Document Title

Summary of the fate and behaviour in the environment for Mesosulfuron-methyl

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

2014-06-20

1st update: 2015-02-27

2nd update: 2015-04-23

Author(s)

[redacted]

Bayer CropScience

M-489131-03-5

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Version history

Date	Data points containing amendments or additions[1] and brief description	Document identifier and version number
Feb. 2015	Document update in response to ANSES request for additional information, received via email [redacted] (Anses) to [redacted] (BCS) of 15th December 2014 (17:48). Document modifications are marked yellow.	
April 2015	Document update in response to ANSES request for additional information, received via email [redacted] (ANSES) to [redacted] (BCS) of 14th April 2015 (18:41). Document modifications are marked green.	

[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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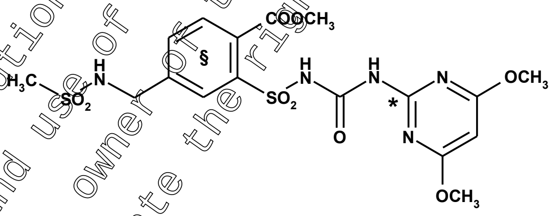
CA 7 FATE AND BEHAVIOUR IN THE ENVIRONMENT

This document provides detailed summaries of new fate and behaviour studies which were not available at the time of the first EU review of mesosulfuron-methyl and were therefore not evaluated for the Annex I inclusion of this active substance. Existing studies already submitted for the first EU review are found evaluated in the Monograph or its Addenda; in the present document these studies are marked in grey shade, and EU agreed data from these studies is only briefly repeated. Complete reports to all studies are included in the electronic dossier provided by Bayer CropScience. The numbering and the headlines correspond to latest EU requirements.

For transparent overall data interpretion and risk assessment, key endpoints derived from both, old and new studies, are listed in overview tables, where applicable. For easy discrimination, new information is printed black, whilst existing information is repeated in grey shaded font.

The studies concerning the fate and behaviour of mesosulfuron-methyl in the environment were conducted using two different radiolabel positions, [phenyl-UL-^{14}C] and [pyrimidyl-2-^{14}C], as well as unlabelled mesosulfuron-methyl. The structure of mesosulfuron-methyl and the positions of the different radiolabels are as follows:

Structural formula of mesosulfuron-methyl (AE F130060): § = phenyl-UL-^{14}C label * = pyrimidyl-2-^{14}C label	

Substance coding

For historic reason, different coding or naming systems have been used for the designation of metabolites in study reports and associated documents. For better transparency and readability, a single primary identifier for each component will be used consistently throughout the present Section. To maintain comparability to documents from the first submission for Annex I inclusion, this will be (a) the AgrEvo/Aventis CropScience alphanumeric substance code (AE xxxxxx), or, where none assigned, (b) the Bayer CropScience alphanumeric substance code (BCS-XXxxxxx).

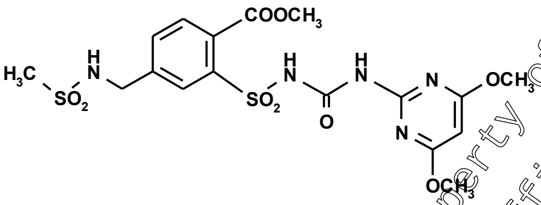
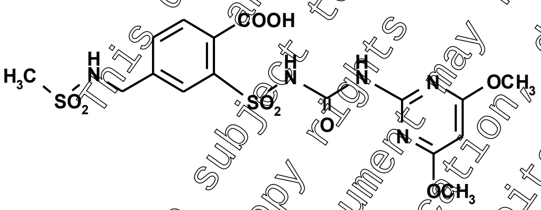
Where applicable, substances will consistently be addressed in the following compound sequence. This applies for tabulated information, as well as for the order of appearance of study summaries in the document text.

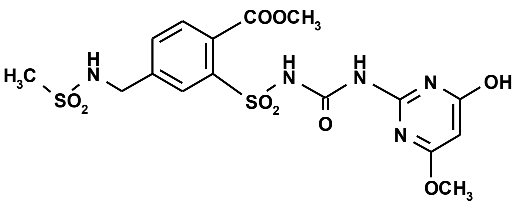
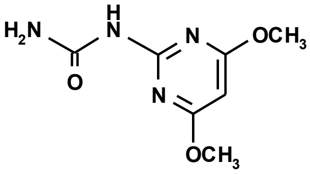
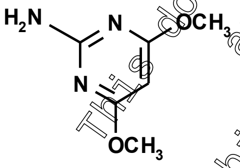
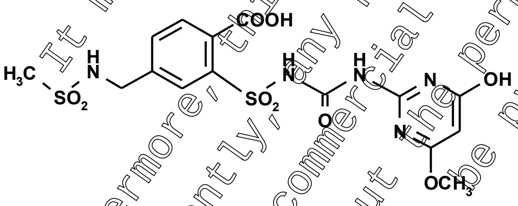
1) mesosulfuron-methyl (parent substance)
2) AE F154851
3) AE F160459
4) AE F099095
5) AE F092944
6) AE F160460
7) AE F140584
8) AE F147447
9) BCS-CO60720
10) BCS-CV14885
11) BCS-CO60721
12) BCS-CY51284

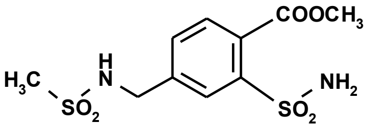
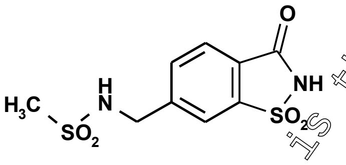
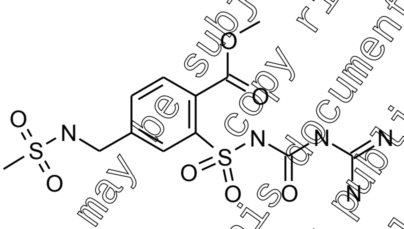
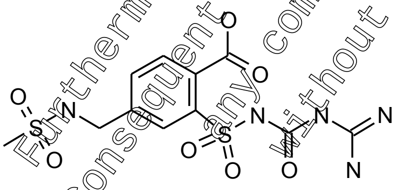
An overview of chemical structures, names and synonyms of the components discussed in Section 7 is provided below, extracted from Document N3.

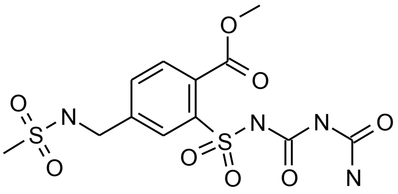
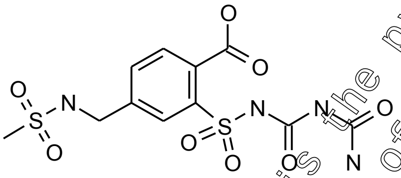
Nomenclature version information:

CAS index names:	according to the Chemical Abstracts Services 9th Collective Index (9CI)
IUPAC names:	generated using ACD/Name Batch software, version 9.02 (Advanced Chemistry Development Inc.)

Company Code Numbers **Chemical Structures** **Chemical Formulas / Molecular Weights**	***CAS# / CA index name*** **IUPAC nomenclature** **Other names / codes**	**Occurrence**
AE F130060  Stoichiometric formula: $C_{17} H_{21} N_5 O_9 S_2$ Molecular weight: 503.5	*CAS-No.: 208465-21-8* *Benzoic acid, 2-[[[[(4,6-dimethoxy-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]-4-[[(methylsulfonyl)amino]methyl]-, methyl ester (CAS, 9CI)* methyl 2-[({[(4,6-dimethoxypyrimidin-2-yl)amino]carbonyl}amino)sulfonyl]-4-{[(methylsulfonyl)amino]methyl}benzoate (IUPAC) Mesosulfuron-methyl HOE 130060 BCS-AK65185	Used as active substance in all reports
AE F154851  Stoichiometric formula: $C_{16} H_{19} N_5 O_9 S_2$ Molecular weight: 489.5	*CAS-No.: 400852-66-6* Benzoic acid, 2-[[[[(4,6-dimethoxy-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]-4-[[(methylsulfonyl)amino]methyl]- (CAS, 9CI) 2-[({[(4,6-dimethoxypyrimidin-2-yl)amino]carbonyl}amino)sulfonyl]-4-{[(methylsulfonyl)amino]methyl}benzoic acid (IUPAC) BCS-AU80405 "Mesosulfuron acid"	Aerobic Soil (Anaerobic Soil) Hydrolysis Water/Sed. Rat

Company Code Numbers **Chemical Structures** **Chemical Formulas / Molecular Weights**	***CAS# / CA index name*** **IUPAC nomenclature** **Other names / codes**	**Occurrence**
AE F160459  Stoichiometric formula: $C_{16}\,H_{19}\,N_5\,O_9\,S_2$ Molecular weight: 489.5	*CAS-No.: 888225-60-3* methyl 2-[({[(4-hydroxy-6-methoxypyrimidin-2-yl)amino] carbonyl}amino)sulfonyl]-4-{[(methylsulfonyl)amino] methyl}benzoate (IUPAC) BCS-AU84907 "O-desmethyl Mesosulfuron"	Aerobic Soil Anaerobic Soil Water/Sed. Wheat Laying Hen Dairy Cow Rat
AE F099095  Stoichiometric formula: $C_7\,H_{10}\,N_4\,O_3$ Molecular weight: 198.2	*CAS-No.: 151331-81-6* *Urea, (4,6-dimethoxy-2-pyrimidinyl)- (CAS, 9CI)* N-(4,6-dimethoxypyrimidin-2-yl)urea (IUPAC) BCS-AB40283	Aerobic Soil (Anaerobic Soil) Water/Sed.
AE F092944  Stoichiometric formula: $C_6\,H_9\,N_3\,O_2$ Molecular weight: 155.2	*CAS-No.: 36315-01-2* *2-Pyrimidinamine, 4,6-dimethoxy- (CAS, 9CI)* 4,6-dimethoxypyrimidin-2-amine (IUPAC) BCS-AA25052	Aerobic Soil Anaerobic Soil Hydrolysis Water/Sed. Rat
AE F160460  Stoichiometric formula: $C_{15}\,H_{17}\,N_5\,O_9\,S_2$ Molecular weight: 475.5	*CAS-No.: 888225-61-4* 2-[({[(4-hydroxy-6-methoxypyrimidin-2-yl)amino]carbonyl}amino)sulfonyl]-4-{[(methylsulfonyl)amino]methyl} benzoic acid (IUPAC) BCS-AU84908 "O-desmethyl Mesosulfuron acid"	Aerobic Soil Anaerobic Soil Water/Sed. Laying Hen

Company Code Numbers **Chemical Structures** **Chemical Formulas / Molecular Weights**	***CAS# / CA index name*** **IUPAC nomenclature** **Other names / codes**	**Occurrence**
AE F140584  Stoichiometric formula: $C_{10} H_{14} N_2 O_6 S_2$ Molecular weight: 322.4	*CAS-No.: 393509-80-3* *Benzoic acid, 2-(aminosulfonyl)-4-[[(methylsulfonyl)amino]methyl]-, methyl ester (CAS, 9CI)* methyl 2-(aminosulfonyl)-4-{[(methylsulfonyl)amino]methyl} benzoate (IUPAC) BCS-AU66443 "ester sulfonamide"	Aerobic Soil Anaerobic Soil Hydrolysis Water/Sed. Wheat Laying Hen Dairy Cow Rat
AE F147447  Stoichiometric formula: $C_9 H_{10} N_2 O_5 S_2$ Molecular weight: 290.3	*CAS-No.: 888225-62-5* N-[(1,1-dioxido-3-oxo-2,3-dihydro-1,2-benzisothiazol-6-yl)methyl]methane sulfonamide (IUPAC) BCS-AU73625 "benzisothiazole"	Aerobic Soil Anaerobic Soil Hydrolysis Water/Sed. Wheat Laying Hen Dairy Cow Rat
BCS-CO60720  Stoichiometric formula: $C_{12} H_{17} N_5 O_7 S_2$ Molecular weight: 407.4	*CAS-No. and -name not available (compound not indexed in CAS)* methyl 2-[(carbamimidoylcarbamoyl) sulfamoyl]-4-{[(methylsulfonyl) amino]methyl}benzoate (IUPAC) "guanidine" "U3"	Water/Sed.
BCS-CV14885  Stoichiometric formula: $C_{11} H_{15} N_5 O_7 S_2$	*CAS-No. and -name not available (compound not indexed in CAS)* 2-[(amidinocarbamoyl)sulfamoyl]-4-[(methanesulfonamido)methyl]benzoic acid (IUPAC) BCS-CV14885 "U1" "des-methyl-guanidine"	Lysimeter Water/Sed.

Molecular weight: 393.4		
Company Code Numbers **Chemical Structures** **Chemical Formulas / Molecular Weights**	***CAS# / CA index name*** **IUPAC nomenclature** **Other names / codes**	**Occurrence**
BCS-CO60721  Stoichiometric formula: $C_{12} H_{16} N_4 O_8 S_2$ Molecular weight: 408.4	*CAS-No. and -name not available (compound not indexed in CAS)* methyl 2-[(carbamoyl-carbamoyl) sulfamoyl]-4-{[(methylsulfonyl) amino]methyl}benzoate (IUPAC) "U5"	Water/Sed.
BCS-CY51284  Stoichiometric formula: $C_{11} H_{14} N_4 O_8 S_2$ Molecular weight: 394.4	*CAS-No. and -name not available (compound not indexed in CAS)* 2-[(carbamoylcarbamoyl)sulfamoyl]-4-{[(methylsulfonyl)amino]methyl} benzoic acid (IUPAC) "U2"	Water/Sed.

CA 7.1 Fate and behaviour in soil

CA 7.1.1 Route of degradation in soil

Route of degradation of mesosulfuron-methyl in soil, aerobic conditions:

In laboratory studies using ^{14}C-radiolabels positioned in the pyrimidyl and phenyl moieties, two initial degradation routes were observed for mesosulfuron-methyl in aerobic soil: Cleavage of the methyl ester at the phenyl ring to result in AE F154851, and ether demethylation at the pyrimidine ring to yield AE F160459. As common successor product of both intermediates, AE F160460 may be formed via metabolic loss of the respective second methyl group. Moreover, breakdown of the molecule backbone occurs via cleavage of the sulfonylurea bridge, leading to the fragments AE F099095 and AE F092944 derived from the pyrimidine moiety, and AE F140584 and its cyclisation product AE F147447 derived from the phenyl moiety.

The absolute abundance of the individual metabolites showed significant soil-to-soil variation, predominant products reaching major levels were AE F154851 (up to 16.2%), AE F160459 (up to 8.9%), AE F099095 (up to 29.2%), AE F092944 (up to 10.1%), AE F160460 (up to 8.6%), AE F140584 (up to 7.1%), and AE F147447 (up to 6.5%). All degradates are transient intermediates, which are either transformed to their respective metabolic downstream products, mineralized to carbon dioxide (up to 49.2%), or integrated into the soil matrix as non-extractable residues (up to 63.8%). The degradation of mesosulfuron-methyl in soil was shown to be a microbially mediated process.

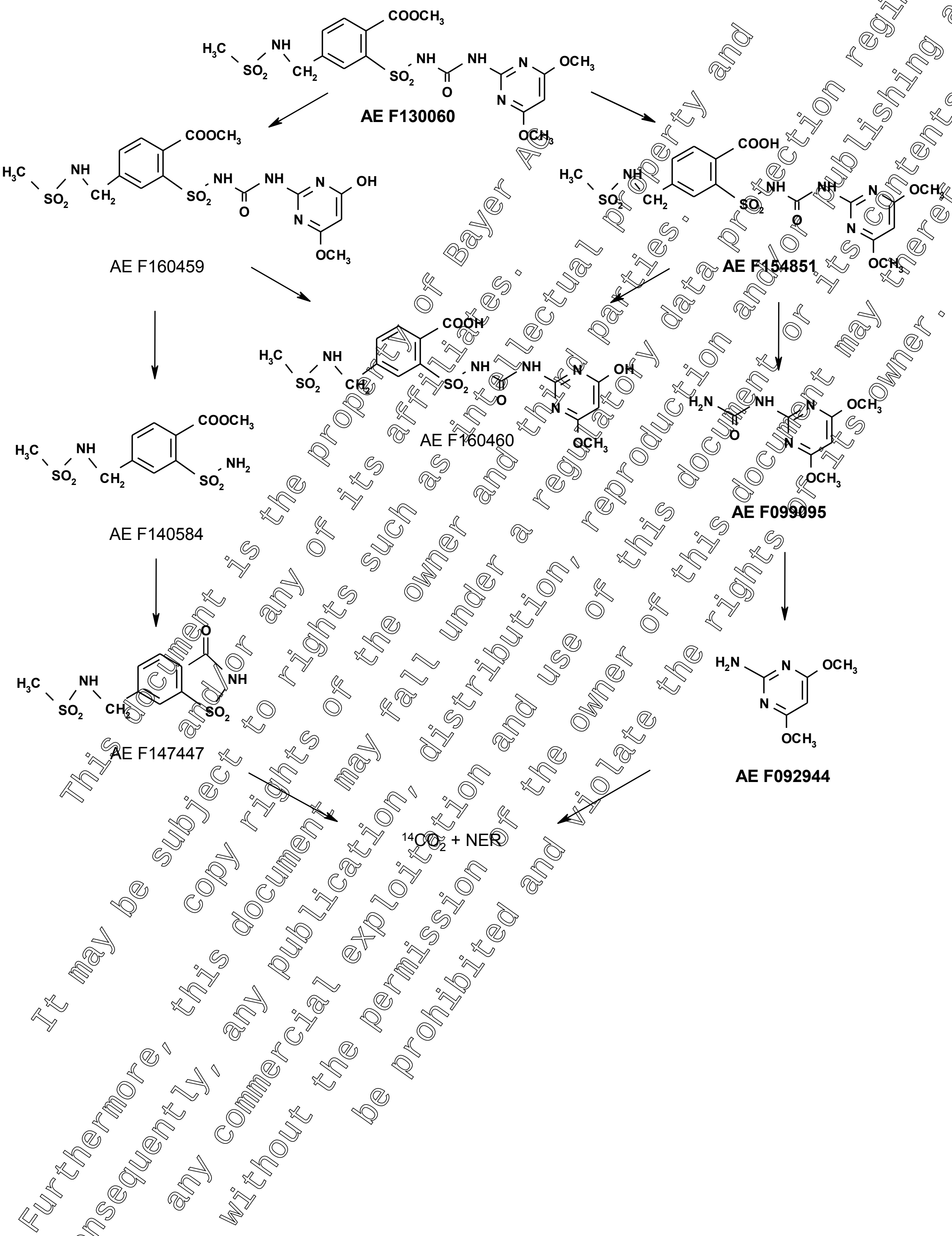
Route of degradation of mesosulfuron-methyl in soil, anaerobic conditions:

Degradation in soil under anaerobic conditions follows the same pathways as observed under aerobic conditions, with no additional metabolites formed. AE F160459 represents the predominant anaerobic product (up to 25.9%), and mineralisation is less pronounced than under aerobic conditions.

Route of degradation of mesosulfuron-methyl in soil, photolysis:

Mesosulfuron-methyl is not significantly photodegraded on soil surface.

Figure 7.1.1- 1: Proposed degradation pathway of mesosulfuron-methyl in soil



CA 7.1.1.1 Aerobic degradation

The route of degradation of Mesosulfuron-methyl in soil under aerobic conditions in the dark was investigated in a comprehensive set of laboratory studies, using soils of varying texture, physico-chemical properties and different regional provenance. Two different radiolabel positions, [phenyl-UL-^{14}C] and [pyrimidyl-2-^{14}C], were employed; the treatments were based on an application rate equivalent to 15 g/ha:

- eight soils under standard aerobic conditions at 20 °C and 50 % maximum water holding capacity (MWHC), pyrimidyl-2-^{14}C label;
- one soil under standard aerobic conditions at 20 °C and 50% MWHC, phenyl-UL-^{14}C label;
- one soil under cold aerobic conditions at 10 °C and 50% MWHC, phenyl-UL-^{14}C and pyrimidyl-2-^{14}C label

All studies were considered acceptable during the original EU review of mesosulfuron (Review Report SANCO/10298/2003-Final, 25 June 2004). The following studies are included in the baseline dossier. No additional studies are submitted in the context of application for approval renewal.

Report:	[redacted]0;[redacted];2000;M-199426-01
Title:	Kinetics and Metabolism in Soil LS 2.2 at 10°C and 20°C under Aerobic Conditions Code: [2-^{14}C-pyrimidyl]AE F130060
Report No:	CB96/011
Document No:	M-199426-01-1
Guidelines:	**BBA: IV, 4-1;USEPA (=EPA): §162-1; SETAC Europe: Procedures for assessing the environmental fate and ecotoxicity of pesticides; Deviation not specified**
GLP/GEP:	**yes**

Reference	Followed guidance	Guidance currently in force	Differences	Critical assessment of the study / Deviations / conclusion about its Reliability
M-199426-01-1	1) BBA: IV, 4-1;USEPA (=EPA): §162-1 2) SETAC Europe: Procedures for assessing the environmental fate and ecotoxicity of pesticides	OECD 307	None	Study fulfills criteria of current guideline and is considered reliable.

Report:	[redacted]l;[redacted];2000;M-199432-01
Title:	Kinetics and Metabolism in Soil LS 2.2 at 10°C and 20°C under Aerobic Conditions Code: [U-^{14}C-phenyl]AE F130060
Report No:	CB97/053
Document No:	M-199432-01-1
Guidelines:	**BBA: IV, 4-1; USEPA (=EPA): §162-1; SETAC Europe: Procedures for assessing the environmental fate and ecotoxicity of pesticides**
GLP/GEP:	**yes**

Reference	Followed guidance	Guidance currently in force	Differences	Critical assessment of the study / Deviations / conclusion about its Reliability
M-	1) BBA: IV, 4-1;USEPA (=EPA):	OECD 307	None	Study fulfills criteria of

199432-01-1	§162-1 2) SETAC Europe: Procedures for assessing the environmental fate and ecotoxicity of pesticides			current guideline and is considered reliable.

Report:	**[redacted]; [redacted];2000;M-199434-01**
Title:	Degradation in three soils at 20°C under aerobic conditions Code: [2-^{14}C-pyrimidyl]AE F130060
Report No:	CB96/056
Document No:	M-199434-01-1
Guidelines:	**BBA: IV, 4-1; USEPA (=EPA): §162-1; SETAC Europe: Procedures for assessing the environmental fate and ecotoxicity of pesticides**
GLP/GEP:	**yes**

Reference	Followed guidance	Guidance currently in force	Differences	Critical assessment of the study / Deviations / conclusion about its Reliability
M-199434-01-1	1) BBA: IV, 4-1;USEPA (=EPA): §162-1 2) SETAC Europe: Procedures for assessing the environmental fate and ecotoxicity of pesticides	OECD 307	None	Study fulfills criteria of current guideline and is considered reliable.

Report:	**[redacted];[redacted];2000;M-199424-01**
Title:	Degradation in four Soils at 20°C under Aerobic Conditions Code: [2-^{14}C-pyrimidyl]AE F130060
Report No:	CB96/140
Document No:	M-199424-01-1
Guidelines:	**BBA: IV, 4-1; USEPA (=EPA): N 162-1; USEPA (=EPA): §162-1; SETAC Europe: Procedures for assessing the environmental fate and ecotoxicity of pesticides; Deviation not specified**
GLP/GEP:	**yes**

Reference	Followed guidance	Guidance currently in force	Differences	Critical assessment of the study / Deviations / conclusion about its Reliability
M-199424-01-1	1) BBA: IV, 4-1;USEPA (=EPA): §162-1 2) SETAC Europe: Procedures for assessing the environmental fate and ecotoxicity of pesticides	OECD 307	None	Study fulfills criteria of current guideline and is considered reliable.

A brief overview summary of metabolite abundances accross above studies is provided in Table CA 7.1.1.1- 1.

Table CA 7.1.1.1- 1 Abundance ranges for degradation products of mesosulfuron-methyl in aerobic soil [% of applied]. Maximum values are marked bold / underlined.

Study Reference	**KCA 7.1.1.1 /01**	**KCA 7.1.1.1 /02**	**KCA 7.1.1.1 /03**			**KCA 7.1.1.1 /04**			
Soil desgination	LS2.2	LS2.2	CHL	SLV	SLI	SCL	FF	SLS	CLF

and type	loamy sand		loamy sand		loamy sand	loamy sand	sandy loam	clay	loam	silt loam	loam
Radiolabel	py	py	ph	ph	py	py	py	py	py	py	py
Temperature	20°C	10°C	20°C	10°C	20°C	20°C	20°C	20°C	20°C	20°C	20°C
AE F154851	4.2	2.4	7.6	6.9	2.2	5.7	8.9	1.2	13.4	4.7	**16.2**
AE F160459	5.4	4.3	1.9	2.6	n.d.	n.d.	**8.9**	4.4	4.5	0.6	7.0
AE F099095	2.4	2.6	N/A	N/A	1.1	2.0	1.4	1.1	2.4	**29.2**	2.0
AE F092944	3.1	3.8	N/A	N/A	**10.1**	6.1	n.d.	7.6	7.5	3.1[1]	6.8
AE F160460	4.8	5.5	3.3	3.6	1.8	4.7	**8.6**	1.8	6.0	1.3	4.3
AE F140584	N/A	N/A	5.1	**7.1**	N/A	N/A	N/A	N/A	N/A	N/A	N/A
AE F147447	N/A	N/A	**6.5**	4.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Max. individual unidentified	3.1	1.7	2.3	2.4	2.1	3.7	2.3	1.4	2.1[1]	2.5[1]	2.1
CO_2	29.8	9.6	18	6.5	27.7	24.2	25.4	14.3	21.1	**49.2**	31.2
NER	40.1	20.3	**63.8**	57.1	28.1	33.3	57.7	49.4	50.4	43.7	58.2

n.d. = not detected; N/A = not applicable (due to radiolabel position tested in study)

[1] higher day 0 value by analytical artefact; cf. study report page 29.

Applying the trigger values specified in Regulation 1107/2009, it is concluded that the following components should be considered relevant for risk assessment: Mesosulfuron-methyl (AE F130060), AE F154851, AE F160459, AE F099095, AE F092944, AE F160460, AE F140584, and AE F147447.

CA 7.1.1.2 Anaerobic degradation

The route of degradation of mesosulfuron-methyl in soil under anaerobic conditions in the dark in the laboratory was studied in one soil using two radiolabel positions, [phenyl-UL-^{14}C] and [pyrimidyl-2-^{14}C]. The data was EU reviewed for Annex I inclusion, and was considered acceptable during the original EU review of mesosulfuron (Review Report SANCO/10298/2003-Final, 25 June 2004). It was concluded that degradation in soil under anaerobic conditions follows the same fundamental pathways as under aerobic conditions, with no additional metabolites formed.

The following study is included in the baseline dossier. No additional studies are submitted within this supplemental dossier for approval renewal of mesosulfuron-methyl.

Report:	**[redacted]8;[redacted];2000;M-199429-01**
Title:	Kinetics and Metabolism in Soil LS 2.2 at 20°C under Anaerobic Conditions Code: [U-^{14}C-phenyl]AE F130060 and [2-^{14}C-pyrimidyl]AE F130060
Report No:	CR 98/136
Document No:	M-199429-01-1
Guidelines:	**SETAC: 1, 1.2; USEPA (=EPA): §162-2; Deviation not specified**
GLP/GEP:	**yes**

Reference	Followed guidance	Guidance currently in force	Differences	Critical assessment of the study / Deviations / conclusion about its Reliability
M-199429-01-1	1) SETAC Europe: Procedures for assessing the environmental fate and ecotoxicity of pesticides (1995) 2) EPA Pesticide Assessment Guideline Subdiv. N, § 162-2 (1982)	OECD 307	Test item applied onto water surface to flooded soil. Monitoring of anaerobic conditions for one week prior to application.	This is a strictly anaerobic study and fulfills all criteria of the OECD guideline 307 for soil degradation studies. Therefore, it is considered reliable.

CA 7.1.1.3 Soil photolysis

The route of degradation of mesosulfuron-methyl on soil under photolytic conditions in the laboratory was studied on one soil using two radiolabel positions, [pyrimidyl-2-^{14}C] and [phenyl-UL-^{14}C]. The data was EU reviewed for Annex I inclusion, and was considered acceptable during the original EU review of mesosulfuron (Review Report SANCO/10298/2003-Final, 25 June 2004). It was concluded that no degradation was observed and accordingly mesosulfuron-methyl is to be considered photolytically stable on soil surface.

The following study is included in the baseline dossier. No additional studies are submitted within this supplemental dossier for approval renewal of mesosulfuron-methyl.

Report:	**[redacted]6;[redacted];2000;M-194849-02;M-194849-01**
Title:	Photolysis of ^{14}C-AE F130060 on soil surface under laboratory conditions
Report No:	738088
Document No(s):	M-194849-01-1
Guidelines:	**USEPA (=EPA): N 161-3, Oct 18,1982; Directives 95/36/EEC; Deviation not specified**
GLP/GEP:	**yes**

Reference	Followed guidance	Guidance currently in force	Differences	Critical assessment of the study / Deviations / conclusion about its Reliability
M-194849-01-1	Pesticide Assessment Guidelines, Subdivision N, Chemistry: Environmental Fate, EPA-540/9-82-021, Section 161-3; October 18,1982.	OECD guideline draft: phototransformation of chemicals on soil surfaces	Limit of detection not stated	Besides lack of LOD definition study fulfills criteria of current guideline and is considered reliable. Chromatograms indicate actual LOD to be <1 % of applied.

Executive Summary

The photodegradation of [^{14}C]mesosulfuron-methyl (mixture of pyrimidyl-2- and phenyl-UL-label) applied to the surface of thin-layers of soil using a xenon arc light source with a 12 hours light/dark cycle was investigated for 30 days. This irradiation period corresponded to 41.4 days natural Florida sun days.

Soil	Source	Soil type	pH	OC [%]
[redacted]	[redacted], Great Britain	clay loam	7.3	2.4

For this purpose, the test substance was applied on clay loam soil plates at a target concentration of 3.75 µg/25 cm², corresponding to the maximum recommended field rate of 15 g a.i./ha. The soil plates were incubated under the following conditions: 75% FC (field capacity 1/3 bar), 20 °C. The effective applied average dose was found to be 3.61 µg/25 cm².

The plates were placed in a stainless steel cooling tank and irradiated in a "Suntest" exposure table unit, fitted with a xenon arc light source. Cooling water was pumped through the base of the tank to keep the temperature constant at 20 °C. Moistened air was sucked through the tank and any volatile products formed were trapped. Control samples were treated in the same way, except that they were kept in the dark during the exposure period.

Duplicate soil samples of irradiated and control soil was sampled at 0, 3, 7, 14, 21 and 30 days after application. The samples from days 0, 14 and 30 were extracted and the radioactivity in the extracts was determined by LSC. Metabolite patterns were determined by HPLC. The residual radioactivity in the extracted soil samples was determined by combustion.

The average of total recoveries was 100.3 ± 2.2% AR for the irradiated samples and 99.7 ± 2.2% AR for the control samples.

For the irradiated samples, the extractable radioactivity decreased from 100.2% AR on DAT-0 to 79.7% on DAT-30 (end of the irradiation period). In the same period, the non-extractable residues increased from 0.8 to 20.0% AR. The amount of radioactivity evolved as $^{14}CO_2$ amounted to 2.4% AR after 30 days. The other radioactive volatile substances remained below 0.1% AR.

For the control samples, the extractable radioactivity decreased from 100.2% AR on DAT-0 to 80.8% AR on DAT-30. The non-extractable residues increased from 0.8 to 20.2% AR during 30 days. Volatile substances, i.e., $^{14}CO_2$ and the other volatiles remained below 0.1% AR.
After illumination for 30 days, the amount of [^{14}C]mesosulfuron-methyl at DAT-30 was still 100% and no degradation products were detected by HPLC. Therefore, the photolytic half-life of [^{14}C]mesosulfuron-methyl on soil was clearly above 30 days.

After 30 days of incubation in the dark, the amount of [^{14}C]mesosulfuron-methyl at DAT-30 was still 100% and no degradation products were detected.

In conclusion, [^{14}C]mesosulfuron-methyl was not degraded by photolysis during 30 days of illumination. No metabolites were detected by HPLC. Volatile radioactivity (CO_2) was measured in an amount of 2.4%. Assuming a first order decay, these results would implicate a photolytic half-life of [^{14}C]mesosulfuron-methyl of >300 days corresponding to > 414 Florida summer sunlight days.

I. MATERIALS AND METHODS

A. MATERIALS

1. Test Item

[pyrimidyl-2]mesosulfuron-methyl

Sample ID:	Z 28095-1
Specific Activity:	4184 MBq/g
Radiochemical Purity:	≥ 99.5%
Chemical Purity:	not reported

[phenyl-UL]mesosulfuron-methyl

Sample ID:	Z 28004-3
Specific Activity:	6263 MBq/g
Radiochemical Purity:	≥ 98.4%
Chemical Purity:	not reported

2. Test Soil

One soil was used (see Table CA 7.1.1.3- 1), which was sampled freshly from the field and sieved to 2 mm equivalent diameter.

Table CA 7.1.1.3- 1: Physico-chemical properties of test soil

Parameter	**Results / Units**
Soil Designation	[redacted]
Geographic Location	
City	[redacted]
Country	Great Britain
Soil Taxonomic Classification (USDA)	no information available
Soil Series	no information available
Textural Class (USDA)	clay loam
Sand [50 µm – 2 mm]	34.9%
Silt [2 µm – 50 µm]	26.2%
Clay [< 2 µm]	38.8%
pH	7.3
Organic Carbon	2.4%
Organic Matter [1]	4.1%
Cation Exchange Capacity [meq/100 g]	25.0
Water Holding Capacity	
Field capacity (FC, pF 2.5)	30.6%
75% FC	22.9%

[1] % organic matter = % organic carbon x 1.724
USDA: United States Department of Agriculture

B. STUDY DESIGN

1. Experimental Conditions

The test samples for exposure were irradiated in a "Suntest" accelerated exposure table unit, fitted with a xenon arc light source and filters to cut off light of less than 290 nm wavelength.

The spectral energy distribution (300-800 nm) of the light source, i.e. the incident light available at the soil level was recorded at four exposure positions of the suntest apparatus at the beginning of the study using a portable spectroradiometer, LI-COR Model LI-1800.

The radiant flux incident on receiving surface (irradiance through all filters) in the range 300 to 400 nm was 18.6 W/m^2, on average and was comparable to the light intensity of natural daylight in the summer with vertical incidence of the sun measured on a clear, cloudless day (17.2 W/m^2; August 25, 1999 at RCC facilities).

Soil thin layers were prepared by applying an aqueous slurry of soil to a glass plate (about 100 g soil mixed with 120 ml bi-distilled water) so that a layer of < 2 mm thickness was formed. The layers were allowed to dry. Each plate was divided into two treatment areas of 25 cm^2. Each treatment area consisted of about 2 g dry soil equivalents.

Based on a target amount of 3.75 µg/treatment area, 370 µl of the application solution (mixture of both labels of test item dissolved in acetonitrile) were used for the application of each treatment area of 25 cm^2. This concentration corresponds to the maximum recommended field rate of the test item of 15 g a.i./ha. A total of 9 plates (each with two treatment areas) were applied dropwise using a syringe.

Right after the application the plates were adjusted to a soil moisture of 75% FC. During the incubation, as far as possible, the soil samples were maintained at 75% of the field capacity. The required amount of water was added to the plates in regular intervals. It should be pointed out that the irradiated soil plates dried out more rapidly compared to the control plates.

In order to control the temperature of the irradiated plates and to trap any volatile product formed, the plates were placed in a stainless steel cooling tank. The tank was sealed with a double quartz lid which was cooled with water and placed beneath the xenon burner. Cooling water at a pre-set temperature was pumped through the base of the tank and the quartz lid to control the temperature of the irradiated soil coated plates. The actual temperature (20.0 ±1.0 °C) during irradiation was continuously monitored with a thermocouple inside the tank and remained constant. Moistened air was sucked through the cooling tank and any volatile products formed were trapped. For the collection of volatiles, airflow through system was installed with a constant gas flow. The outlet air passed two traps for absorbing volatiles in sequence, containing 2 N NaOH and ethylene glycol. Dark control samples were incubated in the same way, with an identical gas flow system and maintained in darkness. Irradiation was performed with a 12 hours light/dark cycle.

2. Sampling

The soil samples (in duplicate) were collected after 0, 3, 7, 14, 21 and 30 days of irradiation. The soil samples of days 0, 14 and 30 were immediately extracted and analysed. Control samples were similarly collected after 0 (same as treated sample), 3, 7, 14, 21 and 30 days of incubation in the dark. The soil samples of days 14 and 30 were immediately extracted and analysed. Except for day 0, at each sampling interval, volatiles were measured for both, irradiated and non-irradiated tanks. The traps were exchanged at each sampling interval. One plate was taken at the start and one plate (irradiated and control) at 30 days of incubation.

3. Analytical Procedures

The radioactivity in the samples was determined by LSC. All measurements were performed at least in duplicate and counted for a time interval allowing a counting error below 5%.

At the corresponding sampling interval, the soil was scrapped off from the plate (irradiated and control). The duplicate soil samples were exhaustively extracted three times by ultrasonic treatment followed by agitation with Acetonitrile/purified water (80/20, *v/v*). After extraction the samples were centrifuged afterwards for 10 minutes at approximately 1500 x *g* before decanting. The radioactivity in each extract was determined by LSC of duplicate aliquots. Thereafter, the three extracts per sampling interval were combined and analysed by high-performance liquid chromatography (HPLC). The residual radioactivity remaining in the extracted soil samples was determined by combustion and LSC.

Samples of sodium hydroxide solutions (0.5 ml) from the trapping flasks were mixed with 4.0 ml of water. Thereafter, the samples were measured with 10 ml of scintillation mixture. Samples of ethylene glycol (0.5 ml) from adsorption bottles were mixed with 10 ml of scintillation mixture and measured by LSC. Barium hydroxide precipitation was carried out to confirm that the radioactivity contained in the NaOH solutions was $^{14}CO_2$. For this purpose, 1 ml portions of the alkaline solutions were diluted with 3 ml of purified water and precipitation was induced by addition of 3 ml of a saturated barium hydroxide solution. The suspensions were centrifuged for about 10 min. at approximately 700 g and the supernatants were tested for quantitative precipitation by adding another one to two drops of the saturated $Ba(OH)_2$ solution. If no turbidity developed upon the second addition of $Ba(OH)_2$, the supernatants were counted by LSC measurement. If turbidity was observed, LSC measurements were performed after another precipitation step.

Microbial activity was determined at start and end of incubation by a plate count assay.

II. RESULT AND DISCUSSION

Results indicated that the anticipated standardized conditions were maintained over the duration of the laboratory study. The results showed that the selected soil was viable.

A. DATA

Table CA 7.1.1.3- 2: Photodegradation of [^{14}C]mesosulfuron-methyl (pyrimidyl-2- and phenyl-UL-label) on soil [redacted] in irradiated samples (values expressed as % AR)

Compound	Replicate No.	DAT		
		0	14	30
mesosulfuron-methyl	A	101.0	81.7	78.6
	B	99.3	83.9	80.7
	Mean	100.2	82.8	79.7
Total Extractable Residues	A	101.0	81.7	78.6
	B	99.3	83.9	80.7
	Mean	100.2	82.8	79.7

Compound	Replicate No.	DAT 0	DAT 14	DAT 30
Carbon Dioxide	Mean	-	0.7	2.4
Other volatiles in ethylene glycol	Mean	-	< 0.1	< 0.1
Non-Extractable Residues	A	0.8	13.0	19.4
	B	0.7	15.5	20.6
	Mean	0.8	14.3	20.0
Total Recovery	Mean	101.0	97.8	102.1

Table CA 7.1.1.3- 3: Degradation of [^{14}C]mesosulfuron-methyl (pyrimidyl-2- and phenyl-UL-label) on soil [redacted] in dark samples (values expressed as % AR)

Compound	Replicate No.	DAT 0	DAT 14	DAT 30
mesosulfuron-methyl	A	101.0	82.2	80.8
	B	99.3	84.2	80.8
	Mean	100.2	83.2	80.8
Total Extractable Residues	A	101.0	82.2	80.8
	B	99.3	84.2	80.8
	Mean	100.2	83.2	80.8
Carbon Dioxide	Mean	-	< 0.1	< 0.1
Other volatiles in ethylene glycol	Mean	-	< 0.1	< 0.1
Non-Extractable Residues	A	0.8	14.2	19.4
	B	0.7	13.8	21.0
	Mean	0.8	14.0	20.2
Total Recovery	Mean	101.0	97.2	101.0

B. MATERIAL BALANCE

Mean material balances were 100.3% AR (range of 97.8 to 102.1% AR) for irradiated samples and 99.7% AR (range of 97.2 to 101.0% AR) for dark samples.

C. EXTRACTABLE AND NON-EXTRACTABLE RESIDUES

Extractable residues decreased from 100.2% AR at DAT-0 to 79.7 and 80.8% AR at DAT-30 in irradiated and dark samples, respectively.

Non-extractable residues (NER) increased from 0.8% AR at DAT-0 to 20.0 and 20.2% AR at DAT-30 in irradiated and dark samples for samples, respectively.

D. VOLATILES

The maximum amount of carbon dioxide was 2.4 and < 0.1% AR at DAT-30 in irradiated and dark samples, respectively. Formation of volatile organic compounds was insignificant as demonstrated by values of < 0.1% AR at all sampling intervals for both irradiated and dark samples.

E. DEGRADATION OF PARENT COMPOUND

For the irradiated samples, the amount of [^{14}C]mesosulfuron-methyl at DAT-30 was still 100% and no degradation products were detected. Therefore, the photolytic half-live of [^{14}C]mesosulfuron-methyl on soil was clearly above 30 days. Taking into account an amount of 2.4% of volatile radioactivity formed during 30 days of irradiation and assuming a first order decay, these results would implicate a photolytic half-life of [^{14}C]mesosulfuron-methyl of > 300 days corresponding to > 414 Florida summer sunlight days. For the samples incubated in the dark, [^{14}C]mesosulfuron-methyl the amount of [^{14}C]mesosulfuron-methyl at DAT-30 was still 100% and no degradation products were detected. In conclusion, [^{14}C]mesosulfuron-methyl was photolytically stable.

III. CONCLUSIONS

Illumination or incubation in the dark of [^{14}C]mesosulfuron-methyl on soil thin-layer plates was performed for 30 days. Extractability of the test item and/or metabolites decreased slightly during that time interval.

Mesosulfuron-methyl was not degraded by photolysis during 30 days of illumination. No metabolites were detected by HPLC. Volatile radioactivity (CO_2) was measured in an amount of 2.4%.

Assuming a first order decay, these results would implicate a photolytic half-life of [^{14}C]mesosulfuron-methyl of > 300 days corresponding to > 414 Florida summer sunlight days.

CA 7.1.2 Rate of degradation in soil

CA 7.1.2.1 Laboratory studies

CA 7.1.2.1.1 Aerobic degradation of the active substance

Mesosulfuron-methyl was found well degraded in soil under aerobic conditions in the laboratory. To implement new guidance for kinetic evaluation of experimental data, and new experimental data on metabolites, an update of the overall pathway kinetic evaluation was made (~~KCA 7.1.2.1.1 /07~~ updated version: KCA 7.1.2.1.1/08 and ~~KCA 7.1.2.1.2 /02~~ updated version: KCA 7.1.2.1.2/07). An overview of the DT_{50}/DT_{90} and formation fractions of mesosulfuron-methyl and its major degradation products under aerobic conditions in the laboratory is provided in Tables Table CA 7.1.2.1.1- 1 to Table CA 7.1.2.1.1-3 below, for details reference is made to the individual study summaries.

Table CA 7.1.2.1.1- 1: Overview of DT$_{50}$ values (20 °C, pF2) for mesosulfuron-methyl and its metabolites based on laboratory studies.

Soil	DT$_{50}$ [days]								
	Model used for test substance	Mesosulfuron-methyl	AE F154851	AE F160459	AE F099095	AE F092944	AE F160460	AE F140584	AE F147447
SLI	SFO	10.3	11.5	79.3	64.9	n.d.	14.9	n.d.	n.d.
SLV	SFO	39.8	22.1	n.d.	- [2]	- [2]	n.d.	n.d.	n.d.
CHL	DFOP	80.5 [1]	- [2]	n.d.	- [2]	21.9	n.d.	n.d.	n.d.
SLS	SFO	6.7	- [2]	- [2]	43.4 [3]	- [2]	- [2]	n.d.	n.d.
SCL	SFO	57.8	- [2]	- [2]	- [2]	- [2]	- [2]	n.d.	n.d.
FF	SFO	29.5	57.4	116.3	234	- [2]	29.1	n.d.	n.d.
CLF	SFO	11.9	34.6	28.8	59.8	46.7	- [2]	n.d.	n.d.
LS 2.2 pyrimidyl	DFOP	155 [1]	64.6	- [2]	80.4	- [2]	- [2]	n.d.	n.d.
LS 2.2 phenyl	FOMC	30.8 [1]	29.8	61.9	n.d.	n.d.	14.1	- [2]	- [2]
[redacted] AIIIa (metabolite appl.)	SFO/ HS [5]	-	-	-	-	-	-	4.0	82.7 [1]
[redacted] AXXa (metabolite appl.)	SFO/ HS [5]	-	-	-	-	-	-	7.0	111.4 [1]
[redacted] 4a (metabolite appl.)	SFO/ HS [5]	-	-	-	-	-	-	2.4	203.0 [1]
[redacted] II (metabolite appl.)	SFO/ DFOP [5]	-	-	-	-	-	-	1.5	73.3 [1]
Geometric Mean	-	**30.3**	**31.5**	**63.7**	**77.7**	**46.7** [4]	**18.3**	**3.2**	**108.2**

[1] DT$_{50}$ calculated slow degradation rate of DFOP or HS model or from DT90 value of FOMC model.
[2] Value statistically not acceptable (p(t-test) or Chi^2-error too large) and not considered for calculation of mean.
[3] Derived from decline fit.
[4] Maximum of two values used instead of geometric mean.
[5] SFO for AE F140584; bi-phasic for AE F147447

~~**Soil**~~	~~**DT$_{50}$ [days]**~~								
	~~Model used for test substance~~	~~Mesosulfuron-methyl~~	~~AE F154851~~	~~AE F160459~~	~~AE F099095~~	~~AE F092944~~	~~AE F160460~~	~~AE F140584~~	~~AE F147447~~
~~SLI~~	~~SFO~~	~~12.2~~	~~13.6~~	~~93.9~~	~~76.4~~	~~n.d.~~	~~17.5~~	~~n.d.~~	~~n.d.~~
~~SLV~~	~~SFO~~	~~54.3~~	~~30.1~~	~~n.d.~~	~~–^{2}~~	~~–^{2}~~	~~n.d.~~	~~n.d.~~	~~n.d.~~
~~CHL~~	~~DFOP~~	~~109.7^{1}~~	~~–^{2}~~	~~n.d.~~	~~–^{2}~~	~~20.8~~	~~n.d.~~	~~n.d.~~	~~n.d.~~
~~SLS~~	~~SFO~~	~~7.7~~	~~–^{2}~~	~~–^{2}~~	~~47.6~~	~~–^{2}~~	~~–^{2}~~	~~n.d.~~	~~n.d.~~
~~SCL~~	~~SFO~~	~~–^{2}~~	~~–^{2}~~	~~–^{2}~~	~~–^{2}~~	~~–^{2}~~	~~–^{2}~~	~~n.d.~~	~~n.d.~~
~~FF~~	~~SFO~~	~~33.4~~	~~64.3~~	~~130~~	~~234~~	~~–^{2}~~	~~32.6~~	~~n.d.~~	~~n.d.~~
~~CLF~~	~~SFO~~	~~15.4~~	~~44.8~~	~~37.3~~	~~77.4~~	~~60.4~~	~~–^{2}~~	~~n.d.~~	~~n.d.~~
~~*LS 2.2 (pyr. label 20°C)*~~	~~*DFOP*~~	~~*155*^{1}~~	~~*63.9*~~	~~–^{2}~~	~~*79.5*~~	~~–^{2}~~	~~*44.2*^{3}~~	~~*n.d.*~~	~~*n.d.*~~
~~*LS 2.2 (pyr. label, 10°C)*~~	~~*SFO*~~	~~*64.4*~~	~~–^{2}~~	~~–^{2}~~	~~–^{2}~~	~~–^{2}~~	~~–^{2}~~	~~*n.d.*~~	~~*n.d.*~~
~~Geom. LS 2.2 pyrimidyl~~	~~-~~	~~99.9^{6}~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~*LS 2.2 (ph. label, 20°C)*~~	~~*SFO*~~	~~*32.0*~~	~~*37.5*~~	~~*72.4*~~	~~*n.d.*~~	~~*n.d.*~~	~~*16.9*~~	~~–^{2}~~	~~*647*~~
~~*LS 2.2 (ph. label, 10°C)*~~	~~*SFO*~~	~~*43.5*~~	~~*32.2*~~	~~*38.8*~~	~~*n.d.*~~	~~*n.d.*~~	~~–^{2}~~	~~*5.9*~~	~~*176*~~
~~Geom. LS 2.2 phenyl~~	~~-~~	~~37.3^{6}~~	~~34.7^{6}~~	~~53.0^{6}~~	~~-~~	~~-~~	~~-~~	~~-~~	~~337^{6}~~
[redacted] ~~AIIIa (metabolite appl.)~~	~~SFO~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~4.0~~	~~60.6~~
[redacted] ~~AXXa (metabolite appl.)~~	~~SFO~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~7.1~~	~~78.5~~
[redacted] ~~4a (metabolite appl.)~~	~~SFO~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~2.4~~	~~75.3~~
[redacted] ~~II (metabolite appl.)~~	~~SFO/ DFOP^{5}~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~1.5~~	~~73.7^{1}~~
~~**Geometric Mean**~~	~~-~~	~~**31.9**~~	~~**37.1**~~	~~**70.1**~~	~~**87.9**~~	~~**60.4**^{4}~~	~~**25.6**~~	~~**3.6**~~	~~**97.7**~~

[1] ~~DT$_{50}$ calculated slow degradation rate of DFOP model.~~

[2] ~~Value statistically not acceptable (p(t-test) or Chi^{2} error too large) and not considered for calculation of mean.~~

[3] ~~Derived from decline fit.~~

[4] ~~Maximum of two values used instead of geometric mean.~~

[5] ~~SFO for AE F140584; DFOP for AE F147447~~

[6] ~~values obtained from the same batches of soil LS 2.2 were averaged before calculating overall mean values.~~

~~n.d. = not determined~~

Table CA 7.1.2.1.1- 2: Overview of DT_{90} values (calculated as DT_{50} *3.32; 20°C, pF2) for mesosulfuron-methyl and its metabolites.

