue data before 10 mm of rain has been fallen, have to be excluded. In case of HS, the breakpoint time t_b has to be equal or later than the day at which the 10 mm rainfall criterion was reached.

Calculation of DT_{50}/ DT_{90} values: A half-life is defined as the time taken for 50% of substance to disappear/dissipate from a compartment following single first-order kinetics, whereas DT_{50} and DT_{90} values are not strictly connected to a first order kinetics. In this report half-lives, DT_{50} and DT_{90} values are calculated from the appropriate rate constant k as $DT_{50} = \ln(2)/k$ and $DT_{90} = \ln(10)/k$, respectively.

II. RESULTS AND DISCUSSION

Modelling endpoints (temperature and moisture normalised) for fluoxastrobin and HEC 5725-*E*-des-chlorophenyl (*M48-E*) were derived following the procedure described in EFSA (2014) and FOCUS (2014). Daily soil temperatures and moisture contents were used to normalise the data to reference conditions according to FOCUS groundwater assumptions.
An overview of the modelling endpoints is given in Table 7.1.2.2.1- 7 and Table 7.1.2.2.1- 8 in the Executive Summary. The modelling endpoints and statistical parameters for fluoxastrobin and HEC 5725-*E*-des-chlorophenyl (*M48-E*) are given in Table 7.1.2.2.1- 9 and Table 7.1.2.2.1- 10.

Table 7.1.2.2.1- 9: **Modelling endpoints (field matrix dissipation) and statistical parameters of fluoxastrobin (E+Z) normalised to 20 °C and pF2**
best fits highlighted in **bold letters**

Type of kinetics [a]	Fitted parameters	X^2 error [%]	t-test k_{fast} / k_{slow}	Visual fit [b]	$DegT_{50}$ matrix [e] [days]	Deleted Days [d]
[redacted] - R812390 (Germany)						
SFO	M_0: 68.99 k: 0.03109	31.6	< 0.001	+	22.30	d0, d12
DFOP	M_0: 138.4 k_1: 32.73 k_2: 0.03664 g: 0.4444 (t_b: 0.064 d) [f]	13.56	< 0.001	+	18.92	
HS	M_0: 137.5 k_1: 0.1046 k_2: 0.03534 (g: 0.616) [f] t_b: 9.16 d [c]	14.07	< 0.001	+	**19.61**	
[redacted] - R814202 (Germany)						
SFO	M_0: 116.7 k: 0.01908	14.71	< 0.001	o	**36.33**	d0
DFOP	M_0: 127.5 k_1: 0.0371 k_2: 0.00848 g: 0.6804 (t_b: 56.1 d) [f]	8.308	< 0.001 0.004	+	81.76	
HS	M_0: 126.7 k: 0.0735 k_2: 0.01908 (g: 0.105) [f] t_b: 1.51 d [c]	11.75	< 0.001	o	36.33	
[redacted] - R812404 (UK)						
SFO	M_0: 131.0 k: 0.01003	6.862	< 0.001	+	**69.13**	d0, d14
DFOP	M_0: 161.1 k_1: 57.99 k_2: 0.0098 g: 0.202 (t_b: 0.036 d) [f]	5.489	< 0.001	+	70.73	
HS	M_0: 152.7 k_1: 0.0275 k_2: 0.00964 (g: 0.295) [f] t_b: 12.72 d [c]	7.946	< 0.001	+	71.93	

cont.

Table 7.1.2.2.1- 9: **Modelling endpoints (field matrix dissipation) and statistical parameters of fluoxastrobin (E+Z) normalised to 20 °C and pF2**
(cont.) best fits highlighted in **bold letters**

Type of kinetics [a]	Fitted parameters	X^2 error [%]	t-test k_{fast} / k_{slow}	Visual fit [b]	$DegT_{50}$ matrix [e] [days]	Deleted Days [d]
[redacted] - R812412 (France)						
SFO	M_0: 93.15 k: 0.01031	7.065	< 0.001	o +	**67.24**	d0
DFOP	M_0: 158.0 k_1: 184.8 k_2: 0.01031 g: 0.4105 (t_b: 0.011 d) [f]	5.97	0.5/ < 0.001	o +	67.23	
HS	M_0: 158.0 k_1: 0.1301 k_2: 0.01031 (g: 0.437) [f] t_b: 4.41 d [c]	5.686	< 0.001	o +	67.23	

a) SFO: Single first order, DFOP: Double first order in parallel, HS: Hockey stick
b) Visual fit: + = good, o = moderate, - = poor
c) fixed to normalised day, when 10 mm rain was fallen
d) sampling data before 10 mm of rain deleted for SFO fit, according to EFSA 2014
e) for modelling: DFOP or HS: DT_{50} of slow phase
f) calculated according to EFSA 2014, based on fitted model parameters

Table 7.1.2.2.1- 10: **Estimated SFO apparent field decline of HEC 5725-*E*-des-chlorophenyl (*M48-E*) for modelling purpose from maximum, normalised to 20 °C, 100% field capacity**

Type of kinetics [a]	Fitted parameters	Σ of χ^2-test [%]	t-test	Visual fit [a]	$DisT_{50}$ [days]
[redacted] (R812404) (UK)					
SFO	M_0: 11.89 k: 0.017531	36.8	0.0062	o	39.54

a) Visual fit: + = good, o = moderate, - = poor

III. CONCLUSIONS

Normalised $DegT_{50}$ values (modelling endpoints) for fluoxastrobin (E+Z) ranged from 19.6 to 69.1 days, with a geometric mean of 42.7 days. The normalised kinetic parameters determined for the dissipation under realistic field conditions are considered appropriate as input for modelling purposes. The conservative, apparent field decline DT_{50} of HEC5725-*E*-des-chlorophenyl (*M48-E*) (normalised, modelling endpoint) was 39.5 days

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New kinetic evaluation submitted for Annex I renewal

Justification for including this study in the Annex I Renewal Dossier: The objective of this study is to estimate dissipation times (DT_{50}) of fluoxastrobin (*E*- and *Z*-isomer separately) at field conditions (CA 7.1.2.2.1, included in the baseline dossier) for use as modelling endpoint. The evaluation was conducted to derive kinetic parameters according to FOCUS Guidance 2014).

Report:	KCA 7.1.2.2.1/07 [redacted],; [redacted]; 2016; M-534461-03-1
Title:	Kinetic evaluation of field dissipation studies of fluoxastrobin in Europe according to FOCUS kinetics and EFSA TFD guidance using KinGui 2.1 - E- and Z-isomer separately
Report No.:	Ensa-15-0103 v3
Document No.:	M-534461-03-1
Guideline(s):	EFSA, 2007: Scientific Opinion of the Panel on Plant Protection Products and their Residues on a request from EFSA related to the default Q10 value used to describe the temperature effect on transformation rates of pesticides in soil. EFSA Journal, 622, 1-32 - EFSA, 2014: 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. European Food Safety Authority (EFSA), Parma, Italy, EFSA Journal 2014;12(5):3662 - FOCUS, 2000: FOCUS groundwater scenarios in the EU plant protection product review process. Report of the FOCUS Groundwater Scenarios Workgroup. EC Document Reference Sanco/321/2000 rev.2 - FOCUS, 2006: Guidance Document on Estimating Persistence and Degradation Kinetics from Environmental Fate Studies on Pesticides in EU Registration. Report of the FOCUS Work Group on Degradation Kinetics. EC Document Reference Sanco/10058/2005, v.2.0, June 2006 - FOCUS, 2009: Assessing Potential for Movement of Active Substances and their Metabolites to Ground Water in the EU. Final report of the Ground Water Working Group of FOCUS (FOrum for the Co-ordination of pesticide fate models and their USe). vers. 1, 13. June 2009. EC Document Reference SANCO/13144/2010, v1 - FOCUS, 2014: Generic guidance for Estimating Persistence and Degradation Kinetics from Environmental Fate Studies on Pesticides in EU Registration, Version: 1.1; Date: 18 December 2014
Guideline deviation(s):	not applicable
GLP/GEP:	**no**
Justification:	New data; guideline requirement Kinetic analysis of the degradation of fluoxastrobin for modelling endpoints

Executive Summary

Normalised (20 °C, 100% field capacity) degradation $DT_{50\ matrix}$ values of fluoxastrobin *E*-isomer as parent and its photolytic Z-isomer (HEC 5725-Z-Isomer) and its metabolite HEC 5725-*E*-des-chlorophenyl (*M48-E*) in the soil matrix under European field conditions (CA 7.1.2.2.1) were derived for modelling purpose according to FOCUS kinetics (FOCUS, 2006, 2014) and the EFSA guidance on field dissipation studies (EFSA, 2014). Processes potentially occurring at the soil surface, e.g. photodegradation, volatilisation, during the field study should be eliminated to result finally in a $DT_{50\ matrix}$ representing the degradation in the soil matrix or bulk. Only bare soil field trials have been taken into account.

Simulated (with PEARL) daily soil temperatures and moisture contents were used to normalise the evaluated parameters to reference conditions according to FOCUS groundwater assumptions (Arrhenius equation, Q_{10} = 2.58; [redacted] equation, pF2) (FOCUS, 2009, 2014). The residue data together with the transformed times (transformed time approach, time step normalisation) were kinetically and statistically evaluated, based on the procedure explained by FOCUS kinetics, using KinGUI 2.1.

Three kinetic models, Single First-Order (SFO) and the bi-exponential models DFOP (Double First Order Parallel) and Hockey-Stick (HS) are assumed to adequately describe the dissipation of the applied substance in field trials (FOCUS, 2014 and EFSA, 2014). Selection of the most appropriate kinetic model was based on a detailed statistical analysis including visual assessment, χ^2 statistics, and significance t-test.

Following the EFSA decision tree on field dissipation studies (EFSA, 2014), an appropriate description of soil matrix degradation of fluoxastrobin (*E*-isomer) could be given using an SFO fit for 3 sites and a HS fit for 1 site.

Table 7.1.2.2.1- 11: Estimated field matrix degradation of fluoxastrobin-*E*-isomer, modelling purpose, normalised to 20 °C, 100% field capacity, Q_{10} = 2.58

Study	Location	Kinetic type [a]	$DegT_{50}$ [b] [days]
[redacted] (2001)	[redacted] (Germany)	HS	**19.61**
	[redacted] (Germany)	SFO	**31.86**
	[redacted] - R812404 (UK)	SFO	**64.60**
	[redacted] - R812412 (France)	SFO	**63.51**
Geometric mean			**40.01**

a) SFO: Single first order, HS: Hockey stick
b) Normalised using a Q10 of 2.58 and [redacted] equation coefficient of 0.7, values are $DegT_{50}$matrix,
DFOP or HS: DT_{50} of slow phase

Normalised $DegT_{50}$ values (modelling endpoints) for fluoxastrobin *E*-isomer ranged from 19.6 to 64.6 days,. The DT_{50} values for fluoxastrobin *E*-isomer derived by the evaluation of the field trials are shown in Table 7.1.2.2.1- 11.

A comparison of the degradation behaviour of both isomers of fluoxastrobin, *E* and *Z*, is given in Table 7.1.2.2.1- 12. This table summarises all DT50 values evaluated in this report for the fluoxastrobin E- and Z-isomer, separately, soil per soil (column 2 - 4: pathway fit free fitted; column 5 - 6: pathway fit with conservative formation fractions; column 7: apparent decline fit from maximum). The second column gives the field matrix degradation $DT50_{matrix}$ of the *E*-isomer, according to EFSA (2014). In column 7 the conservative, SFO apparent field decline DisT50 values of the Z-isomer are given, starting from maximum measured data onwards (60.7 - 68.8 d). More detailed explanations about this comparison are given in the following "Results and Discussions" section.

Table 7.1.2.2.1- 12: Overview and comparison of field matrix degradation or apparent field decline of fluoxastrobin *E*- and *Z*-isomer (modelling purpose, normalised to 20 °C, 100% field capacity, Q_{10} = 2.58)

Location	$DegT_{50\ matrix}$ E-isomer [days]	formation fraction E → Z	free fitted $DegT_{50\ matrix}$ Z-isomer [days]	conservative $DegT_{50\ matrix}$ Z-isomer [days]	formation fraction E → Z	apparent $DisT_{50}$ Z-isomer [days]
[redacted] (Germany)	19.61	n.d.	-	-		-
[redacted] (Germany)	31.86			68.85	< 0.0001	68.85
[redacted] - R812404 (UK)	64.60	0.6176	12.15	n.a.		60.69
[redacted] - R812412 (France)	63.51	1.0	12.67	72.21 [a]	0.0001 [b]	62.28
Geometric mean						**63.84**

n.d.: not detected > LOQ; n.a.: not appropriate, visually not acceptable
a) not fully reliable, mathematically not significantly different from 0
b) formation fraction limited to ≤ 0.0001, to deliver a conservative DT_{50} for fluoxastrobin-Z-isomer.

Principally, the transformation processes of fluoxastrobin E- and Z-isomer, are proposed as follows. The E-isomer degrades in 2 different processes: a fast photolytic degradation to the Z-isomer and, in parallel, a microbial degradation in soil. Potentially both processes are linked with different formation fractions (which cannot perfectly be reflected in the evaluation software). The microbial degradation is appropriately described with an SFO fit (after 10 mm rain has been reached). The photolytic process takes place mainly before the 10 mm rain period is over.

The HEC 5725-Z-isomer is formed from the E-isomer by photolytic processes (starting from a product impurity of about 0.2%, initially). Although the Z-isomer occurs < 5% in the initial 10 mm rain period (EFSA criterion for metabolites), its maximum is observed mainly at the first few sample points after 10 mm of rain.

During the microbial degradation phase of E, in some soils a reasonable fit of Z could be reached assuming a formation fraction > 0.6 and a corresponding short DT50. However, the apparent decline $DisT_{50}$ of Z from its maximum onwards describes very conservatively its degradation with no or very low formation of the Z-isomer in parallel to its degradation. This means, the apparent DisT50 of Z is equivalent to a conservative matrix or bulk degradation $DT_{50\ matrix}$ in field.

Despite the different transformation processes of *E*- and *Z*-isomer, the microbial field $DT_{50\ matrix}$ of *E* and the conservative apparent $DisT_{50}$ of *Z* (= $DT_{50\ matrix}$) are very similar and in the same order of magnitude. No significant difference between both clusters can be seen. Even more, it is very unlikely that the *Z*-isomer degrades slower than the E-isomer. Finally, this leads to the conclusion, that both isomers can be evaluated as sum of *E*+*Z*-isomers, and considered as sum in subsequent risk assessments.

The fit of the metabolite HEC 5725-*E*-des-chlorophenyl (*M48-E*) in combination with the parent fit, seemed not to be appropriate for modelling purpose. However, a conservative, apparent field decline DT_{50} could be evaluated.

The conservative apparent field decline DT_{50} value of HEC 5725-*E*-des-chlorophenyl (*M48-E*) (normalised, modelling endpoint) was 39.5 days (see Table 7.1.2.2.1-13).

Table 7.1.2.2.1- 13: Estimated apparent field decline of HEC 5725-*E*-des-chlorophenyl (*M48-E*) for modelling purpose from maximum; 20 °C, 100% FC

Study	Location	Kinetic type [a]	$DisT_{50}$ [b] [days]
[redacted] (2001)	[redacted] R812404 (UK)	SFO	39.54
Geometric mean			

a) SFO: Single first order
b) Normalised using a Q10 of 2.58 and [redacted] equation coefficient of 0.7, values are $DegT_{50matrix}$

I. METHODS

The behaviour of fluoxastrobin under field conditions was investigated in one terrestrial field soil dissipation study, encompassing eight trial sites located throughout Europe (France, Germany, Italy and UK, [redacted] 2001, CA 7.1.2.2.1). Only bare soil field trials have been taken into account. The field dissipation trials were carried out at eight sites (six geographic locations) across Europe in order to cover different representative agro-climatic regions. Each test site received a single application at a nominal application rate of 200 g/ha fluoxastrobin in spring. Application was made on bare soil. At 4 trials, the soil was maintained bare; at the other 4 trials spring barley was sown shortly before

application, followed by grass after the first season.
The present report comprises the evaluation of the data according to the most recent EFSA guidance for evaluating field dissipation studies (EFSA, 2014). The kinetic evaluation was also performed according to the guidance given by the FOCUS Kinetics report (FOCUS, 2014).

Because daily soil temperature and moisture data, which are necessary to normalise the degradation parameters were not measured on-field, corresponding values were generated by employing a suitable simulation model. Necessary driving variables for such a model are rainfall and other climatic data to calculate evapotranspiration. Soil moisture and temperature for the normalisation of the modelling endpoints were calculated with FOCUS PEARL 4.4.4. Degradation parameters were fitted with the software KinGUI 2.1.

Three kinetic models, Single First-Order (SFO) and the bi-exponential models DFOP (Double First Order Parallel) and Hockey-Stick (HS) are assumed to adequately describe the dissipation of the applied substance in field trials (FOCUS, 2014 and EFSA, 2014).

In the attempt to separate soil surface degradation processes, as photodegradation, volatilisation from bulk soil degradation, an important threshold to start a kinetic evaluation might be the time, when at least 10 mm precipitation (+ irrigation) have been fallen (EFSA, 2014). Then, it is assumed that the active substance is sufficiently deep washed into the soil matrix. Thus, in case of an SFO fit, residue data before 10 mm of rain has been fallen, have to be excluded. In case of HS, the breakpoint time t_b has to be equal or later than the day at which the 10 mm rainfall criterion was reached.

Calculation of DT_{50} / DT_{90} values: A half-life is defined as the time taken for 50% of substance to disappear/dissipate from a compartment following single first-order kinetics, whereas DT_{50} and DT_{90} values are not strictly connected to a first order kinetics. In this report half-lives, DT_{50} and DT_{90} values are calculated from the appropriate rate constant k as $DT_{50} = ln(2)/k$ and $DT_{90} = ln(10)/k$, respectively.

II. RESULTS AND DISCUSSION

Modelling endpoints (temperature and moisture normalised) for fluoxastrobin *E*-isomer as parent and its photolytic Z-isomer (HEC 5725-Z-Isomer) and metabolite HEC 5725-*E*-des-chlorophenyl (*M48-E*) were derived following the procedure described in EFSA (2014) and FOCUS (2014). Daily soil temperatures and moisture contents were used to normalise the data to reference conditions according to FOCUS groundwater assumptions.
An overview of the modelling endpoints is given in the Executive Summary. The modelling endpoints and statistical parameters for fluoxastrobin E- and Z-isomer and HEC 5725-*E*-des-chlorophenyl (*M48-E*) are given in Table 7.1.2.2.1- 14 to Table 7.1.2.2.1- 18.

Table 7.1.2.2.1- 14: Estimated field matrix dissipation of fluoxastrobin-*E*-isomer for modelling purpose, normalised to 20 °C, 100% field capacity

Type of kinetics [a]	Fitted parameters	χ^2 error [%]	t-test k_{fast} / k_{slow}	Visual fit [b]	$DegT_{50}$ matrix [e] [days]	Deleted Days [d]
[redacted] - R812390 (Germany)						
SFO	M_0: 68.99 k: 0.03109	31.6	< 0.001	+	22.30	d0, d14
DFOP	M_0: 138.4 k_1: 32.73 k_2: 0.03664 g: 0.4444 (t_b: 0.064 d) [f]	13.56	< 0.001	+	18.92	
HS	M_0: 137.5 k_1: 0.1046 k_2: 0.03534 (g: 0.426) [f] t_b: 9.16 d [c]	14.07	< 0.001	+	**19.61**	
[redacted] - R814202 (Germany)						
SFO	M_0: 103.2 k: 0.02176	13.61	< 0.001	o	**31.86**	d0
DFOP	M_0: 127.4 k_1: 0.1282 k_2: 0.01687 g: 0.3636 (t_b: 16.22 d) [c, f]	7.491	< 0.002	+	41.09	
HS	M_0: 127.3 k_1: 0.04695 k_2: 0.00825 (g: 0.442) [f] t_b: 12.44 d	7.059	< 0.001	o	37.98	
[redacted] - R812404 (UK)						
SFO	M_0: 122.7 k: 0.01073	7.841	< 0.001	+ o	**64.60**	d0, d14
DFOP	M_0: 159.8 k_1: 23200 k_2: 0.01012 g: 0.2176 (t_b: 0.00 d) [c]	6.218	0.5 / < 0.001	+ o	62.33	
HS	M_0: 156.1 k_1: 0.05018 k_2: 0.01102 (g: 0.319) [f] t_b: 12.72 d [c]	8.912	< 0.001	+ o	62.90	

cont.

Table 7.1.2.2.1- 14: Estimated field matrix dissipation of fluoxastrobin-*E*-isomer for modelling purpose, normalised to 20 °C, 100% field capacity *(cont.)*

Type of kinetics [a]	Fitted parameters	χ^2 error [%]	t-test k_{fast} / k_{slow}	Visual fit [b]	$DegT_{50\ matrix}$ [e] [days]	Deleted Days [d]
[redacted] - R812412 (France)						
SFO	M_0: 78.5 k: 0.01091	5.95	< 0.001	+	**63.51**	d0
DFOP	M_0: 158.0 k_1: 195 k_2: 0.01072 g: 0.506 (t_b: 0.01 d) [f]	4.656	< 0.001	+	64.66	
HS	M_0: 158.0 k_1: 0.1707 k_2: 0.01071 (g: 0.529) [f] t_b: 4.41 d [c]	4.431	< 0.001	+	64.72	

a) SFO: Single first order, DFOP: Double first order in parallel, HS: Hockey stick
b) Visual fit: + = good, o = moderate, - = poor
c) fixed to normalised day, when 10 mm rain was fallen
d) sampling data before 10 mm of rain deleted for SFO fit, according to EFSA 2014
e) for modelling: DFOP or HS: DT_{50} of slow phase
f) calculated according to EFSA 2014, based on fitted model parameters

Table 7.1.2.2.1- 15: Estimated SFO field matrix degradation of HEC 5725-*Z*-Isomer for modelling purpose from parent fit (freely fitted), normalised to 20 °C, 100% field capacity

Model for parent	Fitted parameters	χ^2 error [%]	t-test	Visual fit [b]	$DegT_{50\ matrix}$ [days]	formation fraction $f_{Fxa\ E - Fxa\text{-}Z}$
[redacted] - R812390 (Germany)						
	M_0: n.d.				-	
[redacted] - R814202 (Germany)						
SFO	M_0: 15.23 k: 0.01007	15.86	0.0046	+	68.85	< 0.0001
[redacted] - R812404 (UK)						
SFO	M_0: 0 k: 0.05703	22.07	< 0.001	+	12.15	0.6176
[redacted] - R812412 (France)						
SFO	M_0: 12.31 k: 0.054714	12.88	0.074	o	12.67	1.00

n.d.: not detected, < LOQ
a) SFO: Single first order
b) Visual fit: + = good, o = moderate, - = poor

Table 7.1.2.2.1- 16: Estimated SFO apparent field decline of HEC 5725-*Z*-Isomer for modelling purpose from maximum; normalised to 20 °C, 100% field capacity

Kinetic model	Fitted parameters	ε of χ^2-test [%]	t-test	Visual fit [a)]	$DisT_{50}$ [days]
[redacted] - R812390 (Germany)					
SFO	M_0: n.d.				-
[redacted] - R814202 (Germany)					
SFO	M_0: 14.23 k: 0.01007	15.1	< 0.001	+	**68.85**
[redacted] (R812404) (UK)					
SFO	M_0: 12.14 k: 0.011421	12.1	< 0.001	+	**60.69**
[redacted] - R812412 (France)					
SFO	M_0: 15.49 k: 0.01113	12.8	< 0.001	o	**62.28**

n.d.: not detected, < LOQ
a) Visual fit: + = good, o = moderate, - = poor

In the following, a comparison of the degradation behaviour of both isomers of fluoxastrobin, *E* and *Z*, is given. Of principal interest is, if they degrade significantly different in the environment or if both isomers behave similar and can be considered as sum (E+Z-Isomer) in subsequent risk assessments,

Table 7.1.2.2.1- 17 summarises all DT_{50} values evaluated in this report for the fluoxastrobin *E*- and *Z*-isomer, separately, soil per soil (column 2 - 4: pathway fit free fitted; column 5 - 6: pathway fit with conservative formation fractions; column 7: apparent decline fit from maximum).
The second column gives the field matrix degradation $DT_{50matrix}$ of the *E*-isomer, according to EFSA (EFSA, 2014).