Soil	DT90 [days]								
	Model used for test substance	Mesosulfuron-methyl	AE F154851	AE F160459	AE F099095	AE F092944	AE F160460	AE F140584	AE F147447
SLI	SFO	34.2	38.2	263.3	215.5	n.d.	49.5	n.d.	n.d.
SLV	SFO	132.1	73.4	n.d.	- [2]	- [2]	n.d.	n.d.	n.d.
CHL	DFOP	267.3 [1]	- [2]	n.d.	- [2]	72.7	n.d.	n.d.	n.d.
SLS	SFO	22.2	- [2]	- [2]	144.1 [3]	- [2]	- [2]	n.d.	n.d.
SCL	SFO	191.9	- [2]	- [2]	- [2]	- [2]	- [2]	n.d.	n.d.
FF	SFO	97.9	190.6	386.1	776.9	- [2]	96.9	n.d.	n.d.
CLF	SFO	39.5	114.9	95.6	198.5	155.0	- [2]	n.d.	n.d.
LS 2.2 pyrimidyl	DFOP	514.6 [1]	214.5	- [2]	266.9	- [2]	- [2]	n.d.	n.d.
LS 2.2 phenyl	FOMC	102.3	98.9	205.5	n.d.	n.d.	46.8	- [2]	- [2]
[redacted] AIIIa (metabolite appl.)	SFO/ HS [5]	-	-	-	-	-	-	13.3	274.6 [1]
[redacted] AXXa (metabolite appl.)	SFO/ HS [5]	-	-	-	-	-	-	23.2	369.8 [1]
[redacted]4a (metabolite appl.)	SFO/ HS [5]	-	-	-	-	-	-	8.0	674.0 [1]
[redacted]II (metabolite appl.)	SFO/ DFOP [5]	-	-	-	-	-	-	5.0	243.4 [1]
Geometric Mean	-	**100.6**	**104.6**	**211.5**	**258.0**	**155.0 [4]**	**60.8**	**10.6**	**359.2**

1) DT_{50} calculated slow degradation rate of DFOP or HS model or from DT90 value of FOMC model.
2) Value statistically not acceptable (p(t-test) or Chi²-error too large) and not considered for calculation of mean.
3) Derived from decline fit.
4) Maximum of two values used instead of geometric mean.
5) SFO for AE F140584; bi-phasic for AE F147447

~~Soil~~	~~DT_{90} [days]~~								
	~~Model used for test substance~~	~~Mesosulfuron-methyl~~	~~AE F154851~~	~~AE F160459~~	~~AE F099095~~	~~AE F092944~~	~~AE F160460~~	~~AE F140584~~	~~AE F147447~~
~~SLI~~	~~SFO~~	~~40.5~~	~~45.2~~	~~312~~	~~254~~	~~n.d.~~	~~58.1~~	~~n.d.~~	~~n.d.~~
~~SLV~~	~~SFO~~	~~180~~	~~99.9~~	~~n.d.~~	~~–[1]~~	~~–[1]~~	~~n.d.~~	~~n.d.~~	~~n.d.~~
~~CHL~~	~~DFOP~~	~~364~~	~~–[1]~~	~~n.d.~~	~~–[1]~~	~~98.9~~	~~n.d.~~	~~n.d.~~	~~n.d.~~
~~SLS~~	~~SFO~~	~~25.6~~	~~–[1]~~	~~–[1]~~	~~158~~	~~–[1]~~	~~–[1]~~	~~n.d.~~	~~n.d.~~
~~SCL~~	~~SFO~~	~~–[1]~~	~~–[1]~~	~~–[1]~~	~~–[1]~~	~~–[1]~~	~~–[1]~~	~~n.d.~~	~~n.d.~~
~~FF~~	~~SFO~~	~~111~~	~~213~~	~~432~~	~~777~~	~~–[1]~~	~~108~~	~~n.d.~~	~~n.d.~~
~~CLF~~	~~SFO~~	~~51.1~~	~~149~~	~~124~~	~~257~~	~~201~~	~~–[1]~~	~~n.d.~~	~~n.d.~~
~~*LS 2.2 (pyr. label 20°C)*~~	~~*DFOP*~~	~~*515*~~	~~*212*~~	~~*–[1]*~~	~~*264*~~	~~*–[1]*~~	~~*147[2]*~~	~~*n.d.*~~	~~*n.d.*~~
~~*LS 2.2 (pyr. label, 10°C)*~~	~~*SFO*~~	~~*214*~~	~~*–[1]*~~	~~*–[1]*~~	~~*–[1]*~~	~~*–[1]*~~	~~*–[1]*~~	~~*n.d.*~~	~~*n.d.*~~
~~Geom. LS 2.2 pyrimidyl~~	~~-~~	~~332[5]~~							
~~*LS 2.2 (ph. label 20°C)*~~	~~*SFO*~~	~~*106*~~	~~*125*~~	~~*240*~~	~~*n.d.*~~	~~*n.d.*~~	~~*56.1*~~	~~*–[1]*~~	~~*2148*~~
~~*LS 2.2 (ph. label, 10°C)*~~	~~*SFO*~~	~~*144*~~	~~*107*~~	~~*129*~~	~~*n.d.*~~	~~*n.d.*~~	~~*–[1]*~~	~~*19.6*~~	~~*584*~~
~~Geom. LS 2.2 phenyl~~	~~-~~	~~124[5]~~	~~115[5]~~	~~176[5]~~					~~1119[5]~~
[redacted] ~~AIIIa (metabolite appl.)~~	~~SFO~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~13.4~~	~~201~~
[redacted] ~~AXXa (metabolite appl.)~~	~~SFO~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~23.4~~	~~261~~
[redacted] ~~4a (metabolite appl.)~~	~~SFO~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~7.9~~	~~250~~
[redacted] ~~II (metabolite appl.)~~	~~SFO/ DFOP[4]~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~5.0~~	~~245~~
~~Geometric Mean~~	~~-~~	**~~106~~**	**~~123~~**	**~~233~~**	**~~292~~**	**~~201[3]~~**	**~~85.0~~**	**~~11.9~~**	**~~324~~**

[1] ~~Value statistically not acceptable (p(t-test) or Chi² error too large) and not considered for calculation of mean.~~

[2] ~~Derived from decline fit.~~

[3] ~~Maximum of two values used instead of geometric mean.~~

[4] ~~SFO for AE F140584; DFOP for AE F147447~~

[5] ~~values obtained from the same batches of soil LS 2.2 were averaged before calculating overall mean values.~~

~~n.d. = not determined~~

Table CA 7.1.2.1.1- 3: Compilation of formation fractions for the formation of metabolites in aerobic soil

Soil	**Formation Fraction**							
	Mesosulfuron-methyl → AE F154851	Mesosulfuron-methyl → AE F160459	Mesosulfuron-methyl → AE F099095	Mesosulfuron-methyl → AE F092944	Mesosulfuron-methyl → AE F140584	Mesosulfuron-methyl → AE F147447	AE F160459 → AE F160460	AE F154851 → AE F160460
SLI	0.236	0.124	0.021				1.0	1.0
SLV	0.191		0.037	-[1]				
CHL	0.036		0.016	0.392				
SLS	-[1]	-[1]	-[1]	-[1]			-[1]	-[1]
SCL	-[1]	-[1]	-[1]	-[1]			-[1]	
FF	0.243	0.075	-[1]	-[1]			1.0	1.0
CLF	0.262	0.119	0.033	0.083			1.0	-[1]
LS 2.2 pyrimidyl	0.074		0.046	0.040			1.0	-[1]
LS 2.2 phenyl	0.172	0.034			0.139	0.072	1.0	1.0
Arithmetic Mean	**0.173**	**0.088**	**0.031**	**0.172**	**0.139**	**0.072**	**1.0**	**1.0**

[1] Reaction not explicitly considered in final model due to very low formation fraction.

~~**Soil**~~	~~**Formation Fraction**~~							
	~~Mesosulfuron-methyl → AE F154851~~	~~Mesosulfuron-methyl → AE F160459~~	~~Mesosulfuron-methyl → AE F099095~~	~~Mesosulfuron-methyl → AE F092944~~	~~Mesosulfuron-methyl → AE F140584~~	~~AE F160459 → AE F160460~~	~~AE F154851 → AE F160460~~	~~AE F140584 → AE F147447~~
~~SLI~~	~~0.236~~	~~0.124~~	~~0.021~~			~~1.0~~	~~1.0~~	
~~SLV~~	~~0.191~~		~~0.037~~	~~–[1]~~				
~~CHL~~	~~0.036~~		~~0.016~~	~~0.392~~				
~~SLS~~	~~–[1]~~	~~–[1]~~	~~0.324~~	~~–[1]~~		~~–[1]~~	~~–[1]~~	
~~SCL~~	~~–[1]~~	~~–[1]~~	~~–[1]~~	~~–[1]~~		~~–[1]~~		
~~FF~~	~~0.245~~	~~0.076~~	~~0.034~~	~~–[1]~~		~~1.0~~	~~1.0~~	
~~CLF~~	~~0.262~~	~~0.119~~	~~0.033~~	~~0.083~~		~~–[1]~~	~~–[1]~~	
~~*LS 2.2 (pyr. label 20°C)*~~	~~*0.075*~~	~~*–[1]*~~	~~*0.046*~~	~~*0.040*~~		~~*–[1]*~~	~~*–[1]*~~	
~~*LS 2.2 (pyr. label, 10°C)*~~	~~*–[1]*~~	~~*–[1]*~~	~~*0.092*~~	~~*–[1]*~~		~~*–[1]*~~	~~*–[1]*~~	
~~Geom. LS 2.2 pyrimidyl~~			~~0.069~~					
~~*LS 2.2 (ph. label 20°C)*~~	~~*0.191*~~	~~*0.038*~~			~~*–[1]*~~	~~*1.0*~~	~~*1.0*~~	~~*0.100*~~
~~*LS 2.2 (ph. label, 10°C)*~~	~~*0.221*~~	~~*0.075*~~			~~*0.704*~~	~~*–[1]*~~	~~*–[1]*~~	~~*0.094*~~
~~Geom. LS2.2 phenyl~~	~~0.206~~	~~0.056~~			~~0.704~~	~~1.0~~	~~1.0~~	~~0.097~~
~~**Geometric Mean**~~	~~**0.179**~~	~~**0.094**~~	~~**0.076**~~	~~**0.172**~~	~~**0.704**~~	~~**1.0**~~	~~**1.0**~~	~~**0.097**~~

~~[1] Reaction not explicitly considered in final model due to very low formation fraction.~~

Experimental data:

The following experimental studies are included in the baseline dossier. The data were EU reviewed for Annex I inclusion, and were considered acceptable during the original EU review of mesosulfuron (Review Report SANCO/10298/2003-Final, 25 June 2004).

Report:	**[redacted]l;[redacted];2000;M-199426-01**
Title:	Kinetics and Metabolism in Soil LS 2.2 at 10°C and 20°C under Aerobic Conditions Code: [2-^{14}C-pyrimidyl]AE F130060
Report No:	CB96/011
Document No:	M-199426-01-1
Guidelines:	**BBA: IV, 4-1;USEPA (=EPA): §162-1; SETAC Europe: Procedures for assessing the environmental fate and ecotoxicity of pesticides; Deviation not specified**
GLP/GEP:	**yes**

Report:	**[redacted]*; [redacted];2000;M-199432-01**
Title:	Kinetics and Metabolism in Soil LS 2.2 at 10°C and 20°C under Aerobic Conditions Code: [U-^{14}C-phenyl]AE F130060
Report No:	CB97/053
Document No:	M-199432-01-1
Guidelines:	**BBA: IV, 4-1; USEPA (=EPA): §162-1; SETAC Europe: Procedures for assessing the environmental fate and ecotoxicity of pesticides**
GLP/GEP:	**Yes**

Report:	**[redacted]2; [redacted];2000;M-199434-01**
Title:	Degradation in three soils at 20°C under aerobic conditions Code: [2-^{14}C-pyrimidyl]AE F130060
Report No:	CB96/056
Document No:	M-199434-01-1
Guidelines:	**BBA: IV, 4-1; USEPA (=EPA): §162-1; SETAC Europe: Procedures for assessing the environmental fate and ecotoxicity of pesticides**
GLP/GEP:	**Yes**

Reference	Followed guidance	Guidance currently in force	Differences	Critical assessment of the study / Deviations conclusion about its Reliability
M-199434-01-1	1) BBA: IV, 4-1;USEPA (=EPA): §162-1 2) SETAC Europe: Procedures for assessing the environmental fate and ecotoxicity of pesticides	OECD 307	None	Study fulfills criteria of current guideline and is considered reliable

Report:	**[redacted]7; [redacted];2000;M-199424-01**
Title:	Degradation in four Soils at 20°C under Aerobic Conditions Code: [2-^{14}C-pyrimidyl]AE F130060
Report No:	CB96/140
Document No:	M-199424-01-1
Guidelines:	**BBA: IV, 4-1; USEPA (=EPA): N 162-1; USEPA (=EPA): §162-1; SETAC Europe: Procedures for assessing the environmental fate and ecotoxicity of pesticides, Deviation not specified**
GLP/GEP:	**Yes**

Reference	Followed guidance	Guidance currently in force	Differences	Critical assessment of the study / Deviations conclusion about its Reliability
M-199424-01-1	1) BBA: IV,4-1;USEPA (=EPA): §162-1 2) SETAC Europe: Procedures for assessing the environmental fate and ecotoxicity of pesticides	OECD 307	None	Study fulfills criteria of current guideline and is considered reliable

New data is submitted in the context of application for approval renewal, in form of an amendment to report for one of the above studies (KCA 7.1.2.1.1 /03):

Report:	[redacted] 2; [redacted] ;2001;M-201930-01
Title:	Degradation in three soils under aerobic conditions First addendum to report CB96/056 2-14C-pyrimidyl Code: AE F130060
Report No:	C012008
Document No:	M-201930-01-1
Guidelines:	**Deviation not specified**
GLP/GEP:	**yes**

The amendment reports field capacity values at 0.33 bar of the test soils, which were not included in the original study report (KCA 7.1.2.1.1 /03). The information is summarized in Table 7.1.2.1.1- 4 below.

Table CA 7.1.2.1.1- 4: Field Capacities at 0.33 bar in Test Soils of Study KCA 7.1.2.1.1 /03

	Soil (soil type)			
	CHL (loamy sand)	CLV (loamy sand)	SLI batch #941019A (sandy loam)	SLI batch #971001 (sandy loam)
Field capacity at 0.33 bar [g water/100 g soil]	22.2	22.85	35.56	19.4

Kinetic evaluation of above experimental data :

Report:	[redacted] 9; [redacted] ;2000;M-199574-01
Title:	Kinetic evaluation of AE F130060 aerobic soil degradation studies using TopFit 2.0 Code: AE F130060
Report No:	OE 00/105
Document No:	M-199574-01-1
Guidelines:	**Deviation not specified**
GLP/GEP:	**no**

This kinetic evaluation of studies KCA 7.1.2.1.1 /01 to /04 as reported in the baseline dossier predates FOCUS kinetic guidance. The evaluation was updated for approval renewal, compliant with current modelling practice. Report KCA 7.1.2.1.1 /05 is therefore replaced by new evaluation ~~KCA 7.1.2.1.1 /07~~ KCA 7.1.2.1.1/08 summarised below:

update note Feb 2015: upon RMS request, the kinetic evaluation was revisited and a new modelling report KCA 7.1.2.1.1/08 replacing KCA 7.1.2.1.1/07 was generated. For details on the updates, see the introductory text to report KCA 7.1.2.1.1/08.

~~**Report:**~~	[redacted] ~~.;~~ [redacted] ~~;~~ [redacted] ~~;~~ [redacted] ~~;2014;M-481029-01~~
~~Title:~~	~~Mesosulfuron-methyl (MSM) and metabolites: Kinetic evaluation of laboratory aerobic soil degradation according to FOCUS~~
~~Report No:~~	~~EnSa-13-0483~~
~~Document No:~~	~~M-481029-01-1~~
~~**Guidelines:**~~	~~**not applicable;not applicable**~~
~~**GLP/GEP:**~~	~~**no**~~

~~A kinetic evaluation of the degradation behaviour of mesosulfuron-methyl and its major metabolites in soil under aerobic conditions in the laboratory has been performed according to FOCUS kinetics (2006) to derive kinetic parameters suitable for modelling purpose and environmental risk assessment using the baseline dossier studies KCA 7.1.2.1.1 /1 to 4, amended with new soil moisture information KCA 7.1.2.1.1 /06. Note that the present study focuses on an overall pathway evaluation based on the soil degradation studies for the parent active substance. Additionally, soil degradation tests have been performed for two individual metabolites, and are kinetically evaluated in a separate modelling study, KCA 7.1.2.1.2 /07.~~

~~Executive Summary~~

~~A kinetic analysis of soil residue data from the aerobic soil degradation studies (KCA 7.1.2.1.1 /1 to 4) was performed with the software KinGUI 2 according to FOCUS kinetics (2006) to derive~~

- ~~half-lives for mesosulfuron-methyl and its degradation products AE F154851, AE F160459, AE F099095, AE F092944, AE 160460, AE F140584 and AE F147447~~
- ~~formation fractions for degradation products~~

~~which are suitable for input to environmental exposure simulation models.~~

~~The most appropriate kinetic model to describe degradation of mesosulfuron-methyl was single first order for the datasets of soils SLI, SLV, SLS, SCL, FF, CLF and LS 2.2 (pyrimidyl label at 10 °C, phenyl label at 10 °C and 20 °C), and dual first order in parallel for soils CHL and LS 2.2 (pyrimidyl label at 20 °C). Single first order was used to describe the behaviour of all degradation products.~~

~~For mesosulfuron-methyl and its metabolites the evaluation resulted in geometric mean half-lives of 31.9 days for mesosulfuron-methyl, 37.1 days for AE F154851, 70.1 days for AE F160459, 87.9 days for AE F099095, 60.4 days for AE F092944, 25.6 days for AE F160460, 5.9 days[1] for AE F140584, and and 337 days[1] for AE F147447.~~

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[1] ~~Note that additional data is available from separate studies with metabolites AE F140584 and AE F147447 directly dosed to test soils, see **KCA 7.1.2.1.2 /05**.~~

~~Table CA 7.1.2.1.1- 5: Overall compilation of normalised DT_{50} –values for mesosulfuron-methyl and its metabolites derived from the different data sets. Values obtained from the same batches of soil LS 2.2 were averaged before calculating mean values.~~

~~Soil~~	~~Model used for parent~~	~~Mesosulfuron-methyl~~	~~AE F154851~~	~~AE F160459~~	~~AE F099095~~	~~AE F092944~~	~~AE F160460~~	~~AE F140584~~	~~AE F147447~~
~~SLI~~	~~SFO~~	~~12.2~~	~~13.6~~	~~93.9~~	~~76.4~~	~~n.d.~~	~~17.5~~	~~n.d.~~	~~n.d.~~
~~SLV~~	~~SFO~~	~~54.3~~	~~30.1~~	~~n.d.~~	~~–~~[2]	~~–~~[2]	~~n.d.~~	~~n.d.~~	~~n.d.~~
~~CHL~~	~~DFOP~~	~~109.7~~[1]	~~–~~[2]	~~n.d.~~	~~–~~[2]	~~29.8~~	~~n.d.~~	~~n.d.~~	~~n.d.~~
~~SLS~~	~~SFO~~	~~7.7~~	~~–~~[2]	~~–~~[2]	~~47.6~~	~~–~~[2]	~~–~~[2]	~~n.d.~~	~~n.d.~~
~~SCL~~	~~SFO~~	~~–~~[2]	~~–~~[2]	~~–~~[2]	~~–~~[2]	~~–~~[2]	~~–~~[2]	~~n.d.~~	~~n.d.~~
~~FF~~	~~SFO~~	~~33.4~~	~~64.3~~	~~130~~	~~234~~	~~–~~[2]	~~32.6~~	~~n.d.~~	~~n.d.~~
~~CLF~~	~~SFO~~	~~15.4~~	~~44.8~~	~~37.3~~	~~77.4~~	~~60.4~~	~~–~~[2]	~~n.d.~~	~~n.d.~~
~~LS 2.2 (pyrimidyl label, 20°C)~~	*~~DFOP~~*	*~~155~~*[1]	*~~63.9~~*	*~~–~~*[2]	*~~79.5~~*	*~~–~~*[2]	*~~44.2~~*[3]	*~~n.d.~~*	*~~n.d.~~*
~~LS 2.2 (pyrimidyl label, 10°C)~~	*~~SFO~~*	*~~64.4~~*	*~~–~~*[2]	*~~–~~*[2]	*~~–~~*[2]	*~~–~~*[2]	*~~–~~*[2]	*~~n.d.~~*	*~~n.d.~~*
~~LS 2.2 (Geomean for pyrimidyl label)~~		~~99.9~~[5]							
~~LS 2.2 (phenyl label, 20°C)~~	~~SFO~~	*~~32.0~~*	*~~37.5~~*	*~~72.4~~*	*~~n.d.~~*	*~~n.d.~~*	*~~16.9~~*	*~~–~~*[2]	*~~647~~*
~~LS 2.2 (phenyl label, 10°C)~~	~~SFO~~	*~~43.5~~*	*~~32.2~~*	*~~38.8~~*	*~~n.d.~~*	*~~n.d.~~*	*~~–~~*[2]	*~~5.9~~*	*~~176~~*
~~LS 2.2 (Geomean for phenyl label)~~		~~37.3~~[5]	~~34.7~~[5]	~~53.0~~[5]					~~337~~[5]
~~Geometric Mean~~		**~~31.9~~**	**~~37.1~~**	**~~70.1~~**	**~~87.9~~**	**~~60.4~~**[4]	**~~25.6~~**	**~~5.9~~**	**~~337~~**

~~n.d. = not determined~~

[1] ~~DT_{50} calculated slow degradation rate of DFOP model.~~

[2] ~~Value statistically not acceptable (p(t-test) or Chi²-error too large) and not considered for calculation of mean.~~

[3] ~~Derived from decline fit.~~

[4] ~~Maximum of two values used instead of geometric mean.~~

[5] ~~values obtained from the same batches of soil LS 2.2 were averaged before calculating overall mean values.~~

~~**Table CA 7.1.2.1.1- 6: Overall compilation of formation fractions derived from the different data sets from laboratory studies; values obtained from the same batches of soil LS 2.2 were averaged before calculating mean values.**~~

~~Soil~~	~~Mesosulfuron-methyl -> AE F154851~~	~~Mesosulfuron-methyl -> AE F160459~~	~~Mesosulfuron-methyl -> AE F099095~~	~~Mesosulfuron-methyl -> AE F092944~~	~~Mesosulfuron-methyl -> AE F140584~~	~~AE F154851 -> AE F160460~~	~~AE F160459 -> AE F160460~~	~~AE F140584 -> AE F147447~~
~~SLI~~	~~0.236~~	~~0.124~~	~~0.021~~			~~1.0~~	~~1.0~~	
~~SLV~~	~~0.191~~		~~0.037~~	~~–[1]~~				
~~CHL~~	~~0.036~~		~~0.016~~	~~0.392~~				
~~SLS~~	~~–[1]~~	~~–[1]~~	~~0.324~~	~~–[1]~~		~~–[1]~~	~~–[1]~~	
~~SCL~~	~~–[1]~~	~~–[1]~~	~~–[1]~~	~~–[1]~~			~~–[1]~~	
~~FF~~	~~0.245~~	~~0.076~~	~~0.034~~	~~–[1]~~		~~1.0~~	~~1.0~~	
~~CLF~~	~~0.262~~	~~0.119~~	~~0.033~~	~~0.083~~		~~–[1]~~	~~–[1]~~	
~~*LS 2.2 (pyrimidyl label, 20°C)*~~	~~*0.075*~~	~~–[1]~~	~~*0.046*~~	~~*0.040*~~		~~–[1]~~	~~–[1]~~	
~~*LS 2.2 (pyrimidyl label, 10°C)*~~	~~–[1]~~	~~–[1]~~	~~*0.092*~~	~~–[1]~~		~~–[1]~~	~~–[1]~~	
~~LS 2.2 (Geomean for pyrimidyl label)~~			~~0.069~~					
~~*LS 2.2 (phenyl label, 20°C)*~~	~~*0.191*~~	~~*0.038*~~			~~–[1]~~	~~*1.0*~~	~~*1.0*~~	~~*0.100*~~
~~*LS 2.2 (phenyl label, 10°C)*~~	~~*0.221*~~	~~*0.075*~~			~~*0.704*~~	~~–[1]~~	~~–[1]~~	~~*0.094*~~
~~LS 2.2 (Geomean for phenyl label)~~	~~0.206~~	~~0.056~~			~~0.704~~	~~1.0~~	~~1.0~~	~~0.097~~
~~**Arithmetic Mean**~~	~~**0.179**~~	~~**0.094**~~	~~**0.076**~~	~~**0.172**~~	~~**0.704**~~	~~**1.0**~~	~~**1.0**~~	~~**0.097**~~

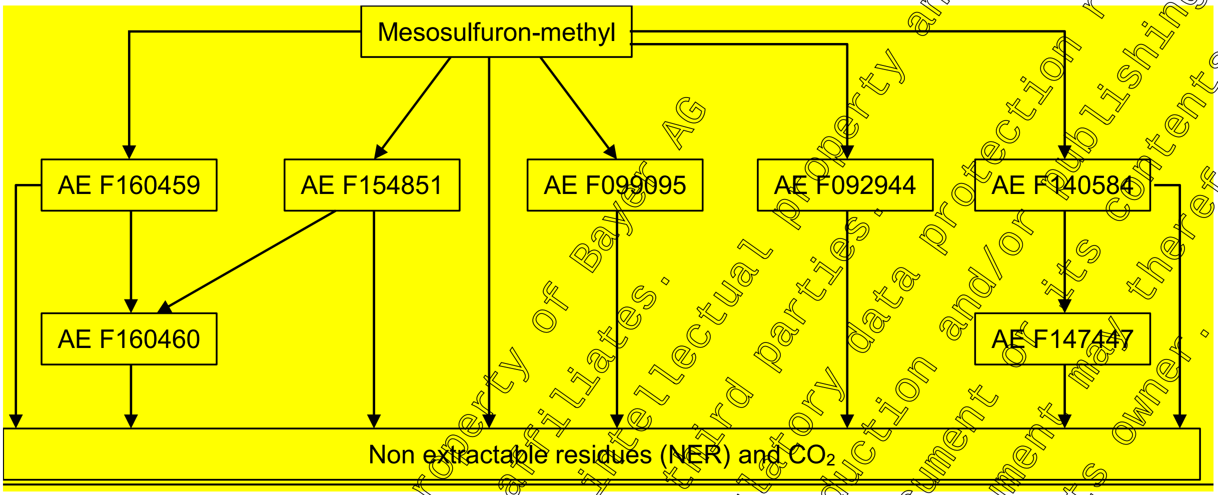
~~[1] Reaction not explicitly considered in final model due to very low formation fraction.~~

~~I. METHODS~~

~~Soil residue data from the aerobic soil degradation studies KCA 7.1.2.1.1 /01 (M-199426-01-1), KCA 7.1.2.1.1 /02 (M-199432-01-1), KCA 7.1.2.1.1 /03 (M-199434-01-1) and KCA 7.1.2.1.1 /04 (M-199424-01-1) were used. In these studies, the degradation of mesosulfuron-methyl was studied in soils SLI (sandy loam), SLV (loamy sand), CHL (loamy sand), SLS (silt loam), SCL (clay), FF (loam), CLF (loam) and LS 2.2 (loamy sand) under aerobic conditions in the dark in the laboratory for up to 365 days at different temperatures (20 and 10 °C), a soil moisture of 50% of the maximum water holding capacity, and a test concentration of 20.0 µg/kg soil.~~

~~A compartmental model for simulation purposes was developed via an iterative process, starting from the metabolic pathway scheme as shown in Figure 7.1.1- 1. An exact reproduction of this pathway in the kinetic model was however found non-optimal, due to difficulties with the description of the consecutive (2nd and 3rd) metabolite generations. The modelling pathway was therefore stepwise optimised to mathematically best represent the observed residues in the soil column, their temporal evolution, and their dependences. Finally, the simplified degradation scheme shown in Figure 7.1.2.1.1- 1 was proposed for use in kinetic evaluations in order to obtain good fits and stable~~

~~results~~[2]~~. More detailed description of the process together with example fits is given in the appendix of the kinetic report.~~



~~**Figure 7.1.2.1.1- 1: Compartmental model for evaluation of the degradation of mesosulfuron-methyl in soil under aerobic conditions**~~

~~The kinetic analysis was performed according to FOCUS kinetics (2006) using the software KinGUI 2 with four different kinetic models; single first order, first order multi compartment, hockey stick (double first order sequential) and double first order in parallel. Model input datasets were the residual amounts found in each replicate test system at each sampling interval. In some cases degradation products of the applied substance were already detected at time zero. In these cases the respective percentages were added to the parent values and the values for the metabolite were set to zero. The most appropriate kinetic model was selected on the basis of a detailed statistical analysis including visual assessment of the goodness of the fits, chi~~^{2}~~ scaled error criterion, t-test significance, correlation analysis and standard deviation. The DT~~$_{50}$~~ value was calculated from the resulting kinetic parameters. The degradation of degradation products was described with the single first order model. The DT~~$_{50}$~~ value taken for modelling is based on the iteratively calculated value from KinGUI 2. For use as input to environmental exposure simulation models, the degradation half-lives were referenced to 20 °C and pF2 soil moisture, where the laboratory testing conditions deviated from these standard values.~~

~~Formation fractions:~~

~~In order to maximise representativity and consistency of the parameter set, the notifier recommends to include as many formation fractions in the overall evaluation as scientifically justifiable. It is important to note that formation fraction is not exclusively “bound” to the respective metabolite, but is also dependent on its predecessor in the metabolic scheme. Cases were observed where formation of a metabolite was well described by the model, even though the DT~~$_{50}$~~ parameter derived for the concerned metabolite did formally not fulfill acceptability criteria.~~

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[2] ~~note in this context that also the laboratory pathway scheme is not aiming to be an accurate „real world representation”, but an empiric sorting of the identified components into chemically reasonable sequence, linked by hypothesised metabolic steps.~~

~~The following principles were therefore applied for inclusion or rejection of formation fractions in cases where no valid DT_{50} parameter could be derived for a component~~[3]~~:~~

~~Formation phase of the metabolite is well described: DT_{50} value rejected, formation fraction kept. These cases occurred for metabolites AE F154851, AE F099095, and AE F092944, and are clearly noted and explained in the text of the kinetic report.~~

~~Formation phase of the metabolite is not well described: both, the DT_{50} and the formation fraction values, were discarded.~~

~~II. RESULTS~~

~~The most appropriate kinetic model to describe degradation of mesosulfuron-methyl was single first order (SFO) in soils SLI, SLV, SLS, SCL, FF, CLF and LS 2.2 (pyrimidyl label at 10 °C; phenyl label at 10 and 20 °C) and dual first order in parallel (DFOP) for soils CHL and LS 2.2 (pyrimidyl label at 20 °C). Single first order (SFO) was used to describe the behaviour of all degradation products.~~

~~In cases where it turned out that the degradation of the parent compound mesosulfuron-methyl could not acceptably be fitted with SFO kinetics, the best fitting kinetic model was determined by fitting only the parent data separately to alternative models. Then this model was implemented in the model for the whole degradation scheme which was then fitted to the full data set.~~

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[3] ~~Formation fractions, Supportive information:~~

~~For informative purpose, a strictly formally derived set of formation fractions is provided as supportive information in the report as well, as requested by RMS France (ANSES). Herein, only formation fractions are considered where they are associated with a statistically significant DT_{50} value of the next generation metabolite. This would reduce the number of individual values contributing to metabolites AE F154851, AE F099095, and AE F092944 by rejecting a total of 5 data points. Effect of such procedure is illustrated in the following table:~~

	~~Notifier recommended approach~~	~~Strictly formal approach~~
~~parent → AE F154851~~	~~0.179 (n=8)~~	~~0.203 (n=7)~~
~~parent → AE F099095~~	~~0.076 (n=8)~~	~~0.092 (n=5)~~
~~parent → AE F092944~~	~~0.172 (n=3)~~	~~0.238 (n=2)~~

~~Table CA 7.1.2.1.1- 7: DT$_{50}$ and DT$_{90}$ values for the degradation of mesosulfuron-methyl in soils under aerobic conditions for modelling purpose (normalised) according to FOCUS~~

~~Temp. [°C]~~	~~Soil~~	~~Texture (USDA)~~	~~Kinetic Model~~ [1]	~~DT$_{50}$ [days]~~	~~DT$_{90}$ [days]~~ [2]
~~20~~	~~SLI~~	~~Sandy loam~~	~~SFO~~	~~12.2~~	~~40.5~~
	~~SLV~~	~~Loamy sand~~	~~SFO~~	~~54.3~~	~~180~~
	~~CHL~~	~~Loamy sand~~	~~DFOP~~	~~109.7~~ [3]	~~364~~
	~~SLS~~	~~Silt Loam~~	~~SFO~~	~~7.7~~	~~25.6~~
	~~SCL~~	~~Clay~~	~~SFO~~	~~–~~ [4]	
	~~FF~~	~~Loam~~	~~SFO~~	~~33.4~~	~~111~~
	~~CLF~~	~~Loam~~	~~SFO~~	~~15.4~~	~~51.1~~
	~~*LS 2.2 (pyrimidyl label, 20°C)*~~	~~Loamy sand~~	~~*DFOP*~~	~~*155*~~ [3]	~~*515*~~
	~~*LS 2.2 (pyrimidyl label, 10°C)*~~	~~Loamy sand~~	~~*SFO*~~	~~*64.4*~~	~~*214*~~
	~~Geomean for soil LS 2.2 (pyrimidyl label)~~			~~99.9~~	~~332~~
	~~*L 2.2 (phenyl label, 20°C)*~~	~~Loamy sand~~	~~*SFO*~~	~~*32.0*~~	~~*106*~~
	~~*LS 2.2 (phenyl label, 10°C)*~~	~~Loamy sand~~	~~*SFO*~~	~~*43.5*~~	~~*144*~~
	~~Geomean for soil LS 2.2 (phenyl label)~~			~~37.3~~	~~124~~
~~**Geometric Mean**~~				~~**31.9**~~	

[1] ~~SFO: single first order, DFOP: double first order in parallel~~

[2] ~~DT$_{90}$ was calculated as DT$_{50}$ * 3.32~~

[3] ~~DT$_{50}$ calculated slow degradation rate of DFOP model.~~

[4] ~~Value statistically not acceptable (p(t-test) or Chi^2 error too large) and not considered for calculation of mean.~~

~~Table CA 7.1.2.1.1- 8: Kinetic parameters for the degradation of mesosulfuron-methyl in aerobic soils for trigger evaluation (non-normalised)~~

~~Temp. [°C]~~	~~Soil~~	~~Texture (USDA)~~	~~Kinetic Model~~ [1]	~~DT$_{50}$ [days]~~	~~Chi^2 Error [%]~~	~~t-test~~
~~20~~	~~SLI~~	~~Sandy loam~~	~~SFO~~	~~16.7~~	~~6.2~~	~~< 0.0001~~
	~~SLV~~	~~Loamy sand~~	~~SFO~~	~~71.6~~	~~9.1~~	~~< 0.0001~~
	~~CHL~~	~~Loamy sand~~	~~DFOP~~	~~141~~ [2]	~~3.8~~	~~< 0.0001~~
	~~SLS~~	~~Silt Loam~~	~~SFO~~	~~7.7~~	~~20.9~~	~~< 0.0001~~
	~~SCL~~	~~Clay~~	~~SFO~~	~~–~~ [3]		
	~~FF~~	~~Loam~~	~~SFO~~	~~37.0~~	~~8.3~~	~~< 0.0001~~
	~~CLF~~	~~Loam~~	~~SFO~~	~~16.0~~	~~2.5~~	~~< 0.0001~~
	~~LS 2.2 (pyrimidyl label, 20°C)~~	~~Loamy sand~~	~~DFOP~~	~~155~~ [2]	~~3.2~~	~~0.0009~~
~~10~~	~~LS 2.2 (pyrimidyl label, 10°C)~~	~~Loamy sand~~	~~SFO~~	~~166~~	~~8.2~~	~~< 0.0001~~
~~20~~	~~LS 2.2 (phenyl label, 20°C)~~	~~Loamy sand~~	~~SFO~~	~~32.0~~	~~9.1~~	~~< 0.0001~~
~~10~~	~~LS 2.2 (phenyl label, 10°C)~~	~~Loamy sand~~	~~SFO~~	~~112~~	~~9.2~~	~~< 0.0001~~

[1] ~~SFO: single first order, DFOP: double first order in parallel~~

[2] ~~DT$_{50}$ calculated slow degradation rate of DFOP model.~~

[3] ~~Value statistically not acceptable (p(t-test) or Chi^2-error too large) and not considered for calculation of mean.~~

~~Table CA 7.1.2.1.1- 9: DT$_{50}$ and DT$_{90}$ values for degradation of AE F160459 in aerobic soils for modelling purpose (normalised) according to FOCUS~~

~~Temp. [°C]~~	~~Soil~~	~~Texture (USDA)~~	~~Formation Fraction~~[1]	~~Kinetic Model~~[2]	~~DT$_{50}$ [days]~~	~~DT$_{90}$ [days]~~[3]
~~20~~	~~SLI~~	~~Sandy loam~~	~~0.124~~	~~SFO~~	~~93.9~~	~~312~~
	~~SLS~~	~~Silt Loam~~	~~–~~[4]	~~SFO~~	~~–~~[5]	
	~~SCL~~	~~Clay~~	~~–~~[4]	~~SFO~~	~~–~~[5]	
	~~FF~~	~~Loam~~	~~0.076~~	~~SFO~~	~~130~~	~~432~~
	~~CLF~~	~~Loam~~	~~0.119~~	~~SFO~~	~~37.3~~	~~124~~
	~~*LS 2.2 (pyrimidyl label, 20°C)*~~	~~Loamy sand~~	~~–~~[4]	~~SFO~~	~~–~~[5]	
	~~*LS 2.2 (pyrimidyl label, 10°C)*~~	~~Loamy sand~~	~~–~~[4]	~~SFO~~	~~–~~[5]	
	~~Geomean for soil LS 2.2 (pyrimidyl label)~~					
	~~*LS 2.2 (phenyl label, 20°C)*~~	~~Loamy sand~~	~~*0.038*~~	~~SFO~~	~~*72.4*~~	~~*240*~~
	~~*LS 2.2 (phenyl label, 10°C)*~~	~~Loamy sand~~	~~*0.075*~~	~~SFO~~	~~*38.8*~~	~~*129*~~
	~~Geomean for soil LS 2.2 (phenyl label)~~		~~0.056~~		~~53.0~~	~~176~~
	~~**Mean value**~~[6]		~~**0.094**~~[7]		~~**70.1**~~[8]	

[1] ~~AE F130060 →AE F160459~~

[2] ~~SFO: single first order~~

[3] ~~DT$_{90}$ was calculated as DT$_{50}$ * 3.32~~

[4] ~~Reaction not explicitly considered in final model due to very low formation fraction.~~

[5] ~~Value statistically not acceptable (p(t-test) or Chi² error too large) and not considered for calculation of mean.~~

[6] ~~Mean values were calculated considering the averages for soils with more then one testing result.~~

[7] ~~arithmetic mean~~ [8] ~~geometric mean~~

~~Table CA 7.1.2.1.1- 10: Kinetic parameters for the degradation of AE F160459 in aerobic soils for trigger evaluation (non-normalised)~~

~~Temp. [°C]~~	~~Soil~~	~~Texture (USDA)~~	~~Kinetic Model~~[1]	~~DT$_{50}$ [days]~~	~~Chi² Error [%]~~	~~t-test~~
~~20~~	~~SLI~~	~~Sandy loam~~	~~SFO~~	~~129~~	~~10.2~~	~~0.0002~~
	~~SLS~~	~~Silt Loam~~	~~SFO~~	~~–~~[2]		
	~~SCL~~	~~Clay~~	~~SFO~~	~~–~~[2]		
	~~FF~~	~~Loam~~	~~SFO~~	~~144~~	~~11.7~~	~~< 0.0001~~
	~~CLF~~	~~Loam~~	~~SFO~~	~~38.7~~	~~15.0~~	~~< 0.0001~~
	~~LS 2.2 (pyrimidyl label, 20°C)~~	~~Loamy sand~~	~~SFO~~	~~–~~[2]		
~~10~~	~~LS 2.2 (pyrimidyl label, 10°C)~~	~~Loamy sand~~	~~SFO~~	~~–~~[2]		
~~20~~	~~LS 2.2 (phenyl label, 20°C)~~	~~Loamy sand~~	~~SFO~~	~~72.4~~	~~14.0~~	~~< 0.0001~~
~~10~~	~~LS 2.2 (phenyl label, 10°C)~~	~~Loamy sand~~	~~SFO~~	~~100~~	~~12.1~~	~~< 0.0001~~

[1] ~~SFO: single first order~~

[2] ~~Value statistically not acceptable (p(t-test) or Chi²-error too large) and not considered for calculation of mean.~~

~~Table CA 7.1.2.1.1- 11: DT$_{50}$ and DT$_{90}$ values for degradation of AE F154851 in aerobic soils for modelling purpose (normalised) according to FOCUS~~

~~Temp. [°C]~~	~~Soil~~	~~Texture (USDA)~~	~~Formation Fraction~~[1]	~~Kinetic Model~~[2]	~~DT$_{50}$ [days]~~	~~DT$_{90}$ [days]~~[3]
~~20~~	~~SLI~~	~~Sandy loam~~	~~0.236~~	~~SFO~~	~~13.6~~	~~45.2~~
	~~SLV~~	~~Loamy sand~~	~~0.191~~	~~SFO~~	~~30.1~~	~~99.9~~
	~~CHL~~	~~Loamy sand~~	~~0.036~~	~~SFO~~	~~–~~[5]	
	~~SLS~~	~~Silt Loam~~	~~–~~[4]	~~SFO~~	~~–~~[5]	
	~~SCL~~	~~Clay~~	~~–~~[4]	~~SFO~~	~~–~~[5]	
	~~FF~~	~~Loam~~	~~0.245~~	~~SFO~~	~~64.3~~	~~213~~
	~~CLF~~	~~Loam~~	~~0.262~~	~~SFO~~	~~44.8~~	~~149~~
	~~*LS 2.2 (pyrimidyl label, 20°C)*~~	~~Loamy sand~~	~~*0.075*~~	~~SFO~~	~~*63.9*~~	~~*212*~~
	~~*LS 2.2 (pyrimidyl label, 10°C)*~~	~~Loamy sand~~	~~–~~[4]	~~SFO~~	~~–~~[5]	
	~~Geomean for soil LS 2.2 (pyrimidyl label)~~					
	~~*LS 2.2 (phenyl label, 20°C)*~~	~~Loamy sand~~	~~*0.191*~~	~~SFO~~	~~*37.5*~~	~~*125*~~
	~~*LS 2.2 (phenyl label, 10°C)*~~	~~Loamy sand~~	~~*0.221*~~	~~SFO~~	~~*32.2*~~	~~*107*~~
	~~Geomean for soil LS 2.2 (phenyl label)~~		~~0.206~~		~~34.7~~	~~115~~
	~~Mean value~~[6]		**~~0.179~~**[7]		**~~37.1~~**[8]	

[1] ~~AE F130060 →AE F154851~~

[2] ~~SFO: single first order, DFOP: double first order in parallel~~

[3] ~~DT$_{90}$ was calculated as DT$_{50}$ * 3.32~~

[4] ~~Reaction not explicitly considered in final model due to very low formation fraction.~~

[5] ~~Value statistically not acceptable (p(t-test) or Chi^2-error too large) and not considered for calculation of mean.~~

[6] ~~Mean values were calculated considering the averages for soils with more then one testing result.~~

[7] ~~arithmetic mean~~ [8] ~~geometric mean~~

~~Table CA 7.1.2.1.1- 12: Kinetic parameters for the degradation of AE F154851 in aerobic soils for trigger evaluation (non-normalised)~~

~~Temp. [°C]~~	~~Soil~~	~~Texture (USDA)~~	~~Kinetic Model~~[1]	~~DT$_{50}$ [days]~~	~~Chi^2 Error [%]~~	~~t-test~~
~~20~~	~~SLI~~	~~Sandy loam~~	~~SFO~~	~~18.7~~	~~18.6~~	~~0.0001~~
	~~SLV~~	~~Loamy sand~~	~~SFO~~	~~39.7~~	~~14.8~~	~~0.0006~~
	~~CHL~~	~~Loamy sand~~	~~SFO~~	~~–~~[2]		
	~~SLS~~	~~Silt Loam~~	~~SFO~~	~~–~~[2]		
	~~SCL~~	~~Clay~~	~~SFO~~	~~–~~[2]		
	~~FF~~	~~Loam~~	~~SFO~~	~~71.2~~	~~14.9~~	~~< 0.0001~~
	~~CLF~~	~~Loam~~	~~SFO~~	~~46.4~~	~~13.6~~	~~< 0.0001~~
	~~LS 2.2 (pyrimidyl label, 20°C)~~	~~Loamy sand~~	~~SFO~~	~~63.9~~	~~23.6~~	~~0.0064~~
~~10~~	~~LS 2.2 (pyrimidyl label, 10°C)~~	~~Loamy sand~~	~~SFO~~	~~–~~[2]		
~~20~~	~~LS 2.2 (phenyl label, 20°C)~~	~~Loamy sand~~	~~SFO~~	~~37.5~~	~~19.2~~	~~< 0.0001~~
~~10~~	~~LS 2.2 (phenyl label, 10°C)~~	~~Loamy sand~~	~~SFO~~	~~83.1~~	~~12.7~~	~~< 0.0001~~

[1] ~~SFO: single first order, DFOP: double first order in parallel~~

[2] ~~Value statistically not acceptable (p(t-test) or Chi^2-error too large) and not considered for calculation of mean.~~

~~Table CA 7.1.2.1.1- 13: DT$_{50}$ and DT$_{90}$ values for degradation of AE F099095 in aerobic soils for modelling purpose (normalised) according to FOCUS~~

~~Temp. [°C]~~	~~Soil~~	~~Texture (USDA)~~	~~Formation Fraction~~ [1]	~~Kinetic Model~~ [2]	~~DT$_{50}$ [days]~~	~~DT$_{90}$ [days]~~ [3]
~~20~~	~~SLI~~	~~Sandy loam~~	~~0.021~~	~~SFO~~	~~76.4~~	~~254~~
	~~SLV~~	~~Loamy sand~~	~~0.037~~	~~SFO~~	~~–~~[5]	
	~~CHL~~	~~Loamy sand~~	~~0.016~~	~~SFO~~	~~–~~[5]	
	~~SLS~~	~~Silt Loam~~	~~0.324~~	~~SFO~~	~~47.6~~	~~158~~
	~~SCL~~	~~Clay~~	~~–~~[4]	~~SFO~~	~~–~~[5]	
	~~FF~~	~~Loam~~	~~0.034~~	~~SFO~~	~~234~~	~~777~~
	~~CLF~~	~~Loam~~	~~0.033~~	~~SFO~~	~~77.4~~	~~257~~
	~~LS 2.2 (pyrimidyl label, 20°C)~~	~~Loamy sand~~	*~~0.046~~*	~~SFO~~	*~~79.5~~* [6]	~~264~~
	~~LS 2.2 (pyrimidyl label, 10°C)~~	~~Loamy sand~~	*~~0.092~~*	~~SFO~~	~~–~~[5]	
	~~Geomean for soil LS 2.2~~		~~0.069~~			
~~Mean value~~ [7]			**~~0.076~~** [8]		**~~87.9~~** [9]	

[1] ~~AE F130060 → AE F099095~~

[2] ~~SFO: single first order, DFOP: double first order in parallel~~

[3] ~~DT$_{90}$ was calculated as DT$_{50}$ * 3.32~~

[4] ~~Reaction not explicitly considered in final model due to very low formation fraction.~~

[5] ~~Value statistically not acceptable (p(t-test) or Chi² error too large) and not considered for calculation of mean.~~

[6] ~~Parent slow phase from DFOP evaluation~~

[7] ~~Mean values were calculated considering the averages for soils with more then one testing result.~~

[8] ~~arithmetic mean~~ [9] ~~geometric mean~~

~~Table CA 7.1.2.1.1- 14: Kinetic parameters for the degradation of AE F099095 in aerobic soils for trigger evaluation (non-normalised)~~

~~Temp. [°C]~~	~~Soil~~	~~Texture (USDA)~~	~~Kinetic Model~~ [1]	~~DT$_{50}$ [days]~~	~~Chi² Error [%]~~	~~t-test~~
~~20~~	~~SLI~~	~~Sandy loam~~	~~SFO~~	~~105~~	~~13.8~~	~~0.0031~~
	~~SLV~~	~~Loamy sand~~	~~SFO~~	~~–~~[2]		
	~~CHL~~	~~Loamy sand~~	~~SFO~~	~~–~~[2]		
	~~SLS~~	~~Silt Loam~~	~~SFO~~	~~47.6~~	~~27.1~~	~~0.0016~~
	~~SCL~~	~~Clay~~	~~SFO~~	~~–~~[2]		
	~~FF~~	~~Loam~~	~~SFO~~	~~259~~	~~10.7~~	~~< 0.0001~~
	~~CLF~~	~~Loam~~	~~SFO~~	~~80.2~~	~~18.7~~	~~< 0.0001~~
	~~LS 2.2 (pyrimidyl label, 20°C)~~	~~Loamy sand~~	~~SFO~~	~~79.5~~	~~14.1~~	~~0.0003~~
~~10~~	~~LS 2.2 (pyrimidyl label, 10°C)~~	~~Loamy sand~~	~~SFO~~	~~–~~[2]		

[1] ~~SFO: single first order, DFOP: double first order in parallel~~

[2] ~~Value statistically not acceptable (p(t-test) or Chi²-error too large) and not considered for calculation of mean.~~

~~Table CA 7.1.2.1.1- 15: DT_{50} and DT_{90} values for degradation of AE F092944 in aerobic soils for modelling purpose (normalised) according to FOCUS~~

~~Temp. [°C]~~	~~Soil~~	~~Texture (USDA)~~	~~Formation Fraction~~ [1]	~~Kinetic Model~~ [2]	~~DT_{50} [days]~~	~~DT_{90} [days]~~ [3]
~~20~~	~~SLI~~	~~Sandy loam~~		~~SFO~~	~~n.d.~~	
	~~SLV~~	~~Loamy sand~~	~~–~~[4]	~~SFO~~	~~–~~[5]	
	~~CHL~~	~~Loamy sand~~	~~0.392~~	~~SFO~~	~~29.8~~	~~98.9~~
	~~SLS~~	~~Silt Loam~~	~~–~~[4]	~~SFO~~	~~–~~[5]	
	~~SCL~~	~~Clay~~	~~–~~[4]	~~SFO~~	~~–~~[5]	
	~~FF~~	~~Loam~~	~~–~~[4]	~~SFO~~	~~–~~[5]	
	~~CLF~~	~~Loam~~	~~0.083~~	~~SFO~~	~~60.4~~	~~201~~
	~~*LS 2.2 (pyrimidyl label, 20°C)*~~	~~Loamy sand~~	~~0.040~~	~~SFO~~	~~–~~[5]	
	~~*LS 2.2 (pyrimidyl label, 10°C)*~~	~~Loamy sand~~	~~–~~[4]	~~SFO~~	~~–~~[5]	
	~~Geomean for soil LS 2.2~~					
	~~**Mean value**~~ [6]		~~**0.172**~~ [7]		~~**60.4**~~ [8]	

[1] ~~AE F130060 → AE F092944~~

[2] ~~SFO: single first order, DFOP: double first order in parallel~~

[3] ~~DT_{90} was calculated as DT_{50} * 3.32~~

[4] ~~Reaction not explicitly considered in final model due to very low formation fraction.~~

[5] ~~Value statistically not acceptable (p(t-test) or Chi² error too large) and not considered for calculation of mean.~~

[6] ~~Mean values were calculated considering the averages for soils with more then one testing result.~~

[7] ~~arithmetic mean~~ [8] ~~Maximum of two values used instead of geometric mean.~~

~~Table CA 7.1.2.1.1- 16: Kinetic parameters for the degradation of AE F092944 in aerobic soils for trigger evaluation (non-normalised)~~

~~Temp. [°C]~~	~~Soil~~	~~Texture (USDA)~~	~~Kinetic Model~~ [1]	~~DT_{50} [days]~~	~~Chi² Error [%]~~	~~t-test~~
~~20~~	~~SLI~~	~~Sandy loam~~	~~SFO~~	~~n.d.~~		
	~~SLV~~	~~Loamy sand~~	~~SFO~~	~~–~~[2]		
	~~CHL~~	~~Loamy sand~~	~~SFO~~	~~38.3~~	~~21.3~~	~~0.0031~~
	~~SLS~~	~~Silt Loam~~	~~SFO~~	~~–~~[2]		
	~~SCL~~	~~Clay~~	~~SFO~~	~~–~~[2]		
	~~FF~~	~~Loam~~	~~SFO~~	~~–~~[2]		
	~~CLF~~	~~Loam~~	~~SFO~~	~~62.6~~	~~21.6~~	~~< 0.0001~~
	~~LS 2.2 (pyrimidyl label, 20°C)~~	~~Loamy sand~~	~~SFO~~	~~–~~[2]		
~~10~~	~~LS 2.2 (pyrimidyl label, 10°C)~~	~~Loamy sand~~	~~SFO~~	~~–~~[2]		

[1] ~~SFO: single first order~~

[2] ~~Value statistically not acceptable (p(t-test) or Chi² error too large) and not considered for calculation of mean.~~

~~Table CA 7.1.2.1.1- 17: DT_{50} and DT_{90} values for degradation of AE F160460 in aerobic soils for modelling purpose (normalised) according to FOCUS~~

~~Temp. [°C]~~	~~Soil~~	~~Texture (USDA)~~	~~Formation Fraction~~ [1]	~~Formation Fraction~~ [2]	~~Kinetic Model~~ [3]	~~DT_{50} [days]~~	~~DT_{90} [days]~~ [4]
~~20~~	~~SLI~~	~~Sandy loam~~	~~1.0~~	~~1.0~~	~~SFO~~	~~17.5~~	~~58.1~~
	~~SLS~~	~~Silt Loam~~			~~SFO~~	~~–~~[6]	
	~~SCL~~	~~Clay~~			~~SFO~~	~~–~~[6]	
	~~FF~~	~~Loam~~	~~–~~[5]	~~–~~[5]	~~SFO~~	~~32.6~~	~~108~~
	~~CLF~~	~~Loam~~	~~–~~[5]		~~SFO~~	~~–~~[6]	
	~~*LS 2.2 (pyrimidyl label, 20°C)*~~	~~Loamy sand~~	~~*1.0*~~	~~*1.0*~~	~~*SFO*~~	~~*44.2*~~[7]	~~*147*~~
	~~*LS 2.2 (pyrimidyl label, 10°C)*~~	~~Loamy sand~~	~~–~~[5]	~~–~~[5]	~~*SFO*~~	~~–~~[6]	
	~~Geomean for soil LS 2.2~~		~~–~~[5]	~~–~~[5]			
	~~*LS 2.2 (phenyl label, 20°C)*~~	~~Loamy sand~~	~~–~~[5]	~~–~~[5]	~~*SFO*~~	~~*16.9*~~	~~*56.1*~~
	~~*LS 2.2 (phenyl label, 10°C)*~~	~~Loamy sand~~			~~*SFO*~~	~~–~~[6]	
	~~Geomean for soil LS 2.2~~		~~1.0~~	~~1.0~~			
~~Mean value~~ [8]			~~1.0~~ [9]	~~1.0~~ [9]		~~25.6~~ [10]	

[1] ~~AE F160459 → AE F160460~~ [2] ~~AE F154851 → AE F160460~~

[3] ~~SFO: single first order~~

[4] ~~DT_{90} was calculated as DT_{50} * 3.32~~

[5] ~~Reaction not explicitly considered in final model due to very low formation fraction.~~

[6] ~~Value statistically not acceptable (p(t-test) or Chi²-error too large) and not considered for calculation of mean.~~

[7] ~~Derived from decline fit.~~

[8] ~~Mean values were calculated considering the averages for soils with more then one testing result.~~

[9] ~~arithmetic mean~~ [10] ~~geometric mean~~

~~Table CA 7.1.2.1.1- 18: Kinetic parameters for the degradation of AE F160460 in aerobic soils for trigger evaluation (non-normalised)~~

~~Temp. [°C]~~	~~Soil~~	~~Texture (USDA)~~	~~Kinetic Model~~ [1]	~~DT_{50} [days]~~	~~Chi² Error [%]~~	~~t-test~~
~~20~~	~~SLI~~	~~Sandy loam~~	~~SFO~~	~~24.1~~	~~12.0~~	~~0.1127~~
	~~SLS~~	~~Silt Loam~~	~~SFO~~	~~–~~[2]		
	~~SCL~~	~~Clay~~	~~SFO~~	~~–~~[2]		
	~~FF~~	~~Loam~~	~~SFO~~	~~36.1~~	~~13.1~~	~~0.0121~~
	~~CLF~~	~~Loam~~	~~SFO~~	~~–~~[2]		
	~~LS 2.2 (pyrimidyl label, 20°C)~~	~~Loamy sand~~	~~SFO~~	~~44.2~~ [3]	~~27.1~~	~~0.0618~~
~~10~~	~~LS 2.2 (pyrimidyl label, 10°C)~~	~~Loamy sand~~	~~SFO~~	~~–~~[2]		
~~20~~	~~LS 2.2 (phenyl label, 20°C)~~	~~Loamy sand~~	~~SFO~~	~~16.9~~	~~10.7~~	~~0.0043~~
~~10~~	~~LS 2.2 (phenyl label, 10°C)~~	~~Loamy sand~~	~~SFO~~	~~–~~[2]		

[1] ~~SFO: single first order~~

[2] ~~Value statistically not acceptable (p(t-test) or Chi²-error too large) and not considered for calculation of mean.~~

[3] ~~Derived from decline fit.~~

~~Table CA 7.1.2.1.1- 19: DT_{50} and DT_{90} values for degradation of AE F140584 in aerobic soils for modelling purpose (normalised) according to FOCUS~~

~~Temp. [°C]~~	~~Soil~~	~~Texture (USDA)~~	~~Formation Fraction~~ [1]	~~Kinetic Model~~ [2]	~~DT_{50} [days]~~	~~DT_{90} [days]~~ [3]
~~20~~	~~*LS 2.2 (phenyl label, 20°C)*~~	~~Loamy sand~~	~~–~~[4]	~~SFO~~	~~–~~[5]	
	~~*LS 2.2 (phenyl label, 10°C)*~~	~~Loamy sand~~	~~*0.704*~~	~~SFO~~	~~*5.9*~~	~~*19.6*~~
	~~Geomean for soil LS 2.2~~		~~0.704~~			
~~**Mean value**~~ [6]			~~**0.704**~~ [7]		~~**5.9**~~ [8]	

~~[1] AE F160460 → AE F140584~~

~~[2] SFO: single first order~~

~~[3] DT_{90} was calculated as DT_{50} * 3.32~~

~~[4] Reaction not explicitly considered in final model due to very low formation fraction.~~

~~[5] Value statistically not acceptable (p(t-test) or Chi² error too large) and not considered for calculation of mean.~~

~~[6] Mean values were calculated considering the averages for soils with more then one testing result.~~

~~[7] arithmetic mean~~ ~~[8] geometric mean~~

~~Table CA 7.1.2.1.1- 20: Kinetic parameters for the degradation of AE F140584 in aerobic soils for trigger evaluation (non-normalised)~~

~~Temp. [°C]~~	~~Soil~~	~~Texture (USDA)~~	~~Kinetic Model~~ [1]	~~DT_{50} [days]~~	~~Chi² Error [%]~~	~~t-test~~
~~20~~	~~LS 2.2 (phenyl label, 20°C)~~	~~Loamy sand~~	~~SFO~~	~~–~~[2]		
~~10~~	~~LS 2.2 (phenyl label, 10°C)~~	~~Loamy sand~~	~~SFO~~	~~15.2~~	~~23.8~~	~~0.0012~~

~~[1] SFO: single first order~~

~~[2] Value statistically not acceptable (p(t-test) or Chi² error too large) and not considered for calculation of mean.~~

~~Table CA 7.1.2.1.1- 21: DT_{50} and DT_{90} values for degradation of AE F147447 in aerobic soils for modelling purpose (normalised) according to FOCUS~~

~~Temp. [°C]~~	~~Soil~~	~~Texture (USDA)~~	~~Formation Fraction~~ [1]	~~Kinetic Model~~ [2]	~~DT_{50} [days]~~	~~DT_{90} [days]~~ [3]
~~20~~	~~LS 2.2 (phenyl label, 20°C)~~	~~Loamy sand~~	~~*0.100*~~	~~SFO~~	~~*647*~~	~~*2148*~~
	~~LS 2.2 (phenyl label, 10°C)~~	~~Loamy sand~~	~~*0.094*~~	~~SFO~~	~~*176*~~	~~*584*~~
	~~Geomean for soil LS 2.2~~		~~0.097~~		~~337~~	~~1119~~
~~**Mean value**~~ [4]			~~**0.097**~~ [5]		~~**337**~~ [6]	

~~[1] AE F140584 → AE F147447~~

~~[2] SFO: single first order~~

~~[3] DT_{90} was calculated as DT_{50} * 3.32~~

~~[4] Mean values were calculated considering the averages for soils with more then one testing result.~~

~~[5] arithmetic mean~~ ~~[6] geometric mean~~

~~Table CA 7.1.2.1.1- 22: Kinetic parameters for the degradation of AE F147447 in aerobic soils for trigger evaluation (non-normalised)~~

~~Temp. [°C]~~	~~Soil~~	~~Texture (USDA)~~	~~Kinetic Model ^{1}~~	~~DT$_{50}$ [days]~~	~~Chi^2 Error [%]~~	~~t-test~~
~~20~~	~~LS 2.2 (phenyl label, 20°C)~~	~~Loamy sand~~	~~SFO~~	~~648~~	~~12.5~~	~~0.0334~~
~~10~~	~~LS 2.2 (phenyl label, 10°C)~~	~~Loamy sand~~	~~SFO~~	~~453~~	~~13.2~~	~~0.0663~~

[1] ~~SFO: single first order~~

[2] ~~Value statistically not acceptable (p(t-test) or Chi^2-error too large) and not considered for calculation of mean.~~

[3] ~~Geomean considered valid for values obtained from the same soil~~

~~III. CONCLUSIONS~~

~~The calculated half-lives for modelling purpose (referenced to standard laboratory conditions) for the degradation of mesosulfuron-methyl and its degradation products in soil under aerobic conditions in the dark in the laboratory are summarized in Table CA 7.1.2.1.1- 5. The mean DT$_{50}$ values (geomean) were 31.9 days for mesosulfuron-methyl, 37.1 days for AE F154851, 70.1 days for AE F160459, 87.9 days for AE F099095, 60.4 days (maximum of two values) for AE F092944, 25.6 days for AE F160460, 5.9 days[4] (single value) for AE F140584 and 337 days[4] for AE F147447 in the tested soils.~~

~~The calculated half lives for trigger evaluation (non-referenced) for the degradation of mesosulfuron-methyl and its degradation products in soil under aerobic conditions in the dark in the laboratory are shown in Table CA 7.1.2.1.1- 8, Table CA 7.1.2.1.1- 10, Table CA 7.1.2.1.1- 12, Table CA 7.1.2.1.1- 14, Table CA 7.1.2.1.1- 16, Table CA 7.1.2.1.1- 18, Table CA 7.1.2.1.1- 20 and Table CA 7.1.2.1.1- 22.~~

~~A tabular overview summary of formation fractions is provided in Table CA 7.1.2.1.1- 3.~~

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update note Feb 2015: upon RMS request, the kinetic evaluation was revisited and a new modelling report KCA 7.1.2.1.1/08 replacing KCA 7.1.2.1.1/07 was generated to consider the following points:

- Input data were checked, and slight errors in the underlying residue data were noted and corrected: day 0 values in soils SLS and LS2.2 both labels; day 15 value for metabolite AE F092944 in soil SLS.
- Additional alternatives to the degradation pathway were tested and discussed in a stepwise approach. In consequence, for soil LS 2.2 phenyl label, the final degradation scheme was changed: AE F147447 now formed directly from the parent and not from AE F140584.
- The revised kinetic evaluation includes extensive supportive information for justification of the final pathway selection.

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[4] ~~Note that additional data is available from separate studies with metabolites AE F140584 and AE F147447 directly dosed to test soils, see **KCA 7.1.2.1.2 /05**.~~

- The moisture normalisation was revisited, and slightly modified to avoid inconsistencies in the handling of the different soils noted in the former submission. A new document KCA 7.1.2.1.1/09 provides detailed explanation to the specifics of the present case as implemented in the updated kinetic evaluation. The approach is considered compliant with general FOCUS methodology, and common with other submissions.

- As requested by RMS, the studies performed at 10°C are not used any further in the updated kinetic data set where a test on the same soil is also available for the standard temperature of 20°C.

Report:	KCA 7.1.2.1.1 /08; [redacted] 2014;M-511078-01
Title:	Mesosulfuron-methyl (MSM) and metabolites: Kinetic evaluation of laboratory aerobic soil degradation according to FOCUS
Report No:	EnSa-15-0131
Document No:	M-511078-01-1
Guidelines:	**not applicable;not applicable**
GLP/GEP:	**no**

Executive Summary

A kinetic analysis of soil residue data from the active substance aerobic soil degradation studies[5] (KCA 7.1.2.1.1 /1 to 4) was performed to derive

- an optimised model representation of the degradation pathway
- half-lives for mesosulfuron-methyl and its degradation products AE F154851, AE F160459, AE F099095, AE F092944, AE 160460, AE F140584 and AE F147447
- formation fractions for degradation products

which are suitable for input to environmental exposure simulation models.

As the result of extensive stepwise testing, an optimised compartmental model of the overall degradation pathway and sub-models for the individual radiolabel postions were developed. Based on this pathway representation[6], the most appropriate kinetic models to describe degradation of mesosulfuron-methyl were identified, and applied to derive a set of kinetic parameters for all components.

The evaluation was performed following the guideline given by the report of the FOCUS group on kinetic evaluation (FOCUS, 2011). For modelling purposes and use in environmental exposure simulation models the resulting degradation half-lives were normalised to reference temperature of 20°C and reference soil moisture of pF2 = 100 % field capacity.

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[5] Note that additionally soil degradation tests have been performed for individual metabolites, and are kinetically evaluated in a separate modelling report, KCA 7.1.2.1.2 /08.

[6] note in this context that also the laboratory pathway scheme is not aiming to be an accurate „real world representation", but an empiric sorting of the identified components into chemically reasonable sequence, linked by hypothesised metabolic steps.

All reliable degradation half-lives of mesosulfuron-methyl and its metabolites which were derived from the kinetic evaluation of the soil metabolism studies with mesosulfuron-methyl are given in Table CA 7.1.2.1.1- 23. A table with the fraction with which the metabolites are formed from their predecessor substances is given in Table CA 7.1.2.1.1- 24

Table CA 7.1.2.1.1- 23: Normalised DT50 values for mesosulfuron-methyl and its metabolites.

Soil	DT50 [days]								
	Model used for Mesosulfuroin-methyl	Mesosulfuron-methyl	AE F160459	AE F154851	AE F099095	AE F092944	AE F160460	AE F140584	AE F147447
SLI	SFO	10.3	79.3	11.5	64.9		14.9		
SLV	SFO	39.8		22.1	-	-			
CHL	DFOP[1]	80.5		-	-	21.9			
SCL	SFO	57.8	-	-	-	-	-		
FF	SFO	29.5	116.3	57.4	209.9	-	29.1		
SLS	SFO	6.7	-	-	43.4[3]	-	-		
CLF	SFO	11.9	28.8	34.6	59.8	46.7	-		
LS 2.2 (pyrimidyl)	DFOP[1]	155.0	-	64.6	80.4	-	-		
LS 2.2 (phenyl)	FOMC[2]	30.8	61.9	29.8			14.1	-	-
Geometric Mean[4]		**30.3**	**63.7**	**31.5**	**77.7**	**46.7**	**18.3**	**-**	**-**

[1] DT50 calculated from slow degradation rate of DFOP model.
[2] DT50 calculated from DT90 value of FOMC model.
[3] derived from decline fit.
[4] where only two values available, maximum is taken instead of geomean

Table CA 7.1.2.1.1- 24: Compilation of formation fractions for the formation of metabolites in aerobic soil

Soil	Meso -> AE F160459	Meso -> AE F154851	Meso -> AE F099095	Meso -> AE F092944	Meso -> AE F140584	Meso -> AE F147447	AE F160459 -> AE F160460	AE F154851 -> AE F160460
SLI	0.124	0.236	0.021				1.0	1.0
SLV		0.191	0.037					
CHL		0.036	0.016	0.392				

SCL								
FF	0.075	0.243					1.0	1.0
SLS								
CLF	0.119	0.262	0.033	0.083			1.0	
LS 2.2 (pyrimidyl)		0.074	0.046	0.040			1.0	
LS 2.2 (phenyl)	0.034	0.172			0.139	0.072	1.0	1.0
Arithmetic Mean	**0.088**	**0.173**	**0.031**	**0.172**	**0.139**	**0.072**	**1.000**	**1.000**

I. METHODS

Soil residue data from the aerobic soil degradation studies KCA 7.1.2.1.1 /01 (M-199426-01-1), KCA 7.1.2.1.1 /02 (M-199432-01-1), KCA 7.1.2.1.1 /03 (M-199434-01-1) and KCA 7.1.2.1.1 /04 (M-199424-01-1) were used. In these studies, the degradation of mesosulfuron-methyl was studied in soils SLI (sandy loam), SLV (loamy sand), CHL (loamy sand), SLS (silt loam), SCL (clay), FF (loam), CLF (loam) and LS 2.2 (loamy sand) under aerobic conditions in the dark in the laboratory for up to 365 days, a soil moisture of 50% of the maximum water holding capacity, and a test concentration of 20.0 µg/kg soil. For one soil (LS2.2), the studies included testing at different temperatures (20°C and 10 °C), upon request of the RMS hereof only the data generated at standard temperature (20°C) were considered.

Deviating from the recommendation in the OECD guideline 307 (OECD, 2002), it was decided to include data points in the evaluation that were derived longer than 120 d after application. This allowed deriving DT50 values also for late and slowly formed metabolites with the consequence that the half-lives are potentially very conservative, due to decreased biological activity.

Data pre-processing

The residue data were checked for consistency and clear outliers. In case outliers were removed this was clearly mentioned in the report. For the calculation of the total residue employed for the kinetic evaluation the procedure recommended in FOCUS was followed:

- all samples < LOD were set to 1/2 LOD or after the first non-detect, to zero in case no detects appeared later on. For some studies no LOD was given in the original report. In these cases no values were added.
- initial pesticide concentration were adjusted where necessary by adding all the measured values of non-extractable residues and metabolites in case they occurred on day 0 to the amount of parent. Metabolites initial concentrations were set to 0.

Development of modelling pathway

Reference is made to headline ‘Results’.

Kinetic analysis

Four kinetic models, the Single First-Order (SFO), first-order multiple-compartment (FOMC, Gustafson-Holden), the hockey-stick model (HS, DFOS = double first order sequential), and the bi-exponential model (DFOP = double first order parallel) may be used to describe the experimental residue values of the applied parent substance. The selection of a kinetic model is done on a step by step decision process based on statistic criteria:

Step 1: Because of the general need of the most exposure models it was defined that the preferred model is SFO. If the SFO fit is visually acceptable, ε does not significantly exceed 15%, and t-test for the degradation rate is less than 0.05 for parent and 0.10 for metabolite, the SFO fit and parameters are accepted.

Step 2: If ε is significantly greater than 15%, model parameters may be fixed based on available information (e.g. initial amount).

Step 3: If ε is still significantly greater than 15%, then bi-phasic models can be tested on a case by case basis. The standard biphasic models recommended by FOCUS (201) are Gustafson and Holden (FOMC) model, Double First Order in Parallel (DFOP) and Hockey Stick (HS). However, the FOMC model is only used, if residues reach 10% of the initial concentration by the end of the study and the worst case DT50 value is calculated as DT90(FOMC)/3.32. In the other cases, the DT50 is calculated from the slow k-rate of DFOP or HS model.

Step 4: If none of the bi-phasic models leads to a significantly improved fit, the SFO model is chosen, if it is visually acceptable. The purpose of this rule is to avoid an over-parameterised model based on a marginally better fit only.

The model fit as well as the statistical evaluation of the results was carried out with the in-house developed software KinGUI version 2.1. In this software the fitting algorithms as well as the statistical evaluation of the results is implemented on the basis of the statistical computing language R. For the optimization the implemented algorithm Iteratively Reweighted Nonlinear Least Squares (IRLS) was used.

Apart from the kinetic rates k and the formation fractions f for the applied compound also the initial amount of applied substance was fitted. The residue at time zero for metabolites formed from the applied substance was on the other hand kept constant at a value of zero. Degradation half-lives (DT50) were calculated from the degradation rates k, as DT50 = ln(2) / k.

Normalisation to reference conditions

For the use in simulations for the predictions of environmental concentrations the degradation half-lives have to be normalised to a reference temperature of 20°C and standard reference soil moisture at a soil water tension of 10 kPa (pF2) [FOCUS convention for 100 % field capacity]. The temperature normalisation does not lead to any changes, since the considered studies in this assessment were conducted at 20±2 °C. The normalisation to reference moisture was performed following the Walker equation approach proposed in FOCUS. For the moisture normalisation it is checked if the actual experimental soil moisture content is below the corresponding field capacity at pF2 (suction pressure of 0.1 bar or 10 kPa). According to FOCUS if this value is not provided it can be approximated. As in all of the studies moisture retention capacity of the test soils was reported for the suction pressure of pF2.5, these values were used to estimate field capacity at pF2 via scaling based on the ratio between pF 2.5 and pF 2 as given in FOCUS Table 2.2 for undisturbed soils. For backgrounds and details on this procedure reference is made to the supportive information given in KCA 7.1.2.1.1 /09.

Table CA 7.1.2.1.1- 25: Moisture correction factors

Soil	Actual study soil moisture[*)] [%w/w]	FC at pF 2.5 (reported) [%w/w]	FC at pF 2 (estimated)[**)] [%w/w]	FC at pF 2.5 [%w/w]	FC at pF 2 [%w/w]	Moisture correction factor
	Study moisture conditions			FOCUS moisture values		
SLI	22.6	35.6	45.4	15	19	0.617
SLV	15.4	22.9	35.6	9	14	0.556
CHL	15.5	22.2	34.5	9	14	0.571
SCL	29.9	42.5	47.4	43	48	0.724
FF	21.6	24.8	29.5	21	25	0.804
SLS	27.5	26.5	32.8	21	26	0.884
CLF	23.8	30.4	36.2	21	25	0.746
LS 2.2 (pyrimidyl)	27.7	n. d.	n. d.	9	14	1[***)]
LS 2.2 (phenyl)	19.1	20.9	32.5	9	14	0.689

[*)] 50% of soil MWHC.
[**)] estimated from the ration between pF 2 and pF 2.5 moisture contents given in FOCUS, 2014.
[***)] FOCUS value for FC at pF 2 was used for normalisation in the view of no available information from the report.
n. d. not determined

II. RESULTS

Development of modelling pathway

A compartmental model for simulation purposes was developed via a stepwise process, starting from the metabolic pathway scheme as shown in Figure 7.1.1- 1. Because the concentrations of all metabolites, also those in later generations, rise immediately from the beginning, this structure with consecutive metabolite formation was not adequate to describe the observed data. Only additional reactions directly from parent to some of the metabolites could solve this issue. It was thus decided to test different model combinations by adding the fluxes from parent to the "second generation" metabolites.

These steps are illustrated in Figure CA 7.1.2.1.1- 2 and exemplarily summarised in the following for the pyrimidyl radiolabel dataset; the development methodology for the phenyl labelled study was similar to that used for pyrimidyl labelled study. Detailed information per soil is accessible in the original modelling report.

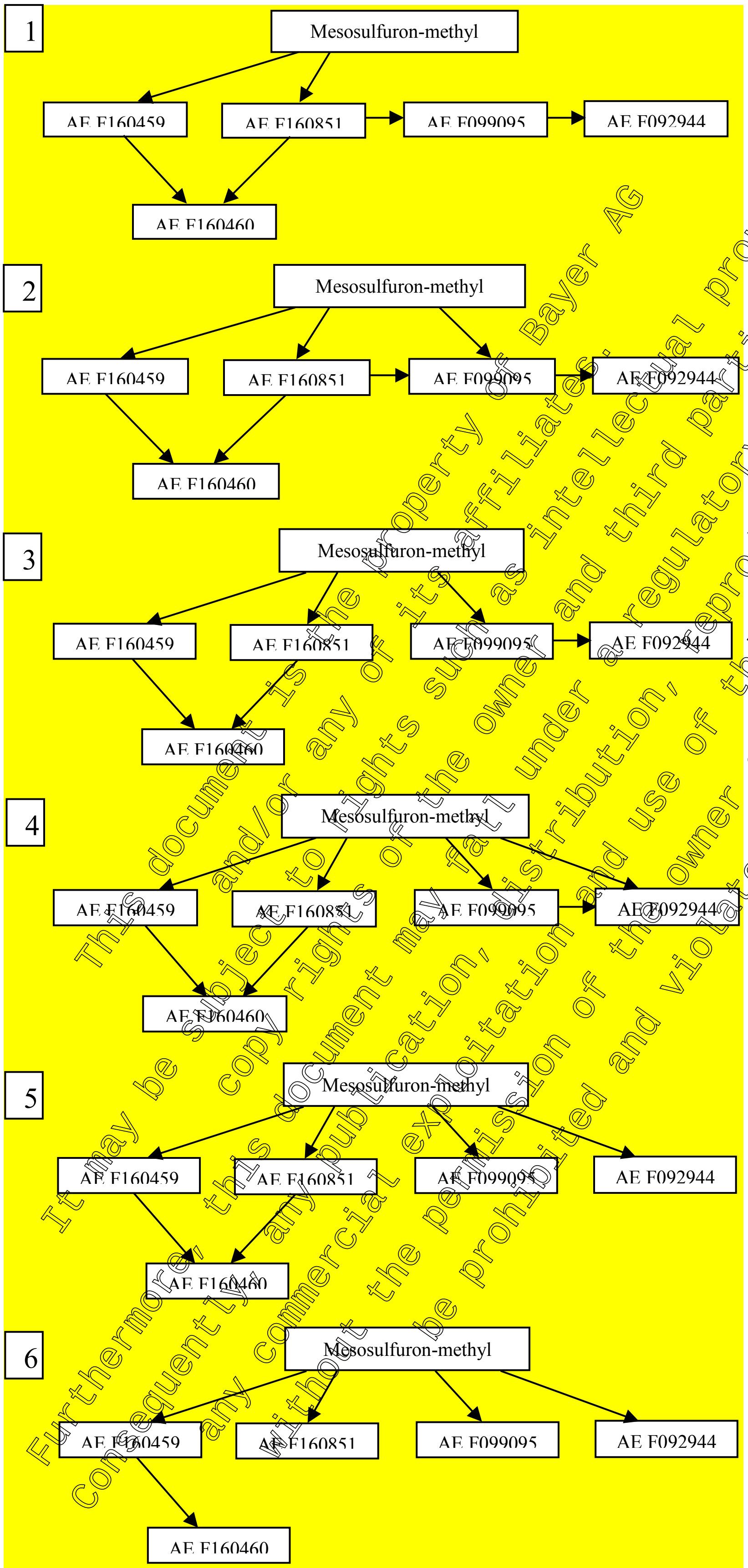
1
Mesosulfuron-methyl
AE F160459
AE F160851
AE F099095
AE F092944
AE F160460
2
Mesosulfuron-methyl
AE F160459
AE F160851
AE F099095
AE F092944
AE F160460
3
Mesosulfuron-methyl
AE F160459
AE F160851
AE F099095
AE F092944
AE F160460
4
Mesosulfuron-methyl
AE F160459
AE F160851
AE F099095
AE F092944
AE F160460
5
Mesosulfuron-methyl
AE F160459
AE F160851
AE F099095
AE F092944
AE F160460
6
Mesosulfuron-methyl
AE F160459
AE F160851
AE F099095
AE F092944
AE F160460

Figure CA 7.1.2.1.1- 2: Steps of the model structure development

As mentioned above, step 1 reflects the laboratory soil degradation pathway scheme proposed in the environmental fate studies (Figure 7.1.1- 1). As a next step a flux from parent to the metabolite AE F099095 was added without changing any other fluxes (step 2). This improved the fit but still did not produce optimal results in all of the three cases. It was then decided to include also the flux from the parent to AE F092944 (step 3).

These steps already led to a significantly improved kinetic fit. However, in the view of practical assessment with the groundwater models the implemented pathway should not be overly complex. In the next step it was planned to test the importance of the fluxes from AE F154851 to AE F099095 and from AE F099095 to AE F092944 (step 4). But in practice already at step 3 the formation fraction from AE F154851 to AE F099095 was assessed to be negligible, thus step 4 was omitted and the next step where both of these fluxes were excluded was tested (step 5). For the soil FF this led to very good results both visually and statistically. For the other two soils the model was still showing some discrepancies with respect to metabolite AE F160460. In both cases the flux from AE F154851 to this metabolite was quite low, and its resulting DT50, though rather short was characterised by very high t-test probabilities. The t-test probability shows whether the obtained degradation rate is significantly different from 0. Poor t-test values are quite usual, when the rates are very slow, but in this case such t-test results show that the estimated rate is highly unreliable. This information introduced the idea to test the importance of the flux from AE F154851 to AE F160460 (step 6). Excluding this additional flux indeed improved the statistics for the latter metabolite and it was decided to check its relevance in other soils. In a few cases (soils FF and SL1), however, this flux proved to be indispensable as the formation of AE F160460 from AE F160459 was not sufficient to explain the observed residue data, and was thus left in the model structure.

After testing the model in such an extensive manner for three of the soils it could be shown that except for the pathway from AE F154851 to AE F160460, all other fluxes behave in a similar manner in different experiments and only the final two steps were repeated for the rest of the soils. This led to acceptable results in all of the cases where the residue data were reasonable. These evaluations are included and discussed further in the individual result sections for each soil, where these three metabolites were observed. Pathway development for the phenyl labelled study is described in the corresponding results chapter of the modelling report. The development methodology was similar to that used for pyrimidyl labelled studies.

The model structure testing led to the development of a “mixed” compartmental model (Figure CA 7.1.2.1.1- 3), which is used for the purpose of the kinetic evaluation and is also proposed as a workable alternative for groundwater modelling calculations.

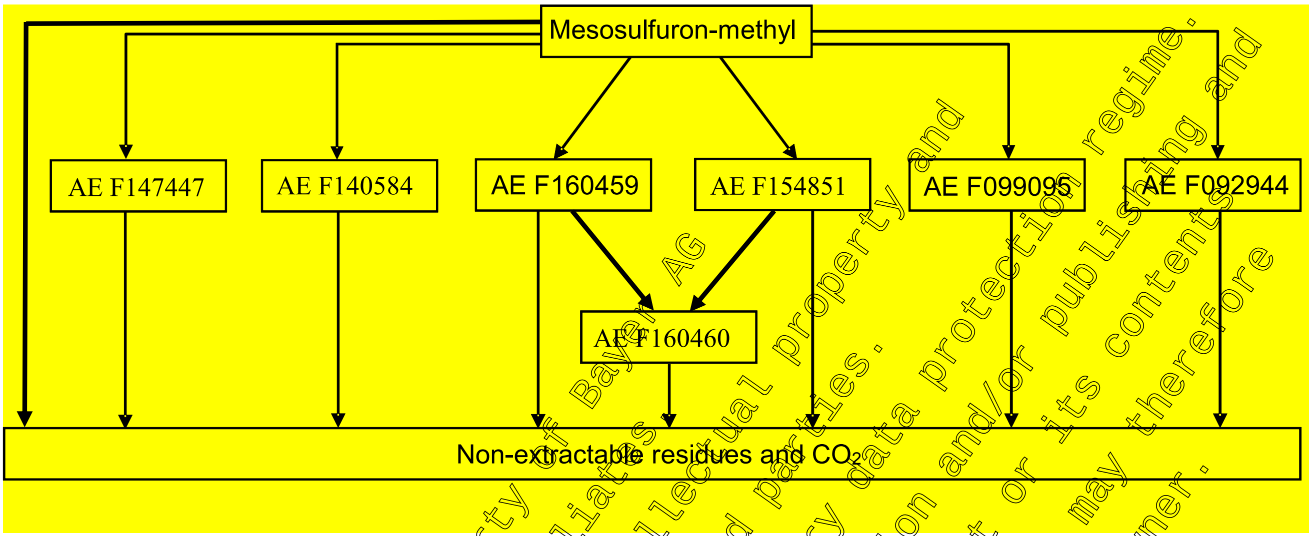

Figure CA 7.1.2.1.1- 3: Compartmental model for evaluation of the degradation of mesosulfuron-methyl in soil under aerobic conditions

Based on this overall model, Figure CA 7.1.2.1.1- 4 and Figure CA 7.1.2.1.1- 5 present the respective compartmental sub-models as employed for the evaluation of pyrimidyl and phenyl labelled studies:

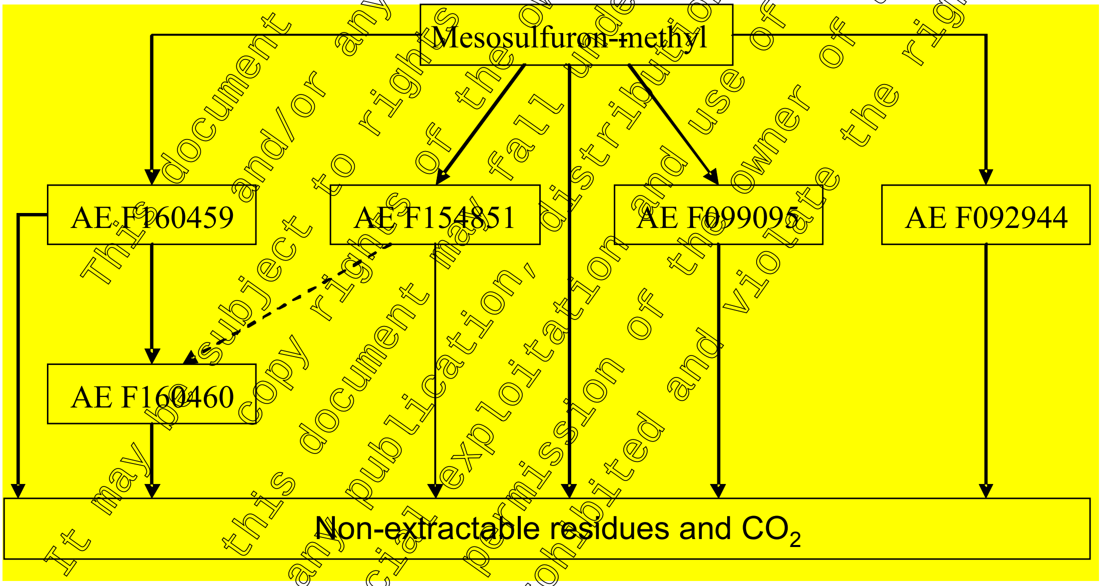

Figure CA 7.1.2.1.1- 4: Model of soil degradation of pyrimidyl labelled mesosulfuron-methyl. The dashed line denotes a reaction that contributed significantly only in three soils.

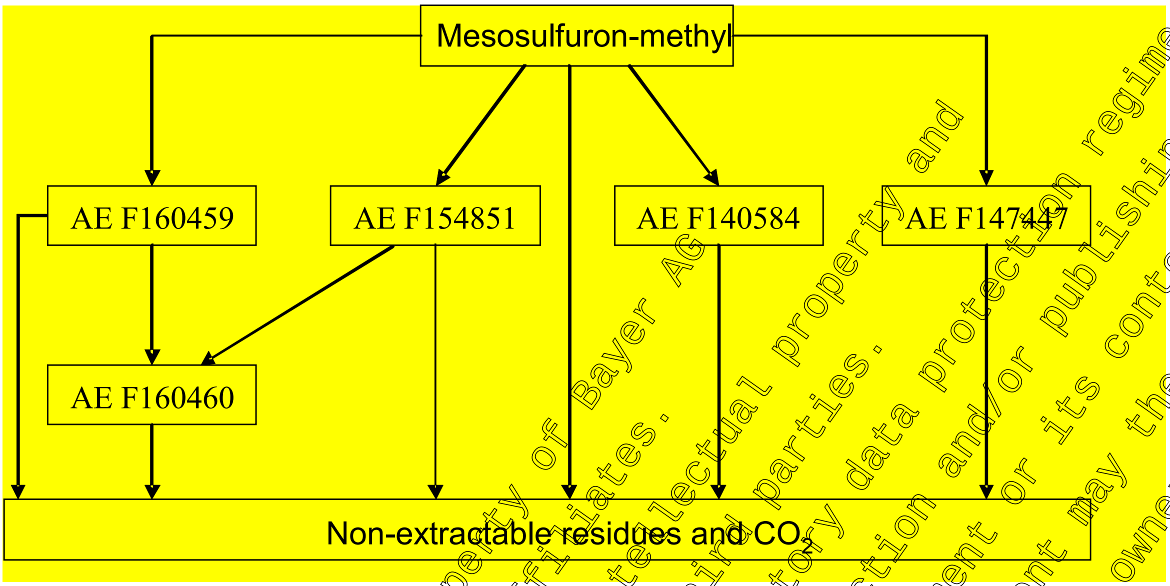

Figure CA 7.1.2.1.1- 5: Model of soil degradation of phenyl labelled mesosulfuron-methyl

Kinetic parameters

The most appropriate kinetic model to describe degradation of mesosulfuron-methyl was single first order (SFO) in soils SLI, SLV, SCL, FF, SLS, CLF, dual first order in parallel (DFOP) for soils CHL and LS 2.2 (pyrimidyl label at 20°C), or first order multicompartment (FOMC) for LS 2.2 (phenyl label at 20°C). Single first order (SFO) was used to describe the behaviour of all degradation products.

Based on the optimised pathway representation, the DT50 values of mesosulfuron-methyl and its metabolites AE F160459, AE F154851, AE F099095, AE F092944, AE F160460, AE F140584 and AE F147447 were derived from the different data sets. The values that were found acceptable according to statistical and visual criteria and thereby qualify for inclusion into the further assessment are compiled in Table CA 7.1.2.1.1- 26. It should be noted that in the majority of the studies the duration of the test was significantly longer than the recommended time of 120 days. Thus a decreasing activity of the soils can be expected at the end of the tests, leading to unrealistically high DT50 values particularly for the metabolites which only occur after some time. Thus all results are considered to be rather conservative.

Table CA 7.1.2.1.1- 26: Compilation of DT50–values for mesosulfuron-methyl and its metabolites derived from the different data sets.

Soil	**DT50 [days] – non-referenced**								
	Model used for Mesosulfuroin-methyl	Mesosulfuron-methyl	AE F160459	AE F154851	AE F099095	AE F092944	AE F160460	AE F140584	AE F147447
SLI	SFO	16.7	128.6	18.7	105.2		24.1		
SLV	SFO	71.6		39.7	-	-			
CHL	DFOP[1]	141		-	-	38.3			
SCL	SFO	79.8	-	-	-	-	-		
FF	SFO	36.7	144.8	71.4	261.2	-	36.2		
SLS	SFO	7.6	-	-	49.1[3]	-	-		
CLF	SFO	16.0	38.6	46.4	80.2	62.6	-		
LS 2.2 (pyrimidyl)	DFOP[1]	155	-	64.6	80.4	-	-		
LS 2.2 (phenyl)	FOMC[2]	44.7	89.8	43.3			20.5	-	-
Geometric Mean[4]		**42.1**	**89.6**	**43.6**	**97.3**	**62.6**	**26.2**	**-**	**-**

[1] DT50 calculated from slow degradation rate of DFOP model.

[2] DT50 calculated from DT90 value of FOMC model.

[3] Derived from decline fit.

[4] where only two values available, maximum is taken instead of geomean

Modelling endpoints

Normalised DT50 values for the FOCUS reference conditions concerning temperature (20°C) and soil moisture (pF2) for mesosulfuron-methyl and its metabolites are tabulated in Table CA 7.1.2.1.1- 27:, the formation fractions are listed in Table CA 7.1.2.1.1- 28. These figures are the relevant substance parameters suitable as input to environmental exposure simulation models.

Table CA 7.1.2.1.1- 27: Normalised DT50 values for mesosulfuron-methyl and its metabolites.

Soil	**DT50 [days] – referenced to 20°C / pF2**								
	Model used for Mesosulfuroin-methyl	Mesosulfuron-methyl	AE F160459	AE F154851	AE F099095	AE F092944	AE F160460	AE F140584	AE F147447
SLI	SFO	10.3	79.3	11.5	64.9		14.9		
SLV	SFO	39.8		22.1	-	-			
CHL	DFOP[1]	80.5		-	-	21.9			
SCL	SFO	57.8	-	-	-	-	-		
FF	SFO	29.5	116.3	57.4	209.9	-	29.1		
SLS	SFO	6.7	-	-	43.4[3]	-	-		
CLF	SFO	11.9	28.8	34.6	59.8	46.7	-		
LS 2.2 (pyrimidyl)	DFOP[1]	155.0	-	64.6	80.4	-	-		
LS 2.2 (phenyl)	FOMC[2]	30.8	61.9	29.8			14.1	-	-
Geometric Mean[4]		**30.3**	**63.7**	**31.5**	**77.7**	**46.7**	**18.3**	**-**	**-**

[1] DT50 calculated from slow degradation rate of DFOP model.
[2] DT50 calculated from DT90 value of FOMC model.
[3] derived from decline fit.
[4] where only two values available, maximum is taken instead of geomean

Table CA 7.1.2.1.1- 28: Compilation of formation fractions for the formation of metabolites in aerobic soil

Soil	Meso -> AE F160459	Meso -> AE F154851	Meso -> AE F099095	Meso -> AE F092944	Meso -> AE F140584	Meso -> AE F147447	AE F160459 -> AE F160460	AE F154851 -> AE F160460
SLI	0.124	0.236	0.021				1.0	1.0
SLV		0.191	0.037					
CHL		0.036	0.016	0.392				
SCL								
FF	0.075	0.243					1.0	1.0
SLS								
CLF	0.119	0.262	0.033	0.083			1.0	

LS 2.2 (pyrimidyl)		0.074	0.046	0.040			1.0	
LS 2.2 (phenyl)	0.034	0.172			0.139	0.072	1.0	1.0
Arithmetic Mean	**0.088**	**0.173**	**0.031**	**0.172**	**0.139**	**0.072**	**1.000**	**1.000**

******

Report:	KCA 7.1.2.1.1 /09; [redacted] 2015;M-510889-01
Title:	Soil Moisture Correction Methodology of Laboratory DT50 Values
Report No:	N/A
Document No:	M-510889-01-1
Guidelines:	**not applicable;not applicable**
GLP/GEP:	**no**

This position paper provides backgrounds and explanation of the soil moisture correction methodology applied in the generation of laboratory soil DT50 values referenced to FOCUS standard conditions, for the active substance and its metabolites.

Backgrounds

The rate of degradation of plant protection products is influenced to a high degree by soil moisture content and temperature. According to current EU guidelines (FOCUS, 2014), laboratory DT50 values have to be normalised to a reference temperature of 20°C if the test was conducted under an incubation temperature other than 20°C. The degradation rates also have to be normalised to a reference moisture content corresponding to a soil water tension of 10 kPa (pF2) considered equivalent to 100% field capacity (FC) based on measured soil water retention values.

Strictly speaking it is not possible to exactly determine the field capacity of a given soil with laboratory methods. The term "field capacity" is used in soil science to describe the maximum soil moisture which can be achieved under realistic outdoor conditions at a field plot scale. Field capacity is defined as the amount of water that an initially water-saturated soil can hold against gravity in 2 to 3 days. In central European latitudes, the field capacity is usually reached as quasi-equilibrium value after the winter period with low evapotranspiration and an excess of rainfall (March / April). Laboratory methods determine the moisture content of a given soil corresponding to a soil water tension which is applied to a disturbed or undisturbed soil core. Different water tensions have been used in literature to approximate the behaviour under field conditions. Frequently used are soil water tensions of 33 kPa (pF2.5; 1/3 bar), 10 kPa (pF2) and 6 kPa (pF1.8). The soil moisture is always determined as equilibrium value based on the experimental period. Under hydrostatic conditions the pF-value corresponds to the logarithm of the vertical distance to the water table in cm (e.g., pF2 corresponds to a distance of 100 cm).

The specific water tension employed to approximate the field capacity depends on convention. FOCUS (2014) states: “For the purposes of FOCUS the water content at 10kPa (pF2) can be considered equivalent to field capacity. If this value is not provided it can be approximated.”

Procedures and Employed Approximation Methodology

When deriving kinetic input parameters to the exposure model, as part of the FOCUS normalisation procedure it is checked whether in the degradation experiment the actual gravimetric soil moisture content over the test period was maintained at a value at or above the corresponding field capacity value pF2 of the disturbed soil (= FOCUS reference moisture). If this moisture condition was not met in the experiment, i.e. the soil in the test was dryer than field capacity pF2, a correction for soil moisture influence shall be applied to derive the representative normalised substance half-life under reference conditions.