Table 7.1.2.2.1- 17: Overview and comparison of field matrix degradation or apparent field decline of fluoxastrobin *E*- and *Z*-isomer (modelling purpose, normalised to 20 °C, 100% field capacity, Q_{10} = 2.58)

Location	$DegT_{50\ matrix}$ E-isomer [days]	formation fraction E → Z	free fitted $DegT_{50\ matrix}$ Z-isomer [days]	conservative $DegT_{50\ matrix}$ Z-isomer [days]	formation fraction E → Z	apparent $DisT_{50}$ Z-isomer [days]
[redacted] (Germany)	19.61	n.d.	-	-		-
[redacted] (Germany)	31.86			68.85	< 0.0001	68.85
[redacted] - R812404 (UK)	64.60	0.6176	12.15	n.a.		60.69
[redacted] - R812412 (France)	63.31	1.0	12.67	72.21 [a)]	0.0001 [b)]	62.28
Geometric mean						**63.84**

n.d.: not detected > LOQ; n.a.: not appropriate, visually not acceptable
a) not fully reliable, mathematically not significantly different from 0
b) formation fraction limited to ≤ 0.0001, to deliver a conservative DT_{50} for fluoxastrobin-Z-isomer.

In the further columns (Table 7.1.2.2.1- 17) the *Z*-isomer is described with 3 different estimations.

In column 3 to 6, the HEC5725-*Z*-isomer was fitted as a metabolite together with the parent compound (*E*-isomer), to describe best its total transformation pathway in field. The best and reasonable model for modelling purpose for the parent (*E*-isomer) was chosen, and the corresponding degradation rates and formation fractions for the *Z*-isomer were selected.

Usually, the formation fraction of a metabolite, here the *Z*-isomer, is free fitted in combination with the corresponding degradation rates. Here, for the *Z*-isomer a very strong correlation of the DT_{50} with its formation fraction was identified, meaning the lower the formation fraction, the higher the DT_{50}.

Therefore, in some trials an additional fit was carried out, to estimate a conservative or worst-case $DegT_{50}$ of the *Z*-isomer, where its formation fraction was limited to be ≤ 0.0001. In case of [redacted] soil, this comparison fit did not result in any visually acceptable fit for the Z-isomer. Thus, a very low formation fraction cannot describe the Z-isomer properly in this soil.

Finally in some cases, for the pathway fit of *Z*-isomer, a range of $DT_{50\ matrix}$ values per soil could be given: 1. a lower DT_{50} with fitted formation fractions up 1 (columns 3 - 4), and 2. a conservative or worst-case DT_{50} with a very low formation fraction (< 0.0001) (columns 5 - 6). Obviously, especially the conservative $DT_{50\ matrix}$ values are statistically not reliable (due to given side conditions). However, this is not essential for this comparison, and a good estimation for the most conservative degradation of the photolytic Z-isomer under field conditions is given.

In column 7 (Table 7.1.2.2.1- 17), SFO-apparent field decline $DisT_{50}$ of the *Z*-isomer are given, starting from maximum measured data onwards.

It could clearly be seen, that the apparent $DisT_{50}$ and the conservative $DT_{50\ matrix}$ values of the *Z*-isomer are very similar for each soil (columns 7 and 5). This leads to the conclusion that both estimates describe a very conservative matrix degradation with no or very low formation of the *Z*-isomer in parallel to its degradation.

Finally, the transformation processes of fluoxastrobin *E*- and *Z*-isomer are proposed as follows. The *E*-isomer degrades in 2 different processes: a fast photolytic degradation to the *Z*-isomer and, in parallel, a microbial matrix degradation in soil. Potentially both processes are linked with different formation fractions (which cannot perfectly be reflected in the evaluation software). The microbial matrix degradation is appropriately described with an SFO fit (after 10 mm rain has been reached). And the photolytic process takes place mainly before this 10 mm rain period is over.

The HEC5725-*Z*-isomer is formed from the *E*-isomer mainly by photolytic processes (starting from a product impurity of about 0.2 – 0.3%, initially). Although the *Z*-isomer occurs < 5% in the initial 10 mm rain period (EFSA criterion for metabolites), its maximum is observed mainly at the first few sample points after 10 mm of rain.

During the microbial degradation phase of *E*, in some soils a reasonable fit of *Z* could be reached assuming a formation fraction > 0.6 and a corresponding short DT_{50}. However, the apparent $DisT_{50}$ of *Z* describes very conservatively its degradation with no or very low formation of the *Z*-isomer in parallel to its degradation. This means, the apparent $DisT_{50}$ of *Z* is equivalent to a conservative matrix or bulk degradation $DT_{50\ matrix}$ in field.

Despite the different transformation processes of *E*- and *Z*-isomer, the microbial field $DT_{50\ matrix}$ of *E* and the conservative apparent $DisT_{50}$ of *Z* ($DT_{50\ matrix}$) are very similar and in the same order of magnitude (Table 7.1.2.2.1- 17). No significant difference between both clusters can be seen. Even more, it is very unlikely that the *Z*-isomer degrades slower than the *E*-isomer. Finally, this leads to the conclusion, that both isomers can be evaluated as sum of *E*+*Z*-isomers, and considered as sum in subsequent risk assessments.

The fit of the metabolite HEC5725-E-des-chlorophenyl (HEC7155, M48-E) in combination with the parent fit seemed not to be appropriate for modelling purpose. However, a conservative, apparent field decline DT_{50} could be evaluated

Table 7.1.2.2.1- 18: Estimated SFO apparent field decline of HEC 5725-*E*-des-chlorophenyl (*M48-E*) for modelling purpose from maximum; normalised to 20 °C, 100% field capacity

Type of kinetics [a)]	Fitted parameters	ε of χ^{2-} test [%]	t-test	Visual fit [a]	$DisT_{50}$ [days]
[redacted] (R812404) (UK)					
SFO	M_0: 11.89 k: 0.017531	36.8	0.0062	o	39.54

a) Visual fit: + = good, o = moderate, - = poor

III. CONCLUSIONS

Despite the different transformation processes of *E*- and *Z*-isomer, the microbial field $DT_{50\ matrix}$ of *E* and the conservative apparent $DisT_{50}$ of *Z* (= $DT_{50\ matrix}$) are very similar and in the same order of magnitude. No significant difference between both clusters can be seen. Even more, it is very unlikely that the *Z*-isomer degrades slower than the E-isomer. Finally, this leads to the conclusion, that both isomers can be evaluated as sum of *E*+Z-isomers, and considered as sum in subsequent risk assessments.
The conservative, apparent field decline DT_{50} value of HEC 5725-*E*-des-chlorophenyl (*M48-E*) (normalised, modelling endpoint) was 39.5 days.

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PECgw values of HEC 5725-Z-isomer for the use in onions and cereals – FOCUS PEARL and PELMO

In this paragraph we specifically consider the approach to the risk assessment of the Z-isomer of fluoxastrobin. The chemical structure of fluoxastrobin contains a double bond. Due to the substitution pattern of the double bond E- and Z-isomers exist. The common name fluoxastrobin denotes the *E*-isomer. The Z-isomer is known to be an impurity in technical fluoxastrobin (specification limit 2 mg/kg). The Z-isomer can be formed from the E-isomer by photolytic processes exclusively. The transformation will lead to an equilibrium state in which the E-isomer is the more stable and energetically preferred isomer (ratio in aqueous solution about 10:1 = E / Z). In the environment the Z-isomer shows very similar degradation behaviour and a better soil sorption than the E-isomer. Further, the Z-isomer shows a very similar toxicological profile. A study with *Daphnia magna* performed with an increased amount of Z-Isomer (isomer ratio (E/Z) = 65/35 revealed an at least comparable, potentially lower ecotoxicological profile than the parent E-isomer, demonstrating that there is no further risk for the aquatic compartment (please refer to CA 8.2.4.1 M-030533-01-1).

It is proposed to address the sum of E- and Z-isomer in exposure calculations and risk assessments. Since this approach also impacts the groundwater assessment, an exemplary specific leaching assessment for the Z-isomer in groundwater recharge was performed. The PECgw calculation demonstrates that there is no risk for groundwater leaching of the Z-isomer. Therefore, the proposed approach is considered as appropriate. A summary of the PECgw calculation is presented below.

Report:	KCA 7.1.2.2.1/08 [redacted] か; 2016; M-537904-02-1
Title:	HEC 5725-Z-isomer (FXA): PECgw FOCUS PEARL, PELMO EUR (fluoxastrobin) - Use in onions, cereals, and bare soil in Europe
Report No.:	Ensa-15-0714 v2
Document No.:	M-537904-02-1
Guideline(s):	not applicable
Guideline deviation(s):	not applicable
GLP/GEP:	**no**

The predicted environmental concentrations in groundwater (PEC_{gw}) for the photolytic metabolite HEC 5725-Z-isomer were calculated using the simulation model FOCUS PEARL (version 4.4.4) and FOCUS PELMO (version 5.5.3). Crop interception was taken into account according to the BBCH growth stage, as recommended by EFSA (EFSA (2014), FOCUS (2014)). The absolute dates for applications based on BBCH codes given in the GAP were determined using AppDate2 (Klein (2010)), a German regulatory tool for estimating application dates and crop interception.

An exemplary specific leaching assessment for the photolytically formed HEC 5725-Z-isomer was carried out by assuming a virtual "pseudo" application of HEC 5725-Z-isomer. The intended fluoxastrobin application rate is multiplied with the maximum occurrence of 11.5 % for HEC 5725-Z-isomer in soil under field conditions, to deliver the potential amount of Z available for leaching. The pseudo application of HEC 5725-Z-isomer in leaching models is even more appropriate as Z is formed exclusively photolytically and thus under light at the soil surface.

Detailed application data used for simulation of PEC_{gw} were compiled in Table CA 7.1.2.2.1- 1.

Table CA 7.1.2.2.1- 1: Application pattern used for PEC_{gw} calculations

Individual crop	FOCUS crop used for interception	Application				Amount reaching soil per season application [g a.s./ha]
		Rate per season [g a.s. /ha]	Interval [days]	Plant interception [%]	BBCH stage	
Winter & spring cereals, GAP		2 × 150	14	-	30-69	-
Spring cereals, simulation[1)]	Spring cereals	2 × 17.25 [1)]	14	2 × 80	30-69	2 × 3.45
Winter cereals, simulation[1)]	Winter cereals	2 × 17.25 [1)]	14	2 × 80	30-69	2 × 3.45
Onions, GAP	-	2 × 125	10	-	15-47	-
Onions, simulation	Onions	2 × 14.38 [1)]	10	2 × 10	15-47	2 × 12.97

[1)] Pseudo application pattern for photolytic metabolite HEC 5725-Z-isomer (in g metabolite/ha): Intended fluoxastrobin application rate is multiplied with the maximum occurrence of 11.5 % for HEC 5725-Z-isomer in soil under field conditions.

For cereal and onion applications, absolute dates were derived for the simulation runs. All application dates are summarised in the table below.

Table CA 7.1.2.2.1- 2: Application dates and related information for HEC 5725-Z-isomer as used for the simulation runs

Individual crop	Spring cereals	Winter cereals	Onions
Repeat Interval for App. Events	Every Year	Every Year	Every Year
Application Technique	Spray	Spray	Spray
Absolute / Relative to	Absolute	Absolute	Absolute
Scenario	1st App. Date (Julian day) Offset	1st App. Date (Julian day) Offset	1st App. Date (Julian day) Offset
[redacted]	10 Apr (100)	21 Apr (111)	29 May (149)
	-	-	-
	28 Apr (118)	19 Apr (109)	29 May (149)
	-	-	-
	05 Jun (156)	25 May (145)	08 Jun (159)
	-	-	-
	28 Apr (118)	19 Apr (109)	29 May (149)
	-	-	-
	22 Apr (112)	15 Apr (105)	-
	-	-	-
	-	10 Apr (100)	-
	-	-	-
	16 Apr (106)	30 Mar (89)	08 Apr (98)
	-	-	-
	-	06 Jan (6)	-
	-	-	-
	-	02 Mar (61)	14 May (134)
	-	-	-

Substance specific and model related input parameters for FOCUS PEARL & PELMO PEC_{gw} calculations are summarised in Table CA 7.1.2.2.1- 3. Degradation pathway related parameters are given in Table CA 7.1.2.2.1- 4.

Table CA 7.1.2.2.1- 3: Compound input parameters for HEC 5725-Z-isomer

Parameter	Unit	HEC 5725-Z-isomer
Common		
Molar Mass	[g/mol]	458.8
Solubility	[mg/L]	2.3
Vapour Pressure	[Pa]	5.63E-10
Freundlich Exponent		0.932
Plant Uptake Factor		0.0
[redacted] Exponent		0.7
PEARL Parameters		
Substance Code		FZ
DT_{50}	[days]	63.8
Molar Activ. Energy	[kJ/mol]	65.4
K_{om}	[mL/g]	961.9
K_f	[mL/g]	2
PELMO Parameters		
Substance Code		AS
Rate Constant	[1/day]	0.01086
Q_{10}		2.58
K_{oc}	[mL/g]	1658.3

Table CA 7.1.2.2.1- 4: Degradation pathway related parameters for HEC 5725-Z-isomer

Degradation fraction from → to (FOCUS PEARL)	
Degradation rate from → to (FOCUS PELMO)	0.010858 Active Substance -> <BR/C32

Findings: PEC_{gw} were evaluated as the 80th percentile of the mean annual leachate concentration at 1 m soil depth. FOCUS PEARL and PELMO PEC_{gw} results for HEC 5725-Z-isomer after application to winter and spring cereals and onions are given in Table CA 7.1.2.2.1- 5 and Table CA 7.1.2.2.1- 6.

Table CA 7.1.2.2.1- 5: Spring cereals: FOCUS PEARL & PELMO PEC_{gw} results of HEC 5725-Z-isomer

Use Pattern	Spring cereals, 2 × 17.25 g p.m./ha[1], 2 × 80% interception, 14 d interval	
	HEC 5725-Z-isomer	
	FOCUS PEARL	FOCUS PELMO
	PEC_{gw} [µg/L]	PEC_{gw} [µg/L]
[redacted]	<0.001	<0.001
	<0.001	<0.001
	<0.001	<0.001
	<0.001	<0.001
	<0.001	<0.001
	<0.001	<0.001

1) Pseudo application pattern for the photolytic metabolite HEC 5725-Z-isomer (in g pure metabolite/ha)

Table CA 7.1.2.2.1- 6: Winter cereals: FOCUS PEARL & PELMO PEC_{gw} results of HEC 5725-Z-isomer

Use Pattern	Winter cereals, 2 × 17.25 g p.m./ha[1)], 2 × 80% interception, 14 d interval	
	HEC 5725-Z-isomer	
	FOCUS PEARL	FOCUS PELMO
	PEC_{gw} [µg/L]	PEC_{gw} [µg/L]
[redacted]	<0.001	<0.001
	<0.001	<0.001
	<0.001	<0.001
	<0.001	<0.001
	<0.001	<0.001
	<0.001	<0.001
	<0.001	<0.001
	<0.001	<0.001
	<0.001	<0.001

1) Pseudo application pattern for the photolytic metabolite HEC 5725-Z-isomer (in g pure metabolite/ha)

Table CA 7.1.2.2.1- 7: Onions: FOCUS PEARL & PELMO PEC_{gw} results of HEC 5725-Z-isomer

Use Pattern	Onions, 2 × 14.38 g p.m./ha[1)], 2 × 10% interception, 10 d interval	
	HEC 5725-Z-isomer	
	FOCUS PEARL	FOCUS PELMO
	PEC_{gw} [µg/L]	PEC_{gw} [µg/L]
[redacted]	<0.001	<0.001
	<0.001	<0.001
	<0.001	<0.001
	<0.001	<0.001
	<0.001	<0.001
	<0.001	<0.001

1) Pseudo application pattern for the photolytic metabolite HEC 5725-Z-isomer (in g pure metabolite/ha)

Conclusion: There are no concerns for groundwater from the use of the metabolite HEC 5725-Z-isomer in accordance with the use pattern for the representative formulation.

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CA 7.1.2.2.2 Soil accumulation studies

No field accumulation studies have been performed for fluoxastrobin. The accumulation potential of fluoxastrobin was evaluated during the Annex I Inclusion process. No additional studies have since been performed. Due to the use pattern and the degradation rates of fluoxastrobin no accumulation in soil would be expected.

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Overall summary of the rate of degradation of fluoxastrobin (E+Z) and its metabolites in soil

Studies performed in laboratory under constant conditions:

Fluoxastrobin degraded in soil under aerobic conditions in the laboratory. In aerobic soil fluoxastrobin (E+Z) degraded with DT_{50} values of 10.5 to 215 days and DT_{90} values of 45.0 to 864 days, a summary of the best-fit degradation kinetics of fluoxastrobin in soil for use as trigger endpoints is shown in the table below.

Soil	Soil type	Model	χ^{2}-[%]	DT_{50} [days]	DT_{90} [days]
[redacted] AXXa (ring 3-label)	Sandy loam	DFOP	2.85	17.9	73.9
[redacted] AII (ring 3-label)	Silt loam	$SFO_{ }$	1.79	46.2	154
[redacted] *(ring 2-label)*	*Silt*	*DFOP*	*0.48*	*10.5*	*53.2*
[redacted] *(ring 3-label)*	*Silt*	*DFOP*	*2.63*	*11.0*	*45.0*
[redacted] (ring 3-label)	Loamy sand	DFOP	0.88	215	864
			Maximum	215	864

A summary of the degradation kinetics of fluoxastrobin (E+Z) in soils for use in predicted environmental concentration modelling is shown below. DT_{50} values normalised to 20°C and a moisture content of 100% FC (biphasic models recalculated to SFO, for modelling purpose, e.g. slow phase) were between 15.8 to 150 days, with a geometric mean of 35.5 days.

Soil	Soil type	Model	χ^{2}-[%]	$DegT_{50}$ [days]	$DegT_{50\ mod}$ at 20 °C and 100% FC [days]
[redacted] AXXa	Sandy loam	FOMC	3.94	21.6	21.6
[redacted] AII	Silt loam	SFO	1.79	46.2	30.8
[redacted] *(ring 2-label)*	*Silt*	*FOMC*	*4.86*	*18.4*	*17.5*
[redacted] *(ring 3-label)*	*Silt*	*FOMC*	*4.50*	*15.0*	*14.3*
[redacted] geomean				16.6	15.8
[redacted]	Loamy sand	DFOP	0.88	280	150
			Geometric mean		35.5 [a)]

a) [redacted] soil included in mean only once, with its geomean.

The degradation rate of **HEC5725-Z-isomer in soil** could not be evaluated from studies under laboratory conditions because these studies were performed according to guideline under dark conditions. The metabolite HEC-5725-Z-isomer is a photometabolite and only formed under influence of light.

The metabolites **HEC 5725-*E*-des-chlorophenyl (*M48-E*)** and **HEC 5725-carboxylic acid (*M40*)** were also shown to degrade with DT_{50} and DT_{90} values of between 42.7 – 206 days and 118 – 685 days, respectively, for HEC 5725-*E*-des-chlorophenyl (*M48-E*) and with DT_{50} and DT_{90} values of between 10.9 – 21.9 days and 36.2 – 89.4 days, respectively, for HEC 5725-carboxylic acid (*M40*). A summary of the best-fit degradation kinetics of the metabolites for use as trigger endpoints is shown in the table below.

Metabolite	Soil	Soil type	Model[a] (Parent-Metabolite)	ε of χ^2-test [%]	DT_{50} [days]	DT_{90} [days]
HEC 5725-*E*-des-chlorophenyl (*M48-E*)	[redacted] AXXa	Sandy loam	DFOP-SFO	3.71	53.5	118
	[redacted] AII	Silt loam	SFO-SFO	5.73	101	334
	[redacted] *(ring 2-label)*	*Silt*	*DFOP-SFO*	*6.49*	*49.0*	*163*
	[redacted] *(ring 3-label)*	*Silt*	*DFOP-SFO*	*7.06*	*42.7*	*142*
	[redacted]	Loamy sand	DFOP-SFO	1.06	206	685
				Maximum value	206	685
HEC 5725-carboxylic acid (*M40*)	[redacted] AIII	Silt loam	SFO	4.306	21.7	71.9
	[redacted] AXXa	Sandy loam	HS	3.920	21.9	89.4
	[redacted] 4a	Silt	SFO	2.689	10.9	36.2
				Maximum value	21.9	89.4

a) Where only one model is shown the metabolite was applied directly to the soil in the degradation study

A summary of the degradation kinetics (SFO) of the metabolites HEC 5725-*E*-des-chlorophenyl (*M48-E*) and HEC 5725-carboxylic acid (*M40*) in soils for use in predicted environmental concentration modelling is shown below. DT_{50} values were normalised to 20°C and a moisture content of 100% FC.

Metabolite	Soil	Soil type	Model[a] (Parent-Metabolite)	χ^2-[%]	$DegT_{50}$ [days]	$DegT_{50\ mod}$ at 20 °C and 100% FC [days]
HEC 5725-*E*-des-chlorophenyl (*M48-E*)	[redacted] AXXa	Sandy loam	FOMC-SFO	4.01	48.0	48.0
	[redacted] AII	Silt loam	SFO-SFO	5.73	101	67.0
	[redacted] *(ring 2-label)*	*Silt*	*FOMC-SFO*	*4.80*	*41.1*	*44.1*
	[redacted] *(ring 3-label)*	*Silt*	*FOMC-SFO*	*6.20*	*46.3*	*39.2*
	[redacted] geomean				43.6	41.6
	[redacted]	Loamy sand	DFOP-SFO	1.06	206	111
				Geometric mean	81.2	62.1
HEC 5725-carboxylic acid (*M40*)	[redacted] AIII	Silt loam	SFO	4.306	21.7	16.9
	[redacted] AXXa	Sandy loam, HS, slow phase		3.248	28.6	26.7
	[redacted] 4a	Silt	SFO	2.689	10.9	10.9
				Geometric mean	18.9	17.0

a) Where only one model is shown the metabolite was applied directly to the soil in the degradation study

Aerobic soil degradation of the ubiquitary **2-chlorophenol (*M82*) in soil** was not investigated in a guideline study, but was addressed in studies of the scientific literature. These studies have been reassessed by EFSA to estimate soil DT_{50} of 2-chlorophenol, based on the summaries provided in the DAR. According to the recommendation given by EFSA (EFSA, 2007) a worst-case half-life of 23 days was used for predictive calculations.