When conducting laboratory experiments, for practical reason soil moisture is usually adjusted to a certain percentage of maximum water holding capacity (MWHC); typical values are 40 to 55 % of MWHC. The studies KCA 7.1.2.1.1 /01, 02, 03, 04 were performed at 50 % of MWHC. This actual soil moisture is maintained during the whole study period. Moisture losses are minimised, checked on a regular basis and compensated (if needed) by adding de-ionised water.

In the reports of the above studies, the test soil characterisation tables include values for MWHC and ‘field capacity’ values for a soil water tension of 33 kPa (pF2.5), however, do not provide values for 10 kPa (pF2) that would allow for a direct use in the FOCUS normalisation procedures.

In consequence, an estimate value for pF2 moisture content will be needed to check whether the actual soil moisture over the test period corresponded to FOCUS reference conditions. The following three options were seen by to exist in principle; thereof the ‘rescaling’ option was clearly preferred for its provision of the highest degree of realism:

Default FOCUS values

As pF2 values are not provided in the study reports, there is a possibility to use default values from Table 2.2 of FOCUS (2014) for the corresponding soil type. However, it is important to keep in mind that these values are only estimates of the moisture contents based on pedotransfer functions calculated for mid-range texture properties and organic carbon contents of each soil type. Soil types as defined in the USDA classification can, however, have rather broad ranges for the portions of sand, silt and clay. Sandy loam, for instance, can contain from 50 to 70 % sand, up to 20 % clay and up to 50 % silt. Soils characterised by sand-silt-clay proportions which are close to the boundaries of the individual classes can have quite different water holding properties than those reported in FOCUS. Thus, the actual measured values for the particular soil should be used when available.

One more potential inconsistency of the default values is the fact that the tabulated FOCUS values are calculated for undisturbed soil profiles whereas soil characteristics reported in laboratory degradation studies are for the disturbed soil batches (soils used in degradation studies are typically sieved and mixed prior to experiments). Water contents in disturbed soils are generally higher than those in undisturbed soils. This can lead to systematic overestimation of soil DT50 values if default FOCUS values are used for normalisation.

Moisture at pF2.5

Next option is to use the reported pF2.5 moisture values of the soils as a conservative estimate of pF2. Soil moisture at pF2 is always higher compared to the moisture at pF2.5 (it is obvious that moisture content at a suction pressure of 33 kPa will be lower than at a suction pressure of 10 kPa, see also Table 2.2 of FOCUS, 2014). This procedure therefore also leads to a worst case soil moisture normalisation and an overestimation of soil DT50 values.

Rescaling of moisture at pF2.5 to pF2

Taking the information provided in previous paragraphs into account, it can be concluded that the FOCUS moisture contents represent a **conservative information source** for conducting moisture normalisation if no data on the actual soil moisture properties is available. It should be also noted that FOCUS (2014) provides also estimated moistures at other water tensions, in particular at pF2.5.

In order not to introduce additional level of conservatism (by using FOCUS or pF2.5-based normalisation) into the risk assessment and to keep in line with the general FOCUS principle of using realistic substance parameter in worst case scenarios, we estimate the moisture at pF2 from reported study values at pF2.5 for the disturbed soil assuming the same ratio between pF2.5 and pF2 as given in FOCUS Table 2.2 for undisturbed soils.

$$\theta_{estimated\ pF\ 2} = \frac{\theta_{FOCUS\ pF\ 2} \cdot \theta_{reported\ pF\ 2.5}}{\theta_{FOCUS\ pF\ 2.5}}$$

The estimated moisture at pF2 is then used in the normalisation procedure.

Conclusion

The employed rescaling approach tries to make best use of the available experimental information. The method itself is not explicitly described in the basic FOCUS groundwater guidance (FOCUS, 2014) but is seen to be in line with the general principles of FOCUS groundwater assessment, i.e. the “worst case” is reflected by the selection of scenarios, whereas the selection of compound specific input parameter should reflect the most likely parameter value.

CA 7.1.2.1.2 Aerobic degradation of metabolites, breakdown and reaction products

An overall summary of the laboratory degradation rates of mesosulfuron-methyl including its degradation products relevant for assessment in soil was already provided in Section CA 7.1.2.1.1.

Report:	**[redacted]9;[redacted];2000;M-199574-01**
Title:	Kinetic evaluation of AE F130060 aerobic soil degradation studies using TopFit 2.0 Code: AE F130060
Report No:	OE 00/105
Document No:	M-199574-01-1
Guidelines:	**Deviation not specified**
GLP/GEP:	**no**

This kinetic evaluation of studies KCA 7.1.2.1.1 /01 to /04 as reported in the baseline dossier was updated to comply with current FOCUS kinetic guidance (2006), and new trigger values according Regulation 1107/2009 applicable for the assessment of soil metabolites. Report 7.1.2.1.2 /01 is therefore replaced by two new evaluations, ~~KCA 7.1.2.1.2 /02~~ updated version: KCA 7.1.2.1.2 /08, and ~~KCA 7.1.2.1.2 /05~~ updated version: KCA 7.1.2.1.2 /07. The updates include new experimental information on metabolites AE F140584, AE F147447, and consider degradates AE F160459, and AE F160460 as nowadays triggered by their abundances > 5% in soil metabolism studies.

~~**Report:**~~	[redacted]; [redacted]; [redacted]; [redacted];~~2014;M-481029-01~~
~~Title:~~	~~Mesosulfuron-methyl (MSM) and metabolites: Kinetic evaluation of laboratory aerobic soil degradation according to FOCUS~~
~~Report No:~~	~~EnSa-13-0483~~
~~Document No:~~	~~M-481029-01-1~~
~~**Guidelines:**~~	~~**not applicable;not applicable**~~
~~**GLP/GEP:**~~	~~**no**~~

~~This study provides an updated overall pathway evaluation based on the soil degradation studies (reviewed during the original EU review) for the parent active substance. A complete summary including the information on metabolites was already given under data point KCA 7.1.2.1.1 /07 before.~~

Report:	KCA 7.1.2.1.2 /08; [redacted];2014;M-511078-01
Title:	Mesosulfuron-methyl (MSM) and metabolites: Kinetic evaluation of laboratory aerobic soil degradation according to FOCUS
Report No:	EnSa-15-0131
Document No:	M-511078-01-1
Guidelines:	**not applicable;not applicable**
GLP/GEP:	**no**

This study provides an updated overall pathway evaluation based on the soil degradation studies (reviewed during the original EU review) for the parent active substance. A complete summary including the information on metabolites was already given under data point KCA 7.1.2.1.1 /08 before.

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To enlarge the dataset for degradates AE F140584 and AE F147447, additional half-life information was generated via two experimental studies testing the degradation of these metabolites when dosed individually to aerobic soils (KCA 7.1.2.1.2 /03 and KCA 7.1.2.1.2 /04). A kinetic modelling evaluation of the degradation behaviour of AE F140584 and AE F147447 based on these new studies was performed according to FOCUS kinetics (2006), to derive kinetic parameters suitable for modelling purpose and environmental exposure assessments. It is reported under KCA 7.1.2.1.2 /05.

Report:	[redacted]$;[redacted];[redacted];2008;M-309403-01
Title:	AE F140584: Aerobic soil degradation in four EU soils
Report No:	MEF-07/472
Document No:	M-309403-01-1
Guidelines:	**OECD 307;None.**
GLP/GEP:	**yes**

Executive Summary

The degradation of AE F140584, a soil degradate of the herbicidal compound mesosulfuron-methyl (AE F130060), was investigated under aerobic conditions at 20 ± 2 °C and a soil moisture of about 55% of MWHC in four European soils by incubation in the dark for up to30 days. The test item was applied at a nominal test concentration of 40 µg AE F140584/kg soil (dry matter), corresponding to the 30-fold maximum amount derived from the single maximum recommended field use rate of the parent active ingredient mesosulfuron-methyl (15 g/ha) and the assumption of 5.1% maximum formation of AE F140584.

The recovered mean amount of AE F140584 directly after soil treatment was 102.1, 99.9, 101.7 and 102.9% of the applied amount [% AA] for soils [redacted] AIIIa, [redacted] AXXa, [redacted] [redacted] [redacted] 4a and [redacted] II, respectively. During study incubation the concentration of the test item decreased rapidly in all soils, dropping below 10% AA at 7 to 30 days after treatment (DAT). At study end the residue levels were 1.4 to 6.7% AA.

Following FOCUS kinetic guidance, the experimental data could be well described by single-first order or biphasic kinetic models with half-lives in the range of 1.4 to 7.1 days. Therefore, the compound will not persist in a viable soil environment.

I. MATERIALS AND METHODS

A. MATERIALS

1. Test Item

AE F140584	
Certificate of Analysis:	AZ 13858
Batch ID:	AE F140584-PU-01
Chemical Purity:	99.9% *w/w*

2. Test Soils

Four soils were used (see Table CA 7.1.2.1.2- 1) in this study. They were chosen to represent typical agricultural soils of European origin. Texture shows variation including sandy loam, sand, silt loam and loam type. Physico-chemical characteristics were not extreme in any parameter. Pesticide history of the collection sites is documented over more than five years, except for soil [redacted] II (non-managed grassland). The soils were sampled freshly from the fields (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 10381-6:1993(E).

Table CA 7.1.2.1.2- 1: Physico-chemical properties of test soils

Soil	[redacted] **Allla**	[redacted] **AXXa**	[redacted] **4a**	[redacted] **II**
Geographic Location (City / State / Country)	[redacted] / NRW / Germany	[redacted] / NRW / Germany	[redacted] NRW / Germany	[redacted] NRW / Germany
GPS coordinates	[redacted]	[redacted]	[redacted]	[redacted]
Pesticide use history	No pesticide use for previous 5 years			non-managed grassland
Collection procedures	Sample taken with spade and placed into plastic bags			
Sampling depth	about 0 – 20 cm			
Storage conditions	2 days at room temperature, 4 days at approx. 5 °C, 5 days at approx. 20 °C for pre-incubation			
Storage length	11 days after sampling until application			
Soil preparation	Sieved (2 mm)			
Soil Taxonomic Classification (USDA)	Sandy, mixed, mesic Typic Cambudolls	Sandy, mixed, mesic Typic Cambudolls	Loamy, mixed, mesic Typic Argudalfs	No information
Texture Class (USDA)	Sandy loam	Sand	Silt Loam	Loam
Sand [50 µm - 2 mm] (%)	55	87	35	45
Silt [2 µm - 50 µm] (%)	32	12	56	36
Clay [< 2 µm] (%)	13	1	9	19
pH in Water	6.7	6.1	6.7	7.4
pH in $CaCl_2$ (0.01 M)	6.3	5.8	6.4	7.2
pH in KCl (1 M)	6.1	5.5	6.1	6.9
Organic Matter ^{A} (%)	2.1	3.1	3.6	7.6
Organic Carbon (%)	1.2	1.8	2.1	4.4
CEC (meq/100 g)	9.5	8.3	12.4	20.4
Maximum water holding capacity (g/100 g)	44.3	41.3	60.6	80.5
Moisture at 1/3 bar = pF 2.5 ($g H_2O$/100 g dry soil)	14.1	9.6	22.0	31.0
Microbial biomass (mg $C_{biomass}$/100 g dry vital soil)				
Initial (Day 0)	286/308	382/396	569/616	2626/2624
Final, Day 30 (untreated)	264/234	313/312	561/550	1966/2014

^{A}: % org. matter = % org. carbon x 1.724; NRW: Northrhine-Westfalia

B. STUDY DESIGN

1. Experimental Conditions

50 g dry matter equivalents of the sieved soils were weighed into Erlenmeyer flasks (300 ml) and soil moisture was adjusted to 55% MWHC for the individual flasks by addition of de-ionized water. The vessels were then closed with cotton wool plugs and acclimated to the intended study incubation conditions for 5 days (darkness, 20 ± 2 °C).

At application, each sample received a dose of AE F140584 equivalent to a nominal test item concentration of 40 µg AE F140584/kg soil, corresponding to the 30-fold maximum amount derived from the single maximum recommended field use rate of the parent active ingredient mesosulfuron-methyl (15 g/ha) and the assumption of 5.1% maximum formation of AE F140584.

For application, the targeted amount of test item was dissolved in methanol/water 1/1 (*v/v*) containing 3% acetonitrile from stock solution and applied as small droplets directly to the soil surface using a pipette. The actual dose applied per test vessel was 2.04 µg of AE F140584 for all soils. After application, each flask was gently shaken to incorporate the chemical into the test soil. All flasks were weighed, closed with cotton wool plugs and immediately placed back into the temperature controlled incubation chamber. Samples were incubated at 20 ± 2 °C and a soil moisture content of 55% MWHC in the dark for 30 days. In addition, samples containing untreated soil were incubated under the same conditions for determination of soil microbial activity at the end of the study.

2. Sampling

Duplicate samples were processed and analysed 0, 0.25, 1, 2, 3, 4, 7, 10 and 14 days after treatment (DAT). In addition, samples were taken at DAT-30 for soil [redacted] AXXa due to a lower degradation rate in this soil. Samples for determination of soil microbial biomass were investigated at DAT-0 and DAT-30. Soil was immediately extracted after each sampling and soil extracts were subjected to quantitative HPLC-MS/MS measurement. Because of a malfunction of the HPLC-MS/MS equipment and the short sampling intervals at the beginning of the test, the extracts were stored in a freezer for up to 14 days. Storage stability was proven under the same storage conditions for 15 days.

3. Analytical Procedures

The entire soil sample in each test vessel was extracted with 100 mL of acetonitrile/water 4/1 (*v/v*) by microwave-accelerated solvent extraction for 10 minutes at 250 W (temperature < 40 °C) under magnetic stirring. The test systems were fortified with an internal stable-labelled standard solution (c = 1050 µg/L [methylsulfonyl-^{13}C, d3; aminomethyl-d2]AE F140584, resulting in an ISTD concentration of 2.1 µg/L corresponding to 4.2 µg/kg) and stirred for another 5 minutes. Sedimentation of soil particles was allowed before aliquots of 1 mL were ultra-centrifuged for 5 min at 14000 x *g*. Aliquots of the clear supernatants were transferred into HPLC vials for quantification by HPLC-MS/MS in the negative electro spray ionization selective reaction monitoring mode. No analysis for possible degradation products was performed.

The HPLC-MS/MS method was validated with regard to linearity, accuracy and precision. The range of the linearity of the detector used was tested in pure solvent. The test was performed by comparison of the injected amount of AE F140584 and the response to the internal stable-labelled standard [methylsulfonyl-^{13}C, d_3; aminomethyl-d_2]AE F140584. The concentration of the internal labelled standard mixture was maintained at a similar level (2.1 µg/L, corresponding to 4.2 µg/kg). The test was performed by injections of standards in solvent at concentrations corresponding to about 1/5 LOQ to 20-times LOQ.

The accuracy of the method was assessed on the basis of determined recovery rates. For this reason control samples of all soils were fortified with AE F140584 at fortification levels of 2.0 µg/kg (LOQ level) and 40 µg/kg (level at application, 20-fold LOQ level).

As a measure for the precision of the method, the intra-laboratory repeatability was shown. The repeatability was determined for all tested soils running five recoveries at the LOQ level, and the level of application.

The lowest fortification level experimentally tested corresponds to the limit of quantification (LOQ = 2.0 µg/kg). The limit of detection (LOD) was set to about 1/5 of the LOQ, being 0.4 µg/kg. At this level the signal to noise ratio was ≥ 3.

Concurrent recovery samples were freshly prepared at each sampling interval by fortification of test item (in duplicate) to a representative control soil ([redacted] AIIIa) at the LOQ level and the level of application (= 20-fold LOQ level). These flasks were extracted and analysed along with the kinetic test systems.

The degradation kinetics of the test item were determined according to FOCUS kinetics (2006) using the software KinGUI with three different kinetic models: single first order (SFO), first order multi compartment (FOMC) and double first order in parallel (DFOP). 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. 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 aerobic conditions were maintained and that the soils were microbially active over the duration of the laboratory study.

A. DATA

The results of the aerobic biotransformation of AE F140584 after incubation in four European soils are summarized in Table CA 7.1.2.1.2- 2 to Table CA 7.1.2.1.2- 5.

Table CA 7.1.2.1.2- 2: Degradation of AE F140584 in soil [redacted] Allla under aerobic conditions (values expressed as % AA)

Compound	Replicate	DAT									
		0	0.25	1	2	3	4	7	10	14	30
AE F140584	A	103.5	89.2	88.1	72.8	61.9	54.7	28.6	16.7	7.2	n.m.
	B	100.7	88.1	87.3	72.1	63.7	48.6	27.1	14.4	8.0	n.m.
	Mean	**102.1**	**88.6**	**87.7**	**72.4**	**62.8**	**51.7**	**27.8**	**15.5**	**7.6**	**n.m.**

DAT: days after treatment; n.m.: not measured

Table CA 7.1.2.1.2- 3: Degradation of AE F140584 in soil [redacted] AXXa under aerobic conditions (values expressed as % AA)

Compound	Replicate	Residues (% Applied) on the following days after treatment (DAT)									
		0	0.25	1	2	3	4	7	10	14	30
AE F140584	A	102.7	93.5	88.4	83.8	70.5	63.9	50.0	36.9	23.1	6.5
	B	97.0	90.9	92.2	79.2	78.0	64.0	48.8	37.6	24.5	6.9
	Mean	**99.9**	**92.2**	**90.3**	**81.5**	**74.3**	**63.9**	**49.4**	**37.3**	**23.8**	**6.7**

DAT: days after treatment; n.m.: not measured

Table CA 7.1.2.1.2- 4: Degradation of AE F140584 in soil [redacted] [redacted] 4a under aerobic conditions (values expressed as % AA)

Compound	Replicate	Residues (% Applied) on the following days after treatment (DAT)									
		0	0.25	1	2	3	4	7	10	14	30
AE F140584	A	103.9	84.6	84.9	55.4	44.0	29.7	10.6	4.3	1.3	n.m.
	B	99.5	84.4	80.2	54.0	43.4	28.2	8.6	4.4	1.4	n.m.
	Mean	**101.7**	**84.5**	**82.5**	**54.7**	**43.7**	**29.0**	**9.6**	**4.4**	**1.4**	**n.m.**

DAT: days after treatment; n.m.: not measured

Table CA 7.1.2.1.2- 5: Degradation of AE F140584 in soil [redacted] II under aerobic conditions (values expressed as % AA)

Compound	Replicate	Residues (% Applied) on the following days after treatment (DAT)									
		0	0.25	1	2	3	4	7	10	14	30
AE F140584	A	103.2	83.2	65.4	40.2	24.9	16.7	5.4	4.3	1.6	n.m.
	B	102.5	78.9	60.6	36.6	24.7	14.6	5.8	4.1	1.5	n.m.
	Mean	**102.9**	**81.0**	**63.0**	**38.4**	**24.8**	**15.7**	**5.6**	**4.2**	**1.6**	**n.m.**

DAT: days after treatment; n.m.: not measured

B. METHOD VALIDATION

The HPLC-MS/MS method was successfully validated prior to application of the degradation samples. Excellent linear correlation between the injected amount and detector response was observed within the range of 0.21 to 22.55 µg/L with a correlation coefficient of 0.9998. The individual method validation recovery rates were in the range of 81 to 111% (overall mean 95%, relative standard deviation (RSD) 2.7%, n = 40). The RSD of the repeatability tests for each recovery set ranged from 2.0 to 8.0%, showing excellent repeatability with this method.

The blank values in control samples were far below 30% of the LOQ for AE F140584 in all soils tested. The recoveries were not corrected for interferences. In addition to the recovery rates during method validation, recovery rates at the same fortification levels were determined concurrently to each sampling interval using samples from soil [redacted] AIIIa. The concurrent recovery rates were in the range of 85% to 104% (overall mean 95%, RSD 5.9%, n = 20). The combination of the very selective MS/MS detection method used with the preceding HPLC separation leads to a high specificity of the method.

C. DEGRADATION OF PARENT COMPOUND

During study incubation the concentration of the test item decreased rapidly in all soils, dropping from 102.1, 99.9, 101.7 and 102.9% AA at DAT-0 to 7.6, 23.8, 1.4 and 1.6% AA towards DAT-14 for soils [redacted] AIIIa, [redacted] AXXa, [redacted] 4a and [redacted] II, respectively. At the additional sampling interval for soil [redacted] AXXa (DAT-30), 6.7% AA were found.

The degradation of AE F140584 followed single first order kinetics (SFO) in soils [redacted] AIIIa, [redacted] AXXa and [redacted] 4a and double first order in parallel (DFOP) kinetics in soil [redacted] II according to the lowest chi^2 error values and the visual assessments. Table CA 7.1.2.1.2- 6 summarizes the results of the DT$_{50}$ and DT$_{90}$ calculations with the best fits highlighted in bold.

Table CA 7.1.2.1.2- 6: Degradation kinetics of AE F140584 in soils under aerobic conditions (for trigger values according to FOCUS)

Soil	Kinetic Model	DT$_{50}$ [days]	DT$_{90}$ [days]	Chi^2 Error [%]
[redacted] AIIIa	**SFO**	**4.0**	**13.4**	**4.5**
	FOMC	4.0	13.6	4.9
	DFOP	4.0	13.4	5.1
[redacted] AXXa	**SFO**	**7.1**	**23.4**	**2.2**
	FOMC	6.9	24.8	2.3
	DFOP	7.0	24.4	2.4
[redacted] 4a	**SFO**	**2.4**	**7.9**	**7.3**
	FOMC	2.4	8.0	7.9
	DFOP	2.4	7.9	8.3
[redacted] II	SFO	1.5	5.0	6.4
	FOMC	1.4	5.6	6.0
	DFOP	**1.4**	**5.2**	**4.0**

Best fits according to the criteria are marked in bold.

III. CONCLUSIONS

The test item AE F140584 was found subject to rapid degradation in a typical soil environment under aerobic laboratory conditions. The decline occurred with calculated half-lives (DT$_{50}$) of 1.4 to 7.1 days in the four soils tested. Due to its short half-life, AE F140584 is unlikely to accumulate in viable soils.

Report:	[redacted]; [redacted];2008;M-304971-01
Title:	AE F147447: Aerobic soil degradation in four EU soils
Report No:	MEF-07/439
Document No:	M-304971-01-1
Guidelines:	**OECD 307;None.**
GLP/GEP:	**yes**

Executive Summary

The degradation of AE F147447, a soil degradate of the herbicidal compound mesosulfuron-methyl (AE F130060), was investigated under aerobic conditions at 20 ± 2 °C and a soil moisture of about 55% of MWHC in four European soils by incubation in the dark for up to 119 days. The test substance was applied at a nominal test concentration of 40 µg AE F147447 /kg soil (dry matter), equivalent to the 27 times the maximum amount expected to be actually formed in soil, as calculated from the maximum observed abundance of AE F147447 in a soil metabolism study (6.5 % of the AR) and the maximum use rate of mesosulfuron-methyl (15 g/ha).

The recovered mean amount of AE F147447 directly after soil treatment was 102.6, 95.5, 102.8 and 113.4% of the applied amount [% AA] for soils [redacted] AIIIa' [redacted] AXXa, [redacted] 4a and [redacted] II, respectively.

Towards the end of the study the concentration of the test item decreased to 29.8, 37.3, 39.4, and 25.7% AA for soils [redacted] AIIIa, [redacted] AXXa, [redacted] 4a and [redacted] II, respectively.

Following FOCUS kinetic guidance, the experimental data could be well described by biphasic kinetic models with half-lives in the range of 31.2 to 70.9 days. Therefore, the compound will not persist in a viable soil environment.

I. MATERIALS AND METHODS

A. MATERIALS

1. Test Item

AE F147447
Certificate of Analysis: AZ 13778
Batch ID: AE F147447 00 1B98 0001
Chemical Purity: 98.1% *w/w*

2. Test Soils

Four soils were used (see Table CA 7.1.2.1.2- 7) in this study. The soils were chosen to represent typical agricultural soils of European origin. Texture shows variation including loam, sandy loam, silt loam and clay loam type, and physico-chemical characteristics were not extreme in any parameter. Pesticide history of the collection sites is documented over more than five years, except for soil [redacted] [redacted] II (non-managed grassland). The soils were sampled freshly from the fields (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 CA 7.1.2.1.2- 7: Physico-chemical properties of test soils

Soil	[redacted] **Allla**	[redacted] **AXXa**	[redacted] **4a**	[redacted] **II**
Geographic Location (City / State / Country)	[redacted] / NRW / Germany	[redacted] / NRW / Germany	[redacted] / NRW / Germany	[redacted] / NRW / Germany
GPS coordinates	[redacted]	[redacted]	[redacted]	[redacted]
Pesticide use history	No pesticide use for previous 5 years			non-managed grassland
Collection procedures	Sample taken with spade and placed into plastic bags			
Sampling depth	about 0 – 20 cm			
Storage conditions	1 day at room temperature, 4 days at approx. 4 °C, 4 days at approx. 20 °C for pre-incubation			
Storage length	9 days after sampling until application			
Soil preparation	Sieved (2 mm)			
Texture Class (USDA)	Loam	Sandy loam	Silt Loam	Clay loam
Sand [50 µm - 2 mm] (%) Silt [2 µm - 50 µm] (%) Clay [< 2 µm] (%)	45 34 21	75 16 9	27 58 15	35 32 33
pH in Water pH in $CaCl_2$ (0.01 M) pH in KCl (1 M)	6.4 6.1 5.8	6.7 6.4 6.3	6.5 6.3 6.0	7.2 7.1 6.8
Organic Matter ^{A} (%)	2.4	4.1	7.2	9.1
Organic Carbon (%)	1.4	2.4	4.2	5.3
CEC (meq/100 g)	9.3	8.5	13.1	21.7
MWHC (g/100 g)	43.2	46.8	67.6	82.8
Moisture at 1/3 bar = pF 2.5 (g H_2O /100 g dry soil)	17.9	13.1	26.5	35.8
Microbial biomass (mg $C_{biomass}$/100 g dry vital soil)				
Initial (Day 0) Final, Day 119 (untreated)	301/312 235/327	642/539 319/320	1559/1650 834/803	2142/2138 1740/1719

^{A}: % org. matter = % org. carbon x 1,724
NRW: Northrhine-Westfalia

B. STUDY DESIGN

1. Experimental Conditions

50 g dry matter equivalents of the sieved soils were weighed into Erlenmeyer flasks (300 ml) and soil moisture was adjusted to 55% MWHC for the individual flasks by addition of de-ionized water. The vessels were then closed with cotton wool plugs and acclimated to the intended study incubation conditions for 4 days (darkness, 20 ± 2 °C).

At application, each sample received a dose of AE F147447 equivalent to a nominal test concentration of 40 µg AE F147447/kg soil, corresponding to the 27-fold amount derived from the single maximum recommended field use rate of the parent active ingredient mesosulfuron-methyl (15 g/ha) and the assumption of 6.5% maximum formation of AE F147447 (2.5 cm depth, 1.5 g/cm^3 bulk density assumed for dose calculation).

For application, the targeted amount of test item was dissolved in methanol/water 1/1 (*v/v*) containing 0.4% acetonitrile and applied as small droplets directly to the soil surface using a pipette. The actual dose applied per test vessel was 2.04 µg of AE F147447 for all soils. After application, each flask was gently shaken to incorporate the test item into the test soil. All flasks were weighed, closed with cotton wool plugs, and immediately placed back into the temperature controlled incubation chamber. Samples were incubated at 20 ± 2 °C and a soil moisture content of 55% MWHC in the dark for 119 days. In addition, samples containing untreated soil were incubated under the same conditions for determination of soil microbial activity at the end of the study.

2. Sampling

Duplicate samples were removed for work-up after 0, 3, 5, 10, 19, 31, 60, 90 and 119 days after treatment (DAT). Samples for determination of soil microbial biomass were investigated at start and end of incubation (DAT-0 and DAT-119). The complete samples were immediately processed by extraction and HPLC-MS/MS analysis was usually performed within one day, except for the samples of DAT-119 which were analysed 7 days after extraction due to service and maintenance of the HPLC-MS/MS equipment. The extracts were stored refrigerated while not in use. Storage stability was proven under the same storage conditions.

3. Analytical Procedures

The entire soil sample in each test vessel was extracted with 100 mL of acetonitrile/water 4/1 (*v/v*) by microwave-accelerated solvent extraction for 10 minutes at 250 W (temperature < 40 °C) under magnetic stirring. The test systems were fortified with an internal stable-labelled standard solution (c = 1049 µg/L [methylsulfonyl-^{13}C, d_3, aminomethyl-d_2]AE F147447, resulting in an ISTD concentration of 2 µg/L corresponding to 4 µg/kg soil) and stirred for another 5 minutes. Sedimentation of soil particles was allowed before aliquots of 1 mL were ultra-centrifuged for 5 min at 14000 x *g*. Aliquots of the clear supernatants were transferred into HPLC vials for quantification by HPLC-MS/MS in the selected reaction monitoring (SRM) mode. No analysis for possible degradation products was performed.

The HPLC-MS/MS method was validated with regard to linearity, accuracy and precision. The range of the linearity of the detector used was tested in pure solvent. The test was performed by comparison of the injected amount of AE F147447 and the response to the internal stable-labelled standard [methylsulfonyl-^{13}C, d_3, aminomethyl-d_2]AE F147447. The concentration of the internal labelled standard mixture was maintained at a similar level (2 µg/L, corresponding to 4 µg/kg). The test was performed by injections of standards in solvent at concentrations corresponding to about 1/5 LOQ to 20-times LOQ.

The accuracy of the method was assessed on the basis of determined recovery rates. For this reason control samples of all soils were fortified with AE F147447 at fortification levels of 2.0 µg/kg (LOQ level) and 40 µg/kg (level at application, 20-fold LOQ level). The lowest fortification level experimentally tested corresponds to the limit of quantification (LOQ = 2.0 µg/kg). The limit of detection (LOD) was set to about 1/5 of the LOQ, being 0.4 µg/kg. At this level the signal to noise ratio was ≥ 3.

As a measure for the precision of the method, the intra-laboratory repeatability was shown. The repeatability was determined for all tested soils running five recoveries at the LOQ level, and the level of application.

Concurrent recovery samples were freshly prepared at each sampling interval by fortification of test item to a representative control soil ([redacted] AIIIa) at the LOQ level and the level of application (= 20-fold LOQ level) in duplicate. These flasks were extracted and analysed along with the kinetic test systems.

The degradation kinetics of the test item was determined according to FOCUS kinetics (2006) using the software KinGUI with three different kinetic models: single first order (SFO), first order multi compartment (FOMC) and double first order in parallel (DFOP). 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. 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 aerobic conditions were maintained and that the soils were microbially active over the duration of the laboratory study.

A. DATA

The results of the aerobic biotransformation of AE F147447 after incubation in four European soils are summarized in Table CA 7.1.2.1.2- 8 to Table CA 7.1.2.1.2- 11.

Table CA 7.1.2.1.2- 8: Degradation of AE F147447 in soil [redacted] AIIIa under aerobic conditions (values expressed as % AA)

Compound	Replicate	DAT								
		0	3	5	10	19	31	60	90	119
AE F147447	A	102.4	96.7	101.6	90.0	76.7	61.0	57.4	36.9	29.2
	B	102.7	101.9	97.0	89.1	80.8	58.8	50.1	38.1	30.4
	Mean	**102.6**	**99.3**	**99.3**	**89.5**	**78.8**	**59.9**	**53.8**	**37.5**	**29.8**

DAT: days after treatment

Table CA 7.1.2.1.2- 9: Degradation of AE F147447 in soil [redacted] AXXa under aerobic conditions (values expressed as % AA)

Compound	Replicate	DAT								
		0	3	5	10	19	31	60	90	119
AE F147447	A	95.9	93.7	91.8	83.9	81.9	62.1	55.2	46.7	39.8
	B	95.1	97.3	94.0	84.7	76.1	61.5	54.6	41.9	34.7
	Mean	**95.5**	**95.5**	**92.9**	**84.3**	**79.0**	**61.8**	**54.9**	**44.3**	**37.3**

DAT: days after treatment

Table CA 7.1.2.1.2- 10: Degradation of AE F147447 in soil [redacted] 4a under aerobic conditions (values expressed as % AA)

Compound	Replicate	DAT								
		0	3	5	10	19	31	60	90	119
AE F147447	A	105.8	103.4	92.7	90.1	84.0	64.1	49.0	49.4	40.8
	B	99.7	102.0	93.1	81.4	83.2	62.4	49.1	49.7	37.9
	Mean	**102.8**	**102.7**	**92.9**	**85.8**	**83.6**	**63.2**	**49.1**	**49.6**	**39.4**

DAT: days after treatment

Table CA 7.1.2.1.2- 11: Degradation of AE F147447 in soil [redacted] II under aerobic conditions (values expressed as % AA)

Compound	Replicate	DAT								
		0	3	5	10	19	31	60	90	119
AE F147447	A	114.5	94.0	86.6	73.2	71.4	53.5	39.5	35.4	25.1
	B	112.2	95.6	84.3	71.8	66.6	53.9	42.4	32.0	26.2
	Mean	**113.4**	**94.8**	**85.4**	**72.5**	**69.0**	**53.7**	**40.9**	**33.7**	**25.7**

DAT: days after treatment

B. METHOD VALIDATION

The HPLC-MS/MS method was successfully validated prior to application of the degradation samples. Excellent linear correlation between the injected amount and detector response was observed within the range of 0.20 to 22.1 µg/L with a correlation coefficient of 0.9997. The individual method validation recovery rates were in the range of 72 to 121% for the four soils (overall mean 99%, relative standard deviation (RSD) 2.2%, n = 160). The RSD of the repeatability tests for each recovery set ranged from 9.8 to 13.2%, showing excellent repeatability with this method.
The blank values in control samples were far below 30% of the LOQ for AE F147447 in all soils tested. The recoveries were not corrected for interferences.

In addition to the recovery rates during method validation, recovery rates at the same fortification levels were performed concurrent to each sampling interval for samples from soil [redacted] AIlla. The concurrent recovery rates were in the range of 81 to 109% (overall mean 98%, RSD 7.4%, n = 18).

The combination of the very selective MS/MS detection method used with the preceding HPLC separation leads to a high specificity of the method.

C. DEGRADATION OF PARENT COMPOUND

During study incubation the concentration of the test item decreased rapidly in all soils, dropping from 102.6, 95.5, 102.8 and 113.4% AA at day 0 to 29.8, 37.3, 39.4 and 25.7% AA towards the end of the study (DAT-119) for soils [redacted] AIIIa, [redacted] AXXa, [redacted] 4a and [redacted] II, respectively.

The degradation of AE F147447 followed single first order multi compartment (FOMC) kinetics in soils [redacted] AIIIa, [redacted] AXXa and [redacted] [redacted] 4a and double first order in parallel (DFOP) kinetics in soil [redacted] II according to the lowest chi^2 error values and the visual assessments. Table CA 7.1.2.1.2- 12 summarizes the results of the DT_{50} and DT_{90} calculations with the best fits highlighted in bold.

Table CA 7.1.2.1.2- 12: Degradation kinetics of AE F147447 in soils under aerobic conditions (for trigger values according to FOCUS)

Soil	Kinetic Model	DT_{50} [days]	DT_{90}* [days]	Chi² Error [%]
[redacted] AIIIa	SFO	60.6	201.3	4.9
	FOMC	**52.5**	**398.4**	**3.6**
	DFOP	53.0	261.6	3.8
[redacted] AXXa	SFO	78.5	260.7	4.5
	FOMC	**70.9**	**910.6**	**2.9**
	DFOP	71.1	412.4	3.1
[redacted] 4a	SFO	75.3	250.1	6.6
	FOMC	**63.2**	**> 1000**	**4.3**
	DFOP	59.7	> 1000	4.3
[redacted] II	SFO	48.7	161.9	10.3
	FOMC	26.2	965.4	4.0
	DFOP	**31.2**	**201**	**3.0**

Best fits according to the criteria are marked in bold.
* all DT_{90} values extrapolated far beyond the duration of the study

III. CONCLUSIONS

The test item AE F147447 was found subject to moderate degradation in a typical soil environment under aerobic laboratory conditions. The decline followed biphasic kinetics with calculated half-lives (DT_{50}) of 31.2 to 70.9 days in the four soils tested. Therefore, the compound will not persist in a viable soil environment.

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A kinetic modelling evaluation of the degradation behaviour of AE F140584 and AE F147447 based on the new studies KCA 7.1.2.1.2/3 and /4 was performed according to FOCUS kinetics (2006), to derive kinetic parameters suitable for modelling purpose and environmental exposure assessments.

update note Feb. 2015: upon request of the RMS, kinetic evaluation of the studies on aerobic soil degradation of metabolites AE F140584 and AE F147447 was revisited to evaluate additional biphasic kinetic models. The data is presented in a new modelling report, which also includes response to a similar request for additional evaluation on the degradation study for metabolite BCS-CV14885. The updated modelling is found filed under KCA 7.1.2.1.2/07.

~~Report:~~	[redacted] ~~1;~~ [redacted] ~~;2009;M-360767-01~~
~~Title:~~	~~Kinetic evaluation of laboratory aerobic soil degradation of AE F140584 and AE F147447~~
~~Report No:~~	~~MEF-09/896~~
~~Document No:~~	~~M-360767-01-1~~
~~Guidelines:~~	**~~not applicable;not applicable~~**
~~GLP/GEP:~~	**~~no~~**

~~Executive Summary~~

~~The kinetic analysis of soil residue data from the aerobic soil degradation studies as described above, was performed with the software KinGUI 2 according to FOCUS kinetics (2006) to derive half-lives for AE F140584 and AE F147447.~~

~~The most appropriate kinetic model for simulating the degradation of AE F140584 and AE F147447 was single first order (SFO) in soils AIIIa, AXXa and~~ [redacted]~~. For soil~~ [redacted] ~~dual first order in parallel (DFOP) and SFO were the most appropriate kinetic model for modelling purpose for the degradation of AE F140584 and AE F147447, respectively.~~

~~For AE F140584 and AE F147447 the evaluation resulted in geometric mean half-lives of 71.7 and 3.17 days, respectively.~~

~~Table CA 7.1.2.1.2- 13: Overall compilation of normalised DT~~$_{50}$ ~~values for AE F140584 and AE F147447 metabolites derived from the different data sets.~~

~~Soil~~	**~~Kinetic Model~~ [1]**	**~~AE F140584~~**	**~~AE F147447~~**
~~AIIIa~~	~~SFO~~	~~4.04~~	~~60.6~~
~~AXXa~~	~~SFO~~	~~7.06~~	~~78.5~~
[redacted]	~~SFO~~	~~2.37~~	~~75.3~~
[redacted]	~~SFO / DFOP~~ [2]	~~1.50~~	~~73.7~~ [3]
~~Geometric Mean~~		**~~3.17~~**	**~~71.7~~**

[1] ~~SFO: single first order, DFOP: double first order in parallel~~
[2] ~~SFO for AE F140584, DFOP for AE F147447~~
[3] ~~Half-life of slowly degrading DFOP compartment~~

~~I. METHODS~~

~~Soil residue data from the aerobic soil degradation studies KCA 7.1.2.1.2 /03 (M-309403-01-1) and KCA 7.1.2.1.2 /04 (M-304971-01-1) were used. In these studies, the degradation of AE F140584 and AE F147447 was tested in soils AIIIa (AE F140584: loam; AE F147447: sandy loam), AXXa (AE F140584: sandy loam; AE F147447: sand),~~ [redacted] ~~(silt loam) and~~ [redacted] ~~(loam and clay loam) under aerobic conditions in the dark in the laboratory for up to 114 days at 20 °C, a soil moisture of 55% of the maximum water holding capacity and a test concentration of 40 µg/kg soil.~~

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

~~model was selected on the basis of a detailed statistical analysis including visual assessment of the goodness of the fits, chi^2 scaled error criterion, t-test significance, correlation analysis and standard deviation. The DT_{50} value was calculated from the resulting kinetic parameters. The DT_{50} value taken for modelling is based on the iteratively calculated value from KinGUI 2.~~

~~II. RESULTS~~

~~The most appropriate kinetic model for modelling purpose for the degradation of AE F140584 and AE F147447 was single first order (SFO) in soils AIIIa, AXXa and~~ [redacted]. ~~For soil~~ [redacted] ~~SFO and dual first order in parallel (DFOP) were the most appropriate kinetic model for modelling purpose for the degradation of AE F140584 and AE F147447, respectively.~~

~~For the use in predictions of environmental concentrations the degradation half lives are to be normalised to standard reference soil moisture (*i.e.* 100 % field capacity). In the present case this normalisation does not lead to any change, since the studies were performed at 20°C and the soil moisture during the study of 55% MWHC was in all cases larger than that at field capacity (pF2) leading to the upper limit of 1 for the moisture correction factor.~~

~~Table CA 7.1.2.1.2- 14: Kinetic parameters for the degradation of AE F140584 in soils under aerobic conditions for modelling purpose (normalised) according to FOCUS~~

~~Temp. [°C]~~	~~Soil~~	~~Texture (USDA)~~	~~Kinetic Model~~ [1]	~~DT_{50} [days]~~	~~DT_{90} [days]~~ [2]	~~Chi^2 Error [%]~~	~~t-test~~
~~20~~	~~AIIIa~~	~~Loam~~	~~SFO~~	~~4.04~~	~~13.4~~	~~4.5~~	~~< 0.0001~~
	~~AXXa~~	~~Sand loam~~	~~SFO~~	~~7.06~~	~~23.4~~	~~2.2~~	~~< 0.0001~~
	[redacted]	~~Silt loam~~	~~SFO~~	~~2.37~~	~~7.9~~	~~7.3~~	~~< 0.0001~~
	[redacted]	~~Clay loam~~	~~SFO~~	~~1.50~~	~~4.98~~	~~6.4~~	~~< 0.0001~~
~~Geometric Mean~~				~~3.17~~			

[1] ~~SFO: single first order, DFOP: double first order in parallel~~

[2] ~~DT_{90} was calculated as DT_{50} * 3.32~~

~~Table CA 7.1.2.1.2- 15: Kinetic parameters for the degradation of AE F147447 in soils under aerobic conditions for modelling purpose (normalised) according to FOCUS~~

~~Temp. [°C]~~	~~Soil~~	~~Texture (USDA)~~	~~Kinetic Model~~ [1]	~~DT_{50} [days]~~	~~DT_{90} [days]~~ [2]	~~Chi^2 Error [%]~~	~~t-test~~
~~20~~	~~AIIIa~~	~~Sandy loam~~	~~SFO~~	~~60.6~~	~~201~~	~~4.9~~	~~< 0.0001~~
	~~AXXa~~	~~Sand~~	~~SFO~~	~~78.5~~	~~261~~	~~4.5~~	~~< 0.0001~~
	[redacted]	~~Silt loam~~	~~SFO~~	~~75.3~~	~~250~~	~~4.9~~	~~< 0.0001~~
	[redacted]	~~Loam~~	~~DFOP~~	~~73.7~~ [3]	~~245~~	~~3.0~~	~~< 0.0001~~
~~Geometric Mean~~				~~71.7~~			

[1] ~~SFO: single first order, DFOP: double first order in parallel~~

[2] ~~DT_{90} was calculated as DT_{50} * 3.32~~

[3] ~~DT_{50} calculated slow degradation rate of DFOP model.~~

~~III. CONCLUSIONS~~

~~The calculated half-lives for modelling purpose (normalised) for the degradation of AE F140584 and AE F147447 in soil under aerobic conditions in the dark in the laboratory were between 1.50 and 7.06 days (geomean: 3.17 days) for AE F140584, and between 60.6 and 78.5 days (geomean: 71.7 days) for AE F147447.~~

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Point 7.1.4.2 (Lysimeter Studies) will discuss structure assignment to a component previously considered unidentified in the original EU dossier. The component has been shown to correspond to a new degradate “BCS-CV14885”. A new study was conducted to generate soil half-life information on BCS-CV14885. For further discussion and interpretation of these results please refer to Point 7.1.4.2.

Report:	[redacted]; [redacted];2013;M-459403-02; Amended: 2013-07-31
Title:	Mesosulfuron-methyl-des-methyl-guanidine (BCS-CV14885): Aerobic dissipation in four European standard soils
Report No:	S11-03921
Document No:	M-459403-02-1
Guidelines:	**OECD Test Guideline No. 307, 2002** **US EPA OCSPP Test Guideline: N/A;not applicable**
GLP/GEP:	**yes**

Executive Summary

The dissipation of BCS-CV14885 was investigated in four European soils under aerobic conditions at 20 °C and a soil moisture of about 55% of MWHC by incubation in the dark for 119 days. The test item was applied at a nominal test concentration of 0.16 mg BCS-CV14885 /kg soil (dry matter).

The amount of the test item in soil extracts accounted for 97.2, 87.8, 97.5 and 95.4% of the applied amount [% AA] at study start (DAT-0) and decreased to 51.3, 29.5, 44.9 and 49.4% AA towards the end of the study (DAT-119) for soils [redacted] AXXa, [redacted] II, [redacted] [redacted] 4a and [redacted] [redacted], respectively.

Following FOCUS kinetic guidance, the experimental data could be well described by biphasic kinetic models with half-lives in the range from 54.0 to 131 days.

I. MATERIALS AND METHODS

A. MATERIALS

1. Test Item

Mesosulfuron-methyl-des-methyl-guanidine (BCS-CV14885)

Certificate of Analysis:	AZ 18045
Batch ID:	BCS-CV 14885-01-01

Chemical Purity: 97.8%

2. Test Soils

Four test soils of European origin were used (see Table CA 7.1.2.1.2- 16). The soils are differing in their physico-chemical characteristics especially with respect to texture, pH and organic carbon content. They are well characterized and pesticide history is known for at least 5 years. The soils were sampled from the fields (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 10381-6:2009(E).

Table CA 7.1.2.1.2- 16: Physico-chemical properties of test soils (soil batch used for main test)

Soil	[redacted] AXXa	[redacted]	[redacted]	[redacted]
Geographic Location (City / State / Country)	[redacted] / NRW / Germany	[redacted] / NRW / Germany	[redacted] / NRW / Germany	[redacted] / NRW / Germany
GPS coordinates	[redacted]	[redacted]	[redacted]	[redacted]
Pesticide use history	No pesticide use for previous 5 years			
Collection procedures	Sample taken with shovel and placed into plastic bags			
Sampling depth	about 0 – 20 cm			
Storage conditions	At the receiving facility: 2 days at approx. 6 °C, 7 days at approx. 20 °C for pre-incubation			
Storage length	17 days from sampling until application			
Soil preparation	Sieved (2 mm)			
Soil Taxonomic Classification (USDA)	N/A	N/A	N/A	N/A
Texture Class (USDA)	Sandy loam	Clay Loam	Silt Loam	Sandy Loam
Sand [50 µm - 2 mm] (%)	75	29	23	55
Silt [2 µm - 50 µm] (%)	17	43	61	29
Clay [< 2 µm] (%)	8	28	16	16
pH in Water (1/1)	6.8	7.5	6.6	5.6
pH in Water (Saturated Paste)	6.7	7.4	6.6	5.6
pH in KCl (1/1)	6.3	7.0	6.0	5.0
pH in $CaCl_2$ (1/2)	6.5	7.3	6.4	5.4
Organic Matter [A] (%)	3.1	8.3	3.8	3.4
Organic Carbon (%)	1.8	4.8	2.2	2.0
CEC (meq/100 g)	9.0	18.9	11.6	9.6
Maximum water holding capacity (g/100 g)	49.4	84.2	60.2	56.8
Water holding capacity at 1/10 bar (%)	14.9	37.8	35.8	25.3
Microbial biomass (mg $C_{biomass}$/100 g dry vital soil)				
Start (untreated)	304.1	541.2/	278.9	248.6
day 61 (untreated/treated)	198.2/100.2	451.4/434.8	206.6/175.8	162.7/145.9
end (untreated/treated)	193.5/183.7	496.7/511.0	142.8/152.9	124.3/96.0

[A]: % org. matter = % org. carbon x 1.724
NRW: Northrhine-Westfalia

B. STUDY DESIGN

1. Experimental Conditions

50 g dry matter equivalents of the sieved soils were weighed into Erlenmeyer flasks (300 mL) and soil moisture was adjusted to 55% MWHC for the individual flasks by addition of de-ionized water. The vessels were then closed with cotton wool plugs and acclimated to the intended study incubation comditions for 7 days (darkness, 20 ± 2 °C). Samples for biomass determination were incubated in 250 mL glass flasks in the same manner.

At application, each sample received a dose of BCS-CV14885 equivalent to a nominal test item concentration of 160 µg BCS-CV14885/kg soil, selected for analytical reasons. The targeted amount of test item was dissolved in methanol/water 1/1 (*v/v*) and applied as small droplets directly to the soil using a pipette. The actual dose applied per test vessel was 8.1 µg of BCS-CV14885 for all soils. After application, the soil was carefully mixed by shaking the flask. The test systems were placed in a dark, temperature controlled climatic cabinet set to 20 ± 2°C target test temperature. In addition, samples containing untreated soil or soil treated with application solvent were incubated under the same conditions for determination of soil microbial activity at the end of the study. Furthermore, samples containing untreated soil were incubated for the determination of the concurrent recovery rates at each sampling interval.

2. Sampling

Duplicate samples were taken for analysis after 0, 1, 4, 7, 13, 27, 61 and 119 days of incubation for all soils. Samples for determination of soil microbial biomass were investigated at start, middle and end of the study (DAT-0, DAT-61 and DAT-119). The soil samples were processed and extracts analysed within 3 days. Thereafter, the extracts were stored in a freezer at < -18°C.