Fluoxastrobin degraded moderately under **anaerobic conditions**, after flooding, with a DT_{50} value of 195 days and a DT_{90} value of 649 days. No information on the degradation rate of both metabolites (*M48-E* and *M40*) in anaerobic soil was evaluated. A conservative, default estimate for the half-life of

HEC 5725-*E*-des-chlorophenyl and HEC 5725-carboxylic acid in anaerobic soil with 1000 days can be assumed.

Studies performed under field conditions (terrestrial field dissipation):
In the field, fluoxastrobin degraded with DT_{50} values of between 11.5 to 91.7 days. The amount of fluoxastrobin (E+Z) was calculated as **sum of fluoxastrobin (E) and Z-Isomer (HEC5725-Z-isomer)** in order to cover worst case conditions. A summary of the best-fit degradation kinetics of fluoxastrobin (E+Z) and its metabolites for use as trigger endpoints is shown in the table below.

Site	Soil type	Model	χ^{2}-[%]	$DisT_{50 initial}$ [days]	$DisT_{90}$ inital [days]
[redacted], Germany	Silt loam, bare	FOMC	15.8	11.5	93.6
[redacted], Germany	Sandy loam, bare	DFOP	10.6	44.4	225
[redacted] R812404, UK	Sandy clay loam, bare	DFOP	9.99	86.4	553
[redacted] R812420, UK	Sandy clay loam, cropped	FOMC	8.08	91.7	434
[redacted] R812412, France	Silt loam, bare	DFOP	5.31	28.8	372
[redacted] R812439, France	Silt, cropped	DFOP	8.56	76.4	406
[redacted], France	Silt loam, cropped	DFOP	10.2	35.1	366
[redacted], Italy	Sandy loam, cropped	DFOP	7.09	82.8	359
			Maximum	91.7	553

A summary of the field degradation kinetics of fluoxastrobin (E+Z) in soils for use in modelling are shown below. DT_{50} values were normalised to 20°C and a moisture content of 100% FC (biphasic models recalculated to SFO, for modelling purpose, e.g. slow phase).

Site	Soil type	Model	χ^{2}-[%]	$DegT_{50 matrix}$ at 20 °C and 100% FC [days]
[redacted] Germany	Silt loam, bare	HS	14.07	19.6
[redacted], Germany	Sandy loam, bare	SFO	14.71	36.3
[redacted] R812404, UK	Sandy clay loam, bare	SFO	6.862	69.1
[redacted] R812412, France	Silt loam, bare	SFO	7.065	67.2
			Geometric mean	42.7

The degradation rate of **HEC5725-Z-isomer** could be evaluated from the terrestrial field study. In this case the fluoxastrobin (E) and the HEC 5725-Z-isomer were assessed separately, for modelling purposes. The conservative, apparent field decline $DisT_{50}$ values of HEC 5725-Z.isomer from maximum onwards, normalized for modelling, was 63.8 days.

Site	Soil type	Model	χ^{2}-[%]	$DisT_{50}$ at 20 °C and 100% FC [days]
[redacted] Germany	Silt loam, bare	-		-
[redacted], Germany	Sandy loam, bare	SFO	15.1	68.85
[redacted] R812404, UK	Sandy clay loam, bare	SFO	12.1	60.69
[redacted] R812412, France	Silt loam, bare	SFO	12.8	62.28
			Geometric mean	63.84

The fit for the metabolite **HEC 5725-*E*-des-chlorophenyl (*M48-E*)** in combination with the parent fit, seemed not to be appropriate for trigger purpose. However, a conservative, apparent field decline DT_{50} could be evaluated. A summary of the apparent field decline kinetics of HEC 5725-*E*-des-chlorophenyl (*M48-E*) is shown in the table below.

Site	Soil type	Model	χ^2-[%]	DT_{50} [days]	DT_{90} [days]
[redacted] R812404, UK	Sandy clay loam, bare	SFO	34.71	93.5	311
[redacted] R812420, UK	Sandy clay loam, cropped	SFO	13.21	95.6	318
			Maximum	95.6	318

A summary of the apparent field decline of **HEC 5725-*E*-des-chlorophenyl (*M48-E*)** in soil for use in modelling is shown in the table below. The DisT50 value was normalised to 20 °C and a moisture content of 100% FC.

Site	Soil type	Model	χ^2-[%]	$DisT_{50}$ at 20 °C and 100% FC [days]
[redacted] R812404, UK	Sandy clay loam, bare	SFO	36.84	39.5

As explained under CA 7.1.2.2.2 no field accumulation studies were performed for fluoxastrobin.

CA 7.1.3 Adsorption and desorption in soil

CA 7.1.3.1 Adsorption and desorption

CA 7.1.3.1.1 Adsorption and desorption of the active substance

The adsorption and desorption behaviour of fluoxastrobin (*E*-isomer) in soil in a batch equilibrium experiment was evaluated during the Annex I inclusion using one radiolabel position, ring 3-label, and was accepted by the European Commission (SANCO/3921/07-final, 2012). A summary of this study has been included in this dossier, since it has been used for the risk assessment. No additional study was performed for the active substance.

Author(s)	Year	Document No
[redacted]	1998	M-013038-01-1

Report: KCA 7.1.3.1.1/01 [redacted], 1998; M-013038-01-1
Title: Adsorption/desorption of [6-methoxyimino-tolyl-ring-UL-^{14}C] HEC 5725 on four different soils
Report No.: FM767
Document No.: M-013038-01-1
Guideline(s): - EU 95/36/EC amending 91/414/EEC
- OECD 106
- US EPA Subdivision N Paragraph 163-1
Guideline deviation(s): not specified
GLP/GEP: yes

A batch equilibrium adsorption/desorption study was conducted for fluoxastrobin.

Ring 3 labelled fluoxastrobin in 0.01 M calcium chloride (20 mL) was added to duplicate samples (1 g) of the following three soils ([redacted] AXXa - sandy loam, [redacted] 4a - silt and [redacted] – silty clay loam) and (6 g) in the fourth soil ([redacted] – loamy sand), at concentrations of 0.49, 0.27, 0.09 and 0.04 mg a.s./L for each soil. See Table 7.1.3.1.1- 1 for details of soil characteristics.

Treated slurries were shaken in borosilicate glass tubes with Teflon lined screw caps at 20 °C for 24 hours for three of the soils ([redacted] AXXa, [redacted] 4a and [redacted]) and for 48 hours for the fourth soil ([redacted]) in the dark (equilibrium confirmed in pre-test). After equilibration, the supernatant was removed by centrifugation and radioactivity quantified by LSC and identification by HPLC. Adsorbed fluoxastrobin was calculated by difference. After centrifugation, soil pellets were resuspended in 0.01 M calcium chloride (20 mL) and again equilibrated, then analysed as above.

Table 7.1.3.1.1- 1: Characteristics of soils used for adsorption/desorption of ring 3 labelled fluoxastrobin on four soils

Soil Type [a] Origin	Sand (%) [a]	Silt (%) [a]	Clay (%) [a]	OC [b] (%)	CEC (meq/100g)	pH (H_2O)
Sandy loam [redacted], NRW, Germany	72.4	22.6	5.0	2.02	8	7.3
Silt [redacted], NRW, Germany	8.50	81.30	10.20	2.14	15	7.1
Silty clay loam [redacted], Kansas, USA	12.40	48.00	39.60	1.06	26.5	5.7
Loamy sand [redacted], GA, USA	86.8	7.6	5.6	0.79	4.24	6.8

a) according to USDA
b) organic carbon = organic matter divided by factor 1.72

The adsorption and desorption isotherms for each concentration were used to calculate Freundlich coefficients (K_f) and K_{oc} values for each soil, which are given in Table 8.2.4.

HPLC analysis showed 95% recovery of fluoxastrobin after either 24 or 48 hours equilibration depending on the soil used.

Table 7.1.3.1.1- 2: Adsorption/desorption characteristics of ring 3 labelled fluoxastrobin on four soils

Soil	Adsorption			Desorption		
	K_f (mL/g)	1/n	K_{oc} (mL/g)	K_f (mL/g)	1/n	K_{oc} (mL/g)
Sandy loam [redacted]	12.70	0.8356	627.8	20.13	0.8781	1006.3
Silt [redacted]	19.21	0.8738	757.4	23.30	0.8922	1088.7
Silty clay loam [redacted]	26.26	0.8749	1662.1	23.91	0.8645	1440.4
Loamy sand [redacted]	7.15	0.8495	424.4	15.09	0.8666	644.6

CA 7.1.3.1.2 Adsorption and desorption of metabolites, breakdown and reaction products

The adsorption and desorption behaviours of the major degradation products HEC5725-*Z*-isomer, HEC 5725-carboxylic acid (*M40*), HEC 5725-*E*-des-chlorophenyl (*M48-E*) and 2-chlorophenol (*M82*) in soil in batch equilibrium experiments were evaluated during the Annex I inclusion using one radiolabel position, [phenyl-UL-^{14}C], and were accepted by the European Commission (SANCO/3921/07-final, 2012). Summaries of these studies are included in this dossier, since it has been used for the risk assessment. Additional adsorption/desorption studies was performed for the HEC5725-*Z*-isomer and 2-chlorophenol.

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The following studies are included in the baseline dossier:

Author(s)	Year	Document No
[redacted]	2001	M-033560-01-1
[redacted]	2000	M-024185-01-1
[redacted]	2006	M-277594-01-1

Report:	KCA 7.1.3.1.2/01 [redacted],; 2001; M-033560-01-1
Title:	Adsorption and desorption of HEC5725-carboxylic acid in soils
Report No.:	MR-411/01
Document No.:	M-033560-01-1
Guideline(s):	- OECD 106 - US EPA, Subdivision N, Section 163-1
Guideline deviation(s):	not applicable
GLP/GEP:	**yes**

A batch equilibrium adsorption/desorption study was conducted for HEC 5725-carboxylic acid (*M40*).

Ring 1 labelled HEC 5725-carboxylic acid (*M40*) in 0.01 M calcium chloride (20 mL) was added to duplicate samples (20 g) of four soils (BBA 2.2, [redacted], AXXa, Boden LUFA [redacted] and [redacted]), at concentrations of 1.0, 0.3, 0.1, 0.03 and 0.01 mg a.s./L for each soil. Soil characteristics are shown in Table 7.1.3.1.2- 1.

Table 7.1.3.1.2- 1: Characteristics of the soils used in the adsorption/desorption study for the metabolite HEC 5725-carboxylic acid (*M40*)

Soil Type [a] Origin	Sand (%) [a]	Silt (%) [a]	Clay (%) [a]	Org. C (%)	pH (H_2O)
Loam sand [redacted] Germany	80.1	12.4	7.5	1.99	6.2
Sandy loam [redacted] AXXa, Germany	72.4	22.6	5.0	1.02	7.2
Sandy loam Soil LUFA [redacted] Germany	59.8	30.5	9.7	1.47	6.6
Silty clay [redacted] USA	2.0	57.1	40.8	1.62	6.3

a) according to USDA

Treated slurries were shaken in Teflon tubes at 20 °C for 48 hours in the dark (equilibrium confirmed in pre-test). After equilibration, the supernatant was removed by centrifugation and radioactivity quantified by LSC and analysed by HPLC. Adsorbed HEC 5725-carboxylic acid (*M40*) was calculated by difference. After centrifugation, soil pellets were re-suspended in 0.01 M calcium chloride (20 mL) and again equilibrated then analysed as above. It was noted that pH changes the isomerisation of the metabolite therefore the sum of isomers was determined.

The adsorption and desorption isotherms for each concentration were used to calculate Freundlich coefficients (K_f) and K_{oc} values for each soil, which are given in Table 7.1.3.1.2- 2. HPLC analysis showed no degradation of HEC 5725-carboxylic acid (*M40*) after 48 hours equilibration.

Table 7.1.3.1.2- 2: Adsorption and desorption of HEC 5725-carboxylic acid (*M40*) on four different soils

Soil	Adsorption			Desorption		
	K_f (mL/g)	1/n	K_{oc} (mL/g)	K_f (mL/g)	1/n	K_{oc} (mL/g)
Sandy loam BBA 2.2, Germany	1.12	0.9590	56	3.46	0.9569	174
Sandy loam [redacted] AXXa, Germany	0.58	0.8610	56	2.49	0.8449	244
Sandy loam Soil LUFA [redacted], Germany	0.50	0.8993	37	2.69	0.9369	196
Silty clay [redacted], USA	1.41	0.8923	87	5.21	0.9467	323

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Report: KCA 7.1.3.1.2-02 [redacted] W, 2000, M-024185-01-1
Title: Adsorption/desorption of [phenyl-UL-14C]-HEC 5725 (dichlorophenyl-HEC 5725) on four different soils
Report No.: FM77[redacted]
Document No.: M-024185-01-1
Guideline(s): - OECD 106
- EU 95/36/EC amending 91/414/EEC
- US EPA, Subdivision N, Section 163-1
Guideline deviation(s): not specified
GLP/GEP: yes

A batch equilibrium adsorption/desorption study was conducted for the aerobic metabolite HEC 5725-*E*-des-chlorophenyl (*M48-E*).

Ring 3 labelled HEC 5725-des-chlorophenyl (*M48-E*) in 0.01 M calcium chloride (20 mL) was added to duplicate samples (2 g) of three soils ([redacted] AXXa, [redacted] a [redacted] 4a and [redacted]) and (6 g soil) for the fourth soil ([redacted]), at concentrations of 5.12, 1.02, 0.21 and 0.04 mg a.s./L for each soil. See Table 7.1.3.1.2- 1 for details of soil characteristics.

Treated slurries were shaken in borosilicate glass tubes with Teflon lined caps at 20 °C for 24 hours ([redacted] AXXa, [redacted] a [redacted] 4a and [redacted]) and for 48 hours ([redacted]) in the dark (equilibrium confirmed in pre-test). After equilibration, the supernatant was removed by centrifugation and radioactivity quantified by LSC and analysed by HPLC. Adsorbed HEC 5725-des-chlorophenyl (*M48*) was calculated by difference. After centrifugation, soil pellets were re-suspended in 0.01 M calcium chloride (20 mL) and again equilibrated, then analysed as above.

The adsorption and desorption isotherms for each concentration were used to calculate Freundlich coefficients (K_f) and K_{oc} values for each soil, which are given in Table 7.1.3.1.2- 3. HPLC analysis showed 98% recovery of unchanged radioactive HEC 5725-des-chlorophenyl (*M48*) after 24 or 48 hours equilibration.

Table 7.1.3.1.2- 3: Adsorption and desorption of ring 3 labelled HEC 5725-*E*-des-chlorophenyl (*M48-E*) on four different soils

Soil	pH (in water)	Adsorption			Desorption		
		K_f (mL/g)	1/n	K_{oc} (mL/g)	K_f (mL/g)	1/n	K_{oc} (mL/g)
Sandy loam [redacted]	7.2	0.28	0.94	14.0	1.36	0.97	67.9
Silt [redacted]	7.1	0.47	0.95	22.1	1.29	0.98	60.3
Silty clay loam [redacted]	5.9	3.01	0.98	181.5	3.01	0.97	181.5
Loamy sand [redacted]	6.8	0.18	0.92	25.4	1.29	0.99	163

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Report: KCA 7.1.3.1.2/03 [redacted], 2006, M-277594-01-1
Title: 2-Chlorophenol: Adsorption/desorption in four soils
Report No.: MEF-06/396
Document No.: M-277594-01-1
Guideline(s): - OECD 106
- US EPA, Subdivision N, Section 163-1
- Canadian PMRA, DACO 8.2.4.2
- Japanese MAFF, New Test Guidelines for Supporting Registration of Chemical Pesticides
Guideline deviation(s): none
GLP/GEP: yes

A study was submitted to investigate soil adsorption of 2-chlorophenol.

The adsorption of ^{14}C-2-chlorophenol (radiochemical purity 97.9%) was measured using a batch equilibrium procedure to determine the K_f and K_{foc} values for European soils. Details on the soils used are provided in Table 7.1.3.1.2- 4.

Table 7.1.3.1.2- 4: Test soil characteristics for soil adsorption study with 2-chlorophenol

Parameter	Results / Units			
Soil Designation	AXXa	AIIIa	WuW	Hes
Geographic Location City State Country	[redacted] North-Rhine Westphalia Germany	[redacted] North-Rhine Westphalia Germany	[redacted] North-Rhine Westphalia Germany	[redacted] North-Rhine Westphalia Germany
GPS Coordinates	[redacted]	[redacted]	[redacted]	[redacted]
Soil Taxonomic Classification (USDA)	Sandy loam; sandy, mixed, mesic Typic Camborthids	Silt loam; loamy, mixed, mesic Typic Argudalfs	Loam; loamy, mixed, mesic Typic Argudalfs	Silt loam; loamy, mixed, mesic Typic Argudalfs
Soil Series	no information available			
Textural Class (USDA) Sand [50 µm – 2 mm] Silt [2 µm – 50 µm] Clay [< 2 µm]	sandy loam 70% 18% 12%	sandy loam 68% 22% 20%	sandy loam 53% 28% 19%	silt loam 18% 60% 22%
pH (0.01 M $CaCl_2$) pH (water) pH (1 M KCl)	6.1 6.9 5.9	6.1 6.9 6.1	5.6 5.9 5.2	6.1 6.5 5.9
Organic Carbon Organic Matter [a)]	2.3% 4.0%	1.1% 1.9%	1.4% 2.4%	1.3% 2.2%
Cation Exchange Capacity [meq/100 g]	10.1	9.7	10.3	11.3
Water Holding Capacity maximum [g/100 g] at 0.33 bar [g/100g]	58.8 14.4%	46.9 19.9%	n.d. 20.1%	56.7 19.6%
Bulk Density (disturbed) [g/cm^3]	1.1	1.1	1.2	1.0
Biomass	N/A	N/A	N/A	N/A

a) % organic matter = % organic carbon x 1.724

The soils were air-dried at room temperature and passed through a 2 mm sieve before use in the study. A preliminary screening test and a kinetics test were conducted to establish the conditions for the definitive test. In the preliminary tests, soil solution ration of 1:10 and equilibrium time of 10 hours were established but should be noted that in the preliminary tests, equilibrium was not reached by 10 hours, but the test substance was not considered to be sufficiently stable to use longer equilibrium times (test substance mass balance in all soils was < 90% after 18 hours). This was particularly problematic for the AXXa soil where test substance mass balance fell < 90% after only 6 hours. As a consequence, the AXXa soil was sterilised using $HgCl_2$ which increased stability to > 90% at 10 hours equilibrium time. The use of a shorter equilibrium time is considered acceptable by the RMS in view of the fact that this is a course of action recommended in the SCP opinion on methods of Koc determination for unstable substances (SCP/KOC/002 – Final, 18 July 2002); it is noted that the SCP considered that shorter equilibrium time will result in under-estimation of adsorption. In the definitive test solutions of [^{14}C]-2-chlorophenol were prepared at 0.009, 0.03, 0.1, 0.3, and 0.9 mg/L in 0.01 M calcium chloride solution. A 2 g soil sample was agitated at 20 ± 1 °C with 20 mL of each of the five test solutions (i.e. soil:solution ratio 1:10) for 10 hours. Following this period, the samples were centrifuged to separate the water from the soil. The water was assayed by liquid scintillation counting and HPLC in the case of the highest tested concentration samples; inspection of the sample chromatograms indicated that there appeared to be no significant metabolites formed. Given that the substance had been confirmed as stable during the 10 hour equilibrium period in the preliminary tests, all radioactivity counted by LSC in the four lower concentration incubations were assumed to comprise 2-chlorophenol; this is considered acceptable by the RMS. Due to limited stability of the test compound, desorption steps were not conducted.

Results from the adsorption test were used to calculate the Freundlich parameters of K_f and 1/n; K_f values were subsequently used to calculate a K_{foc} value for each soil. The adsorption parameters are shown in Table 7.1.3.1.2- 5. The RMS considers that, whilst the range of soil pH tested was not particularly wide, there is no evidence of pH dependent adsorption.

Table 7.1.3.1.2- 5: Soil adsorption parameters for 2-chorophenol

Soil	Adsorption K_F [mL/g]	1/n	r^2	K_{OC} [mL/g]
AXXa (sterile)	2.302	0.7983	0.9986	100
AIIIa	1.700	0.7373	0.9984	155
WuW	1.807	0.7465	0.9955	129
Hoe	1.645	0.7502	0.9871	127

The RMS notes that prior to this study having been conducted, the Notifier had conducted a non-GLP study giving Koc values in the range of 127 – 611 mL/g (mean 252 mL/g) with range of 1/n of 0.61 – 0.69 (mean 0.65).

Two additional studies are submitted within this supplementary dossier for the fluoxastrobin renewal of approval using HEC 5725-*Z*-isomer and 2-chlorophenol (*M782*).

Report: KCA 7.1.3.1.2/07 [redacted]; 2015; M-536661-01-1
Title: [Methoxyiminotolyl-ring-UL-^{14}C]fluoxastrobin (isomer Z): Adsorption/desorption on one US soil and three EU soils
Report No.: M-536661-01-1
Document No.: M-536661-01-1
Guideline(s): - OECD Test Guideline No. 106
- Regulation (EU) No 283/2013 in accordance with Regulation (EC) No 1107/2009
- US EPA OCSPP Test Guideline No. 835.1230
- Japanese MAFF New Test Guidelines for Supporting Registration of Chemical Pesticides
Guideline deviation(s): not specified
GLP/GEP: **yes**
Justification: New data / guideline requirement:
Adsorption and desorption of HEC 5725-Z-isomer

Executive Summary

The adsorption behavior of [methoxyiminotolyl-ring-UL-^{14}C]fluoxastrobin (Z isomer) was studied in four soils in batch equilibrium experiments in the laboratory in the dark at 20 °C.

Table 7.1.3.1.2- 6: Soils used in the equilibrium experiments

Designation	Source	Texture (USDA)	pH[a)]	OC [%
KS	[redacted], KS, US	Silty Clay Loam	5.8	1.8
DF	[redacted] II, [redacted], Germany	Clay Loam	7.3	5.2
HF	[redacted], Germany	Silt Loam	6.3	1.9
WM	[redacted], Germany	Loam	5.2	2.1

a) pH determined in $CaCl_2$

The study followed the OECD Guideline for the Testing of Chemicals No. 106 taking into account additional EU requirements (Regulation (EC) No 1107/2009 and Commission Regulation (EU) No 283/2013) and the US EPA OCSPP Fate, Transport and Transformation Test Guideline No. 835.1230. The study was conducted in compliance with the US EPA FIFRA Good Laboratory Practices.

The adsorption phase of the study was carried out using sieved soils (≤ 2 mm) equilibrated in aqueous 0.01 M $CaCl_2$ solution with a soil-to-solution ratio of 1:20 for KS, HF, and WM soils and 1:100 for DF soil. Test nominal concentrations of 0.5, 0.14, 0.05, 0.015 and 0.005 mg/L of fluoxastrobin (Z isomer) were applied in acetonitrile (< 0.1% in the final test) to the equilibrated system. The adsorption test was performed in centrifuge tubes with screw caps for 24 hours. Desorption after an additional 48 hours was also investigated.

The aqueous supernatant after adsorption was separated by centrifugation and the amount of test substance in the supernatant was analyzed by liquid scintillation counting (LSC). Residues in the soil were determined by extraction followed by combustion/LSC for one replicate per concentration and soil. The sorption parameters were calculated using Freundlich isotherms.

The test substance was sufficiently stable throughout the 24-hour study period, with 100% test substance noted in HPLC analyses of supernatant and soil extracts.

Mean material balances for KS, DF, HF and WM soils were 97.3% AR (range 92.3 to 101.5% AR), 97.6 %AR (range 90.5 to 104.3% AR), 96.9% AR (range 93.0 to 100.6% AR), 95.7% AR (range 91.5 to 97.9% AR),respectively. The overall mean material balance was 97.5% AR (SD 3.0%).

In the definitive adsorption test, the mean %AR sorbed to soil was 55.4 to 69.8% in KS, 57.5 to 67.2% in DF soil, 63.9 to 74.5% in HF soil, and 58.0 to 67.8% in WM soil.

After the desorption step, the mean percentage desorbed of the initially adsorbed amount ranged from 17.2 to 26.0% in KS, 25.1 to 30.7% in DF soil, 13.6 to 18.5% in HF soil, and 17.3 to 16.9% in WM soil.

The calculated adsorption constants KF of the Freundlich isotherms ranged from 19.95 to 118.8 mL/g (mean 52.34 mL/g) for tested soils. The Freundlich exponents 1/n ranged from 0.8581 to 1.001 (mean 0.9316), indicating that the concentration of the test substance affected the adsorption behavior of the examined concentration range. For fluoxastrobin (z-isomer), the $K_{f\text{-}oc}$ values ranged from 1,327 to 2,284 mL/g (mean 1,743 mL/g).

The calculated desorption constants $K_{F\text{-}des}$ of the Freundlich isotherms ranged from 41.90 to 205.7 mL/g (mean: 102.2 mL/g) for the tested soils. The Freundlich exponents 1/n ranged from 0.8874 to 0.9715 (mean: 0.9355), indicating that the concentration of the test substance affected the desorption behavior in the examined concentration range. According to Briggs, fluoxastrobin (z-isomer) can be classified as immobile.

Table 7.1.3.1.2- 7: Adsorption and desorption behavior of fluoxastrobin (Z-isomer) on soils

Soil Texture (USDA)	Adsorption			Desorption		
	$K_{F\text{-}ads}$ [mL/g]	$1/n_{\text{-}ads}$	$K_{F\text{-}OC\text{-}ads}$ [mL/g]	$K_{F\text{-}des}$ [mL/g]	$1/n_{\text{-}des}$	$K_{F\text{-}OC\text{-}des}$ [mL/g]
(KS) Silty clay loam	19.95	0.8581	1,108	41.90	0.8874	2,328
(DF) Clay Loam	118.8	0.9117	2,284	205.7	0.9562	3,955
(HF) Silt loam	42.77	1.001	2,251	72.15	0.9270	3,797
(WM) Loam	27.88	0.9556	1,327	88.95	0.9715	4,236
Mean:	**52.34**	**0.9316**	**1,743**	**102.2**	**0.9355**	**3,579**

I. MATERIALS AND METHODS

A. MATERIALS

1. Test Item

[methoxyiminotolyly-ring-UL-^{14}C]Fluoxastrobin (Z isomer) (HEC5275 Isomer Z)

Reference No:	C1192
Specific Activity:	44.82 µCi/µMol (~216,600 dpm/µg)
Radiochemical Purity:	99%
Chemical Purity:	-

2. Test Soils

Four soils were used (see Table 7.1.3.1.2- 8), representing different geographical origin and different soil properties as required by the guidelines. The soils were sieved to a particle size of ≤ 2 mm for the adsorption / desorption batch equilibrium experiments.

Table 7.1.3.1.2- 8: Physico-chemical properties of test soils

Parameter	Results / Units			
Soil Designation	KS	DF	HF	WM
Geographic Location				
City	[redacted]	[redacted]	[redacted] Germany	[redacted] Germany
State	Kansas	North Rhine-Westphalia	North Rhine-Westphalia	North Rhine-Westphalia
Country	USA	Germany	Germany	Germany
Textural Class (USDA)	silty clay loam	clay loam	silt loam	loam
Sand [50 µm – 2 mm]	49.6%	26%	16%	48%
Silt [2 µm – 50 µm]	28.0%	41%	65%	33%
Clay [< 2 µm]	23%	33%	19%	19%
pH (soil/0.01 M $CaCl_2$)	5.8	7.3	6.3	5.2
Organic Carbon	1.8%	5.2%	1.9%	2.1%
Organic Matter (factor 1.724)	3.1%	9.0%	3.3%	3.6%
Cation Exchange Capacity [meq/100 g]	18.5	20.1	11.6	10.3
Water Holding Capacity at 0.33 bar (pF 2.5)	24.0%	34.2%	19.5%	16.9%
Bulk Density (disturbed) [g/cm^3]	0.97	0.95	1.08	1.15

B. STUDY DESIGN

1. Experimental Conditions

Glass centrifuge tubes (30 mL) with Teflon®-lined screw caps were used as test systems for the KS, HF and WM soils. The DF soil required a 1 to 100 soil-to-solution ratio, thus 250-mL Teflon® bottles were used. The test systems were shaken on a reciprocal shaker for the pre-equilibration phases and post-treatment.

Preliminary tests to determine equilibrium time, parental mass balance, sticking to glass and stability were done prior to the definitive tests. For the definitive test, the dry-weight of for KS, DF, HF and WM soils per test system were 1 g (dry weight), with 20 mL 0.01M $CaCl_2$, (considering water contained in wet soil) added to each test system. The corresponding soil-to-solution ratio for KS, HF, and WM soils was 1:20. For DF soil, the amount of soil added per test system was 1 g (dry weight), with 100 mL 0.0 1M $CaCl_2$, (considering water contained in wet soil) added to each test system. A soil-to-solution ratio of 1:20 was used for KS, HF, and WM soils; and a soil-to-solution ratio of 1:100

was used for the DF soil . The centrifuge tubes for DF, HF and WM were closed with screw caps. For DF soil, 250-mL Teflon bottles were used. The untreated test systems were equilibrated to study conditions by shaking overnight prior to application.

For the preliminary tests and the definitive test, respective application solutions (0.019 mL acetonitrile) were pipetted into the respective equilibrated test systems to obtain a total volume of 20 mL and final nominal test substance concentrations of 0.5 mg fluoxastrobin (z-isomer) per L for the preliminary tests and 0.005, 0.015, 0.05, 0.15 and 0.5 mg fluoxastrobin (z-isomer) per L for the definitive test.
Furthermore, two control samples per concentration were prepared. Therefore, 20 mL of 0.01 M $CaCl_2$ solution and 0.019 mL of application solution of the respective concentration were included in test system (without soil).
After application, the test vessels were closed with screw caps and shaken on reciprocal shaker in an environmental chamber at 20 ± 1 °C. The equilibration time was 24 hours. The desorption phase was for an additional 24 hours.

2. Analytical Procedures

Test systems were set up and were pre-equilibrated with shaking overnight before treatment. After application, the test systems were shaken for 24 hours. Soil and supernatants were separated by centrifugation for 10 min at 3,000 *g* and decantation. The volume of the supernatant was determined by weight (1 mL 0.01 M $CaCl_2$ = 1 g) and aliquots were taken for radioassay. Fresh $CaCl_2$ solution was added back to each test system, and they were then placed on the reciprocal shaker for another 24 hours. The pH of supernatants was measured.
After the additional 24-hour shaking, soil and supernatants were separated by centrifugation for 10 min at 3,000 *g* and decantation. The volume of the supernatant was determined by weight (1 mL $CaCl_2$ = 1 g) and aliquots were taken for radioassay.
To establish a material balance, soils were extracted one time with acetonitrile and a 10-minute ambient shake followed by centrifugation at 3,000 *g*, decantation, and radioassay. Soils were dried and then combusted. The entire soil sample was combusted, and a Kimwipe was used to wipe and collect any remaining soil on weigh boat or centrifuge tube.

The suspensions were centrifuged and the radioactivity contents in the supernatants were analysed by liquid scintillation counting (LSC). After the adsorption and desorption step, the soil of 0.5 mg/L samples was additionally extracted three times at ambient temperature using a reciprocating shaker and acetonitrile/water$_{pH4}$ 4/1 (*v*/*v*). After each extraction step, extract and soil were separated by centrifugation and decantation. The radioactivity contents of the combined soil extracts after the adsorption and desorption step were determined by LSC. Aliquot of the combined soil extracts were concentrated. Aqueous 0.01 M $CaCl_2$ solutions and combined soil extracts were analysed by reversed phase HPLC/radiodetection. The extracted soil was dried and the radioactivity content determined by combustion/LSC to establish the material balance.

The parental mass balances were determined for the 24-hour interval from the equilibration time test.
After supernatants were decanted, soils were extracted sequentially 3 times with acetonitrile. The solvent/soil mixtures were shaken for 10 minutes at ambient conditions and then centrifuged at 3,000 *g* for 5 minutes. Solvent extracts were decanted, volumes of each extract were recorded, and extracts were radioassayed. Aliquots of the supernatant and first soil extract for one replicate of each soil were analyzed by HPLC to determine parental mass balance. Extracted soils were combusted using a Harvey oxidizer, and the overall material balance was determined by the sum of radioactivity in the supernatant, soil extracts, and non-extractable residue.

II. RESULTS AND DISCUSSION

A. MATERIAL BALANCE

The overall mean material balance for all four soils was 97.5% AR (SD 5.0%). The mean material balance for KS was 97.3 (range 92.3 to 101.5% AR), for DF was 97.6%AR (range 90.5 to 104.3% AR), for HF soil was 96.9% AR (range from 93.0 to 100.6% AR) and for WM soil was 95.7% AR (range from 91.5 to 97.9% AR).
The complete material balances found for all samples for all soils demonstrated that there was no significant loss of radioactivity from the test systems or during sample processing.

B. DEGRADATION OF PARENT COMPOUND

Stability of the test substance during the time frame of the definitive test was confirmed by the parental mass balance.

C. FINDINGS

In the definitive adsorption test, the mean % AR sorbed to soil was 55.4 to 69.8% in KS, 57.9 to 67.2% in DF soil, 63.9 to 74.5% in HF soil, 58.0 to 62.9% in WM soil.
After the desorption step, the mean percentage desorbed of the initially adsorbed amount ranged from 17.2 to 26.0% in KS, 25.1 to 30.7% in DF soil, 25.1 to 30.7% in DF soil, 13.6 to 18.5% in HF soil, and 17.3 to 16.9% in WM soil.

For the adsorption phase, the calculated adsorption constants KF-ads of the Freundlich isotherms ranged from 19.95 to 118.8 mL/g (mean: 52.34 mL/g) for the tested soils. The Freundlich exponents 1/n ranged from 0.0.8581 to 1.001 (mean: 0.9316).
For the desorption phase, the calculated desorption constants KF-des of the Freundlich isotherms ranged from 41.90 to 205.7 mL/g (mean: 102.2 mL/g) for the tested soils. The Freundlich exponents 1/n ranged from 0.8874 to 0.9715 (mean: 0.9355).

In general, the organic matter in soil, determined as organic carbon content, is the most important component responsible for binding organic chemicals. Therefore, the adsorption coefficients KF were correlated with the organic carbon content of the soil to get a comparability of the adsorption behaviour in different soils. For fluoxastrobin (z-isomer), the KF-OC-ads values ranged from 1,327 to 2,284 mL/g (mean: 1,743 mL/g). The KF-OC-des values ranged from 2,328 to 4,236 mL/g (mean: 3,579 mL/g). From the desorption data it can be seen that once fluoxastrobin z-isomer is bound to soil, it is less prone to desorb.

Table 7.1.3.1.2- 9: Percentage of adsorbed fluoxastrobin (z-isomer) in soils (mean values)

Concn ID	Initial Concentration of Test substance [a)]	Soil [mg/kg]	Solution [mg/L]	Percentage Adsorbed [% AR] [A]
	KS: [redacted], KS, USA			
A	0.50 mg/L	5.5	0.223	55.4 ± 2.5
B	0.14 mg/L	1.6	0.059	57.9 ± 9.9
C	0.049 mg/L	0.67	0.016	68.1 ± 1.0
D	0.015 mg/L	0.20	0.0050	67.0 ± 10.55
E	0.0050 mg/L	0.069	0.0015	69.8 ± 4.5
	DF: [redacted] II, Germany			
A	0.50 mg/L	29.0	0.214	57.5 ± 1.2
B	0.15 mg/L	8.7	0.058	60.0 ± 4.3
C	0.048 mg/L	3.0	0.018	63.2 ± 1.5
D	0.014 mg/L	0.95	0.0046	67.2 ± 2.4
E	0.0047 mg/L	0.31	0.0016	66.4 ± 0.6
	HF: [redacted], Germany			
A	0.50 mg/L	7.2	0.139	72.2 ± 1.5
B	0.14 mg/L	1.8	0.051	63.9 ± 5.1
C	0.049 mg/L	0.063	0.018	64.1 ± 0.7
D	0.015 mg/L	0.23	0.0039	74.5 ± 8.5
E	0.0050 mg/L	0.064	0.0018	63.9 ± 1.8
	WM: [redacted], Germany			
A	0.50 mg/L	5.8	0.21	58.0 ± 3.3
B	0.14 mg/L	1.7	0.055	60.8 ± 0.3
C	0.049 mg/L	0.66	0.016	67.8 ± 6.7
D	0.015 mg/L	0.19	0.0055	63.9 ± 2.1
E	0.0050 mg/L	0.061	0.0029	61.7 ± 0.3

a) (mean ± SD)

Table 7.1.3.1.2- 10: Percentage of desorbed fluoxastrobin (z-isomer) in soils (mean values)

Concn ID	Initially adsorbed on soil after adsorption [µg per 1 g soil] a)	In Solution at equilbrium [µg per 20 mL] a)	Sorbed to soil after desorption [µg per 1 g] a)	Desorbed Percentage of Adsorbed [% AR]
KS: [redacted], KS, USA				
A	5.5 ± 0.2	1.4 ± 0.1	4.0 ± 0.2	25.4
B	1.6 ± 0.3	0.42 ± 0.1	1.2 ± 0.2	26.0
C	0.67 ± 0.01	0.13 ± 0.01	0.54 ± 0.003	19.2
D	0.20 ± 0.03	0.040 ± 0.01	0.16 ± 0.03	19.7
E	0.069 ± 0.004	0.012 ± 0.0001	0.058 ± 0.004	17.7
DF: [redacted] II, Germany				
A	29.0 ± 0.6	8.7 ± 0.1	20.3 ± 0.1	30.1
B	8.7 ± 0.6	2.7 ± 0.3	6.1 ± 0.3	30.7
C	3.0 ± 0.07	0.84 ± 0.001	2.2 ± 0.001	27.4
D	0.95 ± 0.03	0.24 ± 0.01	0.71 ± 0.01	25.1
E	0.31 ± 0.003	0.088 ± 0.003	0.238 ± 0.003	28.0
HF: [redacted], Germany				
A	7.2 ± 0.2	1.9 ± 0.05	5.9 ± 0.2	18.5
B	1.8 ± 0.1	0.322 ± 0.04	1.5 ± 0.1	17.9
C	0.63 ± 0.01	0.10 ± 0.005	0.53 ± 0.002	15.2
D	0.23 ± 0.03	0.031 ± 0.002	0.20 ± 0.03	13.6
E	0.064 ± 0.002	0.009 ± 0.0011	0.054 ± 0.001	14.7
WM: [redacted], Germany				
A	5.8 ± 0.3	1.0 ± 0.02	4.8 ± 0.3	17.3
B	1.7 ± 0.01	0.30 ± 0.01	1.4 ± 0.02	17.3
C	0.66 ± 0.07	0.10 ± 0.02	0.56 ± 0.043	15.6
D	0.19 ± 0.01	0.028 ± 0.0001	0.17 ± 0.01	14.2
E	0.061 ± 0.0003	0.010 ± 0.0008	0.051 ± 0.001	16.9

a) (mean ± SD)

Table 7.1.3.1.2- 11: Adsorption and desorption constants and correlation coefficients in soils of fluoxastrobin (Z-isomer)

Soil	Adsorption K_F [mL/g]	Adsorption 1/n [1]	Adsorption R^2	Adsorption K_{OC} [mL/g]	Desorption K_F [mL/g]	Desorption 1/n [1]	Desorption R^2	Desorption K_{OC} [mL/g]
(KS) Silty Clay Loam	19.95	0.8581	0.9805	1,108	41.90	0.8874	0.9962	2,328
(DF) Clay Loam	118.8	0.9117	0.9975	2,284	205.7	0.9562	0.9951	3,955
(HF) Silt Loam	42.77	1.001	0.9741	2,251	72.15	0.9270	0.9959	3,797
(WM) Loam	27.88	0.9556	0.9895	1,327	88.95	0.9715	0.9963	4,236
arithmetic mean	52.34	0.9316	**0.9847**	**1,743**	102.2	0.9355	**0.9972**	3,579

III. CONCLUSIONS

The adsorption constant $K_{OC(ads)}$ (arithmetic mean) of CGA 357261, a major photodegradation product of fluoxastrobin, was 1743 mL/g. The Freundlich exponent 1/n (arithmetic mean) was 0.9316.

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Report:	KCA 7.1.3.1.2/08 [redacted]; [redacted]; 2015; M-533623-01-1
Title:	[Phenyl-UL-14C]2-chlorophenol: Adsorption/desorption on two US soils and one EU soil
Report No.:	MEHEN038
Document No.:	M-533623-01-1
Guidelines:	- OECD Test Guideline No. 106 - Regulation (EU) No 283/2013 in accordance with Regulation (EC) No 1107/2009 - Japanese MAFF New Test Guidelines for Supporting Registration of Chemical Pesticides - US EPA OCSPP Test Guideline No. 835.1230
Guideline deviation(s):	not specified
GLP/GEP:	**yes**
Justification:	New data / guideline requirement Adsorption and desorption of the fluoxastrobin degradation product 2-Chlorophenol

Executive Summary

The adsorption behaviour of [UL-^{14}C]2-chlorophenol, a degradation product of fluoxastrobin, was studied in three soils in batch equilibrium experiments in the dark at 20 °C:

Soil	Source	Texture (USDA)	pH	OC [%]
CA	[redacted], CA, USA	Loamy Sand	7.1	0.39
ND	[redacted], ND, USA	Clay Loam	7.3	3.7
DF	[redacted], Germany	Clay Loam	7.3	5.2

The adsorption phase was carried out in sterilized soils using aqueous 0.01 M $CaCl_2$ solution. Soil-to-solution ratios of 1/2, 1/20 and 1/5 were applied for CA, ND and DF soils, respectively. 2-chlorophenol was applied at nominal concentrations of 0.0005, 0.0015, 0.005, 0.015 and 0.05 mg/L. Preliminary tests were performed at a test concentration of 0.05 mg/L. All application solutions were prepared in ethanol, and cosolvent concentrations in all test systems was <0.1%. Adsorption took place for 6 hours equilibration time.

The test substance 2-chlorophenol was stable during the test. HPLC analyses revealed that the test substance was the only component in supernatants and extractable fractions. No major degradation product was observed.

The overall mean material balance for all three soils was 94.7% AR (SD 2.2%). The mean material balances were 94.3% AR (range from 89.3 to 96.4% AR) for soil CA, 96.1% AR (range from 91.4 to 99.5% AR) for soil ND, and 93.8% AR (range from 91.2 to 96.8% AR) for soil DF.

The mean percentage adsorbed to soil after the 6-hour definitive adsorption test in CA, ND and DF soils were 14.5 to 19.6% AR, 24.7 to 27.7% AR and 27.7 to 31.5% AR, respectively.

Based on the measured [UL-^{14}C]2-chlorophenol concentration, the calculated adsorption constants K_F of the Freundlich isotherms ranged from 0.354 to 6.479 mL/g (mean: 2.874 mL/g) for the tested soils and the K_{OC} values (normalised to organic carbon content) ranged from 34.4 to 175.1 mL/g (mean: 100.1 mL/g). The Freundlich exponents 1/n ranged from 0.9727 to 0.9844 (mean: 0.9773), indicating that the concentration of the test substance affected the adsorption behaviour in the examined concentration range.
Using the Briggs classifications for the estimation of the mobility of chemicals in soil based on K_F and/or K_{OC} values, the mobility of 2-chlorophenol can be classified as intermediate, low and mobile in CA, ND and DF soils, respectively, for adsorption.

Table 7.1.3.1.2- 12: Adsorption constants and correlation coefficients in soils of 2-chlorophenol

Soil	Adsorption K_F [mL/g]	1/n	R^2	K_{OC} [mL/g]
CA	0.354	0.9727	0.9931	90.8
ND	6.479	0.9844	0.9972	175.1
DF	1.789	0.9747	0.9983	34.4
arithmetic mean	**2.874**	**0.9773**	**0.9962**	**100.1**

I. MATERIALS AND METHODS

A. MATERIALS

1. Test Item

[UL-^{14}C]2-chlorophenol

Reference No:	C-1191 and C-1194
Specific Activity:	40.3 MBq/mg (140 mCi/mMol, 2,41-7,548 dpm/µg)
Radiochemical Purity:	99%
Chemical Purity:	Not reported

2. Test Soils

Three soils were used (see Table 7.1.3.1.2- 13), representing different geographical origin and different soil properties as required by the guidelines. The soils were sieved to a particle size of ≤ 2 mm and sterilized by gamma radiation for the adsorption batch equilibrium experiments.

Table 7.1.3.1.2- 13: Physico-chemical properties of test soils

Parameter	Results / Units		
Soil Designation	CA	ND	[redacted] II (DF)
Geographic Location City	[redacted]	[redacted]	[redacted]
State	California	North Dakota	North Rhine-Westphalia
Country	USA	USA	Germany
Soil Taxonomic Classification (USDA)	No information available		
Soil Series	Hanford sandy loam	Gardena silt loam, 0 to 2 percent slopes	No information available
Textural Class (USDA)	Loamy Sand	Clay Loam	Clay Loam
Sand [50 µm – 2 mm]	78.6%	22.4%	26%
Silt [2 µm – 50 µm]	16.2%	49.6%	41%
Clay [< 2 µm]	5.2%	28.0%	33%
pH (soil/0.01 M $CaCl_2$: 1/1 for CA an ND and 1/2 for DF)	7.1	7.3	7.3
Organic Carbon	0.4%	3.7%	5.2%
Organic Matter [1]	0.7%	6.4%	9.0%
Cation Exchange Capacity [meq/100 g]	6.0	24.5	20.1
Water Holding Capacity at 0.33 bar (pF 2.5)	8.5%	39.8%	34.2%
Bulk Density (disturbed) [g/cm³]	1.45	0.84	0.95

[1] % organic matter = % organic carbon x 1.724
DW: dry weight
USA: United States of America
USDA: United States Department of Agriculture

B. STUDY DESIGN

1. Experimental Conditions

The test system for adsorption in batch equilibrium experiments consisted of glass centrifuge tubes (volume 30 mL) closed with Teflon® lined screw caps. Glassware and aqueous 0.01 M $CaCl_2$ solution were sterilized using an autoclave. The experiments were performed in duplicate.

In preliminary tests, the stability of the test substance, the adsorption of the test substance to test vessel surface, the soil-to-solution ratio and the equilibration time for adsorption were determined.

The adsorption phase was carried out in sterilized soils using aqueous 0.01 M $CaCl_2$ solution. Soil-to-solution ratios of 1/2, 1/20 and 1/5 were applied for CA, ND and DF soils, respectively. 2-chlorophenol was applied at nominal concentrations of 0.0005, 0.0015, 0.005, 0.015 and 0.05 mg/L. Preliminary tests were performed at a test concentration of 0.05 mg/L. All application solutions were prepared in ethanol and applied to the equilibrated test system. The cosolvent concentrations in all test systems was <0.1%.