3. Analytical Procedures

The entire soil sample in each test vessel was extracted three times with 100 mL of acetonitrile/water 1/1 (*v/v*) by shaking at ambient conditions and once in a microwave for 15 minutes at 70 °C. The ambient and microwave extracts were combined and weighed. About 1-2 mL of the extracts was filtered and transferred into a glass vial for HPLC-MS/MS analysis.

The HPLC-MS/MS method was validated using different batches of the same soils (determined physico-chemical properties are presented in the report). To check the matrix caused ion suppression effects in the HPLC/MS-MS analysis, the validation samples were measured with a solvent calibration and also with a calibration in matrix. Matrix effects of 35 to 65% were observed. Therefore, calibration had to be performed with standards in matrix. The limit of quantification (LOQ) was set to 1 ng/mL.

The accuracy and repeatability of the method were assessed on the basis of a set of recovery samples. For this purpose, 50 g untreated soil (calculated as dry weight) was adjusted with water to 55% MWHC and fortified at LOQ level and at 22-fold LOQ level with test item solution.

Concurrent recovery samples were freshly prepared at each sampling interval by fortification of test item (in duplicate) to a representative control soil ([redacted] AXXa) at the LOQ level and the 22-fold LOQ level. These flasks were extracted and analysed along with the kinetic test systems.

The degradation kinetics of the test item were determined according to FOCUS kinetics (2006) using the software KinGUI version 1 with three different kinetic models: single first order (SFO), first order multi compartment (FOMC) and double first order in parallel (DFOP). 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. 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 aerobic conditions were maintained and that the soils were microbially active over the duration of the entire study.

A. DATA

The results of the aerobic degradation of BCS-CV14885 in four European soils are summarized in Table CA 7.1.2.1.2- 17 to Table CA 7.1.2.1.2- 20.

Table CA 7.1.2.1.2- 17: Dissipation of BCS-CV14885 in soil [redacted] AXXa under aerobic conditions (values expressed as % AA)

Compound	Replicate	DAT							
		0	1	4	7	13	27	61	119
BCS-CV14885	A	98.2	95.7	98.6	89.6	84.7	75.1	62.2	51.5
	B	96.2	99.0	95.4	90.7	85.7	72.8	62.9	51.1
	Mean	**97.2**	**97.4**	**97.0**	**90.2**	**85.2**	**74.0**	**62.6**	**51.3**

DAT: days after treatment

Table CA 7.1.2.1.2- 18: Dissipation of BCS-CV14885 in soil [redacted] II under aerobic conditions (values expressed as % AA)

Compound	Replicate	DAT							
		0	1	4	7	13	27	61	119
BCS-CV14885	A	85.5	82.4	76.9	72.3	68.6	58.9	38.6	28.6
	B	90.0	84.0	73.5	73.3	68.4	53.8	40.8	30.4
	Mean	**87.8**	**83.2**	**75.2**	**72.8**	**68.5**	**56.3**	**39.7**	**29.5**

DAT: days after treatment

Table CA 7.1.2.1.2- 19: Dissipation of BCS-CV14885 in soil [redacted] [redacted] 4a under aerobic conditions (values expressed as % AA)

Compound	Replicate	DAT							
		0	1	4	7	13	27	61	119
BCS-CV14885	A	100.2	93.4	88.8	83.4	80.1	72.8	57.7	44.4
	B	94.8	90.9	89.1	84.8	81.0	72.5	59.0	45.4
	Mean	**97.5**	**92.2**	**89.0**	**84.1**	**80.6**	**72.7**	**58.3**	**44.9**

DAT: days after treatment

Table CA 7.1.2.1.2- 20: Dissipation of BCS-CV14885 in soil [redacted] [redacted] under aerobic conditions (values expressed as % AA)

Compound	**Replicate**	**DAT**							
		0	**1**	**4**	**7**	**13**	**27**	**61**	**119**
BCS-CV14885	A	97.2	91.4	85.6	86.3	78.2	74.0	63.4	50.6
	B	93.7	90.0	86.7	83.7	85.6	72.2	62.5	48.3
	Mean	**95.4**	**90.7**	**86.2**	**85.0**	**81.9**	**73.1**	**62.9**	**49.4**

DAT: days after treatment

B. METHOD VALIDATION

The HPLC-MS/MS method was successfully validated prior to application of the degradation samples. The method used for analysis was linear in a range of 0.2 ng/mL (limit of detection (LOD)) to 100.0 ng/mL (r ≥ 0.997).

During method validation, recoveries of BCS-CV14885 were between 85.2 and 97.5% in soil [redacted] AXXa (mean value at LOQ level: 89.5%, mean value at 22-fold LOQ level: 91.4%), between 69.5 and 88.0% in soil [redacted] II (mean value at LOQ level: 81.0% ; mean value at 22-fold LOQ level: 82.4%), between 88.2 and 99.6% in soil [redacted] [redacted] 4a (mean value at LOQ level: 92.7%, mean value at 22-fold LOQ level: 95.1%) and between 69.1 – 92.4% in soil [redacted] [redacted] (mean value at LOQ level: 75.1%, mean value at 22-fold LOQ level: 89.5%). The accuracy and precision were considered acceptable since mean recoveries were in the range of 70 and 110% with relative standard deviations below 20%. The determined values of the blank samples were less than 20% of the assigned LOQ of the test item in all four soils. The analytical procedure was therefore considered specific for the test item.

In addition to the recovery rates during method validation, recovery rates at the same fortification levels were determined concurrently to each sampling interval using samples from soil [redacted] AXXa. The concurrent recovery rates were in the range of 93.0 to 111.5%.

C. DEGRADATION OF PARENT COMPOUND

During study incubation, the concentration of the test item decreased in all soils, dropping from 97.2, 87.8, 97.5 and 95.4% AA at day 0 to 51.3, 29.5, 44.9 and 49.4% AA towards the end of the study (DAT-119) for soils [redacted] AXXa, [redacted] II, [redacted] [redacted] 4a and [redacted] [redacted] [redacted], respectively.

The degradation of BCS-CV14885 followed first-order multi-compartment kinetics in soils [redacted] [redacted] AXXa and [redacted] II and double first order in parallel (DFOP) kinetics in soils [redacted] [redacted] 4a and [redacted] [redacted] according to the lowest chi^2 error values and the visual assessments. Table CA 7.1.2.1.2- 21 summarizes the results of the DT_{50} and DT_{90} calculations with the best fits highlighted in bold.

Table CA 7.1.2.1.2- 21: Summary of Dissipation kinetics for BCS-CV14885 in Test Soils under aerobic conditions

Soil	Kinetic Model	DT_{50} [days]	DT_{90} [days]	Chi^2 Error [%]
Soil [redacted] AXXa (sandy loam)	SFO	113.6	377.3	3.8
	FOMC	**130.7**	**>1000**	**1.5**
	DFOP	134.7	823.3	1.5
Soil [redacted] II (clay loam)	SFO	65.1	216.2	5.2
	FOMC	**54.0**	**>1000**	**2.2**
	DFOP	55.3	347.6	2.5
Soil [redacted] [redacted] 4a (silt loam)	SFO	102.8	341.4	3.5
	FOMC	108.8	>1000	1.7
	DFOP	**102.6**	**403.5**	**1.4**
Soil [redacted] [redacted] [redacted] (sandy loam)	SFO	125.7	417.6	3.0
	FOMC	156.3	>1000	1.7
	DFOP	**128.2**	**486.6**	**1.4**

Best fits according to the criteria are marked in bold.

III. CONCLUSIONS

BCS-CV14885 was degraded in soils under aerobic laboratory conditions with typical half-lives between 54.0 and 131 days.

update Feb. 2015: upon request of the RMS, kinetic evaluation of the studies on aerobic soil degradation of metabolites AE F140584, AE F147447 and BCS-CV14885 was revisited to evaluate additional biphasic kinetic models. The data is presented in a new modelling report KCA 7.1.2.1.2/07 below, which replaces the former evaluation KCA 7.1.2.1.2/05:

Report:	KCA 7.1.2.1.2 /07: [redacted] M-510617-01
Title:	Kinetic Evaluation of Laboratory Aerobic Soil Degradation of Mesosulfuron-methyl metabolites AE F140584, AE F147447 and Mesosulfuron-methyl-des-methyl-guanidine
Report No:	EnSa-15-0004
Document No:	M-510617-01-1
Guidelines:	**not applicable;not applicable**
GLP/GEP:	**no**

Executive Summary

The aerobic soil degradation of metabolites AE F140584, AE F147447 and BCS-CV14885 had been investigated in three laboratory soil metabolism studies after application to four different soils each (KCA 7.1.2.1.2/03, 04, and 06). The data from these studies were evaluated in order to derive half-lives to be used for prediction of environmental concentration of the substances. The evaluation was performed following the guideline given by the report of the FOCUS group on kinetic evaluation (FOCUS, 2011).

The degradation half-lives derived from the kinetic evaluation of the degradation data are given in the following tables. The geometric mean DT50 values are 3.16 d for AE F140584, 108.2 d for

AE F147447 and 122.7 d for BCS-CV14885. All data are normalised to reference temperature (20°C) and soil moisture at field capacity.

Table CA 7.1.2.1.2- 22: Results of kinetic evaluation of AE F140584 degradation

Aerobic soil test system	Model	DT50 [days]
[redacted] AIIIa	SFO	4.02
[redacted] AXXa	SFO	7.04
[redacted] [redacted] 4a	SFO	2.35
[redacted] II	SFO	1.49
Geometric mean		**3.16**

Table CA 7.1.2.1.2- 23: Results of kinetic evaluation of AE F147447 degradation

Aerobic soil test system	Model	DT50 [days]
[redacted] AIIIa	HS	82.7
[redacted] AXXa	HS	111.4
[redacted] [redacted] 4a	HS	203.0
[redacted] II	DFOP	73.3
Geometric mean		**108.2**

Table CA 7.1.2.1.2- 24: Results of kinetic evaluation of BCS-CV14885 degradation

Aerobic soil test system	Model	DT50 [days]
[redacted] AXXa	HS	202.7
[redacted] [redacted]	DFOP	130.4
[redacted] [redacted] 4a	DFOP	88.2
[redacted] II	DFOP	97.1
Geometric mean		**122.7**

I. METHODS

The kinetic evaluation of degradation behaviour was conducted following a tiered approach as given below. The purpose was to derive kinetic parameter suitable for modelling and environmental risk assessments.

Pre-processing of Soil Residue Data

The evaluation is based on the reported soil residue values; measured and reported true replicates were taken into account singularly. The residue data were checked for consistency and clear outliers. In case outliers were removed this was clearly mentioned in the report. For the calculation of the total residue employed for the kinetic evaluation, following generic procedure was followed:

- values between LOD and LOQ were set to 0.5 x (LOQ + LOD)
- all samples < LOD were set to 1/2 LOD or after the first non-detect, to zero in case no detects appeared later on.

Kinetic Analysis

Four kinetic models, the Single First-Order (SFO), first-order multiple-compartment (FOMC, Gustafson-Holden), the hockey-stick model (HS, DFOS = double first order sequential), and the bi-exponential model (DFOP = double first order parallel) may be used to describe the experimental residue values of the applied parent substance. The selection of a kinetic model is done on a step by step decision process based on statistic criteria:

Step1: Because of the general need of the most exposure models it was defined that the preferred model is SFO. If the SFO fit is visually acceptable, ε does not significantly exceed 15%, and t-test for the degradation rate is less than 0.05 for parent and 0.10 for metabolite, the SFO fit and parameters are accepted.

Step2: If ε is significantly greater than 15%, model parameters may be fixed based on available information (e.g. initial amount).

Step3: If ε is still significantly greater than 15%, then bi-phasic models can be tested on a case by case basis. The standard biphasic models recommended by FOCUS (201) are Gustafson and Holden (FOMC) model, Double First Order in Parallel (DFOP) and Hockey Stick (HS). However, the FOMC model is only used, if residues reach 10% of the initial concentration by the end of the study and the worst case DT50 value is calculated as DT90(FOMC)/3.32. In the other cases, the DT50 is calculated from the slow k-rate of DFOP or HS model.

Step4: If none of the bi-phasic models leads to a significantly improved fit, the SFO model is chosen, if it is visually acceptable. The purpose of this rule is to avoid an over-parameterised model based on a marginally better fit only.

The model fit as well as the statistical evaluation of the results was carried out with the in-house developed software KinGUI version 2.1. In this software the fitting algorithms as well as the statistical evaluation of the results is implemented on the basis of the statistical computing language R. For the optimization the implemented algorithm Iteratively Reweighted Nonlinear Least Squares (IRLS) was used.

Temperature and Moisture Normalisation

In order to obtain standardised input parameters for prediction models of environmental concentrations, the DT50 values derived from the evaluations were normalised to standard reference temperature 20 °C and soil moisture 100 % field capacity (pF2). This normalisation was conducted using the standard approach described in FOCUS, 2000. No temperature normalisation was needed in the present case, since all studies were conducted at the reference temperature of 20 °C. For the moisture normalisation the Walker equation was used.

II. RESULTS

AE F140584

Single first order (SFO) kinetics was fitted to all four data sets for AE F140584. The resulting DT50 values are given in the table below**Error! Reference source not found.** together with the results of the evaluation of the quality of the model fit to observed data.

In all four cases statistical and visual evaluations of the fits lead to acceptable results. The geometric mean DT50 for AE F140584 is **3.16 d**.

Table CA 7.1.2.1.2- 25: Results of kinetic evaluation of AE F140584 degradation in four different soils

Aerobic soil test system	Model	DT50 [days]	ε-error [%]	t-test	Visual fit
[redacted] AIIIa	SFO	4.02	4.2	<0.001	++
[redacted] AXXa	SFO	7.04	2.1	<0.001	++
[redacted] [redacted] 4a	SFO	2.35	6.8	<0.001	++
[redacted] II	SFO	1.49	5.4	<0.001	++
Geometric mean		3.16			

AE F147447

As a first step single first order (SFO) kinetics was fitted to all four data sets for AE F147447. The resulting DT50 values are given in the table below**Error! Reference source not found.** together with the results of the evaluation of the quality of the model fit to observed data.

In all four cases the statistical evaluation of the fits leads to acceptable results for SFO model. However visual inspection indicated that the AE F147447 degradation might be better described by bi-phasic models. As a next step the data were fitted with the DFOP and HS models. Since the degradation of 90% of the applied test item was not reached by the end of the study, FOMC model was not considered for this evaluation.

For all four soils visual assessment for SFO model was only rated as fair due to significant deviations between calculated and observed values at the first data points and a systematic variation of the residuals. In the soils [redacted] AIIIa and [redacted] AXXa HS model provided better fit both visually and statistically, thus as a conservative approach the k_2 rate (slower degradation rate) from the HS model was used to derive reliable endpoints for this two soils. For soils [redacted] [redacted] 4a and [redacted] II visual fit was best described with the DFOP model, which in case of Hoefchen soil, however, did not provide statistically significant result. In this case the k_2 rate from the HS model was used to derive reliable endpoint. For soil [redacted] II DFOP model showed the best fit to the residue data both visually and statistically. Correspondingly, the DT50 calculated from the slowly degrading DFOP compartment (k_{slow}) was considered for the calculation of a geometric mean DT50 for AE F147447 which is **108.2 d**.

Table CA 7.1.2.1.2- 26: Results of kinetic evaluation of AE F147447 degradation in four different soils (values in bold were considered for calculating the geomean DT50)

Aerobic soil test system	Model	DT50 [days]	ε-error [%]	t-test	Visual fit
[redacted] AIIIa	SFO	60.6	4.9	<0.001	o
	DFOP	15.4 / 93.2*	3.8	0.117 / 0.024*	+
	HS	43.5 / **82.7****	2.8	<0.001 / <0.001**	+
[redacted] AXXa	SFO	78.5	4.5	<0.001	o
	DFOP	19.4 / 154.5*	3.1	0.090 / 0.106*	+
	HS	52.0 / **111.4****	2.3	<0.001 / <0.001**	+
[redacted] 4a	SFO	75.3	6.6	<0.001	o
	DFOP	22.2 / 525.9*	4.3	0.051 / 0.406*	+
	HS	47.3 / **203.0****	3.9	<0.001 / 0.023**	+
[redacted] II	SFO	48.7	10.3	<0.001	o
	DFOP	3.37 / **73.3***	3.0	<0.001 / <0.001*	+
	HS	24.4 / 84.2**	6.6	<0.001 / <0.001**	+
Geometric mean		**108.2**			

* from fast and slowly degrading DFOP compartment respectively
** from k_1 and k_2 degradation rates of HS model respectively

BCS-CV14885 (Mesosulfuron-methyl-des-methyl-guanidine)

As a first step single first order (SFO) kinetics was fitted to all four data sets for mesosulfuron-methyl-des-methyl-guanidine. The resulting DT50 values are given in the table below**Error! Reference source not found.** together with the results of the evaluation of the quality of the model fit to observed data.

In all cases the statistical evaluation of the fits leads to acceptable results for SFO model. However visual inspection indicated that the degradation of mesosulfuron-methyl-des-methyl-guanidine might be better described by bi-phasic models. As a next step the data were fitted with the DFOP and HS models. Since the degradation of 90% of the applied test item was not reached by the end of the study, FOMC model was not considered for this evaluation.

For all four soils SFO model failed to properly describe the time zero values as a well as the latter data points, resulting in the systematic distribution of the residuals. DFOP model provided better fit both visually and statistically in all cases, except for the soil [redacted] AXXa. For this soil the k_{slow} (slower degradation rate) appears to be statistically unreliable, thus the k_2 rate from the HS model was used to derive reliable DT50. For all other soils k_{slow} from DFOP model was chosen to calculate the modelling endpoint. Geometric mean DT50 for mesosulfuron-methyl-des-methyl-guanidine is **151.2 d**.

Table CA 7.1.2.1.2- 27: Results of kinetic evaluation of mesosulfuron-methyl-des-methyl-guanidine degradation in four different soils (values in bold were considered for calculating the geomean DT50)

Aerobic soil test system	Model	DT50 [days]	ε-error [%]	t-test	Visual fit
[redacted] AXXa	SFO	113.6	3.8	<0.001	o
	DFOP	19.3 / 297.1*	1.5	0.016 / 0.072*	+
	HS	65.1 / **202.7****	1.3	<0.001 / <0.001**	+
[redacted]	SFO	125.7	3.0	<0.001	o

[redacted]	DFOP	4.22 / **154.2**[*]	1.4	0.046 / <0.001[*]	+
	HS	64.2 / 163.0[**]	1.8	<0.001 / <0.001[**]	+
[redacted] 4a	SFO	102.8	3.5	<0.001	o
	DFOP	4.72 / **129.5**[*]	1.4	0.009 / <0.001[*]	+
	HS	49.3 / 130.8[**]	1.8	<0.001 / <0.001[**]	+
[redacted] II	SFO	65.1	5.2	<0.001	o
	DFOP	13.5 / **129.2**[*]	2.5	0.018 / 0.010[*]	+
	HS	36.6 / 93.8[**]	3.3	<0.001 / <0.001[**]	+
Geometric mean		**151.2**			

[*] from fast and slowly degrading DFOP compartment respectively
[**] from k$_1$ and k$_2$ degradation rates of HS model respectively

Normalisation to reference conditions

AE F140584 and AE F147447

In both cases the normalisation does not lead to any change, since the studies were performed at approximately 20 °C and the soil moisture during the study (55 % MWHC) was in all cases larger than that at field capacity (pF2) leading to the upper limit of 1 for the moisture correction factor.

BCS-CV14885 (Mesosulfuron-methyl-des-methyl-guanidine)

The temperature normalisation was not performed, since the study was performed at approximately 20 °C. Soil moisture normalisation led to a correction factor <1 for three of the test soils, detailed results are presented in the table below. The resulting geometric mean DT50 for use in environmental modelling is **122.7 d**.

Table CA 7.1.2.1.2- 28: Normalised degradation parameters of mesosulfuron-methyl-des-methyl-guanidine

Aerobic soil test system	Actual study moisture (55% WMHC) [%w/w]	Moisture at pF2 (field capacity) [%w/w]	Correction factor	DT50$_{norm}$ [days]
[redacted] AXXa	18.2	14.9	1.00	202.7
[redacted]	19.9	25.3	0.85	130.4
[redacted] 4a	20.7	35.8	0.68	88.2
[redacted] II	25.1	37.8	0.75	97.1
Geomean				**122.7**

CA 7.1.2.1.3 Anaerobic degradation of the active substance

The degradation rate of mesosulfuron-methyl in soil under anaerobic conditions in the dark in the laboratory was EU reviewed for Annex I inclusion, and was considered acceptable during the original EU review of mesosulfuron (Review Report SANCO/10298/2003-Final, 25 June 2004). The following studies are included in the baseline dossier. No additional studies are submitted in the context of application for approval renewal.

Report:	**[redacted]k;[redacted];2000;M-199429-01**
Title:	Kinetics and Metabolism in Soil LS 2.2 at 20°C under Anaerobic Conditions Code: [U-^{14}C-phenyl]AE F130060 and [2-^{14}C-pyrimidyl]AE F130060
Report No:	CB 98/136
Document No:	M-199429-01-1
Guidelines:	**SETAC: 1, 1.2; USEPA (=EPA): §162-2; Deviation not specified**
GLP/GEP:	**yes**

Reference	Followed guidance	Guidance currently in force	Differences	Critical assessment of the study / Deviations / conclusion about its Reliability
M-199429-01-1	1) SETAC Europe: Procedures for assessing the environmental fate and ecotoxicity of pesticides (1995) 2) EPA Pesticide Assessment Guideline Subdiv. N, § 162-2 (1982)	OECD 307	Test item applied onto water surface to flooded soil. Monitoring of anaerobic conditions for one week prior to application.	This is a strictly anaerobic study and fulfills all criteria of the OECD guideline 307 for soil degradation studies. Therefore, it is considered reliable.

Report:	**[redacted]p;[redacted];2000;M-198307-01**
Title:	Kinetic evaluation of AE F130060 anaerobic soil degradation studies using TopFit 2.0 Code: AE F130060
Report No:	OE 00/122
Document No:	M-198307-01-1
Guidelines:	**not applicable (computer modelling report)**
GLP/GEP:	**not applicable (computer modelling report)**

Mesosulfuron-methyl was found to break down under anaerobic conditions with half-lives of 30.1 and 30.5 days in the tested soil for pyrimidyl and phenyl label, respectively. These results indicate that in a flooded soil / anaerobic situation the parent substance will be degraded at similar rate as under aerobic condition; there is no risk of soil accumulation for the parent compound.

CA 7.1.2.1.4 Anaerobic degradation of metabolites, breakdown and reaction products

The degradation rate of the major product AE F160459 detected under anerobic conditions was EU reviewed for Annex I inclusion, and was considered acceptable during the original EU review of mesosulfuron (Review Report SANCO/10298/2003-Final, 25 June 2004). The following studies are included in the baseline dossier. No additional studies are submitted in the context of application for approval renewal.

Report:	**[redacted]4; [redacted];2000;M-198307-01**
Title:	Kinetic evaluation of AE F130060 anaerobic soil degradation studies using TopFit 2.0 Code: AE F130060
Report No:	OE 00/122
Document No:	M-198307-01-1
Guidelines:	**not applicable (computer modelling report)**
GLP/GEP:	**not applicable (computer modelling report)**

AE F160459 was simulated to degrade under anaerobic conditions with half-lives of 70.2 and 81.4 days in the tested soil for pyrimidyl and phenyl label, respectively. These results indicate that AE F160459 is anaerobically degraded at similar rate as under aerobic condition. There is no indication for accumulation in anaerobic soil systems.

CA 7.1.2.2 Field studies

CA 7.1.2.2.1 Soil dissipation studies

Even though formally not triggered under Commission Regulation (EU) No 283/2013 in accordance with Regulation (EC) No 1107/2009, field soil dissipation studies have been conducted for mesosulfuron-methyl at six European sites. The studies tested a by factor 7 exaggerated application rate of 105 g as/ha, and included spring and autumn treatments. The studies were EU evaluated and accepted during the Annex I inclusion of mesosulfuron-methyl (Review Report SANCO/10298/2003-Final, 25 June 2004).

The following studies are included in the baseline dossier:

Report:	**[redacted]:;[redacted];2000;M-198875-01**
Title:	The degradation of AE F130060 in soil following a single application of AE F130060 01 1K12 A1 at 6 locations in Europe
Report No:	C009594
Document No:	M-198875-01-1
Guidelines:	**Deviation not specified**
GLP/GEP:	**yes**

Reference	Followed guidance	Guidance currently in force	Differences	Critical assessment of the study / Deviations / conclusion about its Reliability
M-198875-01-1	1) guideline of the Biologische Bundesanstalt fur Land- und Forstwirtschaft Bundesrepublik Deutschland ([redacted] et al., Teil IV, 4-1, 1986) 2) IVA guideline ([redacted] [redacted] et al. 1993)	1) OECD Harmonized International Guidance for Pesticide Terrestrial Field Dissipation Studies and Crosswalk of North American & European Eco-Regions Part I Guidance for Conducting Pesticide Terrestrial Field Dissipation Studies (draft) 2) EFSA Guidance Document for evaluating laboratory and field dissipation studies to obtain DegT50 values of active substances of plant protection	Study not tailored for DegT50$_{matrix}$ (surface processes not minimised)	Surface processes are not expected to have significantly contributed to the field soil degradation of mesosulfuron-methyl; no relevant photo-degradation on soil surface has been observed in the laboratory (CA 7.1.1.3). Therefore, the study is considered as reliable.

	3)SETAC guideline ([redacted] [redacted] 1995).	products and transformation products of these active substances in soil		

Report:	[redacted]o; [redacted];2000;M-198499-01
Title:	Evaluation of field dissipation data from different sites in Europe Code: AE F130060
Report No:	C010143
Document No:	M-198499-01-1
Guidelines:	**not applicable (computer modelling report)**
GLP/GEP:	**not applicable (computer modelling report)**

Study KCA 7.1.2.2.1 /02, kinetic modelling evaluation of study KCA 7.1.2.2.1 /01, has been updated to comply with current FOCUS kinetic guidance (2006). Report KCA 7.1.2.2.1 /02 is therefore replaced by a new evaluation KCA 7.1.2.2.1 /03 as summarised below:

Report:	[redacted]; [redacted]; [redacted];2009;M-359355-01
Title:	Kinetic evaluation of field dissipation studies with mesosulfuron-methyl under European conditions
Report No:	MEF-09/697
Document No:	M-359355-01-1
Guidelines:	**not applicable;not applicable**
GLP/GEP:	**no**

Executive Summary

A kinetic analysis of soil residue data from the field dissipation study KCA 7.1.2.2.1 /01 (M-198875-01-1) was performed with the software MatLab and PEARL according to FOCUS kinetics (2006) to derive normalised (20 °C and field capacity) half-lives for mesosulfuron-methyl.

Single first order was the most appropriate kinetic model for simulating the degradation of mesosulfuron-methyl at the sites [redacted] (autumn and spring application, Germany), [redacted] (autumn application, Germany), [redacted] (autumn and spring application, France), [redacted] (autumn application, UK), [redacted] (spring application, Italy) and [redacted] (spring application, Spain), as well as first order multi compartment at sites [redacted] (spring application, Germany) and [redacted] (spring application, UK) under field conditions with an application rate of 105 g/ha and normalised to 20 °C and field capacity.

The normalised DT_{50} values of mesosulfuron-methyl ranged from 16.1 days to 54.0 days, the geometric mean DT_{50} value over all studies was 34.6 days. These data are consistent with the laboratory half-life information, considering biological variation, and the exaggerated dose rate tested.

I. METHODS

Soil residue data from the field dissipation study KCA 7.1.2.2.1 /01 (M-198875-01-1) were used. In this study, the degradation of mesosulfuron-methyl was studied at sites [redacted] (Germany), [redacted] (Germany), [redacted] (France), [redacted] (UK), [redacted] (Italy) and [redacted] (Spain) under field conditions for up to 12 months with an application rate of 105 g/ha. At four sites ([redacted], [redacted],

[redacted] and [redacted]) separate field plots were treated either in autumn or in spring. At [redacted] and [redacted], mesosulfuron-methyl was only applied in spring.

For the simulation of water and heat flow in soil, the PEARL model (version 1.5.8-F2) was used. The kinetic evaluations and the statistical calculations for the quality checks were implemented in the numerical software package MatLab 7.0.4.365 (MatLab, 2005) using two different kinetic models: single first order (SFO) and first-order multiple compartment (FOMC). The differential equations were integrated by a Runge-Kutta method, and the Levenberg-Marquardt algorithm was used for the non-linear parameter optimisation. All other calculations were done with Microsoft Excel XP spreadsheets. Model input datasets were the residual amounts found in each test system at each sampling interval. The most appropriate kinetic model was selected on the basis of a detailed statistical analysis including visual assessment of the goodness of the fits, chi^2 scaled-error criterion and t-test significance. The DT_{50} value was calculated from the resulting kinetic parameters.

II. RESULTS

Single first order was the most appropriate kinetic model for modelling purpose for the degradation of mesosulfuron-methyl at the sites [redacted] (autumn and spring application, Germany), [redacted] (autumn application, Germany), [redacted] (autumn and spring application, France), [redacted] (autumn application, UK), [redacted] (spring application, Italy) and [redacted] (spring application, Spain), as well as first order multi compartment at sites [redacted] (spring application, Germany) and [redacted] (spring application, UK). Results of the kinetic analysis are summarised in Table CA 7.1.2.2.1-1.

Table CA 7.1.2.2.1- 1: Kinetic parameters for the degradation of mesosulfuron-methyl in soil under field conditions for modelling purpose according to FOCUS (normalised to 20 °C and field capacity)

Site (season)	Kinetic Model [1]	DT_{50} [2] [days]	Chi^2 Error [%]	t-test	Visual Assessment [3]
[redacted] (autumn)	SFO	38.9	18.6	0.0079	o
[redacted] (spring)	SFO	17.9	13.8	0.0013	+
[redacted] (autumn)	SFO	41.6	15.1	0.0027	+
[redacted] (spring)	FOMC	44.4	2.6	α 0.0001 β 0.0026	+
[redacted] (autumn)	SFO	35.3	12.7	0.0014	+
[redacted] (spring)	SFO	38.5	15.5	0.0088	+
[redacted] (autumn)	SFO	37.4	17.7	0.0041	o
[redacted] (spring)	FOMC	16.1	10.4	α 0.0125 β 0.0911	o
[redacted] (spring)	SFO	43.0	19.1	0.01123	o
[redacted] (spring)	SFO	54.0	10.4	0.0005	+
	geomean	**34.6**			

[1] SFO: single first order, FOMC: first order multi compartment
[2] for FOMC: DT_{50} was calculated as $DT_{90}/3.32$
[3] visual assessment: + = good, o = acceptable

III. CONCLUSIONS

The normalised DT_{50} values of mesosulfuron-methyl ranged from 16.1 days to 54.0 days. The geometric mean DT_{50} value over all studies is 34.6 days. These data are consistent with the laboratory half-life information, considering biological variation, and the exaggerated dose rate tested.

CA 7.1.2.2.2 Soil accumulation studies

As concluded from the various laboratory and field degradation experiments, there there is no potential for an accumulation of residues of mesosulfuron-methyl and its major metabolites in soil following repeated application in subsequent years. Field accumulation studies have not been performed and are not required for mesosulfuron-methyl.

CA 7.1.3 Adsorption and desorption in soil

CA 7.1.3.1 Adsorption and desorption

The mobility in soil of mesosulfuron-methyl and its metabolites relevant for assessment was studied by batch equilibrium tests on a variety of different soils, except for degradate AE F140584 for which use of generic worst case parameters is proposed. An overview of the data is presented in Table 7.1.3.1-1 below. These data did not indicate a correlation of soil adsorption with soil pH for any component.

Table CA 7.1.3.1-1: Soil adsorption data of mesosulfuron-methyl and its metabolites relevant for assessment

Component / Soil	Kf [mL/g]	Koc [mL/g]	Kom [mL/g]	Freundlich exponent 1/n
Mesosulfuron-methyl				
[redacted]	1.69	345	200.1	0.85
[redacted]	3.71	137	79.5	0.93
[redacted]	0.41	37	21.5	0.93
[redacted]	0.71	31	18.0	0.91
[redacted]	2.28	86	49.9	0.90
[redacted]	0.24	26	15.1	0.92
[redacted]	0.60	36	20.9	0.93
[redacted]	1.22	85	49.3	0.90
[redacted]	0.56	48	27.8	0.93
Median		**48.0**	**27.8**	0.92
Arithmetic mean		92.3	53.6	**0.91**
Geometric mean		63.9	37.1	0.91
AE F154851				
A – USA	3.1	98	56.8	0.92
B – Germany	0.79	61	35.4	0.94
C - Germany	0.75	46	26.7	0.95
Arithmetic mean		**68.3**	**39.6**	**0.94**
Geometric mean		65.0	37.7	0.94
AE F160459				
[redacted]	0.1978	11.2	6.5	0.93
[redacted]	0.3797	15.7	9.1	0.94
[redacted] II	0.7630	16.2	9.4	0.93
[redacted]	0.1475	21.1	12.2	0.98
[redacted]	0.7590	44.6	25.9	0.93
Arithmetic mean		**21.8**	**12.6**	**0.94**
Geometric mean		19.3	11.2	0.94
AE F099095				
A – USA	42.8	1360	788.9	0.83
B – Germany	2.94	226	131.1	0.84
C - Germany	2.33	141	81.8	0.86
Arithmetic mean		**576**	**334**	**0.84**
Geometric mean		351	204	0.84

Component / Soil	Kf [mL/g]	Koc [mL/g]	Kom [mL/g]	Freundlich exponent 1/n
AE F092944				
S 2.1	2.47	211	122.4	0.69
LS 2.2	2.59	89	51.6	0.86
SL 2.3	8.25	625	362.5	0.65
Arizona A	1.05 a)	663 a)	384.6 a)	0.52 a)
Arizona B	1.82 a)	696 a)	403.7 a)	0.63 a)
SL V	4.11	395	229.1	0.78
SL 2	81.3 b)	11289 b)	6548.1 b)	0.58 b)
Kanada	16.5	917	531.9	0.62
Arithmetic mean		**447**	**260**	**0.72**
Geometric mean		336	195	0.71
AE F160460				
[redacted]	0.2069	11.5	6.7	0.9745
[redacted]	0.2258	9.4	5.5	0.8692
[redacted] II	0.3488	7.6	4.4	0.8387
[redacted]	0.0743	10.6	6.1	0.9524
[redacted]	0.5329	31.3	18.2	0.8628
Arithmetic mean		**14.1**	**8.2**	**0.90**
Geometric mean		12.2	7.1	0.90
AE F140584				
generic worst case parameters	*0*	*0*	*0*	*1.000*
AE F147447				
[redacted] AXXa	0.097	4.6	2.7	-
[redacted]	0.096	3.8	2.2	-
[redacted] AIIa	0.086	6.6	3.8	-
[redacted]	0.196	7.0	4.1	-
[redacted] II	0.181	4.1	2.4	-
Arithmetic mean		**5.2**	**3.0**	**1.00**
Geometric mean		5.1	2.9	1.00

a) value excluded, not considered in the evaluation (EU-DAR 2003, addendum)
b) variation not understood, not considered in the evaluation (EU-DAR 2003, addendum)

CA 7.1.3.1.1 Adsorption and desorption of the active substance

The adsorption and desorption behaviour of mesosulfuron-methyl in soil was studied via batch equilibrium experiments in 9 soils. The information was EU reviewed for Annex I inclusion, and was considered acceptable during the original EU review of mesosulfuron (Review Report SANCO/10298/2003-Final, 25 June 2004). The following study is included in the baseline dossier. No additional studies are submitted in the context of application for approval renewal.

Report:	**KCA 7.1.3.1.1 /01; [redacted].;200;M-186653-01**
Title:	The adsorption/desorption of (^{14}C)-AE F130060 on nine soils Code: AE F130060
Report No:	CK96E500
Document No:	M-186653-01-1
Guidelines:	**USEPA PAG-N 163-1; OECD 106; Deviation not specified**
GLP/GEP:	yes

Reference	Followed guidance	Guidance currently in force	Differences	Critical assessment of the study / Deviations / conclusion about its Reliability
M-186653-01-1	EPAPAG-N 163-1 EU: Annex II Point-7.1.2	OECD 106 (2000)	Different pre-equilibration time with $CaCl_2$ (2 h instead of 12 h)	Even though the soils were not pre-equilibrated, adsorption equilibrium pre-tests show that the adsorption equilibrium is reached for each soil and therefore, the impact of the pre-equilibration should be small to negligible. The study is considered as reliable.

EU agreed adsorption parameters according to the DAR evaluation of mesosulfuron-methyl:

Mesosulfuron-methyl

Soil type	Kf	Koc	1/n
Sand ([redacted])	1.69	345	0.85
Sandy clay loam ([redacted])	3.71	137	0.93
Loamy sand ([redacted])	0.41	37	0.93
Loamy sand ([redacted])	0.71	31	0.91
Sandy loam ([redacted])	2.28	86	0.90
Sandy loam ([redacted] [redacted])	0.24	26	0.92
Clay loam ([redacted])	0.60	36	0.93
Loam ([redacted])	1.22	85	0.90
Silt loam ([redacted])	0.56	48	0.93

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

The adsorption and desorption behaviour of major degradation products AE F154851, AE F099095 and AE F092944 were EU reviewed for Annex I inclusion, and considered acceptable during the original EU review of mesosulfuron (Review Report SANCO/10298/2003-Final, 25 June 2004).

Due to changes in data requirements (new abundance triggers for requiring metabolite assessment), new data was generated on soil adsorption of metabolites AE F160459, AE F160460, AE F140584, and AE F147447.

Metabolite AE F154581:

The following study is included in the baseline dossier:

Report:	[redacted] 5; [redacted] ;2000;M-196654-01
Title:	AE F154851: Adsorption in three soils
Report No:	1613-1490-017
Document No:	M-196654-01-1
Guidelines:	**OECD: 106;Deviation not specified**
GLP/GEP:	yes

Reference	Followed guidance	Guidance currently in force	Differences	Critical assessment of the study Deviations / conclusion about its Reliability
M-196654-01-1	OECD Guideline 106 (1981)	OECD 106 (2000)	None	Study fulfills criteria of current guideline and is considered reliable.

EU agreed adsorption parameters according to the DAR evaluation of mesosulfuron-methyl:

AE F154851

Soil type	**Kf**	**Koc**	**1/n**
Clay loam (A USA)	3.1	98	0.92
Silt loam (B Germany)	0.79	61	0.94
Sandy loam (C Germany)	0.75	46	0.95

Metabolite AE F160459:

Report:	KCA 7.1.3.1.2 /04; [redacted] 2011;M-406767-02; Amended 2015-02-19
Title:	[Phenyl-UL-14C] AE F160459: Adsorption/desorption in five different soils
Report No:	AS156
Document No:	M-406767-02-1
Guidelines:	**EU 95/36/EC amending 91/414/EEC; OECD 106; US EPA OPPTS 835.1220; Canada PMRA, 1987;not specified**
GLP/GEP:	**yes**

update note #1 – Amendment of study report:

In the case of soil "[redacted] II", a type mismatch error was identified in the table of the physicochemical characteristics of the test soils. The organic carbon content of soil [redacted] II has been stated wrong. The correct value is: 4.72 % organic carbon.

However, Koc-values given within the final report were calculated using the correct Corg-value of 4.72%. Therefore the given Koc-value is not affected by the type mismatch error.

update note #2:

During the evaluation process, RMS requested the notifier to evaluate in how far the upper test soil pH in this study was sufficiently high to exclude pH dependencies in soil adsorption – reference is made to a respective discussion at the end of Point CA7.1.2.1.2.

Executive Summary

The adsorption/desorption characteristics of [phenyl-UL-^{14}C]AE F160459 were studied in five soils in a concentration range of two orders of magnitude. The adsorption phase of the study (definitive test) was carried out in the dark at 20 ± 2 °C for 24 hours. The equilibration solution used was 0.01 M aqueous $CaCl_2$ solution. The soil-to-solution ratio was 1:1 for soils [redacted], [redacted]

[redacted] and [redacted] and 1:2 for soils [redacted] II and [redacted]. The desorption phase of the study was carried out by supplying pre-adsorbed soil specimens with fresh 0.01 M aqueous $CaCl_2$ solution. One desorption cycle was performed for all concentrations, three desorption cycles were performed for the highest concentration.

The test item did not show adsorption to the vessels and for all soils the parental mass balance after 96 h showed that > 90% of the applied [phenyl-UL-^{14}C]AE F160459 could be recovered.

In the definitive test, the overall material balance for all concentrations was in the range of 100.0-109.3%, 99.4-104.4%, 99.4-106.6%, 100.8-104.8%, and 98.4-101.4% of the applied radioactivity in soils [redacted], [redacted], [redacted] II, [redacted] and [redacted], respectively.

The calculated adsorption constants $K_{F(ads)}$ of the Freundlich isotherms ranged from 0.1475 to 0.7630 mL/g with corresponding values related to organic carbon ($K_{OC(ads)}$) to range from 11.2 to 44.6 mL/g (arithmetic mean: 21.8 mL/g). Values for the Freundlich exponent of adsorption 1/n ranged from 0.9320 to 0.9760.

Values for the coefficients of desorption according to Freundlich ($K_{F(des)}$) ranged from 0.1671 to 1.0650 mL/g with corresponding values related to organic carbon ($K_{OC(des)}$) to range from 14.3 to 62.6 mL/g (arithmetic mean: 28.4 mL/g). Values for the Freundlich exponent of desorption 1/n ranged from 0.9378 to 0.9997.

According to Briggs, the mobility of [phenyl-UL-^{14}C]AE F160459 can be classified as mobile or intermediate mobile in the tested soils.

I. MATERIALS AND METHODS

A. MATERIALS

1. Test Item

[phenyl-UL-^{14}C]AE F160459
Sample ID: KML 9023
Specific Activity: 2.74 MBq/mg (74.1 µCi/mg)
Radiochemical Purity: > 98%
Chemical Purity: > 99%

2. Test Soils

Three soils originating from Germany and two soils originating from the USA were used for the test. The soils were taken from agricultural use areas representing different geographical origins and soil properties (see Table CA 7.1.3.1.2- 1).

Table CA 7.1.3.1.2- 1: Physico-chemical properties of test soils

Parameter	Results / Units				
Soil Designation	[redacted] **(soil I)**	[redacted] **(soil II)**	[redacted] **II** **(soil III)**	[redacted] **(soil IV)**	[redacted] **(soil V)**
Geographic Location:					
City	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
State	North Rhine-Westphalia	North Rhine-Westphalia	North Rhine-Westphalia	California	Nebraska
Country	Germany	Germany	Germany	USA	USA
GPS Coordinates	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Pesticide use history	None used			Last use in 2007 (different pesticides)	Last application in 2005
Collection procedures	Packed in plastic bags			shovel, 5 gallon bucket	
Sampling depth	0-20 cm			0-6 inches (0-15.2 cm)	6-8 inches (15.2 – 20.3 cm)
Storage conditions	at ambient conditions from receipt until 2009-12-22, then at 0-10° C				
Storage length	623 days after receipt			601 days after receipt	
Soil Preparation	Air-dried and sieved (2 mm)				
Soil Taxonomic Classification (USDA)	no information available				
Soil Series	no information available				
Textural Class (USDA)	Loam	Silt loam	Clay loam	Sandy loam	Silt loam
Sand [2000– 50 µm]	51%	27%	31%	56%	12.7%
Silt [50 – 2 µm]	28%	54%	38%	32.6%	60.8%
Clay [< 2 µm]	21%	19%	31%	11.4%	26.5%
pH $CaCl_2$	5.3	6.6	7.3	6.7	6.6
pH water	5.5	6.8	7.4	6.8	7.2
Organic Carbon	1.8%	2.4%	~~4.6~~ 4.72%	0.7%	1.7%
Organic Matter [1]	3.1%	4.1%	~~7.9~~ 8.1%	1.1%	2.9%
Cation Exchange Capacity [meq/100 g]	10.8	13.9	21.9	16.1	16.1

[1] % organic matter = % organic carbon x 1.724

GPS: global positioning system

USDA: United States Department of Agriculture

B. STUDY DESIGN

1. Experimental Conditions

The test system for adsorption and desorption in batch equilibrium experiments consisted of borosilicate glass centrifuge tubes (volume 42 or 83 mL) and Teflon® lined screw caps. In general, the respective amounts of dry weight of soil (< 2 mm) were weighed into the test tubes and pre-equilibrated with 18 or 45 mL of 0.01 M aqueous $CaCl_2$ solution (corrected by soil humidity). Then, 2 or 5 mL of the respective application solution were added and the flasks were shaken for the respective time intervals.

In preliminary tests, the solubility and stability of the test item in $CaCl_2$ solution, the adsorption of the test item to the test system surface, the optimal soil-to-solution ratio, the appropriate adsorption equilibration time and the stability of the test item in presence of soil were determined.

In the definitive test 20 g (soils: [redacted], [redacted] and [redacted]) and 10 g (soils: [redacted] II and [redacted]) were weighed into centrifuge tubes, and 18 mL of aqueous 0.01 M $CaCl_2$ stock solution were added. After pre-equilibration, 2 mL of the respective application solution were spiked in. The batches were equilibrated for 24 h at 20 ± 2 °C in the dark on an overhead shaker (20 rpm). After adsorption, one single point desorption was performed on all concentrations. The volume of solution removed by centrifugation and decantation was replaced by an equal volume of fresh $CaCl_2$ solution. The test vessels were then shaken for further 24 h. Two further desorption steps were performed for the samples with the highest concentration.

2. Analytical Procedures

The suspensions were centrifuged (approx. 10 min., 4200 x *g*) and the radioactivity contents in the supernatants were analysed by liquid scintillation counting (LSC). In the definitive test, the pH value was measured in all supernatants of the adsorption phase. The partition of the test item in the adsorption and desorption batch equilibrium experiment was determined based on the radioactivity content in the supernatant only. After desorption, the soil specimen were mixed with approximately 0.4 g cellulose/g soil, air-dried, homogenized and combusted. The resulting carbon dioxide was trapped and analyzed by LSC to establish the material balance.

In the preliminary parental mass balance test, the soil was extracted with 40 mL acetonitrile/0.02 M ammonium carbonate 1/1 (*v/v*) for 30 min. (15 min. using ultrasonic bath) and up to four times with 40 mL acetonitrile/0.02 M ammonium carbonate 7/3 (*v/v*) for 30 min. (15 min. using ultrasonic bath). The amount of radioactivity of the combined extraction solvents was determined by LSC. The amount of the test item in the combined and concentrated extracts was investigated by means of HPLC with radiodetection.

In HPLC/radiodetection analysis, all signals higher than 50 cpm and with a minimum area of 100 area units were integrated. The background was calculated as the cpm-mean value (e.g. 8.5 cpm) of HPLC-runs performed without radioactivity.

3. Calculations

Amounts of test item are expressed as percentage of the applied radioactivity, or as test item concentration after conversion by the specific radioactivity. The amount of test item adsorbed to the soil was calculated by subtracting the plateau (adsorption equilibrium) concentration in the supernatant solution from the initial concentration (applied concentration). The calculation of the distribution of the test item after desorption was based on the plateau radioconcentration measured in the supernatant in the desorption step. All calculations were carried out considering the radioactivity carried over from the adsorption step within the sedimented soil interstitial water.

The equilibrium partitioning in adsorption and desorption measured for five concentration dilution series per soil was used to calculate Freundlich isotherms for adsorption and desorption. Based on the Freundlich K_F-values, the respective Freundlich $K_{F,OC}$-values were derived by normalisation for the soil organic carbon content.

II. RESULTS AND DISCUSSION

A. MATERIAL BALANCE AND RESULTS OF PRELIMINARY TESTS

In preliminary tests it was shown, that the test item did not show significant adsorption to the inner surfaces of the test vessels. No breakdown of the test item in pure $CaCl_2$-solutions was determined in HPLC-analysis. Furthermore, the optimal soil-to-solution ratios were determined as well as the appropriate adsorption equilibration time and the stability of the test item. Parental Mass Balances were ≥ 90% for all soils after 96 h equilibration time calculated as recovery of the test item in supernatants and soil extracts (see Table CA 7.1.3.1.2- 2).

Table CA 7.1.3.1.2- 2: Parental mass balance after incubation for 96 hours, respectively, calculated as percentage of applied in solution and soil extract.

Soil No./ Matrices	I	II	III	IV	V
Test item in supernatant [% AR]	42.5	35.19	43.55	49.02	44.71
Test item in solid phase [% AR]	48.79	55.59	48.79	43.51	45.18
Test item recovery [% AR]	**91.28**	**90.78**	**92.34**	**92.54**	**89.89**

In the definitive test, mean material balances were 102.6, 100.5, 102.0, 103.0 and 100.2% of applied radioactivity [% AR] for soils [redacted], [redacted], [redacted] II, [redacted] and [redacted], respectively (see Table CA 7.1.3.1.2- 3). The complete material balances found for all soils and concentrations demonstrated that no significant amounts of radioactivity dissipated from the test systems or were lost during sample processing.

Table CA 7.1.3.1.2- 3: Overall material balance for the five test soils after adsorption, desorption and combustion, expressed as percentage of applied radioactivity

Soil No.		**I**	**II**	**III**	**IV**	**V**
Soil		[redacted]	[redacted]	[redacted] **II**	[redacted]	[redacted]
		Recovery	**Recovery**	**Recovery**	**Recovery**	**Recovery**
Nominal Test concentration [mg/L]	**Repl.**	**[% AR]**	**[% AR]**	**[% AR]**	**[% AR]**	**[% AR]**
1.0	a	100.0	99.4	100.3	100.8	98.9
	b	100.1	98.8	99.4	101.1	98.4
0.3	a	101.3	100.1	101.8	102.7	100.5
	b	101.4	98.5	100.9	102.3	99.9
0.10	a	102.6	100.7	102.0	104.1	101.3
	b	102.0	101.2	103.1	103.3	100.9
0.03	a	101.9	100.8	101.3	102.7	98.7
	b	101.4	98.6	101.5	103.4	100.7
0.01	a	105.5	102.0	103.1	104.8	101.3
	b	109.3	104.4	106.6	104.5	101.4
Mean (arithmetic)		**102.6**	**100.5**	**102.0**	**103.0**	**100.2**

Data are calculated based on sum of radioactivity in removed supernatants after adsorption and desorption steps and final soil combustion.

B. DEGRADATION OF PARENT COMPOUND

The parental mass balance test showed that the test item was stable over a period of 96 hours (see Table CA 7.1.3.1.2- 2).

C. FINDINGS

Based on the results of the preliminary test for the adequate soil-to-solution ratio, the definitive tests were performed at ratios of 1:1 (soils [redacted], [redacted] and [redacted]) and 1:2 (soils [redacted] II and [redacted]). The equilibration time for adsorption and desorption was 24 hours, respectively, for all soils.

Within definitive tests, 17.2-21.9%, 27.7-33.6%, 28.5-36.0%, 12.7-14.4%, and 28.9-35.2% of the applied test material (mean values) was adsorbed in soils [redacted], [redacted], [redacted]II, [redacted], [redacted] respectively (see Table CA 7.1.3.1.2- 4).

At the end of one adsorption and one desorption phase, 33.3-38.0%, 23.7-25.1%, 34.6-39.0%, 43.6-56.0%, and 33.5-38.8% of the initially adsorbed amount (mean values) were desorbed in soils [redacted] [redacted], [redacted], [redacted] II, [redacted], [redacted], respectively (see Table CA 7.1.3.1.2- 5).

The adsorption behaviour of [phenyl-UL-^{14}C]AE F160459 within a nominal concentration range of 0.01 to 1.0 mg/L could be accurately described by the Freundlich equation for all soils (Table CA 7.1.3.1.2- 6). The adsorption constants $K_{F(ads)}$ of the Freundlich isotherms ranged from 0.1475 to 0.7630 mL/g with associated Freundlich exponents 1/n to be below 1 for all soils (0.9267 to 0.9760). The adsorption behaviour to soil was thus to some extent affected by the concentration of the test item. The corresponding correlation coefficients of the adsorption isotherms ranged from 0.9992 to 1.000, therefore indicating a good linear fit to the measured data.

When being normalized for organic carbon content of soil, values of $K_{OC(ads)}$ varied from 11.2 mL/g (soil [redacted]) to 44.6 mL/g (soil [redacted]) with an arithmetic mean of 21.8 mL/g.

Using the Briggs classifications for the estimation of the mobility of crop protection agents in soil, [phenyl-UL-^{14}C]AE F160459 can be classified as mobile or intermediate mobile in the tested soils.

Desorption constants $K_{F(des)}$ according to Freundlich ranged from 0.1671 mL/g (soil [redacted]) to 1.0650 mL/g (soil [redacted]). The corresponding values for $K_{OC(des)}$ ranged from 14.3 mL/g (soil [redacted]) to 62.6 mL/g (soil [redacted]) to result in an arithmetic mean of 28.4 mL/g.
$K_{OC(des)}$ values were thus slightly higher than the corresponding values of $K_{OC(ads)}$, indicating a strengthening of binding of [phenyl-UL-^{14}C]AE F160459 once adsorbed to soil particles.

Table CA 7.1.3.1.2- 4: Definitive test: Concentration of [phenyl-UL-^{14}C]AE F160459 in aqueous and soil phase at the end of the adsorption period (mean ± s.d.)

Concentration of a.s.	Soil[A] (mg/kg)	Solution (mg/L)	Percentage adsorbed
	Soil [redacted]		
0.010 mg/L	0.002	0.007	21.9 ± 0.1
0.028 mg/L	0.006	0.022	20.8 ± 0.7
0.094 mg/L	0.017	0.077	17.8 ± 1.0
0.285 mg/L	0.051	0.234	17.8 ± 1.5
0.981 mg/L	0.169	0.813	17.2 ± 0.4
	Soil [redacted]		
0.009 mg/L	0.003	0.006	33.5 ± 0.5
0.028 mg/L	0.009	0.019	33.6 ± 0.3
0.093 mg/L	0.029	0.065	30.7 ± 0.1
0.284 mg/L	0.084	0.199	29.8 ± 0.6
0.976 mg/L	0.270	0.705	27.7 ± 0.9
	Soil [redacted] II		
0.010 mg/L	0.007	0.006	36.0 ± 1.3
0.028 mg/L	0.019	0.019	34.3 ± 0.0
0.094 mg/L	0.059	0.064	32.0 ± 1.2
0.285 mg/L	0.170	0.199	30.3 ± 0.8
0.980 mg/L	0.551	0.701	28.5 ± 0.4
	Soil [redacted]		
0.010 mg/L	0.001	0.008	14.3 ± 1.0
0.028 mg/L	0.004	0.024	14.4 ± 0.6
0.094 mg/L	0.012	0.082	12.7 ± 0.1
0.285 mg/L	0.037	0.249	12.8 ± 0.2
0.982 mg/L	0.132	0.850	13.4 ± 0.1
	Soil [redacted]		
0.009 mg/L	0.007	0.006	35.2 ± 0.1
0.028 mg/L	0.019	0.018	34.2 ± 0.8
0.093 mg/L	0.058	0.064	31.4 ± 0.3
0.284 mg/L	0.163	0.200	29.3 ± 0.5
0.976 mg/L	0.554	0.693	28.9 ± 0.0

[A] The amount of test item adsorbed to the soil was calculated by subtracting the equilibrium concentration in the solution from the initial concentration (applied concentration).

Table CA 7.1.3.1.2- 5: Definitive test: Concentration of [phenyl-UL-^{14}C]AE F160459 in aqueous and soil phase at the end of desorption (mean ± s.d.)

Concentration of a.s.	Soil* (mg/kg)	Solution (mg/L)	Percentage desorbed*
Soil [redacted]			
0.010 mg/L	0.001	0.004	33.3 ± 3.3
0.028 mg/L	0.004	0.011	34.9 ± 0.2
0.094 mg/L	0.010	0.039	38.0 ± 0.7
0.285 mg/L	0.032	0.117	37.4 ± 3.0
0.981 mg/L	0.112	0.389	33.5 ± 1.3
Soil [redacted]			
0.009 mg/L	0.002	0.004	24.7 ± 1.2
0.028 mg/L	0.007	0.011	23.7 ± 0.6
0.093 mg/L	0.022	0.037	24.9 ± 0.2
0.284 mg/L	0.064	0.113	24.0 ± 0.3
0.976 mg/L	0.202	0.385	25.1 ± 0.9
Soil [redacted] II			
0.010 mg/L	0.004	0.003	34.6 ± 1.8
0.028 mg/L	0.012	0.010	35.2 ± 0.2
0.094 mg/L	0.036	0.033	38.8 ± 1.1
0.285 mg/L	0.104	0.098	39.0 ± 1.4
0.980 mg/L	0.359	0.335	34.8 ± 0.6
Soil [redacted]			
0.010 mg/L	0.001	0.004	52.0 ± 5.2
0.028 mg/L	0.002	0.011	53.1 ± 0.3
0.094 mg/L	0.005	0.037	56.0 ± 2.9
0.285 mg/L	0.017	0.112	52.9 ± 2.1
0.982 mg/L	0.075	0.393	43.6 ± 0.8
Soil [redacted]			
0.009 mg/L	0.004	0.003	33.5 ± 0.0
0.028 mg/L	0.012	0.008	35.4 ± 1.6
0.093 mg/L	0.037	0.028	37.3 ± 0.0
0.284 mg/L	0.100	0.086	38.8 ± 0.3
0.976 mg/L	0.352	0.291	36.4 ± 0.1

* The calculation of the distribution of the test item after desorption was based on the concentration measured in the supernatant after the desorption step.

Table CA 7.1.3.1.2- 6: Adsorption and desorption constants of [phenyl-UL-^{14}C]AE F160459 in soils

Soil	Soil type	Adsorption					Desorption			
		pH	$K_{F(ads)}$ [mL/g]	1/n	R^2	$K_{OC(ads)}$ [mL/g]	$K_{F(des)}$ [mL/g]	1/n	R^2	$K_{OC(des)}$ [mL/g]
[redacted]	Loam	5.3	0.1978	0.9320	0.9993	11.2	0.2512	0.9412	0.9978	14.3
[redacted]	Silt loam	6.6	0.3797	0.9388	0.9998	15.7	0.5072	0.9527	0.9998	21.0
[redacted] II	Clay loam	7.3	0.7630	0.9267	1.0000	16.2	0.9580	0.9422	0.9994	20.3
[redacted]	Sandy loam	6.7	0.1475	0.9760	0.9992	21.1	0.1671	0.9997	0.9959	23.9
[redacted]	Silt loam	6.6	0.7590	0.9324	0.9998	44.6	1.0650	0.9378	0.9994	62.6
Mean (arithmetic)			0.4494	0.9412	0.9996	21.8	0.5897	0.9547	0.9984	28.4

pH: Value given as determined with 0.01 M calcium chloride solution
K_F: Freundlich coefficient of adsorption (ads) and desorption (des)
1/n : Slope of the Freundlich adsorption/desorption isotherms
K_{oc}: Adsorption/desorption coefficient per organic carbon (K x 100/% organic carbon)
R^2: Regression coefficient of Freundlich equation

III. CONCLUSIONS

Based on the soil sorption parameters measured in this study and classification of soil mobility potential according to Briggs, [phenyl-UL-^{14}C]AE F160459 can be classified as mobile or intermediate for adsorption and for desorption in the soils.

Metabolite AE F099095:

The following study is included in the baseline dossier:

Report:	[redacted]1;[redacted];2000;M-196658-01
Title:	AE F099095: Adsorption in three soils
Report No:	1013-1490-016
Document No:	M-196658-01-1
Guidelines:	**OECD: 106;Deviation not specified**
GLP/GEP:	**yes**

Reference	Followed guidance	Guidance currently in force	Differences	Critical assessment of the study / Deviations / conclusion about its Reliability
M-196658-01-1	OECD Guideline 106 (1981)	OECD 106 (2000)	No LOD stated for HPLC analysis	Besides LOD for HPLC study fulfills current guidelines. Chromatograms of main test indicate a sufficiently low LOD of at least 1% AR. Therefore, the study is considered as reliable.

EU agreed adsorption parameters according to the DAR evaluation of mesosulfuron-methyl:

AE F099095

Soil type	Kf	Koc	1/n
Clay loam (A USA)	42.8	1360	0.83
Silt loam (B Germany)	2.94	226	0.84
Sandy loam (C Germany)	2.33	141	0.86

Metabolite AE F092944:

The following study is included in the baseline dossier:

Report:	[redacted]t; [redacted]; [redacted];1992;M-136973-01
Title:	Adsorption/Desorption of 2-amino-4,6-dimethoxypyrimidine (Hoe 092944) in the system soil/water
Report No:	CP91/093
Document No:	M-136973-01-1
Guidelines:	**OECD: 106;Deviation not specified**
GLP/GEP:	**yes**

Reference	Followed guidance	Guidance currently in force	Differences	Critical assessment of the study / Deviations – conclusion about its Reliability
M-136973-01-1	OECD Guideline 106 (1981)	OECD 106 (2000)	1) No pre-equilibration of soil prior to application 2) Test item concentration covers only one order of magnitude 3) No LOD for LSC and HPLC specified	1) Even if the soils were not pre-equilibrated, adsorption equilibrium pre-tests show that the adsorption equilibrium is reached for each soil and therefore, the impact of the pre-equilibration should be small to negligible. 2) The high r² values (0.9716 to 0.9996) showed that the results were well described using the Freundlich equation 3) Even though LOD for LSC and HPLC analysis are not specified, parental mass balances fulfill current guideline criteria (> 90%) and therefore the accuracy of the measurement is sufficient.

EU agreed adsorption parameters according to the DAR evaluation of mesosulfuron-methyl:

AE F092944

Soil type	Kf	Koc	1/n
Sand (S 2.1)	2.47	211	0.69
Loamy sand (LS 2.2)	2.59	89	0.86
Loamy sand (SL 2.3)	8.25	625	0.65
Loamy sand (Arizona A)	1.05 [a)]	663 [a)]	0.52 [a)]
Sandy loam (Arizona B)	1.82 [a)]	696 [a)]	0.63 [a)]
Sandy loam (SL V)	4.11	395	0.78
Silt loam (SL 2)	81.3 [b)]	11289 [b)]	0.58 [b)]
Silty clay (Kanada)	16.5	917	0.62

a) value excluded (EU 2003, addendum), not considered in the evaluation
b) variation not understood, not considered in the evaluation

Metabolite AE F160460:

Report:	[redacted] ü; [redacted] ;2009;M-362125-01
Title:	[Phenyl-UL-14C] AE F160460: Adsorption/desorption in five different soils
Report No:	AS122
Document No:	M-362125-01-1
Guidelines:	**EU 95/36/EC amending 91/414/EEC; OECD 106; US EPA Subdivision N, Section 163-1;not specified**
GLP/GEP:	**yes**

update note: During the evaluation process, RMS requested the notifier to evaluate in how far the upper test soil pH in this study was sufficiently high to exclude pH dependencies in soil adsorption – reference is made to a respective discussion at the end of Point CA7.1.2.1.2.

Executive Summary

The adsorption/desorption characteristics of [phenyl-UL-^{14}C]AE F160460 were studied in five soils in a concentration range of two orders of magnitude using batch equilibrium experiments. The adsorption phase of the study (definitive test) was carried out in the dark at 20 ± 2 °C for 24 hours using pre-equilibrated air-dried soil. The equilibration solution used was 0.01 M aqueous $CaCl_2$ solution with a soil to solution ratio of 1:1 for the soils [redacted] and [redacted]. For the soils [redacted], [redacted] II and [redacted] a 0.01 M aqueous $CaCl_2$ solution with 50 ppm biocide (50 ppm of $HgCl_2$) was used as equilibration solution with a soil to solution ratio of 1:2.

The Parental Mass Balance after 24 h showed that 92.1-102.0% of applied [phenyl-UL-^{14}C]AE F160460 could be recovered for the soils [redacted], [redacted] II and [redacted] with biocide and 94.2-97.0% for the soils [redacted] and [redacted] without biocide.

In the definitive test, the overall material balance for all concentrations was in the range of 96.8-105.8%, 97.2-102.0%, 97.9-102.1%, 98.4-101.9% and 96.2-99.4% of the applied radioactivity in soils [redacted], [redacted], [redacted] II, [redacted] and [redacted], respectively.

The calculated adsorption constants $K_{F(ads)}$ of the Freundlich isotherm ranged from 0.0743 mL/g to 0.5329 mL/g with corresponding values related to organic carbon $K_{OC(ads)}$ to range from 7.6 mL/g to

31.3 mL/g (arithmetic mean: 14.1 mL/g). Values for the Freundlich exponent of adsorption 1/n ranged from 0.8387 to 0.9745.

Values for the coefficients of desorption according to Freundlich $K_{F(des)}$ ranged from 0.0477 to 0.9359 mL/g with corresponding values related to organic carbon $K_{OC(des)}$ to range from 6.8 to 55.1 mL/g (arithmetic mean: 20.1 mL/g). Values for the Freundlich exponent of desorption 1/n ranged from 0.8306 to 0.9725.

According to Briggs, the mobility of [phenyl-UL-^{14}C]AE F160460 can be classified as very mobile to mobile for adsorption and for desorption.

I. MATERIALS AND METHODS

A. MATERIALS

1. Test Item

[phenyl-UL-^{14}C]AE F160460

Sample ID:	KATH 6295
Specific Activity:	3.08 MBq/mg (83.2 µCi/mg)
Radiochemical Purity:	99%
Chemical Purity:	> 99%

2. Test Soils

Three soils originating from Germany and two soils originating from the USA were used for the test. The soils were taken from agricultural use areas representing different geographical origins and soil properties (see Table CA 7.1.3.1.2- 7).

Table CA 7.1.3.1.2- 7: Physico-chemical properties of test soils

Parameter	**Results / Units**				
Soil Designation	[redacted] **(soil I)**	[redacted] **(soil II)**	[redacted] **II (soil III)**	[redacted] **(soil IV)**	[redacted] **(soil V)**
Geographic Location: City State Country	[redacted] North Rhine-Westphalia Germany	[redacted] North Rhine-Westphalia Germany	[redacted] North Rhine-Westphalia Germany	[redacted] California USA	[redacted] Nebraska USA
GPS Coordinates	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Pesticide use history	None used for the previous five years			Last use in 2007 (different pesticides)	Last application in 2004
Collection procedures	Sample taken with shovel and placed in plastic bags			shovel, 5 gallon bucket	
Sampling depth	0-20 cm			0-6 inches (0-15.2 cm)	6-8 inches (15.2 – 20.3 cm)
Storage conditions	At room temperature (at receiving facility)				
Storage length	75 days after receipt			53 days after receipt	
Soil Preparation	Air-dried and sieved (2 mm)				
Soil Taxonomic Classification (USDA)	no information available				
Soil Series	no information available				
Textural Class (USDA) Sand [2000 – 50 µm] Silt [50 - 2 µm] Clay [< 2 µm]	Loam 51% 28% 21%	Silt loam 27% 54% 19%	Clay loam 31% 38% 31%	Sandy loam 56% 32.6% 11.4%	Silt loam 12.7% 60.8% 26.5%
pH $CaCl_2$ pH water	5.3 5.5	6.6 6.8	7.3 7.4	6.7 6.8	6.6 7.2
Organic Carbon Organic Matter [1]	1.8% 3.10%	2.4% 4.1%	4.6% 7.9%	0.7% 1.1%	1.7% 2.9%
Cation Exchange Capacity [meq/100 g]	10.8	13.9	21.9	16.1	16.1

[1] % organic matter = % organic carbon x 1.724

GPS: global positioning system

USDA: United States Department of Agriculture

B. STUDY DESIGN

1. Experimental Conditions

The test system for adsorption and desorption in batch equilibrium experiments consisted of borosilicate glass centrifuge tubes (volume 42 or 83 mL) and Teflon® lined screw caps. In general, the respective amounts of dry weight of soil (< 2 mm) were weighed into the test tubes and 18 or 45 mL of 0.01 M aqueous $CaCl_2$ solution (with or without biocide) were added (corrected by soil humidity). After pre-equilibration, 2 or 5 mL of the respective application solution were added and the flasks were shaken for the respective time intervals.

In preliminary tests, the solubility and stability of the test item in $CaCl_2$ solution, the adsorption of the test item to the test system surface, the optimal soil-to-solution ratio, the appropriate adsorption equilibration time and the stability of the test item in presence of soil were determined (parental mass balance test).

In the definitive test, the adsorption phase of the study was carried out in duplicate using pre-equilibrated air-dried soil with [phenyl-UL-^{14}C]AE F160460 applied at nominal concentrations of 1, 0.3, 0.1, 0.03, and 0.01 mg/L in the dark at 20 ± 2 °C for 24 hours. The equilibration solution used was 0.01 M aqueous $CaCl_2$ solution with a soil to solution ratio of 1:1 for the soils [redacted] and [redacted] (20 g soil and 20 g solution). For the soils [redacted], [redacted] II and [redacted] a 0.01 M aqueous $CaCl_2$ solution with 50 ppm biocide (50 ppm of $HgCl_2$) was used as equilibration solution with a soil to solution ratio of 1:2 (10 g soil and 20 mL solution). The desorption phase of the study was carried out by supplying pre-adsorbed soil specimens with fresh equilibration solution for one desorption cycle.

2. Analytical Procedures

The suspensions were centrifuged (approx. 10 min., 4200 x *g*) and the radioactivity contents in the supernatants were analysed by liquid scintillation counting (LSC). In the definitive test, the pH value was measured in all supernatants. The partition of the test item in the adsorption and desorption batch equilibrium experiment was determined based on the radioactivity content in the supernatant only. After the desorption step, the soil specimen were mixed with approximately 0.4 g cellulose/g soil, air-dried, homogenized and combusted (except for the 1.0 mg/L concentration of soil [redacted]). The resulting carbon dioxide was trapped and analyzed by LSC to establish the material balance.

In the preliminary parental mass balance test, the soil was extracted with 1 x 40 mL acetonitrile/0.02 M ammonium carbonate = 1/1 (*v/v*) and three or four times with 40 mL acetonitrile/0.02 M ammonium carbonate = 7/3 (*v/v*) for 30 min plus at least 10 min ultrasonic bath. The amount of radioactivity of the combined extraction solvents was determined by LSC. The amount of the test item in the combined and concentrated extracts was investigated by means of HPLC with radiodetection. Radioactivity remaining in the soil was quantified after combustion in a sample oxidiser. Due to the observed insufficient parental mass balance that was determined for soil III and V the test was repeated using a lower soil-to-solution ratio (1:2) and 50 ppm $HgCl_2$ as biocide. The stability of the test item in soil II was investigated using the 1.0 mg/L concentration samples of the definitive test. For this purpose the adsorption as well as the desorption solution were investigated by HPLC with radiodetection. The soil residue was extracted once with 20 mL acetonitrile/0.02 M ammonium-carbonate 1/1 (*v/v*) and three times with 20 mL acetonitrile/0.02 M ammonium carbonate 7:3 (*v/v*) for 30 min followed by 15 min of sonication. The extracts were as well analyzed by

HPLC/radiodetection. The soil residues were combusted like the other soil residues in order to determine the amount of non-extractable residues.

In HPLC/radiodetection analysis, all signals higher than 50 cpm and with a minimum area of 100 area units were integrated. The background was calculated as the cpm-mean value (e.g. 8.94 pm) of HPLC-runs performed without radioactivity.

3. Calculations

Amounts of test item are expressed as percentage of the applied radioactivity, or as test item concentration after conversion by the specific radioactivity. The amount of test item adsorbed to the soil was calculated by subtracting the plateau (adsorption equilibrium) concentration in the supernatant solution from the initial concentration (applied concentration). The calculation of the distribution of the test item after desorption was based on the plateau radioconcentration measured in the supernatant in the desorption step. All calculations were carried out considering the radioactivity carried over from the adsorption step within the sedimented soil interstitial water.

The equilibrium partitioning in adsorption and desorption measured for five concentration dilution series per soil was used to calculate Freundlich isotherms for adsorption and desorption. Based on the Freundlich K_F-values, the respective Freundlich $K_{F,OC}$-values were derived by normalisation for the soil organic carbon content.

II. RESULTS AND DISCUSSION

A. MATERIAL BALANCE AND RESULTS OF PRELIMINARY TESTS

In preliminary tests it was shown, that the test item did not show significant adsorption to the inner surfaces of the test vessels. No breakdown of the test item in pure $CaCl_2$-solutions was determined in HPLC-analysis. Furthermore, the optimal soil-to-solution ratios were determined as well as the appropriate adsorption equilibration time and the stability of the test item in presence of soil. With a soil-to-solution ratio of 1:1, the parental mass balances after 48 hours were > 90% for soils [redacted] and [redacted]. For soils [redacted], [redacted] II and [redacted] parental mass balances > 90% were obtained using a soil-to-solution ratio of 1:2 and an aqueous phase containing $HgCl_2$ to minimise biotic processes (see Table CA 7.1.3.1.2- 8).

Table CA 7.1.3.1.2- 8: Parental mass balance after incubation for 48 hours, respectively, calculated as percentage of applied radioactivity in aqueous supernatants and soil extracts

Soil No./ Matrices	I	II[A]	III[B]	IV	V[B]
Test item in supernatant [% AR]	43.21	(64.13 + 21.27) / (62.95 +21.06)	53.79	52.10	56.02
Test item in solid phase [% AR]	48.06	15.21 / 14.61	41.94	40.64	36.35
Test item recovery [% AR]	**91.27**	**100.6 / 99.0**	**95.73**	**92.74**	**92.37**

[A] Determined within the definitive test for replicate a/b, respectively (soil-to-solution ratio: 1:2, 50 ppm $HgCl_2$). The amount of test item in the supernatant represents the sum of the test item in solution after adsorption and desorption

[B] for soils [redacted] II and [redacted], the parental mass balance test was repeated using a soil-to-solution ratio of 1:2 and 50 ppm $HgCl_2$

In the definitive test, mean material balances were 100.7, 99.7, 100.0, 99.8 and 98.4% of applied radioactivity [% AR] for soils [redacted], [redacted], [redacted] II, [redacted] and [redacted], respectively (see Table CA 7.1.3.1.2- 9). The complete material balances found for all soils and concentrations demonstrated that no significant amounts of radioactivity dissipated from the test systems or were lost during sample processing.

Table CA 7.1.3.1.2- 9: Overall material balance for the five test soils after adsorption, desorption and soil combustion, expressed as percentage of applied radioactivity

Soil No.		I	II	III	IV	V
Soil		[redacted]	[redacted]	[redacted] II	[redacted]	[redacted]
		Recovery	Recovery	Recovery	Recovery	Recovery
Nominal Test concentration (mg/L)	Repl.	[% AR]	[% AR]	[% AR]	[% AR]	[% AR]
1.0	a	100.1	102.0	100.1	99.7	99.1
	b	100.1	101.0	100.3	99.8	99.2
0.3	a	96.8	97.2	100.8	99.3	99.4
	b	99.4	101.2	100.1	100.0	99.2
0.10	a	99.9	99.4	99.7	101.9	99.2
	b	100.5	99.9	99.6	100.8	98.9
0.03	a	101.3	98.8	98.6	99.8	97.2
	b	100.1	97.4	97.9	100.2	96.2
0.1	a	103.0	98.3	100.8	98.4	97.9
	b	105.8	101.6	102.1	98.5	97.9
Mean (arithmetic)		**100.7**	**99.7**	**100.0**	**99.8**	**98.4**

Data are calculated based on sum of radioactivity in removed supernatants after adsorption and desorption steps and final soil combustion.

B. DEGRADATION OF PARENT COMPOUND

The parental mass balance after 48 h showed that 92.37–100.6% of applied [phenyl-UL-^{14}C]AE F160460 could be recovered for the soils [redacted], [redacted] II and [redacted] with $HgCl_2$ and 91.27-92.74% AR for the soils [redacted] and [redacted] without $HgCl_2$.

C. FINDINGS

Based on the results of the preliminary test for the adequate soil-to-solution ratio, the definitive tests were performed at ratios of 1:1 (soils [redacted] and [redacted]) or 1:2 (soils [redacted], [redacted] II and [redacted]). For soils [redacted], [redacted] II and [redacted], 0.01 M aqueous $CaCl_2$ solution with 50 ppm biocide (50 ppm of $HgCl_2$) was used as equilibration solution. The equilibration time for adsorption and desorption was 24 hours, respectively, for all soils.

Within the definitive tests, the portion of [phenyl-UL-^{14}C]AE F160460 adsorbed to soil after 24 hours was found to be 16.4-18.9%, 9.6-18.8%, 17.0-31.9%, 6.6-8.5% and 19.9-36.0% AR in soils [redacted], [redacted], [redacted] II, [redacted] and [redacted], respectively (Table CA 7.1.3.1.2- 10).

Following 24 hours of desorption, the corresponding values for radioactivity desorbed amounted to 26.3 to 31.6%% of initially adsorbed radioactivity for soil [redacted], 32.4 to 48.8% for soil [redacted], 36.4 to 46.6% for soil [redacted] II, 47.2 to 58.8% for soil [redacted] and 27.9 to 32.9% for soil [redacted] (Table CA 7.1.3.1.2- 11).

The adsorption behaviour of [phenyl-UL-^{14}C]AE F160460 within a nominal concentration range of 0.01 to 1.0 mg/L could be accurately described by the Freundlich equation for all soils (Table CA 7.1.3.1.2- 12). The adsorption constants $K_{F(ads)}$ of the Freundlich isotherms ranged from 0.0743 to 0.5329 mL/g with associated Freundlich exponents 1/n to be below 1 for all soils (0.8387 to 0.9745). The adsorption behaviour to soil was thus to some extent affected by the concentration of the test item. The corresponding correlation coefficients of the adsorption isotherms ranged from 0.9862 to 0.9992, therefore indicating a good linear fit to the measured data.

When being normalized for organic carbon content of soil, values of $K_{OC(ads)}$ varied from 7.6 mL/g (soil [redacted] II) to 31.3 mL/g (soil [redacted]) with an arithmetic mean of 14.1 mL/g.

Desorption constants $K_{F(des)}$ according to Freundlich ranged from 0.0477 mL/g (soil [redacted]) to 0.9359 mL/g (soil [redacted]). The corresponding values for $K_{OC(des)}$) ranged from 6.8 mL/g (soil [redacted]) to 55.1 mL/g (soil [redacted]) to result in an arithmetic mean of 20.1 mL/g.
$K_{OC(des)}$ values were thus slightly higher than the corresponding values of $K_{oc(ads)}$, indicating a strengthening of binding of [phenyl-UL-^{14}C]AE F160460 once adsorbed to soil particles.

Using the Briggs classifications for the estimation of the mobility of crop protection agents in soil, [phenyl-UL-^{14}C]AE F160460 can be classified as very mobile to mobile for adsorption and for desorption in the soils.

Table CA 7.1.3.1.2-10: Definitive test: Concentration of [phenyl-UL-^{14}C]AE F160460 in aqueous and soil phase at the end of the adsorption period (mean ± s.d.)

Concentration of a.s.	Soil (mg/kg)	Solution (mg/L)	Percentage adsorbed^{A}

Concentration of a.s.	Soil (mg/kg)	Solution (mg/L)	Percentage adsorbed[A]
Soil [redacted]			
0.010 mg/L	0.002	0.008	18.7 ± 0.6
0.030 mg/L	0.005	0.024	18.5 ± 0.9
0.099 mg/L	0.018	0.081	17.9 ± 0.9
0.299 mg/L	0.057	0.243	18.9 ± 0.5
0.999 mg/L	0.164	0.835	16.4 ± 0.5
Soil [redacted]			
0.010 mg/L	0.003	0.008	15.6 ± 0.4
0.029 mg/L	0.011	0.024	18.8 ± 0.2
0.099 mg/L	0.029	0.084	14.9 ± 0.3
0.289 mg/L	0.055	0.261	9.6 ± 2.2
0.987 mg/L	0.219	0.876	11.3 ± 0.7
Soil [redacted] **II**			
0.010 mg/L	0.006	0.007	31.9 ± 0.1
0.029 mg/L	0.013	0.023	22.1 ± 4.5
0.099 mg/L	0.038	0.080	19.6 ± 2.9
0.289 mg/L	0.097	0.240	17.0 ± 3.4
0.987 mg/L	0.339	0.815	17.4 ± 0.0
Soil [redacted]			
0.010 mg/L	0.001	0.009	8.5 ± 0.6
0.030 mg/L	0.003	0.027	8.5 ± 0.3
0.099 mg/L	0.007	0.092	6.6 ± 1.0
0.299 mg/L	0.025	0.274	8.5 ± 0.5
0.999 mg/L	0.066	0.933	6.6 ± 0.4
Soil [redacted]			
0.010 mg/L	0.006	0.007	30.3 ± 2.5
0.029 mg/L	0.021	0.019	36.0 ± 0.7
0.099 mg/L	0.060	0.068	30.0 ± 1.6
0.289 mg/L	0.146	0.214	25.9 ± 1.2
0.987 mg/L	0.383	0.791	19.9 ± 0.7

[A] The amount of test item adsorbed to the soil was calculated by subtracting the equilibrium concentration in the solution from the initial concentration (applied concentration).

Table CA 7.1.3.1.2- 11: Definitive test: Concentration of [phenyl-UL-^{14}C]AE F160460 in aqueous and soil phase at the end of desorption (mean ± s.d.)

Concentration of a.s.	Soil (mg/kg)	Solution (mg/L)	Percentage desorbed[A]
Soil [redacted]			
0.010 mg/L	0.001	0.004	26.3 ± 3.9
0.030 mg/L	0.004	0.011	30.1 ± 0.1
0.099 mg/L	0.012	0.037	31.6 ± 0.3
0.299 mg/L	0.040	0.115	28.6 ± 1.1
0.999 mg/L	0.113	0.377	30.9 ± 1.3

Concentration of a.s.	Soil (mg/kg)	Solution (mg/L)	Percentage desorbed[A]
Soil [redacted]			
0.010 mg/L	0.002	0.003	41.6 ± 9.3
0.029 mg/L	0.007	0.008	37.3 ± 6.1
0.099 mg/L	0.016	0.029	46.4 ± 0.1
0.289 mg/L	0.035	0.097	32.4 ± 29.1
0.987 mg/L	0.112	0.302	48.8 ± 0.2
Soil [redacted] II			
0.010 mg/L	0.004	0.003	42.8 ± 0.6
0.029 mg/L	0.008	0.010	36.4 ± 6.4
0.099 mg/L	0.023	0.036	40.1 ± 4.7
0.289 mg/L	0.056	0.109	41.5 ± 5.2
0.987 mg/L	0.181	0.341	46.6 ± 0.3
Soil [redacted]			
0.010 mg/L	0.000	0.004	47.2 ± 0.1
0.030 mg/L	0.001	0.010	49.8 ± 6.1
0.099 mg/L	0.003	0.034	58.8 ± 0.8
0.299 mg/L	0.076	0.048	*-198.9 ± 27.8*[B]
0.999 mg/L	0.257	0.167	*-289.2 ± 12.2*[B]
Soil [redacted]			
0.010 mg/L	0.004	0.003	28.8 ± 2.8
0.029 mg/L	0.015	0.007	27.9 ± 0.8
0.099 mg/L	0.042	0.024	29.4 ± 0.0
0.289 mg/L	0.100	0.073	31.7 ± 1.6
0.987 mg/L	0.257	0.269	32.9 ± 1.2

[A] The calculation of the distribution of the test item after desorption was based on the centration measured in the supernatant in the desorption step.

[B] values were not included in the calculation of the desorption isotherm

Table CA 7.1.3.1.2- 12: Adsorption and desorption constants of [phenyl-UL-^{14}C]AE F160460 in soils

Soil	Soil type	Adsorption					Desorption			
		pH	$K_{F(ads)}$ [mL/g]	1/n	R^2	$K_{OC(ads)}$ [mL/g]	$K_{F(des)}$ [mL/g]	1/n	R^2	$K_{OC(des)}$ [mL/g]
[redacted]	Loam	5.3	0.2069	0.9745	0.9992	11.5	0.3064	0.9725	0.9993	17.0
[redacted]	Silt loam	6.6	0.2258	0.8692	0.9862	9.4	0.3073	0.8613	0.9833	12.8
[redacted] II	Clay loam	7.3	0.3488	0.8387	0.9919	7.6	0.4070	0.8502	0.9969	8.8
[redacted]	Sandy loam	6.7	0.0743	0.9524	0.9954	10.6	*0.0477**	*0.8306**	*0.9788**	*6.8**
[redacted]	Silt loam	6.6	0.5329	0.8628	0.9893	31.3	0.9359	0.8750	0.9885	55.1
Mean (arithmetic)			**0.2777**	**0.8995**	**0.9924**	**14.1**	**0.4009**	**0.8779**	**0.9893**	**20.1**

pH: Value given as determined with 0.01 M calcium chloride solution
K_F: Freundlich coefficient for adsorption (ads) or desorption (des)
1/n : Slope of the Freundlich adsorption/desorption isotherms
K_{oc}: Adsorption/desorption coefficient per organic carbon (K x 100/% organic carbon)
R^2: Regression coefficient of Freundlich equation
*The desorption isotherm for soil [redacted] was calculated using only three different concentrations

III. CONCLUSIONS

Based on the soil sorption parameters measured in this study and classification of soil mobility potential according to Briggs, the mobility of [phenyl-UL-^{14}C]AE F160460 can be classified as very mobile to mobile for adsorption and for desorption in the soils.

Metabolite AE F140584:

Report:	[redacted] 8; [redacted] ;2014;M-486416-01
Title:	KOC evaluation of the soil metabolite of mesosulfuron-methyl AE F140584 (BCS-AU66443)
Report No:	EnSa-14-0627
Document No:	M-486416-01-1
Guidelines:	**not specified;not specified**
GLP/GEP:	**n.a.**

The mesosulfuron-methyl metabolite AE F140584 occurred in soil metabolism study (KCA 7.1.1.1 /02) in amounts of up to 5.1% at 20 °C and 7.1% at 10 °C of applied radioactivity.

For the evaluation of the potential of a compound to leach to groundwater the Koc together with the degradation rate in soil are decisive. The lower the Koc the higher is the potential to reach groundwater.

The maximum concentration of a substance in soil is reached if the whole amount of this substance is dissolved in the soil surrounding water and nothing is “bound” or adsorbed to the soil. This case is reflected in the most conservative way if the adsorption of the substance to the soil is set to zero or in other words the Kd value is zero or with respect to organic carbon normalization the K_{OC} value is zero.

Therefore, the K_{OC} value of AE F140584 was assumed to be zero to cover any possible risk in the groundwater leaching assessment which is related to the sorption behavior of AE F140584.

Metabolite AE F147447:

Report:	[redacted]d;[redacted];2008;M-327876-01
Title:	AE F147447: Adsorption to soils
Report No:	MEF-08/463
Document No:	M-327876-01-1
Guidelines:	**OECD 106; EU 95/36/EC amending 91/414/EEC, Annexes II and III; US EPA Subdivision N, Section 163-2; Canadian PMRA DACO No. 8.2.4.2; Japanese MAFF;No deviations.**
GLP/GEP:	**yes**

update note: During the evaluation process, RMS requested the notifier to evaluate in how far the upper test soil pH in this study was sufficiently high to exclude pH dependencies in soil adsorption – reference is made to a respective discussion at the end of Point CA7.1.2.1.2.

Executive Summary

The adsorption behavior of non-labelled AE F147447 was determined in five German soils (0-20 cm depth) at approx. 20 °C in the dark using the batch equilibrium method and a single nominal concentration of 1.0 mg/L. The definitive test was performed with an adsorption time of 24 hours and a soil-to-solution ratio of 1:1 (20 g soil and 20 mL solution) for all soils.

The test item was stable throughout the study. The parental mass balance determined for all soils was in the range of 103.9 to 109.9% of the applied amount.

The calculated adsorption constants K_D for the test soils were in the range of 0.086 to 0.196 mL/g. The respective K_{oc} values were in the range of 3.8 to 7.0 mL/g (mean 5.2 mL/g).

According to BRIGGS, the mobility of AE F147447 can be classified as mobile or very mobile for adsorption.

I. MATERIALS AND METHODS

A. MATERIALS

1. Test Item

AE F147447

Certificate No.:	AZ 13778
Batch No.:	AE F147447 00 1B98 0001
Chemical Purity:	98.1% w/w

2. Test Soils

Soils were taken from agriculturally used areas representing a variety of geographical origins and physico-chemical soil properties, which may influence sorption processes (see Table CA 7.1.3.1.2-13). The soils are well-known from different metabolism and sorption studies.

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

Parameter	**Results/Units**				
Soil (ID)	[redacted] AXXa (AX)	[redacted] (HF)	[redacted] AIIIa (AI)	[redacted] (HN)	[redacted] II (DD)
Geographic Location (City / State / Country)	[redacted] / Northrhine-Westfalia / Germany	[redacted] / Northrhine-Westfalia / Germany	[redacted] / Northrhine-Westfalia / Germany	[redacted] / Northrhine-Westfalia / Germany	[redacted] Northrhine-Westfalia / Germany
Pesticide use history	No pesticides used for more than five years				
Collection procedures	Field sample shoveled into plastic bag				
Sampling depth	0-20 cm				
Storage conditions	Ambient conditions before and after sieving				
Storage length	Less than 6 months after sieving				
Soil Preparation	Passed through a 2 mm sieve, air dried				
Soil Series	N/A	N/A	N/A	N/A	N/A
Texture Class [A]	Sandy loam	Silt loam	Loam	Silt loam	Clay loam
Sand [A]	71%	21%	45%	33%	29%
Silt [A]	22%	62%	36%	52%	42%
Clay [A]	7%	17%	19%	15%	29%
pH ($CaCl_2$)	6.4	6.8	6.8	5.6	7.3
pH (Water)	6.6	6.9	7.0	5.8	7.5
pH (KCl)	6.3	6.5	6.5	5.2	7.1
Organic Matter [B]	3.62%	4.31%	2.24%	4.83%	7.59%
Organic Carbon	2.1%	2.5%	1.3%	2.8%	4.4%
Cation Exchange Capacity (CEC)	9.4 meq/100 g	13.6 meq/100 g	9.5 meq/100 g	9.2 meq/100 g	21.0 meq/100 g
Maximum Water Holding Capacity (MWHC)	45.5 g/100g	59.6 g/100g	45.7 g/100g	66.2 g/100g	79.0 g/100g
Water Holding Capacity at 0.33 bar (pF 2.5)	20.0%	31.6%	19.3%	28.3%	31.6%
Bulk Density	1.28 g/mL	1.09 g/mL	1.20 g/mL	1.04 g/mL	1.01 g/mL
Soil Taxonomic Classification (USDA)	Sandy, mixed, mesic Typic Cambudolls	Loamy, mixed, mesic Typic Argudalfs		Not available	
Soil Mapping Unit	N 51° 04.647' E 06° 53.517'	N 51° 04.011' E 07° 06.327'	N 51° 05.171' E 06° 55.757'	N 51° 04.482' E 07°06.361'	N 50° 22.899' E 06° 43.001'

[A] according to USDA classification

[B] % organic matter = % organic carbon × 1.724

B. STUDY DESIGN

1. Experimental Conditions

The test system for adsorption in batch equilibrium experiments consisted of Teflon® tubes (volume 42 mL) closed with screw caps. All experiments were performed in duplicate. In general, the respective amounts of dry weight of soil (< 2 mm) were weighed into the test tubes and 18 mL of 0.01 M aqueous $CaCl_2$ solution were added (corrected by soil humidity). After pre-equilibration for at least 18 to 24 hours, 2 mL of the respective application solution were added.

Preliminary tests were performed prior to the definitive test in order to test the stability of the test item in 0.01 M $CaCl_2$ solution as well as the possible adsorption of the test item to the test vessel. Furthermore, the test conditions were optimized by the determination of the adequate soil-to-solution ratio and the adequate equilibration time for adsorption. Using these optimized conditions, the parental mass balance was determined for each soil. All preliminary tests were performed with the nominal test concentration of 1 mg/L in duplicate with all soils.

For the parental mass balance test, the residual soil samples were extracted once with an equivalent volume of 0.01 M $CaCl_2$ solution at about 20 °C for 24 hours and once with 40 mL acetonitrile/water (80/20) for 10 min in a micro wave oven at 40 °C. The extraction efficiency of the extraction method was verified in a recovery test.

A soil to solution ratio of 20 g soil and 20 mL solution was used for the definitive test. Adsorption took place in the dark at about 20 °C for 24 hours under continuous agitation on an overhead shaker (30 rpm). The nominal test concentration was 1.0 mg/L. After the adsorption step, the phases were separated by centrifugation and decantation.

2. Analytical Procedures

At the respective sampling times the samples were centrifuged for 15 min at 10000 x *g*. Concentrations of AE F147447 in decanted supernatants or soil extracts were determined by quantitative HPLC-MS/MS measurements using ^{13}C labelled substance as internal standard. The concentrations were determined after fortifying with 50 µL (aqueous solutions, for supernatant samples) or 100 µL (acetonitrile/water mixture, for soil extracts) of internal stable-labelled standard solution (c = 20 mg/L, [methylsulfonyl-^{13}C, d_3; aminomethyl-d_2]AE F147447) and stirring for 5 minutes. Aliquots were centrifuged, diluted with water and mixed for HPLC-MS/MS.

Before analysis, the HPLC-MS/MS method was validated with regard to linearity, blank values, repeatability and specificity. Specificity was shown by chromatographic comparison of test item in pure solvent (aqueous 0.01 M $CaCl_2$ solution) and test item in matrix-containing samples (supernatant of soil suspension after shaking). The linearity of the detector response was tested in aqueous $CaCl_2$ (solvent of adsorption test) as well as in acetonitrile/water mixture (4/1; *v/v*; final solvent in parental mass balance test). The linearity test was performed by comparison of the injected amount of the test item and the corresponding area ratio response which is defined as the ratio between peak area of the test item and peak area of the internal stable-labelled standard. The concentration of the internal stable-labelled standard in all calibration standard solutions was kept the same (about 0.05 mg/L). The linearity test was performed by three injections at three concentration levels within the range between the LOQ and the maximum anticipated concentration of the test item in the samples, extended by each one concentration in the range ca. 20% below the LOQ level and one concentration ca. 30% above the maximum anticipated concentration (0.008 to 1.3 mg/L). Accuracy and repeatability was assessed on the basis of a set of recovery rates. For this reason each 10 control soil samples of all five soils were pre-equilibrated for about 24 h. Test item in $CaCl_2$ solution at fortification levels of 1.0 and 0.01 mg/L was added and shaken for ca. 24 h for adsorption. After centrifugation the supernatants were analyzed with respect to test item concentration using the HPLC-MS/MS method validated before. Subsequently the residual soil was extracted once with 40 mL ACN/water 4/1 (*v/v*) and the extract was analyzed as well. In addition, blank (control) soil solutions in duplicate for each soil were analyzed. The LOQ for AE F147447 in all solutions (aqueous $CaCl_2$ solution as well as acetonitrile/water extracts) by the analytical method employed was set to 0.01 mg/L. In case of the acetonitrile/water extracts performed in the course of the parental mass balance test this is equivalent to 2.0 mg/kg soil.

3. Calculations

The amount of test item adsorbed to the soil was calculated by subtracting the plateau (adsorption equilibrium) concentration in the supernatant solution from the initial concentration (applied concentration). Adsorption constants K_D were calculated by dividing the concentration of test item in soil by the concentration of test item in the aqueous phase, the respective K_{OC}-values were derived by normalisation for the soil organic carbon content. Evaluation according to Freundlich does not apply for this single-concentration test.

II. RESULTS AND DISCUSSION

A. MATERIAL BALANCE AND RESULTS OF PRELIMINARY TESTS

For the definitive test, a material balance was not established. Preliminary tests performed confirmed that the test item was stable in 0.01 M $CaCl_2$ solution and that no adsorption to the surface of the test vessels occurred. The parental mass balance determined for all soils was in the range of 103.9 to 109.9% of the applied amount ([% AA], see Table CA 7.1.3.1.2- 14). Thus, the stability in presence of soil was adequate to determine the distribution by concentration measurement (HPLC-MS/MS) in the aqueous supernatant in the definitive test. Based on the results of the soil-to-solution ratio test, a soil-to-solution ratio of 1:1 was chosen for all soils. Furthermore, it was shown that the adsorption equilibrium was reached after 24 hours.

Table CA 7.1.3.1.2- 14: Parental Mass Balances after 72 hours of incubation, Expressed as % of Applied Amount of Test Item [% AA]

Soil ID	AX	HF	AI	HN	DD
Supernatant [% of applied]	88.1	86.7	89.1	81.1	81.8
Wet soil pellet (ACN extract) [% of applied]	19.8	23.2	19.7	22.8	24.1
Total recovery [% of applied]	**107.9**	**109.9**	**108.8**	**103.9**	**105.9**

B. METHOD VALIDATION

Method development and validation were performed successfully within this study prior to soil sample analyses. The detector signal in 0.01 M $CaCl_2$ was linear over a range from 0.008 to 1.33 mg/L (with r = 0.9989 for the example shown). Background abundance of the test item was far below 30% of the LOQ in all of the test solutions, and no interference by other matrix components occurred.

The efficiency of the extraction method employed within the parental mass balance test was verified in a recovery test which was part of the method validation. 106.3 to 111.1% AA of test item was extracted (mean 108.0% AA). These results indicated that the extraction method was well suited to recover the applied AE F147447 from the test soil matrices.

C. DEGRADATION OF PARENT COMPOUND

The test item was stable for at least 72 hours which was demonstrated in 0.01 M $CaCl_2$ solution as well as in the parental mass balance test (see Table CA 7.1.3.1.2- 14).

D. FINDINGS

In the definitive adsorption test 8.8, 8.7, 7.9, 16.4 and 15.3% AA (mean values) were adsorbed to soils AX, HF, AI, HN and DD, respectively (see Table CA 7.1.3.1.2- 15). The K_D values were in the range of 0.086 to 0.196 mL/g (see Table CA 7.1.3.1.2- 16).When being normalized for organic carbon content of soil, values of $K_{OC(ads)}$ varied between 3.8 and 7.0 mL/g (mean: 5.2 mL/g).

Using the BRIGGS classifications for the estimation of the mobility of crop protection agents in soil based on K_D and/or K_{oc}-values, AE F147447 can be classified as 'mobile' or 'very mobile' for adsorption.

Table CA 7.1.3.1.2- 15: Concentrations of AE F147447 in aqueous phases and adsorbed to soils at the end of the adsorption period (mean values ± s.d.)