The test systems were shaken on a reciprocal shaker in the dark at 20 °C in an environmental chamber for an equilibration time of 6 hours.

The untreated test systems were equilibrated to study conditions by shaking overnight prior to application.

2. Analytical Procedures

The suspensions were centrifuged and the radioactivity contents in the decanted supernatants were analysed by liquid scintillation counting (LSC). Additionally, the pH value of the supernatants was determined. Representative samples of supernatants were analysed by reversed phase HPLC/radiodetection to prove stability of the test item.

To establish a material balance, soils were extracted once with acetonitrile by shaking for 10 min at ambient temperature. Soil and extract were separated by centrifugation at 3000 *x g* and decantation. The radioactivity in the extract was determined by LSC. The extracted soils were dried and radioactivity was determined by combustion/LSC. The entire soil sample was combusted and a kimwipe was used to wipe and collect any remaining soil on weigh boat or centrifuge tube.

Adsorption isotherms were calculated by linear regression analysis of the adsorption data according to the Freundlich equation.

II. RESULTS AND DISCUSSION

A. MATERIAL BALANCE

The overall mean material balance for all three soils was 94.7% AR (SD 2.2%). The mean material balances were 94.3% AR (range from 89.3 to 96.4% AR) for soil CA, 96.1% AR (range from 91.4 to 99.5% AR) for soil ND, and 93.8% AR (range from 91.2 to 96.8% AR) for soil DF. The complete material balances found for all soils and concentrations demonstrated that there was no significant loss of radioactivity dissipated from the test systems or during sample processing.

B. STABILITY OF PARENT COMPOUND

The stability was adequate to determine the test substance distribution based on LSC measurements of the supernatant in the adsorption experiments of the definitive test. No major degradation product was observed.

C. FINDINGS

The mean percentage adsorbed to soil after the 6-hour definitive adsorption test in CA, ND and DF soils were 14.5 to 19.6% AR, 24.7 to 27.7% AR and 27.7 to 31.5% AR, respectively (see Table 7.1.3.1.2- 14).

Based on the measured [UL-^{14}C]2-chlorophenol concentration, the calculated adsorption constants K_F of the Freundlich isotherms ranged from 0.334 to 6.479 mL/g (mean: 2.874 mL/g) for the tested soils and the K_{OC} values (normalised to organic carbon content) ranged from 34.4 to 175.1 mL/g (mean: 100.1 mL/g). The Freundlich exponents 1/n ranged from 0.9727 to 0.9844 (mean: 0.9773), indicating that the concentration of the test substance affected the adsorption behaviour in the examined concentration range (see Table 7.1.3.1.2- 15).

Table 7.1.3.1.2- 14: Percentage of adsorbed 2-chlorophenol in soils (mean values [% AR])

Soil	Test Concentration [mg/L] Adsorption [a)] 0.0005	0.0015	0.005	0.015	0.05
CA	14.5 ± 1.8	19.6 ± 2.2	16.9 ± 0.6	17.7 ± 0.7	17.2 ± 0.7
ND	26.2 ± 3.3	25.5 ± 0.4	24.7 ± NA[b)]	26.0 ± 3.4	27.7 ± 0.4
DF	28.2 ± 1.3	29.3 ± 1.1	27.7 ± 0.9	31.5 ± 1.8	29.9 ± 0.5

a) end of adsorption phase, mean values expressed as percentage of the measured [UL-^{14}C]2-chlorophenol concentration
b) NA = Not available; one rep lost during shaking

Table 7.1.3.1.2- 15: Adsorption constants and correlation coefficients in soils of 2-chlorophenol

Soil	Adsorption K_F [mL/g]	1/n	R^2	K_{OC} [mL/g]
CA	0.354	0.9727	0.9931	90.8
ND	6.479	0.9844	0.9972	175.1
DF	1.789	0.9747	0.9983	34.4
arithmetic mean	**2.874**	**0.9773**	**0.9962**	**100.1**

III. CONCLUSIONS

The adsorption constants K_F of 2-chlorophenol for the tested soils calculated based on the Freundlich isotherms ranged from 0.354 to 6.479 mL/g (mean: 2.874 mL/g). The respective K_{OC} values ranged from 34.4 to 175.1 mL/g (mean: 100.1 mL/g). The Freundlich exponent 1/n ranged from 0.9727 to 0.9844 (mean: 0.9773).

Using the Briggs classifications for the estimation of the mobility of chemicals in soil based on K_F and/or K_{OC} values, the mobility of 2-chlorophenol can be classified as intermediate, low and mobile in CA, ND and DF soils, respectively, for adsorption.

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CA 7.1.3.2 Aged sorption

Studies are not required under Commission Regulation (EU) No 283/2013 in accordance with Regulation (EC) No 1107/2009.

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Overall summary of adsorption/desorption of fluoxastrobin and its metabolites in soil

The adsorption and desorption behaviours of fluoxastrobin and its major degradation products in soil were studied using radioactive labelled fluoxastrobin, HEC5725-Z-isomer, HEC 5725-carboxylic acid (*M40*), HEC 5725-deschlorophenyl and [phenyl-UL-^{14}C]2-chlorophenol. The studies have been performed in a number of soils in batch equilibrium experiments. Adsorption and desorption isotherms were calculated by linear regression analysis of the adsorption or desorption data according to the

Freundlich equation. The calculated adsorption constants and correlation coefficients are listed in Table 7.1.3- 1 to Table 7.1.3- 6.

Table 7.1.3- 1: Overall summary of adsorption constants $K_{OC(ads)}$ in soils of fluoxastrobin and its major degradation products

Compound	$K_{OC(ads)}$ [a] [mL/g]	$K_{OC(ads)}$ [b] [mL/g]
fluoxastrobin (*E*)	848	752.0
HEC5725-*Z*-Isomer	1743	1658.3
HEC 5725-carboxylic acid (*M40*)	59	56.4
HEC 5725-*E*-des-chlorophenyl (*M48-E*)	60	19.2 without soil [redacted]
2-chlorophenol (*M82*)	115.8	104.7

a) arithmetic mean
b) geometric mean

Table 7.1.3- 2: Overall summary of adsorption constants and correlation coefficients in soils of fluoxastrobin

Soil	Texture (USDA)	pH [a]	Annex Point / Reference No	$K_{F(ads)}$ [mL/g]	1/n	$K_{OC(ads)}$ [mL/g]
E-isomer						
LH AXXa	sandy loam	7.2	KCA 7.1.3.1.1 /01	12.7	0.8356	629
HF am F [redacted] 4a	silt	7.1	KCA 7.1.3.1.1 /01	16.21	0.8738	758
[redacted]	silty clay loam	5.9	KCA 7.1.3.1.1 /01	26.26	0.8749	1582
[redacted]	loamy sand	6.8	KCA 7.1.3.1.1 /01	3.35	0.8493	424
			arithmetic mean	14.63	0.8584	848
			geomean			752

Table 7.1.3- 3: Overall summary of adsorption constants and correlation coefficients in soils of HEC5725-Z-isomer

Soil	Texture (USDA)	pH [a]	Annex Point / Reference No	$K_{F(ads)}$ [mL/g]	1/n	$K_{OC(ads)}$ [mL/g]
HEC5725-Z-isomer						
KS	Silty Clay Loam	5.8	KCA 7.1.3.1.2 /01	19.95	0.8581	1,108
DF	Clay Loam	7.3	KCA 7.1.3.1.2 /01	118.8	0.9117	2,284
HF	Silt Loam	6.3	KCA 7.1.3.1.2 /01	42.77	1.001	2,251
WM	Loam	5.2	KCA 7.1.3.1.2 /01	27.88	0.9556	1,327
			arithmetic mean	52.34	0.9316	1,743
			geomean			1658

a) pH value determined in $CaCl_2$

Table 7.1.3- 4: Overall summary of adsorption constants and correlation coefficients in soils of HEC 5725-carboxylic acid (*M40*)

Soil	Texture (USDA)	pH [a)]	Annex Point / Reference No	$K_{F(ads)}$ [mL/g]	1/n	$K_{OC(ads)}$ [mL/g]
BBA 2.2	loamy sand	5.4	KCA 7.1.3.1.2 /01	1.12	0.9590	56
LH AXXa	sandy loam	6.3	KCA 7.1.3.1.2 /01	0.58	0.8610	56
LUFA [redacted]	sandy loam	6.0	KCA 7.1.3.1.2 /01	0.50	0.8993	37
[redacted]	silty clay	5.5	KCA 7.1.3.1.2 /01	1.41	0.8979	87
			arithmetic mean	0.90	0.9043	59
			geomean			56.4

a) pH value determined in $CaCl_2$

Table 7.1.3- 5: Overall summary of adsorption constants and correlation coefficients in soils of HEC 5725-*E*-des-chlorophenyl (*M484-E*)

Soil	Texture (USDA)	pH [a)]	Annex Point / Reference No	$K_{F(ads)}$ [mL/g]	1/n	$K_{OC(ads)}$ [mL/g]
LH AXXa	sandy loam	7.2	KCA 7.1.3.1.2 /02	0.28	0.94	14
HF am [redacted] 4a	silt	7.1	KCA 7.1.3.1.2 /02	0.47	0.95	22
[redacted]	silty clay loam	5.9	KCA 7.1.3.1.2 /02	3.01	0.98	182
[redacted]	loamy sand	6.8	KCA 7.1.3.1.2 /02	0.18	0.92	23
			arithmetic mean	0.99	0.95	60
			Geomean (neutral without soil [redacted]			19.3

a) pH value determined in water

Table 7.1.3- 6: Overall summary of adsorption constants and correlation coefficients in soils of 2-chlorophenol (*M82*)

Soil	Texture (USDA)	pH	Annex Point / Reference No	$K_{F(ads)}$ [mL/g]	1/n	$K_{OC(ads)}$ [mL/g]
LH AXXa (sterile)	sandy loam	6.1	KCA 7.1.3.1.2 /03	2.302	0.7983	100.1
LH AIIIa	sandy loam	6.4	KCA 7.1.3.1.2 /03	1.700	0.7373	154.5
LH [redacted]	sandy loam	5.6	KCA 7.1.3.1.2 /03	1.807	0.7465	129.1
[redacted]	silty loam	6.1	KCA 7.1.3.1.2 /03	1.645	0.7502	126.5
CA	loamy sand	7.1	KCA 7.1.3.1.2 /05	0.354	0.9727	90.8
ND	clay loam	7.3	KCA 7.1.3.1.2 /05	6.479	0.9844	175.1
DF	clay loam	7.2	KCA 7.1.3.1.2 /05	1.789	0.9747	34.4
			arithmetic mean	2.297	0.8520	115.8
			geomean			104.7

CA 7.1.4 Mobility in soil

CA 7.1.4.1 Column leaching studies

No column leaching study was performed for the active substance fluoxastrobin. Instead, the mobility in soil is assessed by environmental modelling, using data on the degradation under aerobic conditions in the laboratory (CA 7.1.1), and on adsorption to soil as determined from batch equilibrium experiments (CA 7.1.3).

CA 7.1.4.1.1 Column leaching of the active substance

Due to the argumentation provided under CA 7.1.4.1 above no soil column leaching study with fluoxastrobin was performed.

CA 7.1.4.1.2 Column leaching of metabolites, breakdown and reaction products

Due to the argumentation provided under CA 7.1.4.1 above no soil column leaching study with metabolites fluoxastrobin was performed.

CA 7.1.4.2 Lysimeter studies

Due to the argumentation provided under CA 7.1.4.1 above no lysimeter study with fluoxastrobin is required.

CA 7.1.4.3 Field leaching studies

The leaching behaviours of fluoxastrobin and its degradation products in soil under field conditions were evaluated during the Annex I inclusion using unlabelled fluoxastrobin formulated as EC 100, and were accepted by the European Commission (SANCO/3921/07-final, 2012). The following study is included in the baseline dossier:

Author(s)	Year	Document No
[redacted]	2001	M-136670-01-1

A short summary of the field study is provided in section CA 7.1.2.2.1.

Hence, no additional field leaching studies are deemed necessary within this supplementary dossier for the fluoxastrobin.

CA 7.2 Fate and behaviour in water and sediment

CA 7.2.1 Route and rate of degradation in aquatic systems (chemical and photochemical degradation)

CA 7.2.1.1 Hydrolytic degradation

The hydrolytic route and rate of degradation of fluoxastrobin in buffers under sterile conditions in the dark in the laboratory were evaluated during the Annex I inclusion using one radiolabel position, ring 3-label, and was accepted by the European Commission (SANCO/3921/07-final, 2012). The following study is included in the baseline dossier:

Author(s)	Year	Document No
[redacted]	1999	M-008681-01-1

Report:	KCA 7.2.1.1/01 [redacted] T, 1999, M-008681-01-1
Title:	Hydrolysis of [methoxyiminotolyl-ring-UL-14C]HEC 5725 in sterile aqueous buffer solutions
Report No.:	MR-058/99
Document No.:	M-008681-01-1
Guidelines:	- EU 96/36/EC and 97/37/EC - SETAC-Europe, Procedures, 1995 - US EPA Subdivision N 161-1
Guideline deviation(s):	not specified
GLP/GEP:	**yes**

The hydrolytic stability of fluoxastrobin was studied.

Hydrolysis of ring 3-labelled fluoxastrobin was tested in aqueous buffer solution (0.24 mg a.s./L) at 50 °C at pH values 4, 7 and 9. Solutions were incubated in the dark under sterile conditions. After 0.08, 0.21, 0.92, 2, 5 and 7 days samples (mostly in duplicate but some single samples) were analysed for radioactivity using LSC and for chemical content by TLC. 1 mL of the solvent acetonitrile was added to aid extraction. Fluoxastrobin was found to be hydrolytically stable under the test conditions as no degradation was seen during the study.

No additional studies are submitted within this supplementary dossier for the fluoxastrobin renewal of approval.

CA 7.2.1.2 Direct photochemical degradation

The photolytic route and rate of degradation of fluoxastrobin in buffers in the laboratory were evaluated during the Annex I inclusion using two radiolabel positions, ring 1- and ring 3-label, as well as unlabelled fluoxastrobin for determination of the quantum yield of direct photodegradation. Furthermore, the DT_{50} value for the photolysis degradation product HEC 5725-oxazepine (*M36*) was calculated. This photometabolite exhibits a completely different structure compared to the parent and the formation is due to complex phototransformation processes in pure water with cyclisation and rearrangement. In order to further assess the formation of the HEC 5725-oxazepine (*M36*) under more realistic conditions, the route and rate of degradation of fluoxastrobin in irradiated water/sediment systems were evaluated during the Annex I inclusion using one radiolabel position, ring 3-label (see also section CA 7.2.2.4). All studies were accepted by the European Commission (SANCO/3921/07-final, 2012). The following studies are included in the baseline dossier:

Author(s)	Year	Document No
[redacted]	2001	M-033515-01-1
[redacted]	2001	M-091029-01-1

Report: KCA 7.2.1.2/01 [redacted] Z, 2001; M-033515-01-1
Title: Determination of the quantum yield and assessment of the environmental half-life of the direct photodegradation in water of HEC 5725
Report No.: MR-540/00
Document No.: M-033515-01-1
Guideline(s): German UBA (Dec. 1997)
Guideline deviation(s): not specified
GLP/GEP: yes

The quantum yield of fluoxastrobin was determined using the Test Method: ECETOC (polychromatic light source).

About 50% degradation of fluoxastrobin was measured by HPLC-UV following the maximum irradiation period of 150 minutes in pure water. It was clearly shown that sunlight first increases the relative amount of fluoxastrobin *E*-isomer. Using the UV absorption data and the degradation kinetics of the duplicate experiments a mean quantum yield (Φ) of 0.00098 (*E*-isomer) or 0.00089 (sum of *E* and *Z*-isomers). Two different arithmetic models (GC-SOLAR and Frank & Klöpffer) were used to predict environmental direct photolysis half-lives using the values obtained for quantum yield and light absorption over a range of wavelengths. It was concluded that the 'environmental direct photolysis half-life' of fluoxastrobin (*E*) isomer lays in the range of 2.3 – 20 days for the periods of major use.

Direct photolysis in aqueous solution is expected to contribute to the elimination of fluoxastrobin in the environment.

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Report:	KCA 7.2.1.2/02[redacted]; 2001; M-091029-01-1
Title:	Photolysis of HEC 5725 in aqueous solution
Report No.:	MR-072/00
Document No.:	M-091029-01-1
Guidelines:	- US EPA, Subdivision N, Paragraph 161-2 - EU 95/36/EC amending 91/414/EEC
Guideline deviation(s):	not specified
GLP/GEP:	**yes**

The aqueous photolysis of fluoxastrobin in a sterile buffer was studied.

Sterile aqueous buffer solutions (pH 7) were prepared, one containing ring 3 labelled and ring 1 labelled fluoxastrobin at concentrations of 0.53 mg/L and 0.23 mg/L, respectively. Aliquots were incubated at 25 °C in quartz glass test vessels fitted with traps for organic volatiles (PU foam plug) and carbon dioxide (soda lime). Vessels were either kept in the dark for 8 days or exposed to light from a Suntest unit with xenon lamp (with cut off at 290 nm) for up to 8 days. The irradiation exposure under Suntest conditions was 1758 W x h x m^{-2} (based on radiometer determination) and 6.3 MJ x m^{-2} for one hour. An exposure time of 3.7 hours was stated by the applicant to correspond to one summer June day in Athens, Greece (38 N with global radiation for day of 20 MJ x m^{-2}). Samples at time 0, 1, 2, 3, 4, 7 and 8 days of irradiation and after 8 days in the dark (control) were quantified directly for radioactivity using LSC and analysed by HPLC and TLC. The major photodegradate HEC 5725-oxazepine (*M36*) was further identified by NMR and LC-MS/MS. The minor degradation compound HEC 5725-phenoxy-aminopyrimidine (*M56*) was identified by comparison of HPLC and LC-MS/MS.

The total recovery of radioactivity ranged from 99.1% to 106.4%. Experimental half-lives were determined to be 3.4 days (R^2 = 0.9787) for the ring 1 labelled and 3.8 days (R^2 = 0.9941) for the ring 3 labelled test substance (sum of *E*- and *Z*-isomers) using linear regression based on pseudo first order kinetics. These values correspond to predicted environmental half-lives under solar summer conditions of Phoenix, AZ (33°N) in June of 21.6 and 18.6 days, respectively. For conditions at Athens, Greece (38°N) in June the predicted environmental half-lives are 33.4 and 28.9 days (mean 31.2 days), respectively.

Photo-isomerisation of the *E*-isomer was the first transformation process. The highest concentrations of the resulting *Z*-isomer were 11.2% (ring 1-label) and 9.8% (ring 3-label) of the applied radioactivity after one day of irradiation. The main photo-degradation product, HEC 5725-oxazepine (*M36*), accounted for a maximum of 23.6% (ring 1-label) and 17.1% (ring 3-label) of the applied radioactivity after 8 days of continuous irradiation. All other dissolved degradation products were less than 5% AR. Photo-mineralisation to carbon dioxide lead to a maximum of 3.7% (ring 1-label) and 8.5% (ring 3-label) of the applied radioactivity after 8 days.

Table 7.2.1.2- 1: Distribution of ring 1 labelled fluoxastrobin (in % AR)

Sample	DAT	fluoxastrobin (*E*)	HEC 5725-*Z*-Isomer	HEC 5725 -oxazepine (M36)	HEC 5725 -phenoxy-aminopyrimidine (M56)	Unknown metabolites [a)]	Volatile compounds		Material balance
							CO_2	Org. volatiles	
Irradiated	0	91.7	8.3	n.d.	n.d.	n.d.	n.m.	n.m.	100.0
	1	73.7	11.2	4.9	n.d.	n.d.	0.1	< 0.1	99.6
	2	68.1	10.8	5.6	n.d.	3.6	0.2	< 0.1	101.9
	3	59.5	8.7	8.8	1.4	2.8	0.4	< 0.1	100.3
	4	52.0	7.4	11.6	4.0	5.9	0.7	< 0.1	100.8
	7	31.7	5.4	16.7	4.3	12.1	2.3	< 0.1	101
	8	23.1	3.5	23.0	4.7	12.8	3.7	< 0.1	102.2
Dark	8	88.0	7.7	n.d.	n.d.	n.d.	< 0.1	< 0.1	100.7

DAT: days after treatment
a) sum of 14 unknown minor metabolites, none exceeded 5% AR

Table 7.2.1.2- 2: Distribution of ring 3 labelled fluoxastrobin (in % AR)

Sample	DAT	fluoxastrobin (*E*)	HEC 5725-*Z*-Isomer	HEC 5725 -oxazepine (M36)	Unknown metabolites [a)]	Volatile compounds		Material balance
						CO_2	Org. volatiles	
Irradiated	0	100.0	n.d.	n.d.	n.d.	n.m.	n.m.	100.0
	1	74.0	9.6	4.3	n.d.	1.4	< 0.1	106.4
	2	61.8	8.9	7.1	8.7	1.0	< 0.1	101.5
	3	52.1	8.7	9.8	10.0	2.1	< 0.1	102.3
	4	45.9	8.0	10.8	14.6	2.7	< 0.1	104.2
	7	24.1	3.5	16.3	26.0	3.3	< 0.1	103.8
	8	20.7	3.2	17.1	25.4	8.5	< 0.1	105.2
Dark	8	103.4	n.d.	n.d.	n.d.	< 0.1	< 0.1	105.9

DAT: days after treatment
a) sum of 13 unknown minor metabolites, none exceeded 5% AR

CA 7.2.1.3 Indirect photochemical degradation

Indirect photochemical degradation of fluoxastrobin was not studied. However, the route and rate of degradation of fluoxastrobin in irradiated water/sediment systems were evaluated during the Annex I inclusion using one radiolabel position, ring 3-label, and were accepted by the European Commission (SANCO/3921/07-final, 2012). The study is included in the baseline dossier and addressed under CA 7.2.2.4 in this supplementary dossier.

CA 7.2.2 Route and rate of biological degradation in aquatic systems

CA 7.2.2.1 "Ready biodegradability"

According to its molecular structure, fluoxastrobin was regarded not to be readily biodegradable. Therefore, a study was not conducted. However, a study for the determination of the route and rate of degradation of fluoxastrobin in surface water under aerobic conditions in the dark in the laboratory has been performed (CA 7.2.2.2) and is summarized in in the subsequent section.

CA 7.2.2.2 Aerobic mineralisation in surface water

A study for the determination of the route and rate of degradation of fluoxastrobin in surface water under aerobic conditions in the dark in the laboratory has been performed and is submitted within this supplementary dossier for the fluoxastrobin renewal of approval using one radiolabel position, ring 3-label.

Report:	KCA 7.2.2.2/01 [redacted]; [redacted]; 2014; M-499357-01-1
Title:	[Methoxyimino-ring-UL-14C]fluoxastrobin: Aerobic mineralisation in surface water
Report No.:	EnSa-14-0572
Document No.:	M-499357-01-1
Guidelines:	- OECD Test Guideline No. 309 - DRAFT SANCO/11802/2010/rev.1 in accordance with Regulation (EC) No 1107/2009
Guideline deviation(s):	not specified
GLP/GEP:	**yes**
Justification:	New data / guideline requirement: Route and rate of degradation of fluoxastrobin in aerobic surface water

Executive Summary

The route and rate of degradation of [methoxyiminotolyl-ring-UL-^{14}C]fluoxastrobin were studied in surface water under aerobic conditions in the dark in the laboratory for 61 days at 20 ± 2 °C.

Study application rates of 10.3 µg/L and 104.2 µg/L surface water were applied for low and high concentration samples, respectively.

Mean material balances were 100.8% AR for the low concentration (range from 97.8 to 104.6% AR) and 100.1% AR for the high concentration (range from 97.5 to 105.3% AR).

Formation of carbon dioxide was insignificant as demonstrated by values ≤ 0.1% AR at all sampling intervals and for both concentrations. The amount of volatile organic compounds was < LOD (0.7% AR) for low concentration test systems and ≤ 0.1% AR for high concentration samples at all sampling intervals.

The amount of fluoxastrobin in the surface water was between 97.6 and 104.6% AR for low concentration test systems and between 96.0 and 105.3% AR for high concentration test systems for all sampling intervals.

Since no degradation products of fluoxastrobin > 5% AR were found, no identification attempts were made. The total unidentified residues amounted to a maximum of 3.6% AR and no single component exceeded 1.0% AR at any sampling interval for both concentrations.

The experimental DT_{50} and DT_{90} values were calculated using a single first order (SFO) kinetic model. The half-lives for fluoxastrobin were extrapolated to be about 944 and > 1000 days for the low and high concentration, respectively.

I. MATERIALS AND METHODS

A. MATERIALS

1. Test Item

[methoxyiminotolyl-ring-UL-^{14}C]fluoxastrobin

Sample ID:	KML 9652
Specific Activity:	3.7 MBq/mg (100 µCi/mg)
Radiochemical Purity:	> 98%
Chemical Purity:	> 99%

2. Test Water

Natural water from a fresh water dam that is used for the preparation of drinking water not receiving effluent discharges was used (see Table 7.2.2.2- 1). The water was sampled freshly from the natural water system (depth of approx. 10 cm) and sieved through a 0.063 mm sieve prior to use.

Table 7.2.2.2- 1: Physico-chemical properties of test water

Parameter	Results / Units
Water Designation	[redacted]
Origin	[redacted] near [redacted], North Rhine-Westphalia, Germany
GPS Coordinates	N 50° 56.8' E 007° 40.0'
Water Temperature [°C] [1]	7.1
pH [a]	5.9
Redox Potential E_H [mV] [1]	255.3
Oxygen Saturation [%] [1]	83.2
DOC [mg C/L]	< 2.0
TOC [mg C/L]	< 2.0
BOD [mg/L]	n.a. [b]
Total Nitrogen [mg/L]	2.5
Total Phosphorous [mg/L]	0.03
Microbial Activity [c]	DT_{50} < 2 days

a) measured at sampling site
b) not applicable due to low amount of DOC
c) degradation of benzoic acid
BOD: biological oxygen demand
DOC: dissolved organic carbon
GPS: global positioning system
TOC: total organic carbon

B. STUDY DESIGN

1. Experimental Conditions

The static test system for degradation in surface water under aerobic conditions consisted of Erlenmeyer glass flasks with baffles (e.g. 250 mL). Each flask was fitted with a trap attachment (permeable for oxygen) containing soda lime for absorption of carbon dioxide and a polyurethane (PU) foam plug for adsorption of volatile organic compounds (VOC).

For preparation of the test systems, 100 mL of the natural water were transferred into each flask. The flasks were then fitted with trap attachments and equilibrated to study conditions for 2 days prior to application. The water was kept in motion during the entire study duration.

Study application rates of 10.3 µg/L and 104.2 µg/L surface water were applied for the low and high concentration, respectively.

The test item was applied dropwise onto the water surface of the respective test systems in 100 µL methanol using a pipette. After application, the test vessels were fitted with trap attachments (except of DAT-0 samples).

The test systems were incubated in the dark for 61 days at 20 ± 2 °C in a climatic cabinet.

2. Sampling

Seven sampling intervals were distributed over the entire incubation period of 61 days. Duplicate samples of each concentration were processed and analysed 0, 7, 14, 21, 30, 48 and 61 days after treatment (DAT). Sterile controls were processed and analysed at DAT-61 for the both concentrations, microbial activity samples at DAT-0 and DAT-2.

3. Analytical Procedures

Carbon dioxide absorbed by soda lime was liberated with 18% aqueous hydrochloric acid and trapped in a scintillation cocktail selective for binding of carbon dioxide using an air-tight assembly. The radioactivity content was determined by liquid scintillation counting (LSC).

The PU foam plugs of the trap attachments were extracted with ethyl acetate in an ultrasonic bath to desorb VOC. The radioactivity content was determined by LSC.

At each sampling interval, pH, oxygen content and redox potential in the water were determined. The water was transferred to a volumetric cylinder and the test vessel was rinsed additionally with acetonitrile. The rinsing solutions were pooled with the water. Radioactivity in samples was determined by LSC and amounts of test item and degradation products were determined by reversed phase HPLC/radiodetection.

The limit of detection (LOD) and limit of quantitation (LOQ) for HPLC/radiodetection analysis of the water in low concentration samples were 1.1 and 3.3% AR, respectively. The limit of detection (LOD) and limit of quantitation (LOQ) for HPLC/radiodetection analysis of the water in high concentration samples were 0.1 and 0.3% AR, respectively.

Test item was identified by HPLC-MS(/MS) including accurate mass determination and ^{1}H-NMR

The degradation kinetics of the test item was determined according to FOCUS kinetics (2006) using the software KinGUI 2 with three different kinetic models: single first order, first order multi compartment and double first order in parallel. Model input datasets were the residual amounts found in each replicate test system at each sampling interval. The initial recovery at DAT-0 was included in the parameter optimization procedure, but for optimal goodness of fit, the value was allowed to be estimated by the model. DT_{50} and DT_{90} values were calculated from the resulting kinetic parameters.

II. RESULTS AND DISCUSSION

Results indicated that the anticipated standardized conditions were maintained and that the water was microbially active over the duration of the laboratory study.

The pH in the water ranged from 7.8 to 8.9 for both low and high concentration.

Oxygen saturation (range from 90 to 99%) and redox potential measurement (E_H, range from 310 to 394 mV) indicated aerobic conditions in the water for both concentrations.

A. DATA

Table 7.2.2.2- 2: Degradation of fluoxastrobin in natural water under aerobic conditions (low concentration, mean values and SD expressed as % AR)

Compound	Mean SD	DAT 0	7	14	21	30	48	61	61 sterile
Fluoxastrobin	Mean	104.6	101.1	100.2	101.2	100.3	97.6	99.5	102.0
	SD	± 0.2	± 1.5	± 0.2	± 0.3	± 1.0	± 2.2	± 0.5	± 0.4
Sum of Unid./Diff. Residues [a]	Mean	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
	SD								
Total Extractable Residues [b]	Mean	104.6	101.1	100.2	101.2	100.3	97.6	99.5	102.0
	SD	± 0.2	± 1.5	± 0.2	± 0.3	± 1.0	± 2.2	± 0.5	± 0.4
Carbon Dioxide [c]	Mean	n.a.	< 0.1	0.1	0.1	0.1	0.1	0.1	< 0.1
	SD								
Volatile Organic Compounds [c]	Mean	n.a.	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD
	SD								
Total Recovery [b]	Mean	104.6	101.2	100.4	101.3	100.5	97.8	99.6	102.2
	SD	± 0.2	± 1.6	± 0.2	± 0.3	± 1.0	± 2.1	± 0.5	± 0.3

n.d.: not detected, n.a.: not analysed, DAT: days after treatment, SD: standard deviation
a) Minor components are summed up to unidentified residue
b) Difference to Material Balance values due to rounding errors as well as clean up and chromatographic losses
c) Values taken from Material Balance

Table 7.2.2.2- 3: Degradation of fluoxastrobin in natural water under aerobic conditions (high concentration, mean values and SD expressed as % AR)

Compound	Mean SD	DAT 0	7	14	21	30	48	61	61 sterile
Fluoxastrobin	Mean	105.3	96.0	98.4	99.1	97.7	96.3	98.5	95.2
	SD	± 0.9	± 0.6	± 1.0	± 0.5	± 0.4	± 0.5	± 0.3	± 0.4
B	Mean	n.d.	0.9	0.9	1.0	0.9	1.0	1.0	1.0
	SD		± 0.0	± 0.0	± 0.0	± 0.0	± 0.0	± 0.1	± 0.0
C	Mean	n.d.	0.6	0.5	0.6	0.5	0.5	0.8	0.9
	SD		± 0.0	± 0.1	± 0.1	± 0.0	± 0.1	± 0.0	± 0.0
D	Mean	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.9
	SD								± 0.1
E	Mean	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.5
	SD								± 0.0
Sum of Unid./Diff. Residues [a]	Mean	n.d.	1.4	1.4	1.6	1.4	1.5	1.7	3.6
	SD		± 0.0	± 0.1	± 0.0	± 0.1	± 0.0	± 0.1	± 0.1
Total Extractable Residues [b]	Mean	105.3	97.5	99.8	100.7	99.1	97.8	100.2	98.9
	SD	± 0.9	± 0.6	± 1.0	± 0.4	± 0.5	± 0.4	± 0.3	± 0.5
Carbon Dioxide [c]	Mean	n.a.	0.1	0.1	0.1	0.1	0.1	0.1	< 0.1
	SD								
Volatile Organic Compounds [c]	Mean	n.a.	< 0.1	< 0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1
	SD		± 0.0	± 0.0	± 0.0	± 0.0	± 0.0	± 0.0	± 0.0
Total Recovery [b]	Mean	105.3	97.5	99.9	100.8	99.2	97.9	100.2	98.9
	SD	± 0.9	± 0.6	± 1.0	± 0.4	± 0.5	± 0.5	± 0.3	± 0.5

n.d.: not detected, n.a.: not analysed, DAT: days after treatment, SD: standard deviation
a) Minor components are summed up to unidentified residues
b) Difference to Material Balance values due to rounding errors as well as clean up and chromatographic losses
c) Values taken from Material Balance

B. MATERIAL BALANCE

Mean material balances were 100.8% of applied radioactivity [% AR] (range from 97.8 to 104.6% AR) for the low concentration and 100.1% AR (range from 97.5 to 105.3% AR) for the high concentration. The complete material balances found at all sampling intervals demonstrated that there was no significant loss of radioactivity dissipated from the test systems or during sample processing.

C. VOLATILES

Formation of carbon dioxide was ≤ 0.1% AR at all sampling intervals for both concentrations. The maximum amount of volatile organic compounds was < LOD (0.7% AR) and ≤ 0.1% AR after 61 days of incubation for the low and high concentrations, respectively.

E. DEGRADATION OF PARENT COMPOUND

The amount of fluoxastrobin in the surface water was between 97.6 and 104.6% AR for low concentration test systems and between 96.0 and 105.3% AR for high concentration test systems for all sampling intervals.

No degradation products of fluoxastrobin > 5% were found. The total unidentified residues amounted to a maximum of 3.6% AR and no single component exceeded 1.0% AR at any sampling interval for both concentrations.

The same was observed in sterile controls.

The experimental DT_{50} values of fluoxastrobin were calculated using single first order (SFO) kinetics (see Table 7.2.2.2- 4).

Table 7.2.2.2- 4: Degradation kinetics of fluoxastrobin in natural pond water under aerobic conditions according to FOCUS

	SFO [a]			
Test System	**DT_{50} [days]**	**DT_{90} [days]**	**Chi² Error [%]**	**Visual Assessment [b]**
Low concentration (10.3 µg/L)	944	> 1000	1.0	o
High concentration (104.2 µg/L)	> 1000	> 1000	2.1	o

a) SFO: single first order

b) visual assessment: o = moderate

III. CONCLUSIONS

Fluoxastrobin did not show significant degradation at two concentration levels in surface water under aerobic conditions in the dark in the laboratory. The calculated best fit half-lives were 944 and > 1000 days for low and high concentrations, respectively.

Formation of carbon dioxide was insignificant (0.1% AR) at study end (DAT-61).

No degradation products > 5% were identified.

CA 7.2.2.3 Water/sediment study

The route and rate of degradation of fluoxastrobin in water/sediment systems under aerobic and anaerobic conditions were evaluated during the Annex I inclusion using one radiolabel position, ring 3-label, and were accepted by the European Commission (SANCO/3921/07-final, 2012). A summary of these studies has been included in this dossier and the kinetics was newly evaluated, since it has been used for the risk assessment. No additional experimental studies were performed. A new kinetic evaluation of the water /sediment study was conducted to derive kinetic parameters according to EFSA Guidance 2014 and FOCUS Guidance 2014.

Annex Point / Reference No	Author(s)	Year	Document No
KCA 7.2.2.3	[redacted]	2002	M-038943-01-1
KCA 7.2.2.3	[redacted]	2002	M-033846-01-1

An aerobic sediment water study was conducted. A short summary of the laboratory study is given below.

Report: KCA 7.2.2.3/01 [redacted]; 2002; M-038943-01-1
Title: Aerobic degradation and metabolism of [ethoxyiminoacetyl-ring-UL-14C]HEC5725 in the water/sediment system
Report No.: MR-336/01
Document No.: M-038943-01-1
Guidelines: - German BBA Part IV, 5-1 (1990)
- EU 91/36/EC amending 91/414/EC
- SETAC Procedures, March 1995
Guideline deviation(s): not specified
GLP/GEP: yes

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Report: KCA 7.2.2.3/02 [redacted]; 2002; M-033846-01-1
Title: [HEC 5725]: Aaerobic aquatic degradation and metabolism of HEC 5725
Report No.: MR-406/01
Document No.: M-033846-01-1
Guidelines: - EU 91/36/EC amending 91/414/EEC
- SETAC-Europe Procedures, March 1995
- US EPA Subdivision N, Paragraph 162-3
- Environmental Chemistry and Fate, Guidelines for Registration of Pesticides in Canada, 1987Canada, 1987
Guideline deviation(s): not applicable
GLP/GEP: yes

Ring 3-labelled fluoxastrobin (here in this study E + Z-Isomer) was used to dose the water layer at a concentration of 405 µg/L (equivalent to an application rate of 810 g/ha and assuming a water depth of 2 m). Sediment ('Fuquay – sandy clay) and some related water were collected from a small pond in Montezuma, Georgia, USA. The characteristics of the sediment and water are shown in Table 7.2.2.3-1.

Table 7.2.2.3- 1: Characteristics of the water/sediment system Fuquay

Origin	Fuquay, GA
Sediment layer characteristics:	
Textural class (USDA)	Sandy clay
Textural analysis (USDA):	
2000 - 50 µm, sand (%)	46.3
50 - 2 µm, silt (%)	16.4
< 2 µm, clay (%)	37.3
pH value:	
Water	5.3
$CaCl_2$	4.7
KCl	4.1
Organic C (%)	0.46
Organic matter [2]	0.79
Cation exchange capacity (meq Ba/100 g)	10
Total nitrogen (% N)	0.04
Total phosphorus (mg P/kg dry matter)	141
$CaCO_3$ (%)	< 0.1
Redox potential prior pre-equilibration (mV)	- 460
Aerobic microbial activity (mg CO_2-C/kg sediment (dry matter):	
080798 BY 1 / 2 (prior to starting the test)	1 / 1
BS03T12 Bio + / - (at DAT-360)	2 /
No. of anaerobic bacteria colonies tested under anaerobic incubation in malt agar at 20 ± 2 °C:	
DAT-0 after 28 days	dilution 10^{-3}: 338
DAT-120 after 21 days	dilution 10^{-3}: 580
DAT-120 after 21 days	dilution 10^{-3}: 416
Water layer characteristics:	
pH	7.8
Total organic carbon, TOC (mg/L)	14
Dissolved organic carbon, DOC (mg/L)	10
Hardness (rad DH)	11.3
Total nitrogen, TNO_5, (mg/L)	1.3
Total phosphorus (mg/L)	0.1
Oxygen saturation (%) at 20 (°C) [a]	82
Redox potential (mV) [a]	234

DAT: days after treatment
a) data must be interpreted with caution since the figures were ≤ LOQ
[2] % organic matter = % organic carbon x 1.724

Homogenised sediment 123.4 g (corresponding to 78.4 g dry matter) and 142.6 g water were weighed into each flask. A portion of sucrose (2 g) was added to each system to enhance microbial growth and to produce anaerobic conditions with a negative redox potential once the test systems were sealed. The following day the flasks were shaken for 7 – 10 minutes whilst being purged with argon/methane to replace the oxygen and closed with a bubble counter attachment filled with water. Flasks were pre-incubated in a box purged with nitrogen in the dark at 20 °C until anaerobic conditions were confirmed. Flasks treated with labelled fluoxastrobin were kept at 20 °C in the dark for up to 360 days. Records of oxygen and redox potential showed strict anaerobic conditions in the water layer during the entire study duration. pH in the supernatant water was in the range 4.7 to 5.3.

At sampling points the water and sediment layers had their radioactivity determined and identified. Radioactivity in the water was determined by LSC with identification of metabolites by TLC and HPLC. Dissolved CO_2 and carbonates were determined. Sediment was extracted three times with acetonitrile with radioactivity determined by LSC and metabolites identified by co-chromatography

with reference standards using TLC. The major metabolite HEC 5725 carboxylic acid (*M40*) was isolated and investigated by LC-MS. Volatiles trapped in the PU foam plug and soda lime were quantified.

Recovery of radioactivity (means of duplicates) was in the range 90.3 to 97.9%. Percentage radioactivity in the water and sediment over the study is shown in Table 7.2.2.3- 2.

Table 7.2.2.3- 2: Distribution and total recovery of the radioactivity after application of fluoxastrobin in the Fuquay, GA water/sediment system (in % AR)

Water/ sediment system	DAT	Water	Sediment			Volatiles $^{14}CO_2$				Org. volatiles	Material balance
			Extracted	NER	Sub-total sediment	Head-space	Water	Sediment	Subtotal $^{14}CO_2$		
Fuquay, GA	0.1	60.6	33.2	2.4	35.6	N/A	n.m.	n.m.	n.m.	N/A	96.2
	1	60.9	30.9	5.0	35.9	< LOQ	< LOQ	n.m.	< LOQ	< LOQ	96.8
	3	56.4	32.6	3.6	36.2	< LOQ	< LOQ	n.m.	< LOQ	< LOQ	92.6
	7	43.6	42.8	9.5	52.3	< LOQ	< LOQ	n.m.	< LOQ	< LOQ	95.9
	14	33.4	46.3	13.6	59.9	< LOQ	< LOQ	n.m.	< LOQ	< LOQ	93.3
	30	27.4	49.8	16.9	66.6	< LOQ	< LOQ	n.m.	< LOQ	< 0.1	94.0
	59	27.4	47.2	19.3	66.5	< LOQ	< LOQ	n.m.	< LOQ	< LOQ	93.9
	91	49.5	24.8	23.1	47.9	< LOQ	< LOQ	n.m.	< LOQ	< LOQ	97.9
	120	24.6	37.9	27.7	65.6	< LOQ	< LOQ	n.m.	< LOQ	< LOQ	90.3
	182	28.1	38.3	30.0	68.2	< LOQ	< 0.1	n.m.	< 0.1	< LOQ	96.3
	240	27.5	33.3	35.0	68.4	< LOQ	< LOQ	n.m.	< LOQ	< LOQ	95.8
	360	30.1	29.1	36.2	65.0	< LOQ	< LOQ	n.m.	< LOQ	< LOQ	95.1
										Mean:	*94.9*

LOQ = Limit of quantitation; n.m. = not measured

Table 7.2.2.3- 3: Dissipation of fluoxastrobin and formation of metabolites in an anaerobic water/sediment system (in % AR)

Compartment	DAT	fluoxastrobin *E-* + *Z*-isomer	HEC 5725-amide (*M38*)	HEC 5725-carboxylic acid (*M40*)	Unknown minor metabolites [a)]
Water	0	98.9	n.d.	n.d.	n.d.
	0.1	59.5	n.d.	n.d.	n.d.
	1	58.8	n.d.	0.3	n.d.
	3	55.6	n.d.	n.d.	n.d.
	7	42.5	0.2	0.1	0.4
	14	32.4	0.6	n.d.	< 0.1
	30	25.6	1.1	n.d.	n.d.
	59	23.1	1.8	0.3	n.d.
	91 [b)]	36.6	4.4	4.4	0.1
	120	13.0	1.9	6.8	n.d.
	182	15.2	3.1	6.0	n.d.
	240	9.3	2.1	9.4	n.d.
	360	12.7	1.1	10.6	3.2
Sediment	0			not treated	
	0.1	32.5	n.d.	n.d.	n.d.
	1	36.6	n.d.	n.d.	n.d.
	3	31.8	0.1	0.2	n.d.
	7	41.0	n.d.	0.4	< 0.1
	14	44.8	0.9	n.d.	n.d.
	30	49.1	3.9	n.d.	n.d.
	59	42.8	4.1	n.d.	n.d.
	91 [c)]	21.3	1.9	1.6	n.d.
	120	25.0	2.0	0.9	n.d.
	182	18.0	3.9	5.7	n.d.
	240	19.4	2.4	11.1	n.d.
	360	14.0	0.7	10.5	2.4

DAT: days after treatment; n.d.: not detected
a) unknown metabolites, none exceeding 2.5% of the applied radioactivity
b) samples of DAT-91 contain a portion of organic sediment extract
c) samples of DAT-91: probably the 1st extract was added to the water phase

One degradation product exceeded 10% AR during the study. This metabolite was identified as HEC 5725-carboxylic acid (*M40*). One minor metabolite reached a maximum of 7.3% AR in the entire system at DAT-182 but was identified as HEC 5725-amide (*M38*). In the water and sediment extracts three unknown metabolites were detected. None of these individually exceeded 2.5% AR in the water layer or sediment.

The data were evaluated using a simple first order kinetics (SFO model) and by a first order multi compartment model (FOMC).

Table 7.2.2.3- 4: Degradation of fluoxastrobin in an anaerobic water/sediment system

	SFO	FOMC
DT_{50} [days]	146	120
DT_{90} [days]	486	1890
r^2	0.928	0.962

*****

An updated kinetic evaluation of the degradation behaviours of fluoxastrobin in water and sediment under aerobic conditions in the dark in the laboratory has been performed according to FOCUS kinetics (2006, 2014) to derive kinetic parameters suitable for modelling purpose and environmental risk assessment and is submitted within this supplementary dossier for the fluoxastrobin renewal of approval.

New kinetic evaluation submitted for Annex I Renewal

Justification for including this study in the Annex I Renewal Dossier: The objective of this study is a kinetic evaluation of the aerobic water/sediment metabolism study of fluoxastrobin (CA 7.2.2.3, included in the baseline dossier). The evaluation was conducted to derive kinetic parameters according to EFSA Guidance 2014 and FOCUS Guidance 2014.

Report:	[redacted]y; [redacted]; [redacted]; 2015; M-534576-01-1
Title:	Kinetic evaluation of aerobic aquatic metabolism of fluoxastrobin in water / sediment systems according to FOCUS kinetics using KinGUI 2.1
Report No.:	EnSa-15-0222
Document No.:	M-534576-01-1
Guidelines:	- FOCUS, 2003: FOCUS Surface Water Scenarios in the EU Evaluation Process under 91/414/EC. Report of the FOCUS Working Group on Surface Water Scenarios. EC Document Reference SANCO/4802/2001-rev2 - FOCUS, 2006: Guidance Document on Estimating Persistence and Degradation Kinetics from Environmental Fate Studies on Pesticides in EU Registration. Report of the FOCUS Work Group on Degradation Kinetics. EC Document Reference Sanco/10058/2005, v.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, Date: 18 December 2014
Guideline deviation(s):	none
GLP/GEP:	**no**
Justification:	New data / guideline requirement: Kinetic analysis of the degradation of fluoxastrobin and its major aquatic metabolites in the water-sediment systems for use in model simulations of environmental exposures and as persistence endpoints

Executive Summary

The purpose of this study was to estimate degradation and dissipation times (DT_{50}) of the active substance fluoxastrobin and its major aquatic metabolites in the water – sediment systems for use in model simulations of environmental exposures and as trigger endpoints.