Description			
Concentration of a.s.	**Soil (mg/kg)**	**Solution (mg/L)**	**Percentage adsorbed**
Soil [redacted] AXXa (ID: AX)			
Control	N/A	N/A	
0.98 mg/L	0.086	0.892	8.8 ± 1.63
Soil [redacted] (ID: HF)			
Control	N/A	N/A	
0.98 mg/L	0.085	0.893	8.7 ± 1.01
Soil [redacted] AIIa (ID: AI)			
Control	N/A	N/A	
0.98 mg/L	0.077	0.901	7.9 ± 1.68
Soil [redacted] (ID: HN)			
Control	N/A	N/A	
0.98 mg/L	0.160	0.818	16.4 ± 0.53
Soil [redacted] II (ID: DD)			
Control	N/A	N/A	
0.98 mg/L	0.150	0.828	15.3 ± 0.73

Table CA 7.1.3.1.2- 16: Adsorption constants of AE F147447 in soils (Mean of duplicates)

Soil ID	**Soil type**	**pH**	**Adsorption**	
			$K_{D(ads)}$ [mL/g]	**$K_{oc(ads)}$ [mL/g]**
AX	Sandy Loam	6.4	0.097	4.6
HF	Silt Loam	6.8	0.096	3.8
AI	Loam	6.8	0.086	6.6
HN	Silt Loam	5.6	0.196	7.0
DD	Clay Loam	7.3	0.181	4.1
Mean (arithmetic)			**0.131**	**5.2**

pH: Value given as determined with 0.01 M calcium chloride solution
K_D: adsorption constant
K_{oc}: Adsorption coefficient per organic carbon (K x 100/% organic carbon)

III. CONCLUSIONS

Using the BRIGGS classifications for the estimation of the mobility of crop protection agents in soil based on K_D and/or K_{oc}-values, AE F147447 can be classified as 'mobile' or 'very mobile' for adsorption.

****

Point 7.1.4.2 (Lysimeter Studies) will discuss structure assignment to a component previously considered unidentified in the original EU dossier. The component has been shown to correspond to a new degradate “BCS-CV14885”. A new study was conducted to generate soil adsorption information on BCS-CV14885. For further discussion and interpretation of these results please refer to Point 7.1.4.2.

Report:	KCA 7.1.3.1.2 /08; [redacted].;2013;M-460714-02; Amended 2015-02-18
Title:	Determination of the adsorption/desorption behaviour of mesosulfuron-methyl-des-methyl-guanidine (BCS-CV14885) in four soils
Report No:	S12-00016
Document No:	M-460714-02-1
Guidelines:	**OECD Test Guideline No. 106** **US EPA OCSPP Test Guideline No. 835.1230; not specified**
GLP/GEP:	**yes**

update note #1- Amendment to study report:

In the case of soil “[redacted] 4a”, an error was noted in the stated $K_F^{(ads)}$ value of 0.23 mL/g instead of 0.27 mL/g, and was corrected via report amendment. The K^{ads}_{Foc} was calculated using the correct $K_F^{(ads)}$ and requires no recalculation.

update note #2:

During the evaluation process, RMS requested the notifier to evaluate in how far the upper test soil pH in this study was sufficiently high to exclude pH dependencies in soil adsorption – reference is made to a respective discussion at the end of Point CA7.1.2.1.2.

Executive Summary

The adsorption/desorption properties of BCS-CV14885 were determined in four soils of European origin at 20 ± 2 °C in the dark using the batch equilibrium method. The definitive test was performed with an adsorption and desorption time of 24 hours, respectively, and a soil-to-solution ratio of 1:1 (50 g soil and 50 mL solution) for all soils. The nominal test item concentrations were 1, 0.3, 0.1, 0.03 and 0.01 mg/L in 0.01 M $CaCl_2$ solution.

The test item was sufficiently stable throughout the study and no adsorption to the surface of the test vessels was observed. The parental mass balance for all soils was in the range of 91.2-101.3% of the applied amount (AA).

The adsorption constants $K_{F(ads)}$ of the Freundlich isotherms ranged from 0.23 to 0.96 mL/g with associated Freundlich exponents 1/n ranging from 1.07 to 1.43. When being normalized for organic carbon content of soil, values of $K_{OC(ads)}$ varied from 13.6 to 21.7 mL/g with an arithmetic mean of 17.8 mL/g.

Desorption constants $K_{F(des)}$ according to Freundlich ranged from 0.33 to 1.95 mL/g with corresponding $K_{OC(des)}$ values ranging from 16.4 to 38.2 mL/g (arithmetic mean: 25.5 mL/g).

Considering the measured values it can be assumed that BCS-CV14885 has a high mobility in the tested soils.

I. MATERIALS AND METHODS

A. MATERIALS

1. Test Item

Mesosulfuron-methyl-des-methyl-guanidine (BCS-CV14885)	
Certificate No.:	AZ 18045
Batch No.:	BCS-CV14885-01-01
Chemical Purity:	97.8% w/w

2. Test Soils

Four test soils of European origin were used, considered representative for agricultural soils. The soils are differing in physico-chemical characteristics (see Table CA 7.1.3.1.2- 17). Soil collection and handling were in accordance to ISO 10381-6:1993(E).

Table CA 7.1.3.1.2- 17: Physico-chemical properties of test soils

Parameter	**Results/Units**			
Soil (ID)	[redacted] **AXXa (AX)**	[redacted] **II** **(DD)**	[redacted] **4a** **(HaH)**	[redacted] **(WW)**
Geographic Location (City / State / Country)	[redacted] Northrhine-Westfalia / Germany	[redacted] / Northrhine-Westfalia / Germany	[redacted] / Northrhine-Westfalia / Germany	[redacted] / Northrhine-Westfalia / Germany
Pesticide use history	No pesticides used for the previous five years			
Collection procedures	Sample taken with shovel and placed in plastic bag			
Sampling depth	0-20 cm			
Storage conditions	Stored at ambient temperature			
Storage length	One year at maximum			
Soil Preparation	Passed through a 2 mm sieve, mixed and air dried			
Soil Series	N/A	N/A	N/A	N/A
Texture Class ^{A}	Loamy Sand	Loam	Silt loam	Loam
Sand ^{A} Silt ^{A} Clay ^{A}	84% 10% 6%	40% 36% 24%	28% 54% 18%	49% 34% 17%
pH in Soil/Water (1/1) pH in Water (Saturated Paste) pH in 1N KCl pH in 0.01 M $CaCl_2$ (1/2)	6.3 6.4 6.0 6.2	7.1 7.1 6.7 7.0	6.3 6.4 5.8 6.1	5.5 5.6 5.0 5.3
Organic Matter ^{B}	2.9%	8.8%	3.4%	3.3%
Organic Carbon	1.7%	5.1%	2.0%	1.9%
Cation Exchange Capacity (CEC)	9.2 meq/100 g	20.6 meq/100 g	12.1 meq/100 g	10.5 meq/100 g

Parameter	Results/Units			
Soil (ID)	[redacted] AXXa (AX)	[redacted] II (DD)	[redacted] 4a (HaH)	[redacted] (WW)
Maximum Water Holding Capacity (MWHC)	48.5 g/100g	77.2 g/100g	49.8 g/100g	54.4 g/100g
Water Holding Capacity at 0.33 bar (pF 2.5)	10.8%	33.1%	19.4%	15.1%
Bulk Density	1.19 g/mL	1.03 g/mL	1.14 g/mL	1.15 g/mL
Soil Taxonomic Classification (USDA)	Not available	Not available	Not available	Not available
Soil Mapping Unit	N 51° 04.647' E 06° 53.517'	N 50° 22.899' E 06° 43.001'	N 51° 04.011' E 07° 06.327'	N 51° 04.857' E 06° 55.251'

[A] according to USDA classification
[B] % organic matter = % organic carbon × 1.724

B. STUDY DESIGN

1. Experimental Conditions

The tests were performed by the serial method in 100 mL glass flasks with PTFE sealed screw caps in duplicate. In general, known amounts of air-dried soil were weighed each into the flasks and a solution of 0.01 M aqueous calcium chloride was added to result in a final volume of 45 mL (taken the residue soil moisture into account). The slurry was pre-equilibrated for at least 12 hours followed by the addition of 5 mL of the corresponding application solution to result in a final volume of 50 mL.

Preliminary tests were performed prior to the definitive test in order to test the stability of the test item in matrix solution as well as the possible adsorption of the test item to the test vessel. Furthermore, the test conditions were optimized by the determination of the adequate soil-to-solution ratio and the adequate equilibration time for adsorption. Using these optimized conditions, the parental mass balance was determined for each soil. All preliminary tests were performed with the highest test concentration (nominal 1 mg/L) in duplicate with all soils according to the general procedure.

For the definitive test the test systems were prepared with a soil-to-solution ratio of 1:1 for all soils (50 g soil dry weight and 50 mL solution, including the application aliquot). Adsorption and desorption took place in the dark at 20 ± 2 °C for 24 hours each using a flatbed shaker with a frequency of around 130 rpm. The nominal test concentrations were 1.0, 0.3, 0.1, 0.03 and 0.01 mg/L. After the adsorption step, the phases were separated by centrifugation and the supernatant was removed as much as possible and replaced with an equivalent volume of untreated aqueous 0.01 M $CaCl_2$ solution. The solid pellet was re-suspended and the samples were continuously agitated again.

2. Analytical Procedures

At the respective sampling times the samples were centrifuged for 4 min at 1295 x *g*. The supernatants of the preliminary and the definitive tests were diluted with 0.01 M $CaCl_2$ and water (1/2–1/30, *v/v*) and analyzed without further preparation by HPLC-MS/MS.

The parental mass balance was determined in a preliminary test for all soils using a soil-to-solution ratio of 1:1. The aqueous phase was recovered as much as possible and acetonitrile/water (50/50, *v/v*) was added to the soil to extract the test item at ambient conditions (three times) and microwave conditions.

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

Validation of the HPLC-MS/MS method was performed for all four soils. To check the matrix caused ion suppression effects in the HPLC/MS-MS analysis, samples of test item in pure 0.01 M $CaCl_2$ diluted with water (1/20, *v/v*) and in soil blank matrix diluted with water (1/20, *v/v*) were measured. Matrix effects of > 10% were observed in soil blank matrices of all soils. Thus, further calibration curves were performed with standards in the respective blank matrix diluted with water (1/20, *v/v*).

The detector linearity was confirmed over the calibration range of interest by constructing a calibration function of peak area versus concentration with the range from 0.2 to 75.0 ng/mL (8-point-calibration) in matrix solution/water (1/20, *v/v*). Quantitative evaluation was done by comparison of the peak areas of mesosulfuron-methyl-des-methyl-guanidine with this calibration curve.

To determine the recovery of mesosulfuron-methyl-des-methyl-guanidine as well as the accuracy and repeatability of the analytical method, soil blank matrix (900 µL) was fortified with the test item at LOQ, and 1000-fold LOQ level, respectively.

The limit of quantification (LOQ) of the method was determined as 1.0 ng/mL and the limit of detection (LOD) was set to 1/5 LOQ, equal to 0.2 ng/mL. At this level the signal to noise ratio was ≥ 3. The LOD of the method was two orders of magnitudes lower than the lowest test concentration of the definitive test (0.01 mg/L = 10 ng/mL).

3. Calculations

The amount of test item adsorbed to the soil was calculated by subtracting the plateau (adsorption equilibrium) concentration in the supernatant solution from the initial concentration (applied concentration). The amount of test item desorbed from the soil was calculated as the difference between the remaining amount of test item after the adsorption step, and the amount determined in the supernatant at the end of the experiment.

The equilibrium partitioning in adsorption and desorption measured for five concentration dilution series per soil was used to calculate Freundlich isotherms for adsorption and desorption. Based on the Freundlich K_F-values, the respective Freundlich $K_{F,OC}$-values were derived by normalisation for the soil organic carbon content.

II. RESULTS AND DISCUSSION

A. MATERIAL BALANCE AND RESULTS OF PRELIMINARY TESTS

For the definitive test, a material balance was not established. Preliminary tests performed confirmed that the test item was stable throughout the study. The parental mass balance determined for all soils after 96 hours was in the range of 91.2 101.3% of the applied amount [% AA]. Furthermore, in control samples without soil the test item did not adsorb to the surface of the test vessels. Based on the results of the soil-to-solution ratio test, a soil-to-solution ratio of 1:1 was chosen for all soils. Furthermore, an equilibration time of 24 hours was chosen for the adsorption and desorption, respectively, in the definitive test.

B. METHOD VALIDATION

Method development and validation was performed successfully within this study prior to soil sample analyses. The detector signal in matrix solution diluted with water (1/20, v/v) was linear over a range from 0.2 to 75 ng/mL (r = 0.9995).

During method validation, recoveries of mesosulfuron-methyl-des-methyl-guanidine were between 88–110% AA in soil AX matrix (mean: 95% AA at LOQ level, 101% AA at 1000-fold LOQ level), between 78–109% AA in soil DD matrix (mean: 102% AA at LOQ level, 85% AA at 1000-fold LOQ level), between 83–108% AA in soil HaH matrix (mean: 100% AA at LOQ level, 104% AA at 1000-fold LOQ level) and between 85–110% AA in soil WW matrix (mean: 102% AA at LOQ level and 100% AA at 1000-fold LOQ level).

The accuracy and precision of the analytical method were considered acceptable (according to the requirements of SANCO/3029/00[7]) since the mean recoveries in all soils were in the range of 70 and 110% AA with relative standard deviations below 20%. Furthermore, the determined values of the blank samples were less than 30% of the assigned LOQ of the test item in all four soils. The analytical procedure was therefore considered specific for the test item.

C. DEGRADATION OF PARENT COMPOUND

The test item was stable for at least 96 hours which was demonstrated in 0.01 M $CaCl_2$ solution as well as in the presence of soil (parental mass balance test).

D. FINDINGS

The concentrations of BCS-CV14885 in the aqueous and solid phases during the adsorption and desorption phase are presented in Table CA 7.1.3.1.2- 18 and Table CA 7.1.3.1.2- 19.

Within the definitive tests, 10-23.3%, 35.5-53.4%, 5.6-23.7% and 14.3-22.3% of the applied test material was adsorbed in soils [redacted] AXXa, [redacted] II, [redacted] und [redacted], respectively.

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[7] European Commission, Directorate general health and consumer protection (2000): Residues; Guidance for generating and reporting methods of analysis in support of pre-registration data requirements for Annex II (part A, Section 4) and Annex III (part A, Section 5) of Directive 91/414. SANCO/3029/99, rev. 4, 11/07/2000.

At the end of the desorption phase, 22.2-50.0%,0.0-38.6%, 0-31.8% and 20.6-100.0% of the initially adsorbed amount were desorbed in soils [redacted] AXXa, [redacted] II, [redacted] und [redacted], respectively.

The adsorption behaviour of BCS-CV14885 could be accurately described by the Freundlich equation for all soils (Table CA 7.1.3.1.2- 20). The adsorption constants $K_{F(ads)}$ of the Freundlich isotherms ranged from 0.23 to 0.96 mL/g with associated Freundlich exponents 1/n ranging from 1.07 to 1.43. The corresponding correlation coefficients of the adsorption isotherms ranged from 0.92 to 0.98, therefore indicating a good linear fit to the measured data.

When being normalized for organic carbon content of soil, values of $K_{OC(ads)}$ varied from 13.6 mL/g (soil [redacted]) to 21.7 mL/g (soil [redacted]) with an arithmetic mean of 17.8 mL/g.

Desorption constants $K_{F(des)}$ according to Freundlich ranged from 0.33 mL/g to 1.95 mL/g with corresponding $K_{OC(des)}$ values ranging from 16.4 mL/g (soil [redacted] 4a) to 38.2 mL/g (soil [redacted] II) to result in an arithmetic mean of 25.5 mL/g.

Table CA 7.1.3.1.2- 18: Definitive test: Concentration of BCS-CV14885 in aqueous and soil phase at the end of adsorption (mean ± s.d.)

Description				
Concentration of a.s.	**Soil (mg/kg)**	**Solution (mg/L)**	**Percentage adsorbed ^{A}**	
Soil [redacted] AXXa (ID: AX)				
Control	N/A	N/A		
0.010 mg/L	0.001	0.009	10.0	± 0.0
0.028 mg/L	0.003	0.024	12.5	± 1.8
0.098 mg/L	0.015	0.083	15.3	± 3.1
0.298 mg/L	0.059	0.239	20.0	± 3.9
1.005 mg/L	0.234	0.771	23.3	± 5.4
Soil [redacted] II (ID: DD)				
Control	N/A	N/A		
0.010 mg/L	0.004	0.006	35.0	± 5.0
0.030 mg/L	0.011	0.019	35.0	± 1.7
0.104 mg/L	0.055	0.049	53.4	± 0.5
0.303 mg/L	0.160	0.143	53.0	± 1.5
0.958 mg/L	0.391	0.567	40.8	± 5.5
Soil [redacted] (ID: HaH)				
Control	N/A	N/A		
0.009 mg/L	0.001	0.008	5.6	± 5.6
0.029 mg/L	0.003	0.026	12.1	± 1.7
0.107 mg/L	0.012	0.095	11.7	± 0.5
0.323 mg/L	0.062	0.261	19.0	± 2.3
1.095 mg/L	0.260	0.836	23.7	± 1.2

Soil [redacted] (ID: WW)				
Control	N/A	N/A		
0.010 mg/L	0.001	0.008	15.0	± 5.0
0.028 mg/L	0.002	0.024	14.3	± 0.0
0.099 mg/L	0.018	0.081	18.2	± 1.0
0.296 mg/L	0.066	0.230	22.3	± 0.3
1.008 mg/L	0.204	0.804	20.2	± 0.9

[A] values were not reported but calculated based on the amounts of test item detected in the supernatant

Table CA 7.1.3.1.2- 19: **Definitive test: Concentration of BCS-CV14885 in aqueous and soil phase at the end of desorption (mean ± s.d.)**

Description				
Concentration of a.s.	**Soil (mg/kg)**	**Solution (mg/L)**	**Percentage desorbed^{A}**	
Soil [redacted] AXXa (ID: AX)				
Control	N/A	N/A		
0.006 mg/L	n.a.	0.006	n.a. ^{B}	± 0.0
0.015 mg/L	0.002	0.014	50.0 ^{C}	± 0.0
0.057 mg/L	0.011	0.046	22.2	± 22.2
0.178 mg/L	0.036	0.142	38.5	± 5.2
0.612 mg/L	0.164	0.449	27.3	± 12.3
Soil [redacted] II (ID: DD)				
Control	N/A	N/A		
0.009 mg/L	0.004	0.005	0.0	± 0.0
0.024 mg/L	0.010	0.015	5.0	± 5.0
0.091 mg/L	0.046	0.046	18.1	± 5.6
0.264 mg/L	0.108	0.156	32.6	± 3.8
0.796 mg/L	0.235	0.561	38.6	± 9.3
Soil [redacted] (ID: HaH)				
Control	N/A	N/A		
0.006 mg/L	0.001	0.005	-100.0	N/A
0.018 mg/L	0.004	0.014	-16.7	± 16.7
0.069 mg/L	0.023	0.047	-79.2	± 20.8
0.218 mg/L	0.042	0.175	31.8	± 7.1
0.758 mg/L	0.197	0.561	23.8	± 2.2
Soil [redacted] (ID: WW)				
Control	N/A	N/A		
0.006 mg/L	0.000	0.005	100.0	± 0.0
0.015 mg/L	0.002	0.013	50.0 ^{C}	± 25.0
0.066 mg/L	0.013	0.053	31.4	± 15.6
0.196 mg/L	0.038	0.157	41.6	± 3.2
0.665 mg/L	0.161	0.504	20.6	± 5.2

[A] values were not reported but calculated based on the amounts of test item in soil after the desorption step
[B] not analyzed
[C] only one replicate analyzed

Table CA 7.1.3.1.2- 20: Adsorption constants of BCS-CV14885 in soils

Soil	Soil type	Adsorption					Desorption			
		pH	$K_{F(ads)}$ [mL/g]	1/n	R^2	$K_{OC(ads)}$ [mL/g]	$K_{F(des)}$ [mL/g]	1/n	R^2	$K_{OC(des)}$ [mL/g]
[redacted] AXXa	Loamy Sand	6.2	0.30	1.17	0.98	17.5	0.40	1.17	0.99	23.4
[redacted] II	Loam	7.0	0.96	1.07	0.97	18.8	1.95	0.91	0.97	38.2
[redacted] 4a	Silt Loam	6.1	~~0.23~~ 0.27	1.18	0.98	13.6	0.33	1.01	0.97	16.4
[redacted]	Loam	5.3	0.41	1.43	0.92	21.7	0.46	1.33	0.99	24.1
Mean (arithmetic)			**0.48**	**1.21**	**0.96**	**17.8**	**0.79**	**1.13**	**0.98**	**25.5**

pH: Value given as determined with 0.01 M calcium chloride solution
K_F: Freundlich coefficient of adsorption (ads) or desorption (des)
1/n : Slope of the Freundlich adsorption/desorption isotherms
K_{oc}: Adsorption/desorption coefficient per organic carbon (K x 100/% organic carbon)
R^2: Regression coefficient of Freundlich equation

III. CONCLUSIONS

Considering the measured values it can be assumed that BCS-CV14885 has a high mobility in the tested soils.

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update – refers to studies M-406767-01-1, M-362125-01-1, M-362125-01-1, (M-327876-01-1):
During the evaluation process, in context of these studies RMS requested the notifier to evaluate in how far the upper test soil pH in adsorption/desorption studies (max. pH 7.3 measured in $CaCl_2$, or pH 7.5 measured in water) was sufficiently high to exclude pH dependencies in soil adsorption.

In response, the following two arguments are provided:

(a) analysis of dissociation behaviour of the tested metabolites

Measurements of pKa have been performed for the four metabolites used as test item in the concerned studies, and are listed in Table CA 7.1.3.1.2- 21 below. In a simplified view, pKa defines the pH condition under which protonated and deprotonated form of a component (or a dissociable moiety) will exist in equimolar ratio. In the present case, pKa values for all concerned metabolites (or their dissociable moieties) are ca. 2-3 log units outside the environmentally relevant range of soil pH of ca. 4.5-7.5 (see KCA 7.1.3.1.2 /13). Due to the logarithmic scale underlying the definitions of pH or pKa, this lets conclude that only negligible changes in dissociation status will occur for any of these components within the environmentally relevant soil pH range. Therfore, it is not to be expected that these components would have exhibited pH dependency in soil adsorption, if the tests would have included slightly more alkaline test soils.

Table CA 7.1.3.1.2- 22: Dissociation constants of metabolites AE F160459, AE F160460, AE F147447, BCS-CV14885

Component	**pKa**	**study reference**
AE F160459	1.6 (1st step) 10.5 (2nd step)	M-451604-01-1 (KCA 7.1.3.1.2/09)
AE F160460	2.2 (1st step) 10.9 (2nd step)	M-451609-01-1 (KCA 7.1.3.1.2/10)
AE F147447	1.7	M-441376-01-1 (KCA 7.1.3.1.2/11)
BCS-CV14885	2.9 (1st step) 11.0 (2nd step)	M-451603-01-1 (KCA 7.1.3.1.2/12)

(b) analysis of agricultural soil pH in Europe

Report:	KCA 7.1.3.1.2 /13; [redacted]. M-510342-01
Title:	Soil pH in Europe
Document No:	M-510342-01-1
Guidelines:	**not applicable (statement)**
GLP/GEP:	**not applicable (statement)**

Information on pH of European soils was accessed from 2 databases:

- The Joint Research Centre (JRC) of the European Commission prepared a quantitative map of estimated soil pH values ($CaCl_2$) across Europe. The underlying data basis for this map was a compilation of 12,333 soil pH measurements, which were used for a geo-statistical framework based on Regression-Kriging.
- The European Statistical Office (EUROSTAT) organised the Land Use/Cover Area frame statistical Survey (LUCAS) to collect information on topsoil properties. Estimates were computed on the basis of monitoring data from more than 250,000 sampling points across the European Union. The resulting map of predicted topsoil pH values measured in $CaCl_2$

The database information consistently shows the range of soil pH to mainly cover values between 4.5 and 7.5, and only in small areas pH values < 4.5 and > 7.5 can be observed. European soils have a variability in pH values with a tendency to generally lower pH values in the northern region and higher values in the southern part of Europe. The differences in the pH mainly depend on the nature of the respective pedogenic material.

A further figure provided within the LUCAS survey illustrates the mean soil pH values for representative countries, relevant to the agricultural use categories cropland, forest, and grassland. (see Figure CA 7.1.3.1.2- 1 below). From the data it can be concluded that the mean cropland soil pH in European countries is typically below the neutral point, or only minimally exceeds pH 7. As indicated by the error bars, in none of the countries standard deviation to these mean values reaches pH 8.

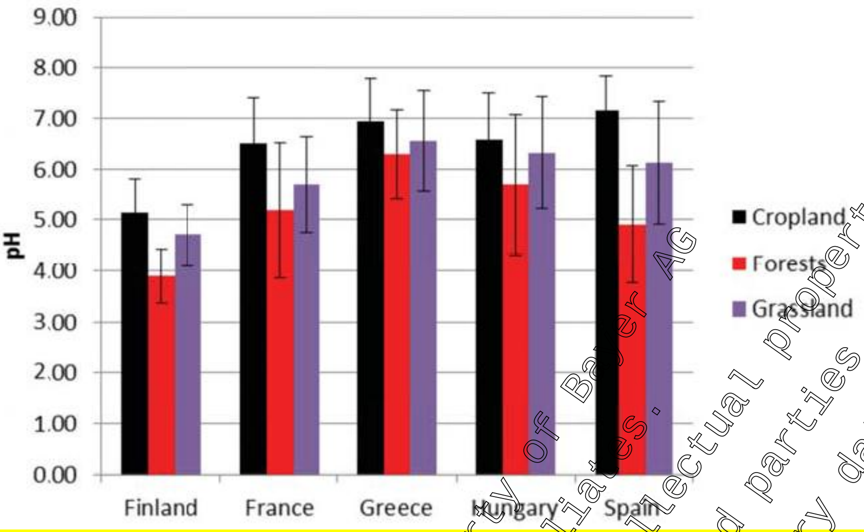


Figure CA 7.1.3.1.2- 1: Predicted topsoil pH values (CaCl2) in Europe based on the LUCAS Topsoil Database

As overall conclusion, it therefore can be stated that the soils used for laboratory testing of adsorption/desorption of metabolites cover the typical pH range of agricultural used soils in Europe.

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.

CA 7.1.4 Mobility in soil

Report:	**[redacted]° ; [redacted];2000;M-198324-01**
Title:	Simulation of the leaching behaviour of mesosulfuron-methyl and its metabolites for nine European worst-case scenarios Code: AE F130060
Report No:	C010064
Document No:	M-198324-01-1
Guidelines:	**Deviation not specified**
GLP/GEP:	**no**

Study included in baseline dossier for formal reason only: The study reports (outdated) Annex III information, errously placed in Annex II dossier of previous submission.

An updated PECgw calculation for the representative uses of mesosulfuron-methyl, according current modelling standards and considering the new information presented in the present supplemental dossier, is found provided in document MCP, Section 9.

CA 7.1.4.1 Column leaching studies

No column leaching study was performed for active substance mesosulfuron-methyl. 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). In addition two lysimeter studies have been conducted with radiolabelled mesosulfuron-methyl (CA 7.1.4.2).

CA 7.1.4.1.1 Column leaching of the active substance

No soil column leaching study with mesosulfuron-methyl has been performed.

CA 7.1.4.1.2 Column leaching of metabolites, breakdown and reaction products

No soil column leaching studies with metabolites of mesosulfuron-methyl have been performed.

CA 7.1.4.2 Lysimeter studies

The leaching behaviour of mesosulfuron-methyl and its degradation products was studied in two lysimeter experiments, for annual application timed in spring or autumn. Even under realistic worst-case conditions for leaching, neither mesosulfuron-methyl nor any of its metabolites identified in the laboratory soil metabolism studies were detected in leachate water samples. The information was EU reviewed for Annex I inclusion, and was considered acceptable during the original EU review of mesosulfuron (Review Report SANCO/10298/2003-Final, 25 June 2004). The following studies are included in the baseline dossier:

Report:	**[redacted]; [redacted];2000;M-199641-01**
Title:	AE F130060-[pyrimidyl-2-^{14}C]: Lysimeter Study (spring application) According to BBA Guideline IV, 4-3, 1990
Report No:	1353-0490-000
Document No(s):	M-199641-01-1
Guidelines:	**BBA: IV 4-3, 1990;Deviation not specified**
GLP/GEP:	**yes**

Reference	Followed guidance	Guidance currently in force	Differences	Critical assessment of the study / Deviations / conclusion about its Reliability
M-199641-01-1	BBA-guideline IV, 4-3, 1990.	OECD Environmental Health and Safety Publications Series on Testing and Assessment No. 22 (Guidance Document for the Performance Of Out-door Monolith Lysimeter Studies)	None	Study fulfills criteria of current guideline and is considered reliable.

Report:	**[redacted]; [redacted];2000;M-197248-01**
Title:	Mass spectroscopic investigation of two lysimeter leachate samples Mesosulfuron-methyl (proposed ISO) Code: AE F130060
Report No:	PA00/011
Document No:	M-197248-01-1
Guidelines:	**not applicable (supportive analytical activity)**
GLP/GEP:	**yes**

Report:	[redacted] d; [redacted] ;2000;M-198278-01
Title:	AE F130060-[pyrimidyl-2-^{14}C]: Lysimeter Study (Autumn Application) According to BBA Guideline IV, 4-3, 1990
Report No:	1381-1490-005
Document No(s):	M-198278-01-1
Guidelines:	**BBA: IV 4-3, 1990;Deviation not specified**
GLP/GEP:	**yes**

Reference	Followed guidance	Guidance currently in force	Differences	Critical assessment of the study / Deviations / conclusion about its Reliability
M-198278-01-1	BBA-guideline IV, 4-3, 1990.	OECD Environmental Health and Safety Publications Series on Testing and Assessment No. 22 (Guidance Document for the Performance Of Out-door Monolith Lysimeter Studies)	None	Study fulfills criteria of current guideline and is considered reliable.

Report:	[redacted] 3; [redacted] ;2002;M-211615-01
Title:	Statement on the nature of not identified radioactivity (NIR) in the leachates of two lysimeter studies with 14C-AE F130060
Report No:	C021656
Document No:	M-211615-01-1
Guidelines:	**Deviation not specified**
GLP/GEP:	**no**

The position paper KCA 7.1.4.2 /04 attempted a qualitative assessment of two polar unidentified degradates, 'M1' and 'M2', that were observed in leachate fractions of lysimeter studies KCA 7.1.4.2 /01 and KCA 7.1.4.2 /03. Annual concentrations of these components, when expressed in units of parent-equivalents, slightly exceeded the parametric trigger value of 0.1 µg/L. With the analytical technology available at the time, no unambiguous structure identification was found possible but it was suggested that the polar radioactivity could be derived from breakdown of the pyrimidine ring system of mesosulfuron-methyl, forming e.g. urea or guanidine type structures. Based on review of toxicological and ecotoxicological information, and supportive ecotoxicological testing conducted on leachate sample material revealing no biological activity (KCA 8.2.7 /02), it was concluded that the unidentified degradates would not be considered relevant in the sense of the Drinking Water Directive.

The case was discussed and accepted during the EU review for Annex I inclusion of mesosulfuron-methyl, no further studies were requested in the review report.

New supplementary information submitted for approval renewal:

Recent technological innovation in instrumental analytics allowed the notifier to generate new confirmative experimental information to validate the above hypothesis on polar leachate radioactivity, applying state-of-the art spectroscopic structure elucidation. The following new experimental study was generated, and the information used in risk assessment:

Report:	[redacted]i;[redacted];[redacted];2013;M-457999-01
Title:	[Pyrimidyl-2-14C]mesosulfuron-methyl (AE F130060): Investigation of metabolites previously detected in lysimeter leachates by an outdoor experiment with three EU soils
Report No:	EnSa-13-0235
Document No:	M-457999-01-1
Guidelines:	**Non-Guideline Study, but Principles based on OECD Test Guideline No. 307, 2002;not specified**
GLP/GEP:	**yes**

Executive Summary

The objective of this study was to retrospectively generate further information regarding two polar metabolites reported in leachates from previous lysimeter studies performed for the active substance [pyrimidyl-2-^{14}C]mesosulfuron-methyl. These metabolites, designated M1 and M2 in the previous studies, were quantified in the range of 0.1-0.4 µg/L (max. annual mean concentration) based on parent equivalents. The chemical structures could not be identified at that time.

In the present study, a simulation experiment in drained plant pots with facilitated leaching was made to reproduce the polar mobile metabolite fraction for re-analysis with current technology. Three different soils originating from Germany were used in order to cover all possible metabolites. For each soil type, one plant pot was filled with soil freshly sampled from the field.

The aqueous leachates of all plant pots were collected 0, 16, 37, 63, 78, 105 and 126 days after application. They were analyzed by LSC and, after a concentration step, by HPLC/radiodetection using the same HPLC method as in the original lysimeter studies. In addition, soil aliquots from each plant pot were taken at day 246 after application and extracted with 160 mL acetonitrile/water (80/20, *v/v*). The extracts were analyzed by LSC and concentrates thereof were analyzed by HPLC/radiodetection.

The four most prominent peaks in the leachates were detected with retention times of 6.6, 25.2, 55.0 and 67.3 min. Clearly most abundant was the polar peak fraction appearing with a retention time of about 6.6 min (max. 7.1% AR, soil [redacted] [redacted]), which was further investigated by structure elucidation methods in several samples. First, the fraction was isolated from a concentrated and purified leachate of soil [redacted] [redacted] 4a (DAT-78). In this fraction, BCS-CV14885 was identified by HPLC-MS(/MS) with accurate mass determination. Furthermore, BCS-CV14885was identified in concentrates of the DAT-63 leachates of each soil by HPLC-MS(/MS) with accurate mass determination.

In the previous lysimeter studies, it was distinguished between two peaks (M1 and M2) observed in the polar fraction. However, in the reported chromatograms of these studies, only one pronounced polar peak was visible. Due to minor shifts in the retention time the polar peak was assigned as M1 or M2 throughout the studies. The slightly different retention times found for M1 and M2 in the previous studies are regarded as chromatographic effects, possibly due to shifts due to different pH values in sample and eluents. The retention times of polar metabolites depend on the HPLC equipment (column, sample volume, etc.) and are therefore not exactly reproducible. In the present study, always only one significant polar peak was observed in the three tested soils and consistently identified as BCS-CV14885. It is therefore justified to assume that this single component corresponds to the peaks assigned to M1 and M2 in the former studies.

Besides the polar degradation product BCS-CV14885, the test item mesosulfuron-methyl and the degradation product AE F154851 were identified in the forced leachates. In a soil solvent extract, one additional degradation product, AE F092944, a known terminal metabolite of mesosulfuron-methyl, was found and identified.

I. MATERIALS AND METHODS

A. MATERIALS

1. Test Item

[Pyrimidyl-2-^{14}C]Mesosulfuron-methyl (applied in a WP20 formulation diluted with water)

Sample ID:	KML 9200
Specific Radioactivity:	4.02 MBq/mg
Radiochemical Purity:	97% (HPLC)
Chemical Purity:	97% (HPLC, UV)

2. Test Soils

Three different soils were used in the study. The soils were taken from agricultural use areas representing different geographical origins and different soil properties. The soils were sampled freshly from the fields (upper horizon of 0 to 20 cm) and sieved to a particle size of ≤ 20 mm.

Table CA 7.1.4.2- 1: Physico-chemical properties of test soils

Soil	[redacted] **4a**	[redacted]**, AXXa**	[redacted]
Geographic Location (City / State / Country)	[redacted] / NRW / Germany	[redacted] / NRW / Germany	[redacted] / NRW / Germany
GPS coordinates	[redacted]	[redacted]	[redacted]
Soil Taxonomic Classification (USDA)	Loamy mixed, mesic Typic Argudalf	Sandy, mixed, mesic Typic Cambudoll	Loamy mixed, mesic Typic Argudalf
Pesticide use history	No pesticide use for previous 5 years		
Collection procedures	Sample taken with shovel and placed into plastic bag/bucket		
Sampling depth	0 – 20 cm		
Storage conditions	Stored after sieving at ambient conditions prior to use		
Storage length	3 days prior to the arrangement of the plant pots which were then equilibrated to outdoor conditions for 26 days until application		
Soil preparation	Soil was passed through a 20 mm sieve		
Texture Class (USDA)	Silt loam	Loamy Sand	Sandy loam
Sand [50 µm - 2 mm] (%) Silt [2 µm - 50 µm] (%) Clay [< 2 µm] (%)	30 53 17	78 14 8	56 25 19
pH (soil / 0.01 M $CaCl_2$ 1/2) pH (soil / water 1/1) pH (saturated paste) pH (soil / 1 N KCl 1/1)	6.4 6.7 6.7 6.1	6.1 6.3 6.3 5.8	5.1 5.4 5.4 4.7
Organic Matter ^{A} (%) Organic Carbon (%)	4.5 2.6	3.3 1.9	3.6 2.1
CEC (meq/100 g)	14.4	9.9	11.1
MWHC (g/100 g) Moisture at 1/10 bar = pF 2 (%)	not determined 33.6	not determined 15.8	not determined 26.6
Bulk density (g/cm³)	1.01	1.20	1.07

^{A} % organic matter = % organic carbon x 1.724

B. STUDY DESIGN

1. Experimental Conditions

Plant pots (diameter about 40 cm, depth about 30 cm) with a drain outlet were used as test vessels. For preparation of the test systems, plant pots were filled with coarse gravel (about 10 cm). After covering the gravel with a gaze in order to avoid elutriation of soil particles, a 15 cm soil layer was filled into the plant pots and slightly compacted. The drain outlet was fitted with a container to sample the leachate (e.g. 5 L). The untreated soil was allowed to equilibrate for 26 days under outdoor conditions.

A nominal test concentration of 0.18 mg per plant pot was applied in order to obtain the same test item concentration as was used in the previous studies. This concentration is based on the highest recommended single use rate for field application (15 g/ha). For the production of higher amounts of degradation products, an additional sample of soil [redacted] [redacted] (MID sample) was applied with the 20-fold amount of test item. For application, the targeted amount of test item was dissolved in in a WP20 formulation diluted with water and applied dropwise directly to the soil surface.

After application, the plant pots were incubated under outdoor conditions from late summer (September) to winter (December). From day 105 onwards, they were placed into a greenhouse due to winter weather conditions.

2. Sampling

Six sampling intervals were distributed over an incubation period of 126 days (regular samples and MID sample). Leachates were collected 16, 37, 63, 78, 105 and 126 days after treatment (DAT). 246 days after application, 1 kg soil was removed from each plant pot over the total depth and 200 g thereof were subjected to an extraction procedure. Samples were analyzed by LSC within 22 days and by HPLC within 49 days after sampling. Until analysis, samples were stored deep-frozen. In the course of method development samples were shown to be stable for that time period.

3. Analytical Procedures

Radioactivity in solutions (e.g. leachate, soil extracts) was determined by liquid scintillation counting (LSC). Soil samples were extracted with 160 mL acetonitrile/water (80/20, v/v) at ambient temperature. After centrifugation, the extracts were decanted and aliquots thereof were analyzed by LSC and, after a concentration step, by HPLC/radiodetection. The leachates were concentrated prior to HPLC/radiodetection analysis as well. The HPLC method was developed in order to reproduce the methods used in the previous lysimeter studies as far as possible.

Degradation products in leachates and soil extracts were identified by HPLC-MS(/MS) including accurate mass determination either directly or after peak isolation by HPLC.

Radioactivity in the extracted soil (non-extractable radioactivity, NER) was not determined.

II. RESULTS AND DISCUSSION

A. DATA

The aim of the present study was the investigation and characterization of the polar peaks M1 and M2 reported in previous lysimeter studies. Therefore, the study focused on the identification of the analyte with a similar retention behaviour.

The maximum amounts of radioactivity in the leachates of all plant pots were found at DAT-63 or DAT-78 accounting for up to 6.4, 8.6, 7.1 and 1.5% of applied radioactivity (% AR) for plant pots [redacted] [redacted] [redacted] 4a, [redacted] AXXa, [redacted] [redacted] and the MID-sample, respectively. The four most prominent peaks in the leachates were detected with retention times of 6.6, 25.2, 55.0 and 67.3 min. The peak with a retention time of 67.3 min (max. 2.5% AR, soil [redacted] AXXa) was assigned to the test item mesosulfuron-methyl according to its retention time.

Clearly most abundant was the polar peak fraction appearing with a retention time of about 6.6 min (max. 7.1% AR, soil [redacted] [redacted]) which was further investigated by structure elucidation methods in several samples.

C. IDENTIFICATION OF DEGRADATION PRODUCTS

In the previous lysimeter studies, it was distinguished between two peaks (M1 and M2) observed in the polar fraction. However, in the reported chromatograms of these studies, only one pronounced polar peak was visible. Due to minor shifts in the retention time the polar peak was assigned as M1 or M2 throughout the studies. The slightly different retention times found for M1 and M2 in the previous studies are regarded as chromatographic effects, possibly due to shifts due to different pH values in sample and eluents. In such cases, also splitting and smearing of peaks can typically be observed. The retention times of polar metabolites depend on the HPLC equipment (column, injection volume, etc.) and are therefore not exactly reproducible in the present investigation.

In the present study, only one polar peak was detected in all leachates with a retention behaviour of M1 and M2 found in previous studies. This polar peak appearing with a retention time of about 6.6 min (max. 7.1% AR, soil [redacted] [redacted]) was analyzed by structure elucidation methods in several samples. First, the polar peak fraction was isolated from a concentrated and purified leachate of soil [redacted] [redacted] 4a (DAT-78). In this fraction, BCS-CV14885 was identified by HPLC-MS(/MS) with accurate mass determination using an Orbitrap type mass spectrometer. Furthermore, BCS-CV14885 was identified in concentrates of the DAT-63 total leachates of each plant pot by HPLC-MS(/MS) with accurate mass determination, as well as in the polar peak fraction of a concentrated soil extract of the MID sample.

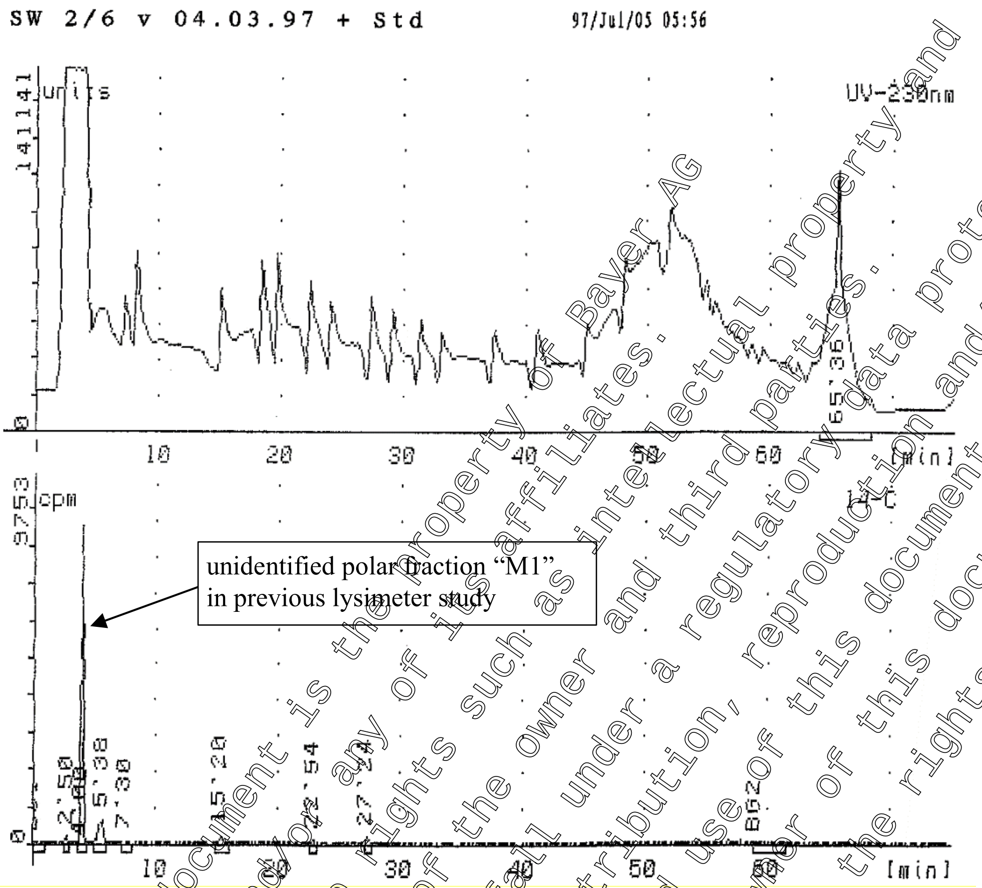
Besides BCS-CV14885, the test item mesosulfuron-methyl and the degradation product AE F154851 were identified by HPLC-MS(/MS) with accurate mass determination in the concentrated DAT-63 total leachate of soil [redacted] AXXa. Additionally, in the soil extract of the MID-sample, AE F092944 was identified by HPLC-MS with accurate mass determination in the peak fraction with a retention time of about 26.9 min.

III. CONCLUSIONS

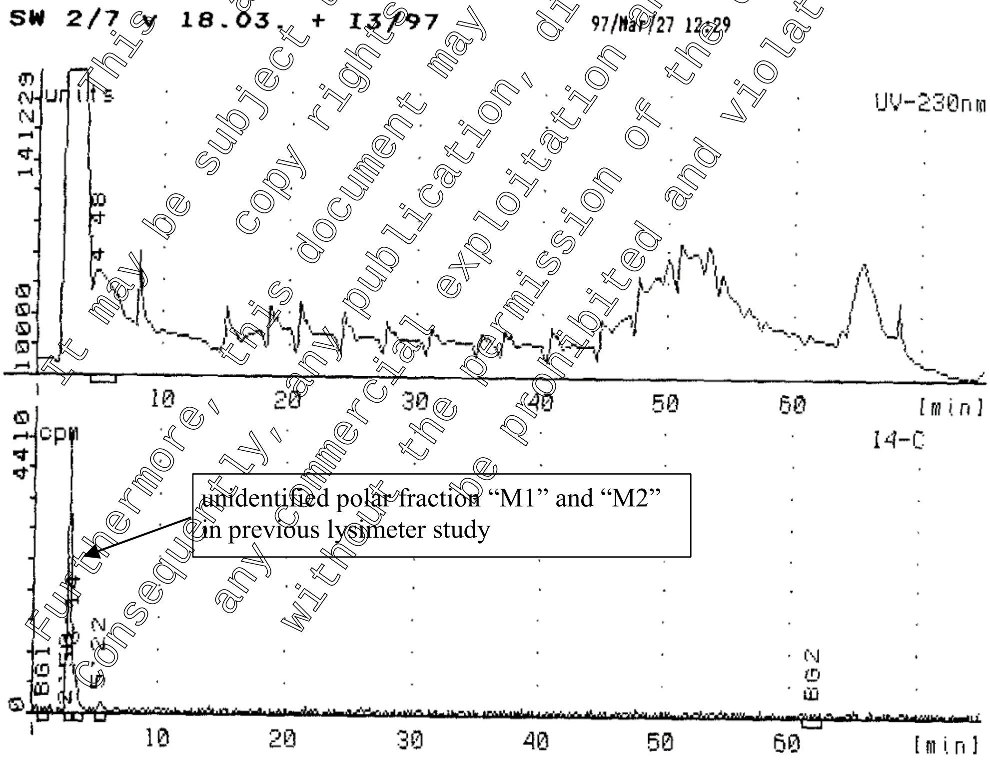
BCS-CV14885 was identified as the only degradation product in the polar peak fraction from leachate and extract. It is assumed that the peak of BCS-CV14885 observed in this study corresponds to the degradation product distinguished as M1 and M2 in the previous lysimeter studies

update: as per RMS request, for illustration a high quality figure of the chromatographic profiles showing the radioactivity assigned to unidentified polar fraction is provided below [example: top: leachate collected on 1997-03-04 from Lysimeter 2/6; bottom: leachate collected on 1997-03-18 from Lysimeter 2/7] derived from the lysimeter study M-199641-01-1 (KCA 7.1.4.2 /01), and from the current study for metabolite investigation M-457999-01-1 (KCA 7.1.4.2 /05) [sample DAT-78, soil [redacted] [redacted] 4a].