The degradation and dissipation behaviour of fluoxastrobin (here - assuming worst case conditions - as sum of *E*+*Z* isomers) and its metabolites HEC 5725-*E*-des-chlorophenyl (*M48-E*) and HEC 5725-carboxylic-acid (*M40*) was investigated by kinetic evaluation of an aerobic water-sediment study conducted with ^{14}C-labelled fluoxastrobin in 2 different test systems for up to 122 days at 20±1 °C and darkness: loamy sediment [redacted] and loamy sand sediment [redacted] (CA 7.2.2.3).

According to recommendations of FOCUS kinetics (FOCUS, 2006, 2014), (Level P-I) dissipation and degradation DT_{50} of fluoxastrobin for water, sediment and total systems were derived, separately, for modelling and trigger endpoints, using the software tool KinGui 2.1, based on the IRLS error model (Iteratively reweighted least square).

Furthermore, a 2-compartmental approach was taken into account to estimate the degradation of fluoxastrobin in water and sediment compartment, in parallel, including partitioning processes via reaction rates (Level P-II). However, as the degradation rates in water as well as sediment were not significantly different from 0 (t-test), these values are not recommended to use in further assessments.

Additionally, Level M-I dissipation or degradation in water, sediment or total system of the metabolites HEC 5725-*E*-des-chlorophenyl (*M48-E*) and HEC 5725-carboxylic acid (*M40*) were evaluated, from maximum onwards or together with the appropriate fit of the parent fluoxastrobin.

As in the experimental study report, HEC 5725-carboxylic acid (*M40* was analysed only in the sum together with HEC 5725-amide (*M38*). This sum was used to represent the fate and behaviour of HEC 5725-carboxylic acid in water/sediment systems, conservatively.

For the soil and aquatic metabolite HEC 5725-*E*-des-chlorophenyl (*M48-E*), no reliable and statistically significant $DegT_{50}$ values could be evaluated in the total system together with the appropriate parent fit (χ^2 error, t-test). However, a set of conservative formation fractions could be estimated by forcing the degradation curve of the metabolite through the highest measured residues. Thus, for [redacted] a formation fraction of 0.51 and for [redacted] of 0.13 was considered as sufficiently conservative, in combination with a $DegT_{50}$ of 1000 days.

An evaluation of the dissipation from water or sediment of the *E*-des-chlorophenol was not possible, due to the fact that no sufficient data points after the maximum have been available. Finally, a conservative DT_{50} of 1000 days could be assumed for all compartments.

The half-life of fluoxastrobin (E+Z) for modelling purpose (geometric means) was 16.0 days in the water, 313 days in the sediment and 238 days in the total system. The half-life of HEC 5725-carboxylic acid (*M40*) for modelling purpose (single value) was 64.9 days in the sediment, 67.9 days in the total system and could not be evaluated in the water.

The half-lives of fluoxastrobin (E+Z) for trigger evaluation were between 1.4 and 3.4 days in the water, between 268 and 365 days in the sediment and between 143 and 351 days in the total system. The half-life of HEC 5725-carboxylic acid (*M40*) for trigger evaluation was 64.9 days in the sediment, 67.6 days in the total system and could not be evaluated in the total system.

Table 7.2.2.3- 5: Trigger endpoints, best fit model, for dissipation and degradation of fluoxastrobin (*E+Z*) in water, sediment and total water-sediment system

Compartment	System	Kinetic level	Kinetic model [a]	$DT_{50, initial}$ [d]	$DT_{90, initial}$ [d]
Water	[redacted]	**P-I: water $DisT_{50}$**	FOMC	**3.38**	**179**
	[redacted]		FOMC	1.36	22.9
Sediment	[redacted]	**P-I: sediment $DisT_{50}$**	SFO	268	892
	[redacted]		SFO	**364.8**	**> 1000**
Total system	[redacted]	**P-I: system $DegT_{50}$**	SFO	143	474
	[redacted]		FOMC	**351**	**> 1000**

a) SFO: Single first order, FOMC: First order multi compartment

Table 7.2.2.3- 6: Modelling endpoints for dissipation and degradation of fluoxastrobin (*E*+*Z*) in water, sediment and total system

Compartment	System	Kinetic level	Kinetic model [a)]	$DT_{50 mod}$ [d]
Water	[redacted]	P-I: water $DisT_{50}$	DFOP	37.0
	[redacted]		FOMC	6.90
	geo mean	**P-I: water $DisT_{50}$**		**16.0**
Water	all	P-II: water $DegT_{50}$		n.s.
Sediment	[redacted]	P-I: sediment $DisT_{50}$	SFO	268
	[redacted]		SFO	365
	geo mean	**P-I: sediment $DisT_{50}$**		**313**
Sediment	all	P-II: sediment $DegT_{50}$		n.s.
Total system	[redacted]	P-I: system $DegT_{50}$	SFO	143
	[redacted]		DFOP	399
	geo mean	**P-I: system $DegT_{50}$**		**238**

n.s. not significant (t-test), not reliable

a) SFO: Single first order, FOMC: First order multi compartment, DFOP: Double first order in parallel

Table 7.2.2.3- 7: HEC 5725-*E*-des-chlorophenyl (*M48*) endpoints from water-sediment study, for trigger and modelling purpose

System	$DegT_{50}$ /DT_{90} total system	$DisT_{50}$ /DT_{90} water	$DisT_{50}$ /DT_{90} sediment	Method of calculation
[redacted]	nr	ne	ne	SFO
[redacted]	nr	ne	ne	SFO
Geometric mean at 20 °C [a)]				

nr not fully reliable, mathematically not significantly different from 0, not usable

ne not evaluable, not sufficient data points

a) Normalised using a Q_{10} of 2.58

Table 7.2.2.3- 8: HEC 5725-carboxylic acid (*M40*) endpoints from water-sediment study, for trigger and modelling purpose

System	$DegT_{50}$ /DT_{90} total system	$DisT_{50}$ /DT_{90} water	$DisT_{50}$ /DT_{90} sediment	Method of calculation
[redacted]	nr	nr	64.9/216	SFO
[redacted]	67.6/225 (parent FOMC)	nr	ne	trigger, SFO
	67.9/226 (parent DFOP)			modelling, SFO
Geometric mean at 20 °C [a)]				

nr not fully reliable, not usable

ne not evaluable, not sufficient data points

a) Normalised using a Q_{10} of 2.58

Table 7.2.2.3- 9: Estimated formation fractions of major metabolites of fluoxastrobin from the total system

	Formation fraction	
	[redacted]	[redacted]
Parent to HEC 5725-*E*-des-chlorophenyl (*M48-E*)	0.51	0.13
Parent to HEC 5725-carboxylic acid (*M40*)	-	0.4841

I. METHODS

Residue data from the aerobic water/sediment degradation study M-038943-01-1 (baseline dossier, CA 7.2.2.3 KCA 7.2.2.3) were used. In this study, the degradation of fluoxastrobin was studied in water/sediment systems [redacted] and [redacted] under aerobic conditions in the dark in the laboratory for up to 122 days at 20 °C and test concentrations of 55.8 µg/L water.

The FOCUS kinetics report distinguishes between two levels of kinetics: At Level 1 a single compartment is used to derive degradation endpoints from the whole system or dissipation endpoints from each compartment separately, the water column or the sediment. Level 2 is for two-compartmental approaches to estimate the real degradation in the water column and sediment compartment considering the exchange rates between water and sediment.
The parent substance fluoxastrobin and its major aquatic metabolites - HEC 5725-*E*-des-chlorophenyl (*M48-E*) and HEC 5725-carboxylic acid (*M40*) - were addressed for the total system (Level 1) and water and sediment phases (Level 1 and 2). All evaluations for metabolites in total systems were carried out together with the appropriate fit of parent for modelling or trigger purpose and all evaluable metabolites.
The kinetic evaluation was performed according to the guidance given by the FOCUS Kinetics report (FOCUS, 2006, 2014); degradation parameters were fitted with the software KinGUI 2.1. Four kinetic models, the single first-order (SFO), first-order multiple-compartment (FOMC, Gustafson-Holden), the hockey-stick model (HS or known as IDFOS = double first order sequential), and the bi-exponential model (DFOP = double first order parallel) may be used to adequately describe the experimental residue values of the applied parent substance. These models use increasing numbers of parameters to describe degradation.
The objective of a kinetic evaluation is to select appropriate kinetic models in order to derive degradation endpoints from their respective calculations. These degradation endpoints, namely the $DisT_{50}$ and $DisT_{90}$ parameters from dissipation and the $DegT_{50}$ and $DegT_{90}$ for degradation, are established differently depending on whether one considers these parameters to assess if further trigger studies are needed (trigger endpoints) or one plans to use them as inputs for pesticide fate models (modelling endpoints). Both options are considered here. As defined in the FOCUS guidance, for modelling endpoints, if the SFO model is deemed sufficiently descriptive then the corresponding DT_{50} parameter is taken; if not FOMC, DFOP and HS kinetics are tested. For trigger endpoints, SFO and FOMC kinetics are tested in a first step; if SFO is not acceptable or worse than FOMC, DFOP and HS kinetics are tested, too.

II. RESULTS

For the dissipation of fluoxastrobin the trigger and modelling endpoints and the statistical parameters for the water layer are given in Table 7.2.2.3- 10 and for the sediment in Table 7.2.2.3- 11.

For HEC 5725-*E*-des-chlorophenyl (*M48-E*) the dissipation in water, sediment or total system was not possible to evaluate, due to the fact that not sufficient data points after the maximum have been available.

The dissipation data for HEC 5725-carboxylic acid (*M40*) for the total system, the water and the sediment are summarised in Table 7.2.2.3- 12.

For the degradation of fluoxastrobin in total system the trigger and modelling endpoints and the statistical parameters are given in Table 7.2.2.3- 13.

For the degradation of HEC 5725-*E*-des-chlorophenyl (*M48-E*) in total system the trigger and modelling endpoints are given in Table 7.2.2.3- 14 and Table 7.2.2.3- 15, respectively, including the statistical parameters.

The degradation data for HEC 5725-carboxylic acid (*M40*) in the total system are summarised in Table 7.2.2.3- 16 for trigger purpose and in Table 7.2.2.3- 17 for modelling purpose.

Estimated parameters for the degradation and partitioning of fluoxastrobin in water and sediment, separately (level P II) are given in Table 7.2.2.3- 17 and Table 7.2.2.3- 18.

The estimated formation fractions of the major fluoxastrobin metabolites from the total systems are given in Table 7.2.2.3- 9 in the Executive Summary.

Table 7.2.2.3- 10: Estimated parameters for dissipation of fluoxastrobin (*E*+*Z*) from water phase (level P-I), for trigger and modelling endpoints

Kinetic model [a]	M_0 [%]	k_{fast} [1/d]	k_{slow} [1/d]	t-test k_{slow}	g_{fast} (DFOP) or t_b in d (HS)	$DisT_{50}$ initial [d]	$DisT_{90}$ initial [d]	$DisT_{50}$ modelling [d]	χ^2-test error [%]	visual fit [b]
[redacted]										
SFO	88.93		0.1038	< 0.001		6.678	22.18	6.678	28.51	-
FOMC [c]	98.85					**3.382**	**179.4**	54.04	3.617	+
DFOP [d]	98.56	0.3584	0.009408	< 0.001	0.683	3.524	122.7	**36.96**	5.036	+
HS	98.82	0.2133	0.011366	< 0.001	5.067	3.249	112.5	33.89	7.039	+
[redacted]										
SFO	96.62		0.2785	< 0.001		2.489	8.268	2.489	24.86	-
FOMC [c, d]	99.12					**1.359**	**22.89**	**6.895**	3.31	+
DFOP	99.13	0.6457	0.03058	< 0.001	0.754	1.614	29.41	8.858	4.811	+
HS	99.16	0.3693	0.03335	< 0.001	3.984	1.877	28.92	8.711	5.19	+
					geomean			**15.96**		

$DT_{50\ mod}$ half-lives for modelling: FOMC: $DT_{50\ mod} = DT_{90} / 3.32$;
DFOP or HS:
if residues > 10 %: $DT_{50\ mod}$ of slow phase
if residues < 10 %: $DT_{50\ mod} = DT_{90} / 3.32$

$DT_{50\ initial}$ initial half-life, for trigger evaluation

a) SFO: single first order, FOMC: first order multi compartment, DFOP: double first order in parallel, HS: hockey stick

b) visual acceptability: + = good, o = medium, - = bad

c) best fit model for trigger evaluation

d) best approach for modelling purpose

Table 7.2.2.3- 11: Estimated parameters for dissipation of fluoxastrobin (*E*+*Z*) from sediment from maximum onwards (level P-I), for trigger and modelling endpoints

Kinetic model [a]	M_0 [%]	k_{slow} [1/d]	t_x-test k_{slow}	$DisT_{50}$ initial [d]	$DisT_{90}$ initial [d]	$DisT_{50}$ modelling [d]	χ^2-test error [%]	visual fit [b]
[redacted]								
SFO [c, d]	38.64	0.002583	0.001	**268.4**	**891.5**	**268.4**	3.182	o
FOMC	60.75			>1000	>1000		3.002	o
[redacted]								
SFO [c, d]	73.10	0.0019	0.001	**364.8**	**>1000**	**364.8**	1.703	+
FOMC	73.10			364.8	>1000		1.945	+
	geomean					**312.9**		

$DT_{50\ mod}$ half-lives for modelling: FOMC: $DT_{50\ mod} = DT_{90} / 3.32$;
DFOP or HS:
if residues > 10 %: $DT_{50\ mod}$ of slow phase
if residues < 10 %: $DT_{50\ mod} = DT_{90} / 3.32$

$DT_{50\ initial}$ initial half-life, for trigger evaluation

a) SFO: single first order, FOMC: first order multi compartment, DFOP: double first order in parallel, HS: hockey stick

b) visual acceptability: + = good, o = medium, - = bad

c) best fit model for trigger evaluation

d) best approach for modelling purpose

Table 7.2.2.3- 12: Estimated SFO parameters for dissipation of HEC 5725-carboxylic acid (*M40*) in water, sediment or total system from maximum onwards (level M I), for modelling or trigger purpose

Compartment	System	M_0 [%]	k [1/d]	t-test k	$DisT_{50}$ initial [d]	$DisT_{90}$ initial [d]	$DisT_{50}$ modelling [d]	χ^2-test error [%]	visual fit [a]
Water	[redacted]	5.96	0.028433	0.0088	24.38 [b]	80.98	24.38 [b]	22.59	o
		5.55	0.00612	0.0339	113.3 [b]	376.2	113.3 [b]	16.5	-
Sediment	[redacted]	2.33	0.010676	0.0013	**64.92**	215.7	**64.92**	13.47	o
		only 2 data points				-	-		
Total system	[redacted]	7.86	0.023936	0.0075	28.96 [b]	96.2	28.96 [b]	20.44	o
		only 2 data points				-	-		

a) visual acceptability: + = good, o = medium, - = bad
b) not fully reliable, not usable

Residues of HEC 5725-*E*-des-chlorophenyl (*M48-E*) were still increasing at end of study. Therefore, in both systems, no reliable and statistically significant degradation parameters (χ^2-error, t-test) could be evaluated for HEC 5725-*E*-des-chlorophenyl.

So, for predictive modelling, a **conservative default DT_{50} of 1000 days** might be assumed in a total water-sediment system for HEC 5725-*E*-des-chlorophenyl (FOCUS 2003, 2006).

In combination with statistically and visually uncertain degradation rates, formation fractions of the metabolite from parent bear a similar uncertainty.

However, to check for reasonable and at least conservative formation fractions some comparisons were carried out (see Table 7.2.2.3- 14). The $DegT_{50}$ of HEC 5725-*E*-des-chlorophenyl was fixed to a conservative value of 1000 days, together with fixing most of the before fitted parameters. Mainly, only the formation fraction parent – HEC 5725-*E*-des-chlorophenyl was varied, to result in a conservative formation and degradation curve which just passes through the highest measured residues. So, for [redacted] a **formation fraction** of **0.51** and for [redacted] of **0.13** can be considered as sufficiently conservative, in combination with a $DegT_{50}$ of 1000 days.

In case of [redacted], for the in parallel formed metabolite HEC 5725-carboxylic acid (*M40*) a reliable formation fraction of 0.4841 could be evaluated (Table 7.2.2.3- 15). Obviously, then no higher fraction than 0.5159 (1 - 0.4841) can be formed as HEC 5725-*E*-des-chlorophenyl from parent. Assuming this formation fraction (0.5159) together with a $DegT_{50}$ of 1000 days results in a very conservative and by far too high residue curve for HEC 5725-*E*-des-chlorophenyl. This leads again to the conclusion, that the formation fraction of 0.13 is a reasonable conservative estimation in the [redacted] system.

Table 7.2.2.3- 13: Estimated SFO parameters for degradation of HEC 5725-*E*-des-chlorophenyl (*M48-E*) in total system (level M-I), for trigger purpose

Test system	Parent model [a]	$f_{Fxa\text{-}E\text{-}des}$	k [1/d]	$DegT_{50}$ [d]	$DegT_{90}$ [d]	χ^2-test error [%]	p > t	visual fit [b]
[redacted]	SFO	0.3070	2E-14 [c]	>1000 [c]	> 1000	43.31	0.5	-
	FOMC	0.0766	3E-11 [c]	>1000 [c]	> 1000	30.08	0.5	o

a) SFO: single first order, FOMC: first order multi compartment
b) visual acceptability: + = good, o = medium, - = bad
c) not fully reliable, mathematically not significantly different from 0

Table 7.2.2.3- 14: Estimated SFO parameters for degradation of HEC 5725-*E*-des-chlorophenyl (*M48-E*) in total system (level M-I), for modelling purpose

Test system	Parent model [a]	$f_{Fxa - E\text{-}des}$	k [1/d]	$DegT_{50}$ [d]	$DegT_{90}$ [d]	χ^2-test error [%]	p > t	visual fit [b]
[redacted]	SFO	0.3070	2 E-14 [c]	> 1000 [c]	> 1000	43.31	0.5	-
Comparison 1								
[redacted]	SFO	**0.51**	0.00069 fix	1000 fix	> 1000	74.3	fix	o
[redacted]	DFOP	0.0764	< 1E-7 [c]	>1000 [c]	>1000	30.48	0.5	o
Comparison 2								
[redacted]	DFOP	**0.13**	0.00069 fix	1000 fix	> 1000	60.2	fix	o +
Comparison 3								
[redacted]	DFOP	0.52	0.00069 fix	1000 fix	1000	468	fix	-

a) SFO: single first order, DFOP: double first order in parallel
b) visual acceptability: + = good, o = medium, - = bad
c) not fully reliable, mathematically not significantly different from 0, not usable

All evaluations for metabolites in total systems were carried out together with the appropriate fit of parent for modelling or trigger purpose and all evaluable metabolites.

As in the experimental study report, HEC 5725-carboxylic acid was analysed only in the sum together with HEC 5725-amide (*M38*), this sum (in study report: M2 = M2a + M2b) was used to represent the fate and behaviour of HEC 5725-carboxylic acid in water/sediment systems, conservatively.

For [redacted], statistically significant degradation parameters could be evaluated for HEC5725-carboxylic acid (level M-I) (Table 7.2.2.3- 15 and Table 7.2.2.3- 16). However, the visual assessment and χ^2 test did not result in an appropriate fit. Thus, this evaluation seems not to be reliable for any modelling use.

For [redacted], reliable and statistically significant degradation parameters could be evaluated for HEC 5725-carboxylic acid (level M-I) (Table 7.2.2.3- 16). The χ^2 error slightly above 15 % is considered to be acceptable together with a significant t-test as it just reflects the low absolute residue data of a metabolite.

So, for further modelling assessments, the **$DegT_{50\ total\ system}$ of 67.89 days** is considered appropriate and reliable for HEC 5725-carboxylic acid (*M40*) in total water-sediment systems, in combination with a **formation fraction** of **0.4841**.

Table 7.2.2.3- 15: Estimated SFO parameters for degradation of HEC 5725-carboxylic acid (*M40*) in total system (level M-I), for trigger purpose

Test system	Parent model [a]	$f_{Fxa - E\text{-}des}$	k [1/d]	$DegT_{50}$ [d]	$DegT_{90}$ [d]	χ^2-test error [%]	p > t	visual fit [b]
[redacted]	SFO	0.6930	0.04767 [c]	14.54 [c]	48.31 [c]	48.99	0.047	-
	FOMC	0.4815	0.01025	**67.63**	**224.7**	20.57	0.0049	+

a) SFO: single first order, FOMC: first order multi compartment
b) visual acceptability: + = good, o = medium, - = bad
c) not fully reliable, mathematically not significantly different from 0, not usable

Table 7.2.2.3- 16: Estimated SFO parameters for degradation of HEC 5725-carboxylic acid (*M40*) in total system (level M-I), for <u>modelling purpose</u>

Test system	Parent model [a]	$f_{Fxa\text{-}E\text{-}des}$	k [1/d]	$DegT_{50}$ [d]	$DegT_{90}$ [d]	χ^2-test error [%]	p > t	visual fit [b]
[redacted]	SFO	0.6930	0.04767 [c]	14.54 [c]	48.31 [c]	48.99	0.047	
	DFOP	**0.4841**	0.01021	**67.89**	225.5	20.17	0.0047	+

a) SFO: single first order, DFOP: double first order in parallel
b) visual acceptability: + = good, o = medium, - = bad
c) not fully reliable, mathematically not significantly different from 0, not usable

A 2-compartmental approach was taken into account to estimate the degradation of fluoxastrobin (*E+Z* isomers) in water and sediment compartment, in parallel, inclusive partitioning processes via reaction rates. A simple first-order (SFO) kinetics was used to describe degradation separately in the water and sediment phase, as well as reversible transfer or partitioning between these compartments.

The evaluation resulted in a good to moderate fit to the measured data of fluoxastrobin in sediment. In water, a moderate to bad fit was reached, visually as well as statistically (χ^2 error) (Table 7.2.2.3- 17).

However, in all cases the t-test indicated, that the degradation rates are not significantly different from 0 and thus not reliable. In all systems, the rates in water k_w or sediment k_s both, are not statistically reliable. Thus, as none of these corresponding degradation rate pairs k_w and k_s are fully reliable, they are not recommended to use in further assessments.

Additionally, the F_{sed} test according to FOCUS kinetics was carried out to assess the reliability of the modelled parameters. The fraction of parent compound that transfers into the sediment at equilibrium (F_{sed}) is calculated using: 1. fitted Level P-II model parameters ($F_{sed,\ modelling}$) as well as 2. conditions of the study ($F_{sed,\ theoretical}$). Theoretical and modelled F_{sed} values show a moderate to excellent conformity, which might confirm the reliability of estimated partitioning rates (Table 7.2.2.3- 12).

Table 7.2.2.3- 17: Estimated (SFO) parameters for <u>degradation</u> and partitioning of fluoxastrobin in water and sediment, separately (level P II)

Test system	Compartment	Mn [%]	k [1/d]	$DegT_{50\ initial}$ [d]	$DegT_{90}$ initial [d]	χ^2-test error [%]	p > t		visual fit [a]
[redacted]	water	96.69	0.01592	43.53 [b]	144.6	8.033	0.107		o
	sediment	0	2.3 E-14	> 1000 [b]	> 1000	5.968	0.5		+
[redacted]	water	89.43	0.0121	57.27 [b]	190.2	26.37	0.39		-
	sediment	0	2.3 E-14	> 1000 [b]	> 1000	2.272	0.5		+

a) visual acceptability: + = good, o = medium, - = bad
b) not fully reliable, mathematically not significantly different from 0; not usable

Table 7.2.2.3- 18: Estimated (SFO) parameters for degradation and <u>partitioning</u> of fluoxastrobin in water and sediment, separately (level P II)

Test system	Partitioning from compartment	$k_{wat\text{-}sed}$ [1/d]	$k_{sed\text{-}wat}$ [1/d]	p > t	F_{sed} modelling	F_{sed} theoretical
[redacted]	water	0.2048		< 0.001	0.7202	0.5687
	sediment		0.07957	< 0.001		
[redacted]	water	0.4975		< 0.001	0.8448	0.8328
	sediment		0.09139	< 0.001		

III. CONCLUSIONS

The half-life of fluoxastrobin for modelling purpose (geometric means) was 16.0 days in the water, 313 days in the sediment and 238 days in the total system. The half-life of HEC 5725-carboxylic acid (*M40*) for modelling purpose (single value) was 64.9 days in the sediment, 67.9 days in the total system and could not be evaluated in the water.

The half-lives of fluoxastrobin for trigger evaluation were between 1.4 and 3.4 days in the water, between 268 and 365 days in the sediment and between 143 and 351 days in the total system. The half-life of HEC 5725-carboxylic acid (*M40*) for trigger evaluation was 64.9 days in the sediment, 67.6 days in the total system and could not be evaluated in the total system.

For the soil and aquatic metabolite HEC 5725-*E*-des-chlorophenyl (*M48-E*) no reliable and statistically significant $DegT_{50}$ values could be evaluated in the total system together with the appropriate parent fit (χ^2 error, t-test). However, a set of conservative formation fractions could be estimated by forcing the degradation curve of the metabolite through the highest measured residues. Thus, for [redacted] a formation fraction of 0.51 and for [redacted] of 0.13 was considered as sufficiently conservative, in combination with a $DegT_{50}$ of 1000 days.

An evaluation of the dissipation from water or sediment of the *E*-des-chlorophenol was not possible, due to the fact that no sufficient data points after the maximum have been available. Finally, a conservative DT_{50} of 1000 days could be assumed for all compartments.

CA 7.2.2.4 Irradiated water/sediment study

The route and rate of degradation of fluoxastrobin in irradiated water/sediment systems were evaluated during the Annex I inclusion using one radiolabel position, ring 3-label, and were accepted by the European Commission (SANCO/3921/07-final, 2012). The following study is included in the baseline dossier:

Author(s)	Year	Document No
[redacted]	2001	M-091063-01-1

Report: KCA 7.2.2.4/01 [redacted], 2001, M-091063-01-1
Title: Photolysis of HEC5725 in water/sediment systems
Report No.: MR-322/01
Document No.: M-091063-01-1
Guidelines: - US EPA Subdivision N, Paragraph 161-2
- US EPA Subdivision N, Paragraph 161-4
- EU 91/36/EC amending 91/414/EEC
Guideline deviation(s): not applicable
GLP/GEP: **yes**

The aqueous photolysis of fluoxastrobin in two natural water sediment systems was studied. The study was done with reference to photolysis and aerobic aquatic metabolism studies (EPA Guidelines 161-2 and 162-4 (1985) and EC Directive 95/36/EC (1995) as there is no guideline for the measurement of photolysis in natural water sediment systems.

The aqueous photo-transformation of fluoxastrobin was studied under continuous artificial light in two natural water/sediment systems sampled from [redacted] and [redacted] (Germany). [redacted]

[redacted] was a loam sediment according to USDA system of classification and had a pH of 6.6 and a %OC 4.8. The [redacted] system was a loamy sand (USDA), with a pH of 8.5 and a %OC of 1.37. The tests were conducted with ring 3 labelled parent compound, which was applied to the supernatant water. The initial concentration of the test substance in the water layer was 1.0 mg a.s./L (based on 390 mL supernatant water). Each micro-ecosystem consisted of 130 mL wet sediment and 390 mL water which equated roughly to 1.5 cm depth sediment and 4.5 cm of overlying water. The two systems had pH values of 7.34 and 7.65 initially and 8.7 and 8.39 after irradiation respectively. The samples were continuously irradiated with artificial light sources simulating sunlight (Suntest® unit equipped with a xenon lamp) for a maximum testing period of 288 hours (12 days). The two irradiation systems had light intensities of 3.91 and 4.13 MJ x m^{-2} respectively. The temperature of the test system was maintained at 25 °C. Determination of oxygen concentration and redox potential in the water layer confirmed that the conditions were aerobic.

The total recovery of radioactivity ranged from 94.1 to 99.9% AR. The amount of radioactivity in the water layer decreased rapidly in the case of the irradiated samples to 26.2% ([redacted]) and 23.8% ([redacted]) of the applied radioactivity after 288 hours. In the case of the dark samples the remaining radioactivity in the water phase was higher and amounted to 40.1 and 43.2%, respectively. Table 7.2.2.4- 1 and Table 7.2.2.4- 2 summarise the distribution and total recovery of the radioactivity in the two systems. Table 7.2.2.4- 3 shows the distribution of the active substance and metabolites. The disappearance of fluoxastrobin (calculated as sum of *E*- and *Z*-isomer) was calculated with a half-life of 106 hours (mean), which are about 4.4 days using Model Maker (simple first order kinetics).

Isomerisation of fluoxastrobin was the first reaction step. The maximum amount of Z-isomer in the water phase was 11.9% ([redacted] sample) of the applied radioactivity after exposure to light for 24 hours. This confirmed the photolytical activation of the test substance in the aqueous layer under water/sediment conditions. The amount of radioactive labelled substance in the aqueous phase decreased steadily throughout the course of continuous exposure to light. After 288 hours (12 days) of exposure to artificial sunlight (day and night), which corresponds to a light intensity of 36 summer days under natural conditions at Phoenix, Arizona, USA (33° N), five degradation products were detected in the water phase. The maximum amount of any single transformation product in the water phase was 5.4% AR. In the dark samples the same degradation products were identified. Therefore, these products were considered not to be photo-transformation products. In addition, the sediment was analysed after 288 hours of exposure. Fluoxastrobin Z-isomer was detected at a maximum of 13.1% in the irradiated samples. In the case of the dark samples the maximum amount of *Z*-isomer was 0.7%.

The test vessels were used without trap attachments. Therefore $^{14}CO_2$ in the gas phase was not determined. However, based on the mass balance (94.1 – 99.0% AR) it was considered that $^{14}CO_2$ was only generated to a low extent.
These data indicate that under natural conditions in aqueous systems the first step of transformation was isomerisation followed by further degradation and adsorption to sediment. Further photo-degradation contributed only to a very low extent in the disappearance of the test substance in the water layer. The cyclic photo-transformation product HEC 5725-oxazepine (*M36*), which was the main metabolite in an artificial system (sterile, buffered solution at pH 7) under comparable light conditions was not seen under more realistic natural conditions. It is concluded from this study that under environmental conditions solar radiation contributes only to a very small extent to the primary degradation of fluoxastrobin (sum of isomers) in water. Isomerisation of fluoxastrobin occurs to some extent as a specific photo-transformation process.

Table 7.2.2.4- 1: Distribution and total recovery of the radioactivity after application of fluoxastrobin in the [redacted] water/sediment system (in % AR)

Incubation condition	Incubation time (hours)	Water	Sediment			$^{14}CO_2$			Material balance
			Extracted	NER	Subtotal sediment	Water	Sediment	Subtotal $^{14}CO_2$	
Irradiated	0	100.0	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
	1	98.9	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
	3	89.9	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
	24	69.2	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
	72	48.5	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
	144	33.8	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
	192	30.9	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
	288	26.2	59.7	8.5	68.2	0.2	0.1	0.3	94.6
Dark	0	100.0	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
	1	204.1[a)]	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
	3	99.3	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
	24	97.0	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
	72	87.0	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
	144	68.0	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
	192	58.1	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
	288	40.1	51.2	3.3	54.3	0.2	0.1	0.2	94.5

n.m.: not measured
[1] due to the short equilibration time, sample was not homogeneous

Table 7.2.2.4- 2: Distribution and total recovery of the radioactivity after application of fluoxastrobin in the [redacted] water/sediment system (in % AR)

Incubation condition	Incubation time (hours)	Water	Sediment			$^{14}CO_2$			Material balance
			Extracted	NER	Subtotal sediment	Water	Sediment	Subtotal $^{14}CO_2$	
Irradiated	0	100.0	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
	1	102.2	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
	3	93.1	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
	24	74.0	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
	72	55.7	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
	144	41.7	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
	192	35.8	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
	288	27.8	59.5	9.3	68.8	1.2	0.3	1.5	94.1
Dark	0	100.0	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
	1	94.4	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
	3	81.2	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
	24	77.9	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
	72	68.6	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
	144	50	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
	192	48.0	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
	288	33.2	60.8	4.8	65.6	0.2	< 0.1	0.2	99.0

n.m.: not measured

Table 7.2.2.4- 3: Distribution of the active substance and metabolites after application of ring 3 labelled fluoxastrobin to two water/sediment systems (in % AR)

Water/sediment system	Incubation conditions	Phases	Incubation time (hours)	fluoxastrobin (*E*)	HEC 5725-*Z*-Isomer	HEC 5725-oxazepine (*M36*)	Unknown metabolites [a]
[redacted]	Irradiated	Water	1	n.m.	n.m.	n.m.	n.m.
			3	83.8	3.9	n.d.	2.2
			24	59.8	8.3	n.d.	1.2
			72	40.0	8.6	n.d.	n.d.
			144	24.2	7.4	n.d.	2.1
			192	21.5	7.5	n.d.	2.0
			288	15.6	3.6	n.d.	6.9
		Sediment	288	41.4	11.7	n.d.	6.8
	Dark	Water	1	n.m.	n.m.	n.m.	n.m.
			3	93.5	2.4	n.d.	3.4
			24	92.8	1.9	n.d.	2.8
			72	84.1	1.6	n.d.	1.9
			144	81.5	1.6	n.d.	2.0
			192	54.1	0.8	n.d.	3.1
			288	35.3	0.8	n.d.	3.9
		Sediment	288	42.2	n.d.	n.d.	5.2
[redacted]	Irradiated	Water	1	n.m.	n.m.	n.m.	n.m.
			3	82.9	3.9	n.d.	4.6
			24	47.5	11.9	n.d.	2.6
			72	43.3	9.6	n.d.	2.8
			144	31	7.2	n.d.	3.3
			192	21	7.0	n.d.	5.9
			288	14.0	3.7	n.d.	6.2
		Sediment	288	41.0	13.1	n.d.	5.4
	Dark	Water	1	n.m.	n.m.	n.m.	n.m.
			3	77.2	2.7	n.d.	2.3
			24	37.6	1.9	n.d.	2.5
			72	6.8	1.5	n.d.	1.3
			144	5.7	n.d.	n.d.	n.d.
			192	40.8	0.4	n.d.	1.7
			288	29.8	n.d.	n.d.	3.4
		Sediment	288	54.4	0.7	n.d.	5.5

n.m.: not measured; n.d.: not detected
a) sum of eight unknown minor metabolites, none exceeded 5.1 % AR

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No additional studies are submitted within this supplementary dossier for the fluoxastrobin renewal of approval.

CA 7.2.3 Degradation in the saturated zone

The degradation of fluoxastrobin in the saturated zone was not studied since fluoxastrobin is not expected to reach the saturated zone after its use according to good agricultural practices.

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Overall summary if the route and rate of degradation of fluoxastrobin and its metabolites in the aquatic environment

Fluoxastrobin (*E-isomer*) is moderately degraded in water and sediment to the major degradation products HEC 5725-*E*-des-chlorophenyl (*M48-E*) and HEC 5725-carboxylic-acid (*M40*), carbon dioxide and non-extractable residues. HEC5725-carboxylic acid (*M40*) and HEC5725-amide (*M38*) could not be separated in the course of the study and were therefore quantified as sum. In presence of light, the HEC 5725-*Z* -isomer was observed. The photodegradation product HEC 5725-oxazepine was observed under artificial conditions in sterile buffer only, but not under more realistic conditions in irradiated natural water/sediment systems. However, the degradation of fluoxastrobin in water and sediment is driven by microbial degradation under typical conditions in the environment and photodegradation plays only a minor role in the overall fate of fluoxastrobin.

The route and rate of degradation of fluoxastrobin in the aquatic environment were studied using two different radiolabel positions, ring 1- and ring 3-label. The studies have been performed in buffers, natural surface water and water/sediment systems in the laboratory at different temperatures. The maximum occurrences of degradation products in percentage of applied radioactivity [% AR] are given as means of duplicates. The DT_{50} values were taken from study reports. These values may slightly differ from the List of Endpoints (SANCO/3221/07-final, 2012).

Fluoxastrobin is hydrolytically stable in sterile buffer solutions under neutral to alkaline conditions. The DT_{50} of fluoxastrobin could be estimated to be more than one year at any environmental pH and temperature value, especially at 25 °C.

Under photolytic conditions in the laboratory in sterile buffers at pH 7, fluoxastrobin (*E-isomer*) was well degraded (DT_{50} 31 days). Fluoxastrobin (*E*) isomerised to its major *Z* isomer (HEC 5725-*Z*-Isomer with max. 11.2% AR and was further degraded to its major degradation product HEC 5725-oxazepine with max. 23.6% AR. Under photolytic conditions in natural water/sediment systems only isomerisation of fluoxastrobin (*E*) to its Z isomer (max. 11.9% AR) was observed without formation of any major photodegradation products. The cyclic photodegradation product HEC 5725-oxazepine, which was the main metabolite in an artificial system (sterile, buffered solution at pH 7) under comparable light conditions, was not formed under natural conditions.

In surface water under aerobic conditions in the dark in the laboratory, fluoxastrobin (*E*) did not show significant degradation ($DT_{50} \geq 944$ days).

In water/sediment systems under aerobic conditions in the dark in the laboratory, fluoxastrobin dissipated rapidly and moderately from the water and sediment, respectively, and was moderately degraded in the total system to the single major degradation products HEC 5725-*E*-chlorophenyl (*M48-E*), HEC 5725-carboxylic acid (*M40*) and HEC 5725-amid (*M38*). The maximum amount of fluoxastrobin in the sediment was 73.3% AR. HEC 5725-*E*-chlorophenyl (*M48-E*) and HEC 5725-carboxylic acid (*M40*, in sum with HEC 5725-amid (*M38*)) had maximum amounts of 15.9 and 5.9% AR in the water, respectively, and 2.4 and 5.8% AR sediment, respectively. Further degradation led to carbon dioxide with a range of 2.1 to 2.9% AR. Non-extractable residues ranged from 12.1 to 12.7% AR. Updated kinetic evaluations resulted half-lives for trigger and for modelling evaluations.
An overview of the estimates half-lives (dissipation or degradation DT_{50}) for fluoxastrobin and its major aquatic metabolite HEC 5725-carboxylic acid (*M40*)for trigger evaluation and modelling purpose is given at the end of this section. Due to a possible back-reaction the fluoxastrobin was calculated as sum of E- and Z-Isomer. For the metabolite HEC 5725-*E*-chlorophenyl (*M48-E*) the evaluation for the half-lives for trigger and modelling evaluation was not possible.

In water/sediment systems under anaerobic conditions fluoxastrobin (*E*) was moderately degraded in the total system (DT_{50} = 146 days) to the single major degradation product HEC 5725-carboxylic acid (*M40*). The maximum amount of fluoxastrobin in the sediment was 44.8% AR. HEC 5725-carboxylic acid (*M40*) had maximum amounts of 10.6 and 11.3% AR in the water and sediment, respectively. Significant amounts of carbon dioxide were not formed and non-extractable residues amounted to a maximum of 36.2% AR.

The proposed overall degradation pathway of fluoxastrobin in water and sediment including the maximum occurrences of the metabolites observed in water and sediment is as follows (major degradation products > 5% AR in bold letters):

Water (corrected structure for M56)**:**

Pathway of Fluoxastrobin in aqueous systems

(including minor metabolites, metabolites > 5% in bold letters)

A summary of DT_{50} and DT_{90} values for degradation of fluoxastrobin in aerobic surface water for trigger evaluation is given in the table below:

Temp. [°C]	Surface Water	Concentration [µg/L]	Kinetic Model [1]	DT_{50} [days]	DT_{90} [days]
20	[redacted]	10.3	SFO	944	> 1000
		104.2	SFO	> 1000	> 1000

[1] SFO: single first order

A summary of estimated half-lives (dissipation or degradation DT_{50}) for fluoxastrobin (E+Z) in aerobic water/sediment systems for modelling purpose and trigger evaluation is given in the table below:

Water/Sediment System	Modelling Purpose		Trigger Evaluation		
	Kinetic Model [a)]	DT_{50} [days]	Kinetic Model [a)]	DT_{50} [days]	DT_{90} [days]
Total System (degradation)					
[redacted]	SFO	143	SFO	143	474
	DFOP	399	FOMC	351	> 1000
	geomean	238			
Water (dissipation)					
[redacted]	DFOP	37.0	FOMC	3.38	179
	FOMC	6.90	FOMC	1.36	22.9
	geomean	16.0			
Sediment (dissipation)					
[redacted]	SFO	268	SFO	268	892
	SFO	365	SFO	365	> 1000
	geomean	313			

a) SFO: single first order, FOMC: first order multi compartment, DFOP: double first order in parallel

A summary of estimated half-lives (dissipation or degradation DT_{50}) for HEC 5725-*E*-des-chlorophenyl (*M48-E*) in aerobic water/sediment systems for modelling purpose and trigger evaluation is given in the table below:

Water/Sediment System	Modelling Purpose		Trigger Evaluation		
	Kinetic Model [a)]	DT_{50} [days]	Kinetic Model [a)]	DT_{50} [days]	DT_{90} [days]
Total System (degradation)					
[redacted]	SFO	n.r.	SFO	n.r.	n.r.
	SFO	n.r.	SFO	n.r.	n.r.
	geomean				
Water (dissipation)					
[redacted]	SFO	n.e.	SFO	n.e.	n.e.
	SFO	n.e.	SFO	n.e.	n.e.
	geomean				
Sediment (dissipation)					
[redacted]	SFO	n.e.	SFO	n.e.	n.e.
	SFO	n.e.	SFO	n.e.	n.e.
	geomean				

n.e.: not evaluable, not sufficient data points; n.r.: not fully reliable, mathematically not significantly different from 0; not usable

a) SFO: single first order

A summary of estimated half-lives (dissipation or degradation DT_{50}) for HEC 5725-carboxylic acid (*M40*) in aerobic water/sediment systems for modelling purpose and trigger evaluation is given in the table below:

Water/Sediment System	Modelling Purpose		Trigger Evaluation		
	Kinetic Model [a)]	DT_{50} [days]	Kinetic Model [a)]	DT_{50} [days]	DT_{90} [days]
Total System (degradation)					
[redacted]	SFO	n.r.	SFO	n.r.	n.r.
	SFO	67.9	SFO	67.9	225
	geomean				
Water (dissipation)					
[redacted]	SFO	n.e.	SFO	n.e.	n.e.
	SFO	n.r.	SFO	n.r.	n.r.
	geomean				
Sediment (dissipation)					
[redacted]	SFO	64.9	SFO	64.9	216
	SFO	n.e.	SFO	n.e.	n.e.
	geomean				

n.e.: not evaluable, not sufficient data points; n.r.: not fully reliable; not usable
a) SFO: single first order

CA 7.3 Fate and behaviour in air

CA 7.3.1 Route and rate of degradation in air

The degradation rate of fluoxastrobin in air was evaluated during the Annex I inclusion using the Atkinson method, and was accepted by the European Commission (SANCO/3921/07-final, 2012). No additional studies are submitted within this supplementary dossier for the fluoxastrobin renewal of approval.

Author(s)	Year	Document No
[redacted]	1999	M-007809-01-1

Report:	KCA 7.3.1/01 [redacted]; 1999; M-007809-01-1
Title:	Calculation of the chemical lifetime of HEC 5725 in the troposphere
Report No.:	MR-091/99
Document No.:	M-007809-01-1
Guidelines:	- German BBA Part IV, 6-1
Guideline deviation(s):	not specified
GLP/GEP:	**no**

A theoretical calculation of the potential for photo-oxidation of fluoxastrobin in the atmosphere was submitted, using the method of Atkinson (AOPWIN (version 1.87). The global 12-hour concentration of OH radicals of 1.5×10^6 cm^{-3} was assumed in the calculation. A rate constant of 13.02×10^{-12} (cm^3/molecules sec) was calculated for reaction with OH radicals. This corresponds to a first order DT_{50} for fluoxastrobin in air of 9.9 hours and a chemical lifetime of fluoxastrobin in air of 14.3 hours. A more conservative assessment of the overall OH radical rate constant could be made by using only half of the estimated rates for all the assumed figures. This approach would result in a maximum chemical lifetime of fluoxastrobin in the air of less than 18.3 hours. On account of the relatively short chemical lifetime of fluoxastrobin in the air it is unlikely that the active substance will be transported in the gaseous phase over large distances.

CA 7.3.2 Transport via air

The transport via air of fluoxastrobin was not studied since its vapour pressure (6×10^{-10} Pa, see Document MCA 2.2, M-058487-01-1) is below the trigger value of 10^{-5} Pa.

CA 7.3.3 Local and global effects

Local and global effects of fluoxastrobin were not considered since its half-life in air is ≤ 10 hours (see M-007809-01-1, CA 7.3.1).

CA 7.4 Definition of the residue

CA 7.4.1 Definition of the residue for risk assessment

The proposed residue definitions relevant for risk assessment for each compartment are the following:

Compartment	Residue Definition
Soil	fluoxastrobin (*E*- isomer), HEC 5725 -*Z*-isomer, HEC 5725-carboxylic acid (*M40*), HEC 5725-*E*-des-chlorophenyl (*M48-E*), 2-chlorophenol (*M82*)
Groundwater	fluoxastrobin (*E*-isomer), HEC 5725-*Z*-isomer, HEC 5725-carboxylic acid (*M40*), HEC 5725-*E*-des-chlorophenyl (M48-*E*), 2-chlorophenol (M82)
Surface water	fluoxastrobin (*E*- isomer), HEC 5725-*Z*-isomer, HEC 5725-carboxylic acid (*M40*), HEC 5725-*E*-des-chlorophenyl (*M48-E*)
Sediment	fluoxastrobin (*E*- isomer), HEC 5725-*Z*-isomer
Air	none

CA 7.4.2 Definition of the residue for monitoring

The proposed residue definition for monitoring is fluoxastrobin only for all compartments since none of the major degradation products is of toxicological or ecotoxicological relevance.

CA 7.5 Monitoring data

Laboratory and field data demonstrated the degradability of fluoxastrobin and its residues in the various compartments of the environment, with no indications for persistence or accumulation.
Under recommended use conditions, no unacceptable leaching of parent compound or of any relevant degradates to groundwater is to be expected. Therefore, monitoring studies under outdoor conditions are considered to be not required.