Previous lysimeter study (M-199641-01-1):

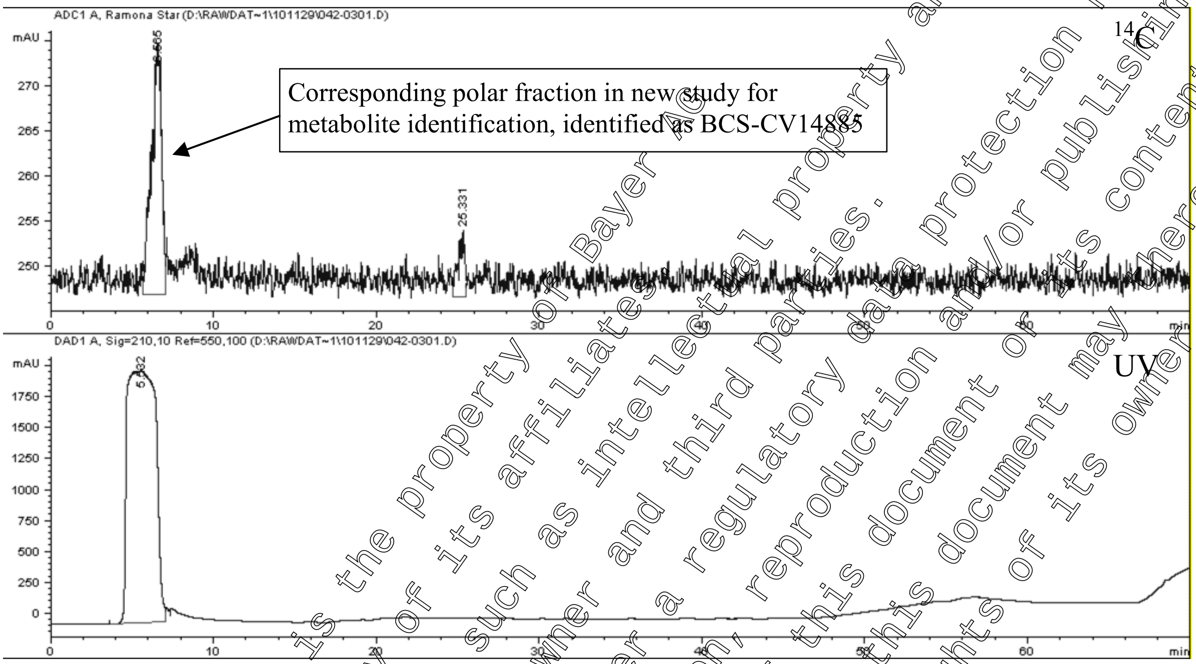


unidentified polar fraction “M1”
in previous lysimeter study



unidentified polar fraction “M1” and “M2”
in previous lysimeter study

New study for identification of metabolites detected in the previous lysimeter studies (M-457999-01-1)



Corresponding polar fraction in new study for metabolite identification, identified as BCS-CV14885

****

In the following, data discussion and updated groundwater exposure assessment is provided for the newly assigned component BCS-CV14885.

Quantification of groundwater exposure to BCS-CV14885:

Groundwater exposure to component BCS-CV14885 was estimated via two alternative routes:

(a) based on the reported experimental data from the lysimeter studies
(i.e. measured values for the one specific experimental worst case soil profile and irrigation setting of the lysimeter experiments)

(b) based on environmental modelling using FOCUSgw scenario calculations
(i.e. analysis for representative regions of European agriculture)

These are described and compared in the following:

a) PECgw of BCS-CV14885 based on experimental data from lysimeter studies

Two lysimeter studies have been conducted on mesosulfuron-methyl, including each two replicate lysimeter cores with annual application of ca. 15 g/ha active substance, timed either in spring

(KCA 7.1.4.2 /01), or in autumn (KCA 7.1.4.2 /03). Supportive experiment KCA 7.1.4.2 /05 for the identification of polar leachate fractions observed in these lysimeter studies lead to the conclusion of chemical identity of the fractions referred to as ‘M1’ and ‘M2’ in the original study reports. Both fractions are consequently assigned the chemical structure of BCS-CV14885. Exposure of groundwater recharge to BCS-CV14885 will equal the sum of the annual mean concentrations reported for both components ‘M1’ and ‘M2’, corrected for molecular weight difference between BCS-CV14885 (MW = 393.4 amu) and parent mesosulfuron-methyl (MW = 503.5 amu). The respective lysimeter study data, and conversion into BCS-CV14885 leachate concentrations is shown in Tables CA 7.1.4.2-2 and -3 below.

Table CA 7.1.4.2- 2: Calculation of annual mean concentrations of BCS-CV14885 based on analytical data for M1 and M2 reported in lysimeter study KCA 7.1.4.2/01 (spring applied).

KCA 7.1.4.2/01 *spring applied*		*Replicate 1* *[Lysimeter 2/6]*			*Replicate 2* *[Lysimeter 2/7]*			**Mean of Replicates**		
fraction / [unit]		*yr 1*	*yr 2*	*yr 3*	*yr 1*	*yr 2*	*yr 3*	yr 1	yr 2	yr 3
M1	[µg/L as. equiv.]	*0.016*	*0.107*	*0.01*	*0.02*	*0.112*	*0.11*	0.020	0.110	0.060
M2	[µg/L as. equiv.]	*0.298*	*0.201*	*0.316*	*0.296*	*0.196*	*0.252*	0.297	0.199	0.284
Sum	[µg/L as. equiv.]	*0.298*	*0.308*	*0.326*	*0.316*	*0.308*	*0.362*	0.307	0.308	0.344
	[µg/L BCS-CV14885]	*0.233*	*0.241*	*0.255*	*0.247*	*0.241*	*0.283*	**0.240**	**0.241**	**<u>0.269</u>**

Table CA 7.1.4.2- 3: Calculation of annual mean concentrations of BCS-CV14885 based on analytical data for M1 and M2 reported in lysimeter study KCA 7.1.4.2/03 (autumn applied)

KCA 7.1.4.2/03 *autumn applied*		Replicate 1 [Lysimeter 1/6]			Replicate 2 [Lysimeter 1/7]			**Mean of Replicates**		
fraction / [unit]		yr 1	yr 2	yr 3	yr 1	yr 2	yr 3	yr 1	yr 2	yr 3
M1	[µg/L as. equiv.]	n.a.	0.445	0.014	n.a.	0.433	0.012	n.a.	0.439	0.013
M2	[µg/L as. equiv.]	n.a.	0.242	0.169	n.a.	0.112	0.2	n.a.	0.177	0.185
Sum	[µg/L as. equiv.]	n.a.	0.687	0.183	n.a.	0.545	0.212	n.a.	0.616	0.198
	[µg/L BCS-CV14885]	*n.a.*	*0.556*	*0.143*	*n.a.*	*0.426*	*0.166*	**n.a.**	**<u>0.481</u>**	**0.154**

The maximum annual mean concentrations of metabolite BCS-CV14885 in groundwater recharge as derived directly from the lysimeter experiments were 0.269 µg/L for spring applications of mesosulfuron-methyl (15 g/ha/year), or 0.481 µg/L for autumn applications of mesosulfuron-methyl (15 g/ha/year).

b) <u>PECgw based on environmental modelling using FOCUSgw scenario calculations</u>

To enable a broader analysis of expected groundwater exposure to metabolite BCS-CV14885 for representative regions of European agriculture, supportive PECgw simulations were made using FOCUSgw environmental modelling approaches. The simulations were based on substance data as generated in individual studies on soil half-life (cf. KCA 7.1.2.1.2 /06) and soil adsorption (cf. KCA 7.1.3.1.2 /08) of BCS-CV14885, and for simplification assumed a direct formation of the component from parent active substance. As an input parameter for formation fraction, a conservative

estimate was derived via iterative approaches for this metabolite of apparently very minor abundance in the soil metabolism studies.
In analogy to the two lysimeter studies, two simulation runs were made to address a use of mesosulfuron-methyl to winter cereals at 15 g/ha/year, timed either in spring, or in autumn.
For details on these simulations, see the summary provided below for study KCA 7.1.4.2 /06.

The annual mean concentrations of metabolite BCS-CV14885 in groundwater recharge as simulated for the FOCUSgw scenarios experiments ranged from 0.079 - 0.282 µg/L for spring applications of mesosulfuron-methyl (15 g/ha/year), or from 0.126 - 0.426 µg/L for autumn applications of mesosulfuron-methyl (15 g/ha/year).

Conclusion: Groundwater exposure to degradate BCS-CV14885 was estimated via two alternative routes: based on measured data from the lysimeter studies, and based on environmental modelling using FOCUSgw scenario simulations. Results of both procedures are in good agreement and indicate that for the assessed uses of 15 g/ha active substance applied to cereals either in spring or in autumn the threshold level of 0.1 µg/L can be exceeded by BCS-CV14885, but concentrations will remain below the trigger level of 0.75 µg/L. An assessment of the relevance of this component in groundwater is therefore required, and will be presented in Document N4.

Note: Owing to the lack of observation of BCS-CV14885 in soil metabolism studies indicating very low formation, and to keep complexity of the overall degradation pathway representation in simulation models at a practical level, it is recommended to not include BCS-CV14885 in standard exposure simulations for the assessment of products. Above numeric considerations will as a 'risk envelope' adequately address the situation of mesosulfuron-methyl uses on cereals at up to 15 g/ha.

Report:	[redacted]2[redacted];[redacted];2014;M-481614-01
Title:	Mesosulfuron-methyl (MSM) and metabolite: PECgw FOCUS PEARL, PELMO EUR (lysimeter) - Use in winter cereals in Europe
Report No:	EnSa-14-0224
Document No:	M-481614-01-1
Guidelines:	**not applicable;not applicable**
GLP/GEP:	**no**

Materials and Methods: Predicted environmental concentrations in groundwater recharge (PECgw) for degradate BCS-CV14885 were calculated using the simulation models FOCUS PEARL 4.4.4 and FOCUS PELMO 4.4.3. The calculation is intended to supplement the interpretation of findings of this degradate in leachate samples of two lysimeter studies, KCA 7.1.4.2 /01 and KCA 7.1.4.2 /03, via providing an analysis of expected groundwater exposure for representative regions of European agriculture.

In analogy to the dosing of the lysimeter studies, simulations were made for an annual application of 15 g/ha[8] mesosulfuron-methyl post emergence to winter cereals, either in early spring (KCA 7.1.4.2 /01) or in autumn (KCA 7.1.4.2 /03).

Table CA 7.1.4.2- 4: Calculated use pattern in FOCUS groundwater simulations

	(A) winter cereals, spring application		**(B) winter cereals, autumn application,**	
Indicative crop	Winter cereals		Winter cereals	
Application rate	1 x 15 g a.s./ha		1 x 15 g a.s./ha	
Application timing for modelling	14 days before scenario-defined emergence date of earliest spring crop		7 days after emergence	
Growth stage	BBCH 20-32		BBCH 13-32	
	Interception [%]	Compound reaching soil [g/ha]	Interception [%]	Compound reaching soil [g/ha]
	50	7.5	25	11.25

Application timing: The treatment timings were implemented in the simulation model as follows:

(A) *spring application:* The application of a mesosulfuron-methyl based herbicide to winter cereals is typically done at the end of winter, at the beginning of the vegetation period (i.e. when the temperature is high enough to expect crop and weed growth), onto well-developed crop. No pre-defined event dates are implemented in the FOCUS model that would directly translate this cropping situation into discrete calender dates for each groundwater scenario setting. Therefore, the following approach was used to define suitable scenario-adapted application dates: the simulated treatment was referenced relative to the tabulated crop emergence date of the earliest emerging spring crop (i.e. not necessarily cereals) that was defined by FOCUS for the respective scenario. An application 14 days before that date was then selected, which is considered an adequate representation for the start of the vegetation period in the respective scenario environment.

(B) *autumn application, post-emergence*: The simulated application was timed 7 days after the crop emergence date for winter cereals as tabulated by FOCUS for the respective scenario, to represent an early post-emergent treatment situation.

Detailed information on the resulting individual application dates for the FOCUS scenarios resulting from above procedures are provided in Table CA 7.1.4.2- 5.

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[8] [Simulations for an additional lower use rate (6 g/ha) were also reported, but will not be summarised here.]

Table CA 7.1.4.2- 5: Detailed application dates for mesosulfuron-methyl as used for the simulation runs

Scenario	*reference: FOCUS listed emergence of earliest spring crop per scenario*	(A) winter cereals, spring application		(B) winter cereals, autumn application	
		Application Date Selected	Julian day	Application Date Selected	Julian day
[redacted]	*spring cereals: 10 Mar*	24 Feb	55	02 Nov	306
[redacted]	*carrots: 10 Mar*	24 Feb	55	08 Nov	312
[redacted]	*spring cereals: 18 May*	04 May	124	27 Sep	270
[redacted]	*carrots: 10 Mar*	24 Feb	55	12 Nov	316
[redacted]	*field beans: 15 Mar*	01 Mar	60	24 Oct	297
[redacted]	*sugar beet: 20 Mar*	06 Mar	65	08 Dec	342
[redacted]	*carrots: 28 Feb*	14 Feb	45	07 Dec	341
[redacted]	*cabbage: 01 Mar*	15 Feb	46	07 Dec	341
[redacted]	*potatoes: 01 Mar*	15 Feb	46	07 Dec	341

Substance, Pathway and Model parameters: An overview of detailed substance and model related information implemented in the simulation is summarised in Table CA 7.1.4.2- 6.

Concerning the parameter 'formation fraction' of BCS-CV14885, a specific approach had to be chosen. This component could be identified only in drainage water samples of a non-guideline mesosulfuron-methyl soil degradation experiment specifically designed for the clarification of polar leachate radioactivity that had been reported in previous lysimeter studies. The degradate was however not found at abundances allowing for identification and quantification in any of the standard parent soil degradation studies (KCA 7.1.1.1 /01 to /04). These experimental results suggest that BCS-CV14885 may be present in soils only at very minor levels; the data though does not allow for an exact numeric description of formation suitable for use as input to simulation models. Considering the apparently very low formation and taking into account the DT_{50} values obtained from the metabolite degradation study, it would seem highly unrealistic to assume as default a worst case of 100% formation.

Therefore, a more realistic estimate of the formation fraction of metabolite BCS-CV14885 for modelling purposes was derived as follows:

For the kinetic system parent → metabolite, possible formation fractions were iterated using the "Solver" functionality in Excel, to identify a formation fraction that would result in a target BCS-CV14885 residue level of maximum 5 %AR abundance in soil. This target residue value of 5% was founded on the formal trigger value that would have required component identification in the soil metabolism studies. It should be noted that in the present case such formation fraction will nevertheless represent a conservative value, since no components >3.7%AR were left unidentified in any of the soil metabolism studies (cf. Table CA 7.1.1.1- 1).

Table CA 7.1.4.2- 6: Compound, model and pathway related input parameters for mesosulfuron-methyl and its degradate BCS-CV14885

Parameter	Unit	Mesosulfuron-methyl	BCS-CV14885
Common			
Molar Mass	[g/mol]	503.5	393.4
Solubility	[mg/L]	483	2000
Vapour Pressure	[Pa]	1.10E-11	7.40E-10
Freundlich Exponent		0.910	1.210
Plant Uptake Factor		0.0	0.0
Walker Exponent		0.7	0.7
PEARL Parameters			
Substance Code		MSM	M885
DT50	[days]	31.9	166.5
Molar Activ. Energy	[kJ/mol]	65.4	65.4
Kom	[mL/g]	27.8	10.4
Kf	[mL/g]	-	-
PELMO Parameters			
Substance Code		AS	A1
Rate Constant	[1/day]	0.02173	0.00416
Q10		2.58	2.58
Koc	[mL/g]	48.0	17.9
Degradation fraction from → to (FOCUS PEARL)		0.07 MSM -> M885	
Degradation rate from → to (FOCUS PELMO)		0.0015210 Active Substance -> A1 0.0202080 Active Substance -> <BR/CO2 0.0041630 A1 -> <BR/CO2	

Findings: The simulated 80th percentile PECgw values of degradate BCS-CV14885 for the assessed uses are given in Table CA 7.1.4.2- 7.

Table CA 7.1.4.2- 7: PECgw of degradate BCS-CV14885, resulting from application of 15 g/ha mesosulfuron-methyl to winter cereals

Scenario	(A) winter cereals, spring application 1 x 15 g a.s./ha		(B) winter cereals, autumn application 1 x 15 g a.s./ha	
	FOCUS PEARL	FOCUS PELMO	FOCUS PEARL	FOCUS PELMO
	PECgw [µg/L]	PECgw [µg/L]	PECgw [µg/L]	PECgw [µg/L]
[redacted]	0.191	0.171	0.305	0.278
[redacted]	0.180	0.159	0.262	0.254
[redacted]	**0.282**	0.211	**0.426**	0.332
[redacted]	0.099	0.118	0.154	0.185
[redacted]	0.096	0.094	0.140	0.140
[redacted]	0.113	0.136	0.182	0.232
[redacted]	0.092	0.087	0.126	0.137
[redacted]	0.098	0.079	0.157	0.137
[redacted]	0.200	0.132	0.337	0.226
overall maximum	**0.282**		**0.426**	

Conclusion: The simulation indicates that the concentration in groundwater recharge of degradate BCS-CV14885 for the assessed uses may exceed the parametric trigger value of 0.1 µg/L in several FOCUS scenarios. The maximum concentrations are predicted for the '[redacted]' scenario situation, but with a wide margin of safety are not expected to reach or exceed the trigger value of 0.75 µg/L.

Alternative PECgw simulation of BCS-CV14885 based on lysimeter study, using RMS requested modelling parameters:

Report:	[redacted]u;[redacted];2015;M-517435-01
Title:	Mesosulfuron-methyl (MSM) and metabolite: PECgw FOCUS PEARL, PELMO EUR (lysimeter) - Use in winter cereals in Europe
Report No:	EnSa-15-0316
Document No:	M-517435-01-1
Guidelines:	**not applicable;not applicable**
GLP/GEP:	**no**

The document reports an alternative calculation of predicted environmental concentrations in groundwater for component BCS-CV14885, following the methodology presented under KCA 7.1.4.2/06 before, but based on a set of kinetic and soil adsorption input parameters for mesosulfuron-methyl and BCS-CV14885 selected by the RMS.

Materials and Methods: reference is made to KCA 7.1.4.2 /06, see summary before.

Table CA 7.1.4.2- 8: Calculated use pattern in FOCUS groundwater simulations

	(A) winter cereals, spring application		**(B) winter cereals, autumn application**	
Indicative crop	Winter cereals		Winter cereals	
Application rate	1 x 15 g a.s./ha		1 x 15 g a.s./ha	
Application timing for modelling	14 days before scenario-defined emergence date of earliest spring crop		7 days after emergence	
Growth stage	BBCH 20-32		BBCH 13-32	
	Interception [%]	Compound reaching soil [g/ha]	Interception [%]	Compound reaching soil [g/ha]
	20	12.0	0	15.0

Application timing: reference is made to KCA 7.1.4.2 /06, see summary before.

Substance, Pathway and Model parameters:

Degradation half-lives and soil adsorption constants were used as requested by the RMS. The formation fraction of BCS-CV14885 was also updated via iteration procedure as previously described for KCA 7.1.4.2 /06, based on the RMS defined kinetic parameters. This resulted in a minor difference to the previous parameter (new value: 0.08, previous simulation: 0.07).

Table CA 7.1.4.2- 9: Compound, model and pathway related input parameters for mesosulfuron-methyl and its degradate BCS-CV14885

Parameter	Unit	Mesosulfuron-methyl	BCS-CV14885
Common			
Molar Mass	[g/mol]	503.5	393.4
Solubility	[mg/L]	483	2000
Vapour Pressure	[Pa]	1.10E-11	7.40E-10
Freundlich Exponent		0.910	1.210
Plant Uptake Factor		0.0	0.0
Walker Exponent		0.7	0.7
PEARL Parameters			
Substance Code		MSM	M885
DT50	[days]	42.4	151.2
Molar Activ. Energy	[kJ/mol]	65.4	65.4
Kom	[mL/g]	37.1	10.3
Kf	[mL/g]	-	-
PELMO Parameters			
Substance Code		AS	A1
Rate Constant	[1/day]	0.01636	0.00458
Q10		2.58	2.58
Koc	[mL/g]	64.0	17.7
Degradation fraction from → to (FOCUS PEARL)		0.08 MSM -> M885	
Degradation rate from → to (FOCUS PELMO)		0.0013080 Active Substance -> A1 0.0150400 Active Substance -> <BR/CO2 0.0045800 A1 -> <BR/CO2	

Findings:

Table CA 7.1.4.2- 10: PECgw of degradate BCS-CV14885, resulting from application of 15 g/ha mesosulfuron-methyl to winter cereals

Scenario	**(A) winter cereals, spring application** 1 x 15 g a.s./ha		**(B) winter cereals, autumn application** 1 x 15 g a.s./ha	
	FOCUS PEARL	FOCUS PELMO	FOCUS PEARL	FOCUS PELMO
	PECgw [µg/L]	PECgw [µg/L]	PECgw [µg/L]	PECgw [µg/L]
[redacted]	0.326	0.294	0.430	0.389
[redacted]	0.320	0.279	0.390	0.372
[redacted]	**0.498**	0.368	**0.627**	0.479
[redacted]	0.175	0.206	0.224	0.270
[redacted]	0.169	0.166	0.209	0.208
[redacted]	0.189	0.232	0.254	0.324
[redacted]	0.161	0.156	0.189	0.202
[redacted]	0.164	0.135	0.215	0.192
[redacted]	0.334	0.227	0.463	0.314
overall maximum	**0.498**		**0.627**	

Conclusion: The simulations indicate that the concentration in groundwater recharge of degradate BCS-CV14885 may exceed the parametric trigger value of 0.1 µg/L in FOCUS scenarios. The trigger value of 0.75 µg/L will however not be reached or exceeded.

CA 7.1.4.3 Field leaching studies

Field leaching studies were not performed and are not required. A comprehensive set of laboratory data on degradation and adsorption of parent active substance and major metabolites to soil allow for an assessment of the mobility of all significant residues under various environmental conditions by the use of computer simulations as given, for example, by the FOCUS scenario approach. Such transfer calculation is more flexible and allows for adaptation to site or country specific climate and soil conditions, such overcoming the limitations of a field leaching experiment.

CA 7.2 Fate and behaviour in water and sediment

Abiotic hydrolysis: Mesosulfuron-methyl is only slowly hydrolysed in sterile buffer solutions at neutral to alkaline pH (DT_{50} = 253 d at pH 7, 25 °C, and 318 d at pH 9, 25 °C), but degrades more rapidly in an acidic environment (DT_{50} = 3.5 d at pH 4, 25 °C). The hydrolytic pathway involves cleavage of the sulfonylurea bridge to form AE F092944 (all pH), and AE F140584 (acidic environment) or AE F147447 (neutral and alkaline environment). As a minor pathway under alkaline conditions, additionally hydrolysis of the methyl ester function may occur, to result in small amounts of AE F154851.

Aqueous photolysis: Mesosulfuron-methyl is not photodegraded to significant extent at wavelengths >290 nm in sterile buffer solution ($DT_{50} \geq 344$ days under environmental conditions). Direct photolysis will therefore not contribute notably to elimination from the aquatic environment, and will not lead to the generation of relevant degradates.

Water/sediment: Mesosulfuron-methyl was found microbially degraded in two tested aerobic sediment/water systems. The proposed route of degradation is consistent with the route of degradation in aerobic soil, all components shown in Figure CA 7.1.1-1 were also identified in the water / sediment study. The products of predominant abundance were AE F160459, AE F147447, and AE F160460, which reached maximum abundances of 21.6%AR , 10.9% AR, and 8.4 %AR in the total systems, respectively. All further degradates remained below 5 %AR until sampling day 140. Terminal bioconversion led into the formation of non-extractable residues, and ^{14}C-carbon dioxide.

The study was kinetically evaluated according FOCUS (2006), an overview of this information provided in the table below:

Table CA 7.2- 1: Total system DT_{50} values and maximum abundances of mesosulfuron-methyl and its metabolites in aerobic water/sediment

Test system	Mesosulfuron-methyl (days)	AE F154851 (days)	AE F160459 (days)	AE F099095 (days)	AE F092944 (days)	AE F160460 (days)	AE F140584 (days)	AE F147447 (days)
[redacted] (phenyl label)	81.2	255	114	n.d.	- [b)]	47.1	n.d.	205
[redacted] (pyrimidyl label)	70.3	98.5	64.8	n.d.	25.9	25.3	n.d.	- [b)]
[redacted] (phenyl label)	33.1	10.8	40.4	n.d.	- [b)]	16.2	n.d.	n.d.
[redacted] (pyrimidyl label)	23.3	8.2	16.8	n.d.	n.d.	111	n.d.	- [b)]
Endpoint [a)]	**45.8**	**38.6**	**47.3**	**(1000)**	**25.9**	**38.3**	**(1000)**	**205**
Max. abundance [%AR]	**(100)**	**4.9**	**21.6**	**0.9**	**3.2**	**8.4**	**1.9**	**10.9**

a) geomean for more than 1 value, worst case default of 1000 days where no reliable DT50 derived
b) component not traced by radiolabel position
n.d.: no reliable value determinable

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 mesosulfuron-methyl in buffers under sterile conditions in the dark in the laboratory were evaluated during the Annex I, and were considered acceptable during the original EU review of mesosulfuron (Review Report SANCO/10298/2003-Final, 25 June 2004). The following study is included in the baseline dossier. No additional studies are submitted within this supplemental dossier for approval renewal of mesosulfuron-methyl.

Report:	[redacted]; [redacted];2000;M-197200-01
Title:	Hydrolysis of ^{14}C-AE F130060 at different pH values
Report No:	738090
Document No:	M-197200-01-1
Guidelines:	**EU (=EEC): 92/69/EEC; OECD: 111; USEPA OPPTS 835.2130; USEPA OPPTS 835.2110; Deviation not specified**
GLP/GEP:	**yes**

Reference	Followed guidance	Guidance currently in force	Differences	Critical assessment of the study / Deviations / conclusion about its Reliability
M-197200-01-1	1) EU (=EEC): 92/69/EEC 2) OECD: 111 3) USEPA OPPTS 835.2130 4) USEPA OPPTS 835.2110	OECD 111	None	Study fulfills criteria of current guideline and is considered reliable.

Endpoints according to the Review Report for mesosulfuron-methyl (SANCO/10298/2003-Final):

pH 4 : DT$_{50}$ 3.5 d (25° C), 7.2 d (20° C)
metabolites : AE F092944 max. 34.6 % and AE F140584 max. 46.2 % (20° C)

pH 7 : DT$_{50}$ 253 d (25° C), 23.1 d (40° C)
metabolites : AE F092944 max. 26.2 % and AE F147447 max. 37.4 % (40° C)

pH 9 : DT$_{50}$ 318 d (25° C), 27.2 d (40° C)
metabolites : same as pH 7

CA 7.2.1.2 Direct photochemical degradation

The photolytic route and rate of degradation of mesosulfuron-methyl in buffer in the laboratory was evaluated during the Annex I inclusion, and were considered acceptable during the original EU review of mesosulfuron (Review Report SANCO/10298/2003-Final, 25 June 2004). The following study is included in the baseline dossier:

Report:	[redacted]h;[redacted];2000;M-197103-01
Title:	Aqueous photolysis under laboratory conditions Code: (U-^{14}C)-phenyl-AE F130060
Report No:	CP97/040
Document No:	M-197103-01-1
Guidelines:	**OECDNo. 7, 1992; USEPA (=EPA): Subdiv. N; §161-2, 1982;Deviation not specified**
GLP/GEP:	**yes**

Reference	Followed guidance	Guidance currently in force	Differences	Critical assessment of the study / Deviations / conclusion about its Reliability
M-197103-01-1	1) OECD No. 7, 1992 2) USEPA (=EPA): Subdiv. N; §161-2, 1982	OECD 316	None	Study fulfills criteria of current guideline and is considered reliable.

Endpoints according to the Review Report for mesosulfuron-methyl (SANCO/10298/2003-Final):

pH 7, 25° C, DT50 45.9 d (continuous artificial light), x 7.5 under real conditions (June, 50° N)
metabolites < 3.7 % each

One additional study is submitted, to generate a numeric value for the quantum yield of photodegradation in water. The study results confirmed only negligible direct photodegradation of mesosulfuron-methyl with a mean quantum yield of $\Phi = 0.024748$, translating into estimated photolytic half-lives > 1000 days under environmental conditions:

Report:	[redacted]6;[redacted];2013;M-473896-01
Title:	Mesosulfuron-methyl: Determination of the quantum yeld and assessment of the environmental half-life of the direct photo-degradation in water
Report No:	EnSa-13-0335
Document No:	M-473896-01-1
Guidelines:	**Commission Regulation (EU) No 283/2013 in accordance with Regulation (EC) No 1107/2009, 2013** **OECD Test Guideline 101, 1981** **OECD Test Guideline 316, 2008;None**
GLP/GEP:	**yes**

Executive Summary

The UV-VIS absorption spectrum of a solution of 12.77 mg/L mesosulfuron-methyl in pure water showed one maximum at about 239 nm (abs 0.5588) and a shoulder at 260 nm (abs 0.3290). The UV-VIS absorption spectra of mesosulfuron-methyl in buffered aqueous solutions showed similar absorption properties. The molar extinction coefficient ε of the test item in pure water at 290 nm was determined to 394 L mol^{-1} cm^{-1} and at 295 nm to 86 L mol^{-1} cm^{-1}. In general, the absorption properties indicate a potential for direct photolytic interactions of Mesosulfuron-methyl with sunlight in aqueous solutions.

The quantum yield of the direct phototransformation of mesosulfuron-methyl was determined in pure water using polychromatic light according to the ECETOC method. Degradation of mesosulfuron-methyl in pure water in a range of about 2 to 4% was measured by HPLC/radiodetection after a maximum irradiation period of 500 min. This indicates low degradability of mesosulfuron-methyl via

direct phototransformation in pure water. A mean quantum yield of Φ = 0.024748 was calculated on the basis of UV absorption data and the degradation kinetics determined from both experiments.
The estimates based on the two modelling concepts (Zepp & Cline, Frank & Kloepffer) were well comparable. Both estimates considered the quantum yield Φ and the absorption in the UV-VIS spectrum being in the range of wavelengths relevant for the environment. Environmental half lives of sunlight exposed top surface water layers were estimated to above 1000 days for a direct phototransformation of mesosulfuron-methyl during periods of use in spring to fall.
Thus, direct phototransformation in water not may contribute to the dissipation of mesosulfuron-methyl from the environment.

I. MATERIALS AND METHODS

A. MATERIALS

1. Test Item

mesosulfuron-methyl
Certificate of Analysis: AZ 17226
Batch code: AE F130060 00 (B99 0002)
Chemical Purity: 98.5% as determined by pot. titration

2. Test Solutions

UV-VIS Spectra: The UV-VIS spectra of the test item were determined in phosphate buffer (pH 7), borate buffer (pH 9) and pure water.

Phototransformation Experiments: For the irradiation experiments three different solutions were prepared. An actinometer solution (A) consisting of uranyl nitrate, water and oxalic acid (0.01 mol/L of uranyl ions and 0.05 mol/L of oxalic acid), a catalytic solution for the titration (K) consisting of manganese sulphate in 1 mol/L aqueous sulphuric acid and a 0.01 mol/L potassium permanganate solution (T) for titration.

B. STUDY DESIGN

1. Experimental Conditions

The test system for the phototransformation experiment consisted of a merry-go-round irradiation apparatus. The merry-go-round irradiation apparatus was warmed up for at least 15 min prior to the exposure of the samples in order to guarantee a constant radiation of the light source as well as the projected sample temperature of 25 °C ± 1 °C at the beginning of the experiment. Subsequently, only the merry-go-round but not the lamp or the cycle cooling was switched off for adding or removing samples.
After equilibration, two measuring cells with 3.0 mL of solution (A) were first exposed to the light in the system for 10 min. The measuring cells containing 3.0 mL of test solution were swiftly placed onto the 10 positions of the merry-go-round apparatus.

1. Sampling

At the respective sampling interval a single sample was removed and clearly labelled (study number, duration of exposure, test number). Finally, i.e. after both degradation experiments were finished, two samples with solution (A) were irradiated and used for actinometry.

3. Analytical Procedures

Each sample for actinometry was transferred into an Erlenmeyer flask and filled up with water to about 50 mL. Then 5 mL of solution (K) was added to each sample. The mixture was slowly titrated with solution (T) under agitation by means of a magnetic stirrer, until the colour changed from colourless to pink. The consumption in mL was determined exactly to 0.05 mL and the mean of four replicates was taken.

The consumption of solution (T) in case of the unexposed actinometer solution (A) was determined in the same way (blank value).

The UV-VIS absorption properties of the test item were characterised by the number and position of the absorption maxima as well as for each maximum by the molar extinction coefficient ε [L mol^{-1} cm^{-1}]. Moreover, the bandwidth was determined for each maximum. This corresponds to the range between the two wavelengths as follows:

λ_1 ($Abs_{\lambda max}/2$) to $\lambda 2$ ($Abs_{\lambda max}/2$)

The extinction E and (in case of the spectrum in pure water above 290 nm) the ε-values were determined in steps of 1 nm. According to the recent instrument baseline test performed in accordance with the manufacturer's manual, an extinction value of 0.0001 was the background noise level of the instrument.

In case of the respective UV-VIS spectrum the extinction values were considered until 490 nm. The input of extinction values E into the spreadsheet calculation by Microsoft Excel® was terminated and set to zero at a wavelength of > 490 nm.

From the titration difference the average intensity of radiation (I_0) acting upon the test solution during the exposure was calculated by means of Microsoft Excel® calculation.

The results of mesosulfuron-methyl analysis (usually means of duplicates) were evaluated on the basis of linear regression and represented as a degradation line in a concentration versus time diagram (log % mesosulfuron-methyl = - kt + b). The time (in min) after which 10% of the molecules of the test item have been degraded, which is necessary to calculate the quantum yield, was calculated according to the decay law from the determined rate constant k [1/min] of phototransformation:

$N = N_0 \cdot e^{-Kt}$ $t_{(10\%)} = \frac{\ln 0.9}{-k}$ (applies for $N=0.9 N_0$)

II. RESULTS AND DISCUSSION

The study results confirmed only negligible direct photodegradation of mesosulfuron-methyl with a mean quantum yield of Φ = 0.024748, translating into estimated photolytic half-lives > 1000 days under environmental conditions.

A. UV-VIS Absorption Properties of Mesosulfuron-methyl

The UV-VIS absorption spectrum of a solution of 12.77 mg/L mesosulfuron-methyl in pure water showed one maximum at about 239 nm (abs 0.5588) and a shoulder at 260 nm (abs 0.3290). The UV-VIS absorption spectra of mesosulfuron-methyl in buffered aqueous solutions containing 12.77 mg/L Mesosulfuron-methyl showed similar absorption properties.

The molar extinction coefficient ε of the test item in pure water at 290 nm was determined to 394 L mol^{-1} cm^{-1} and at 295 nm to 86 L mol^{-1} cm^{-1}.

In general, the absorption properties indicate a potential for direct photolytic interactions of Mesosulfuron-methyl with sunlight in aqueous solutions.

B. Phototransformation in the Merry-Go-Round Irradiation Apparatus

Intensity of Irradiation

The determinations performed by actinometry prior to and at the end of both experiments showed titration differences of 1.72 mL (experiment #1) and 1.74 mL (experiment #2), respectively. The corresponding intensity of irradiation was calculated to 7.8482 x 10^{16} (experiment #1) and 7.9394 x 1016 (experiment #2) photons absorbed per second for the 3 mL actinometry solution in the range of wavelength from 295 to 490 nm.

Table CA 7.2.1.2- 1: Phototransformation of Mesosulfuron-methyl in Pure Water

Duration of Irradiation [min]	Concentration [mg/L]	
	Experiment #1	Experiment #2
0	5.00 (= 100%)	5.00 (= 100%)
50	4.93	4.93
100	4.99	4.95
150	4.96	4.91
200	4.92	4.89
250	4.90	4.87
300	4.86	4.86
350	4.90	4.85
400	4.90	4.85
450	4.81	4.82
500	4.89 (= 97.8%)	4.80(= 96.1%)

Kinetics of Phototransformation

In the pure water solution a degradation of Mesosulfuron-methyl in a range of about 2 to 4% was observed by HPLC/radiodetection after a maximum irradiation period of 500 min. This indicated low degradability of mesosulfuron-methyl towards direct phototransformation in pure water.

In order to check the stability of the test item in pure water phototransformation test solution during the measuring sequence without irradiation, the 0 min samples were stored protected from light and were re-analysed by HPLC at the end of the sequence. This test showed stability of the test item.

Table CA 7.2.1.2- 2: Statistics of Phototransformation Experiments #1 and #2 in Pure Water

	Rate constant (k) [min $^{-1}$]	DT_{50} [min]	DT_{10} [min]	Correlation coefficient
Experiment #1	0.0001	12761	1940	-0.8005
Experiment #2	0.0001	9928	1509	-0.9691
Mean	0.0001	11345	1725	-0.8848

C. Quantum Yield of the Direct Phototransformation

Based on both degradation experiments performed in pure water quantum yields Φ of 2.1799 x 10^{-2} (experiment #1) and 2.7696 x 10^{-2} (experiment #2) were calculated. This results in a mean quantum yield Φ of 0.024748 for the direct phototransformation in neutral aqueous solution, when the test item is regarded most stable with respect to hydrolysis.

D. Assessment of the Environmental Half-life of Direct Phototransformation

Besides compound specific factors like the quantum yield Φ, the extent of absorption of a compound in the relevant range of the tropospheric sunlight spectrum, the degradation by sunlight is influenced by geographic, climatic, seasonal and matrix-specific conditions.

The environmental half-life for different conditions can be assessed by means of arithmetic models. A prerequisite for the assessments made in the following is the presence of the substance in aqueous solution, i.e. surface water, rain, fog or aerosols water so that exposure to sunlight is given. Moreover it is taken for granted that water constituents do not reduce the intensity of sunlight.

The arithmetic model developed by Zepp and Cline allows for a transfer of laboratory data concerning the direct phototransformation in water to field conditions. The model estimates on the basis of a clear summer sky with no influence of clouds. The half-lives calculated therefore may be regarded as minimum half-lives depending on frequency and extent of cover of sky by clouds.

Based on a mean quantum yield of Φ = 0.024748 and the molar extinction coefficients determined for wavelengths of 297.5 to 490 nm, environmental half-lives were calculated.

Table CA 7.2.1.2- 3: Environmental half-lives calculated according to Zepp & Cline

Season	Environmental DT_{50} of the Direct Phototransformation of Mesosulfuron-methyl [days]			
	30th degree lat.	40th degree lat.	50th degree lat.	60th degree lat.
Spring	2.33 x 10^4	7.19 x 10^4	3.70 x 10^5	2.50 x 10^6
Summer	1.23 x 10^4	2.16 x 10^4	4.65 x 10^4	1.25 x 10^5
Fall	4.20 x 10^4	1.70 x 10^4	1.39 x 10^6	9.43 x 10^6
Winter	1.97 x 10^5	2.43 x 10^6	2.44 x 10^7	1.49 x 10^8

Marginal conditions: pure surface water at 0-5 cm depth, 10th degree longitude, clear sky, typical ozone concentrations in the atmosphere, half-lives integrated over the entire day.
The column of the 50th degree of latitude is more or less relevant to the conditions of Central Europe.

In contrast to the model approach by Zepp and Cline, the arithmetic model developed by Frank and Kloepffer considers the influence of clouded sky for the region Central Europe, i.e. Germany.

Using the mean quantum yield of Φ = 0.024748 and the molar extinction coefficients from 292.5 to 490 nm.

Table CA 7.2.1.2- 4: Environmental Half-lives calculated according to Frank & Kloepffer

Month	Photolysis Constant	Environmental DT_{50} of the DirectPhototransformation of Mesosulfuron-methyl [days]		
	[1/sec]	Minimum	Mean	Maximum
January	0.103×10^{-13}	3.7×10^{8}	7.8×10^{8}	3.5×10^{9}
February	0.321×10^{-12}	1.2×10^{7}	2.5×10^{7}	1.1×10^{8}
March	0.645×10^{-11}	6.5×10^{5}	1.2×10^{6}	5.2×10^{6}
April	0.518×10^{-10}	8.6×10^{4}	1.5×10^{5}	6.2×10^{5}
May	0.152×10^{-9}	3.3×10^{4}	5.3×10^{4}	2.1×10^{5}
June	0.290×10^{-9}	1.8×10^{5}	2.8×10^{4}	1.1×10^{5}
July	0.347×10^{-9}	1.5×10^{4}	2.3×10^{4}	7.7×10^{5}
August	0.279×10^{-9}	1.9×10^{4}	2.9×10^{4}	9.6×10^{4}
September	0.758×10^{-10}	6.2×10^{5}	1.1×10^{5}	3.9×10^{5}
October	0.110×10^{-10}	3.9×10^{5}	7.3×10^{5}	3.3×10^{6}
November	0.175×10^{-12}	2.0×10^{7}	4.6×10^{7}	2.3×10^{8}
December	0.313×10^{-14}	1.2×10^{9}	2.6×10^{9}	1.3×10^{10}

Marginal conditions: pure stagnant surface water at 0-5 cm depth, geographic and climatic conditions of Germany (50th degree lat.), no contribution of another mono- or bimolecular elimination process.

III. CONCLUSIONS

Degradation of mesosulfuron-methyl in pure water in a range of about 2 to 4% was measured by HPLC-radiodetection after a maximum irradiation period of 500 min. This indicates low degradability of Mesosulfuron-methyl via direct phototransformation in pure water. A mean quantum yield of $\Phi = 0.024748$ was calculated on the basis of UV absorption data and the degradation kinetics determined from both experiments.

A comparison of the estimates derived from models of Zepp & Cline and Frank & Kloepffer shows that both approaches are well comparable. The two approaches considered the quantum yield and the absorption in a range of wavelengths relevant for the environment. Environmental half lives of sunlight exposed top surface water layers were estimated to above 1000 days for a direct phototransformation of mesosulfuron-methyl during periods of use in spring to fall.

Thus, direct phototransformation in water not may contribute to the dissipation of Mesosulfuron-methyl from the environment.

CA 7.2.1.3 Indirect photochemical degradation

Indirect photochemical degradation of mesosulfuron-methyl was not studied.

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, mesosulfuron-methyl was regarded not to be readily biodegradable. Therefore, a study was not conducted.

CA 7.2.2.2 Aerobic mineralisation in surface water

The data point is a new data requirement under Regulation (EU) No. 1107/2009, one new experimental study is therefore submitted for approval renewal of mesosulfuon-methyl:

Report:	[redacted]ü;[redacted];[redacted];2014;M-486556-01
Title:	[Pyrimidyl-2-14C]mesosulfuron-methyl: Aerobic mineralisation in surface water
Report No:	EnSa-14-0103
Document No:	M-486556-01-1
Guidelines:	**OECD Test Guideline No. 309** **DRAFT SANCO 11802/2010/rev 1 in accordance with Regulation (EC) No 1107/2009;not applicable**
GLP/GEP:	**yes**

Executive Summary

The route and rate of degradation of [pyrimidyl-2-^{14}C]mesosulfuron-methyl were studied in surface water under aerobic conditions in the dark in the laboratory for 62 days at 20.4 °C. Study application rates of 1.10 µg (11.0 µg/L) and 10.93 µg (109.3 µg/L) per test system were applied for the low and high concentration, respectively.

The test was performed in static systems consisting of Erlenmeyer flasks with baffles each containing 100 mL surface water and equipped with traps for the collection of carbon dioxide and volatile organic compounds.

Mean material balances were 99.7% AR (range from 97.9 to 101.8% AR) for the low concentration and 100.3% AR (range from 99.0 to 101.0% AR) for the high concentration. The reference substance benzoic acid degraded with a DT_{50} value of < 2 days in control samples which shows that the microbial activity in the test water was sufficient.

Formation of carbon dioxide was insignificant as demonstrated by values of $\leq 0.1\%$ AR at all sampling intervals for both concentrations. The maximum amount of volatile organic compounds was 1.8% AR at DAT-14 for the low concentration and $< 0.1\%$ AR at all sampling intervals for the high concentration.

The amount of mesosulfuron-methyl in the water slightly decreased from DAT-0 to DAT 62 from 99.4 to 93.7% AR for the low concentration and from 99.2 to 93.6% AR for the high concentration. Besides the test item, AE F092944 was detected as a major metabolite in the test systems with maximum amounts of 6.5 and 6.3% AR at the low and high concentration, respectively. The total unidentified residues amounted to a maximum of 4.3% AR and no single component exceeded 1.2% AR at any sampling interval for both concentrations. Similar results were observed for sterile controls which sampled and analyzed for the last sampling interval.

The experimental DT_{50} and DT_{90} values were calculated using a single first order (SFO) kinetic model. The half-lives for mesosulfuron-methyl were 569 and 672 days for the low and high concentration, respectively.

I. MATERIALS AND METHODS

A. MATERIALS

1. Test Item

[pyrimidyl-2-^{14}C]mesosulfuron-methyl

Sample ID:	KML 9451
Specific Activity:	4.17 MBq/mg (112.77 µCi/mg)
Radiochemical Purity:	> 98% as determined by HPLC/radiodetection
Chemical Purity:	97.6% as determined by HPLC/UV

2. Test Water

The study was carried out using a natural water from the location [redacted] (ID: W), close to [redacted] near [redacted], Germany. This is a fresh water dam that is used for the preparation of drinking water. The water was collected from the forebay Nespen. The water was sampled freshly prior to the start of the study. For characterization of the natural system see Table 7.2.2.2- 1. Prior to use the water was filtered through a 0.063 mm filter.

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

Parameter	Results / Units
Water Designation	[redacted]
Origin	close to [redacted] near [redacted], Germany
Site Description	fresh water dam that is used for the preparation of drinking water
GPS Coordinates	[redacted] [redacted]
Storage	Stored after filtration at ambient conditions prior to use (for 2 days)
Sampling Depth [cm]	10
Temperature [°C] [1]	2.4
pH [1]	7.7
Redox Potential E_H [mV] [1]	271.1
Oxygen Saturation [%] [1]	85
Total Organic Carbon (TOC) [mg /L] [2]	1.9
Dissolved Organic Carbon (DOC) [mg/L] [2]	2.0
Total Nitrogen [mg/L] [2]	2.6
Total Phosphorous [mg/L] [2]	< 0.1
Total suspended solids [mg/L] [3]	No significant amounts

[1] measured at sampling site
[2] measured at start of equilibration
[3] determined during the course of the study
GPS: global positioning system

B. STUDY DESIGN

1. Experimental Conditions

The static test system for mineralization consisted of Erlenmeyer glass flasks with baffles (e.g. 250 mL) and each flask was fitted with a trap attachment (permeable for oxygen) containing soda lime for absorption of carbon dioxide and a polyurethane foam plug for adsorption of volatile organic compounds.

For preparation of the test systems, 100 mL of water were transferred into each flask. For preparation of sterile control samples, flasks were sterilized by autoclaving two times without trap attachments. Trap attachments were autoclaved separately. The flasks were then fitted with trap attachments and equilibrated to study conditions for 2 days prior to application.

Application rates of 11.0 and 109.3 µg/L were applied for the low and the high concentration samples, respectively. Additional samples of both concentrations were incubated under sterile conditions and sampled at the last sampling interval.

After treatment, the test systems were incubated in a temperature-controlled climatic cabinet at 20.4 °C in the dark for up to 62 days. The water was in smooth motion.

Microbial activity was determined by application of an easily degradable control substance (benzoic acid) into additional test vessels and determination of its degradation and formation of carbon dioxide.

2. Sampling

Seven sampling intervals were distributed over the entire incubation period of 62 days. Duplicate samples of each concentration were processed and analyzed 0, 7, 14, 20, 35, 48 and 62 days after treatment (DAT). Sterile samples applied with the test item were processed in duplicate at study end (DAT-62).

Control samples treated with benzoic acid were processed in duplicate 0, 2 and 5 days after treatment. Solvent control samples were processed together with control samples of DAT-5.

3. Analytical Procedures

Prior to opening an incubated test system for processing of water, volatiles possibly still present in the head space of the test system were purged into the trap attachment. Afterwards, the trap attachment was removed. Carbon dioxide absorbed by soda lime was liberated and trapped in a scintillation cocktail selective for binding of carbon dioxide using an air-tight assembly. The PU foam plug was extracted with 50 mL ethyl acetate for approximately 5 minutes in an ultrasonic bath to desorb volatile organic compounds. The respective radioactivity contents were determined by liquid scintillation counting (LSC).

20 mL of the water phase were made alkaline with 1 mL 0.5 M NaOH for determination of dissolved carbon dioxide (in the same manner as described for the soda lime). Furthermore, three 500 µL aliquots of the water were pipetted into LSC-vials containing 100 µL of 5 M aqueous NaOH solution

to determine the radioactivity content of the water by LSC. After determination of redox potentials, pH values and oxygen contents the water was transferred into 100 mL volumetric flasks with 20 mL ACN. For HPLC/radiodetection analysis of the water samples two aliquots (10 mL) of each replicate were transferred into centrifugation tubes and concentrated by a factor of approx. 7.

Samples treated with benzoic acid were analysed for carbon dioxide and organic volatiles, radioactivity in water layer, dissolved radioactive carbon dioxide and for benzoic acid by HPLC/radiodetection. Further microbial degradation of the benzoic acid was inhibited by the addition of NaN_3 solution. The redox potentials, pH values and oxygen contents the water were also investigated.

The data for the test item were evaluated according to the FOCUS guidance document on degradation kinetics using the software KinGUI 2. Model input datasets were the residual amounts found in each replicate test system at each sampling interval. The initial total recovery (material balance) 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. For the evaluation of the data three different kinetic models (SFO, FOMC and DFOP) were tested in order to determine the best-fit kinetic model. 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 (diagrams of measured and calculated values vs. time, diagrams of residuals vs. time). DT_{50} and DT_{90} values (time until 50 or 90% degradation) were calculated from the resulting kinetic parameters.

II. RESULTS AND DISCUSSION

Results indicated that the anticipated standardized conditions were maintained. The reference substance benzoic acid degraded rapidly and was not detectable from DAT-2 onwards which shows that the water was microbially active. Using solvent control samples it was shown, that the solvent methanol had no influence on the microbial activity in the test water. The pH in the water ranged from 7.7 to 9.2 for all test systems treated with mesosulfuron-methyl. Oxygen contents (range from 82 to 95%) indicated aerobic conditions in the water for all experiments.

A. DATA

update Feb 2015: By mistake, summary table CA7.2.2.2-2 listed erroneus information in its column for DAT 62 sterile. The table has been updated with the correct values from the study report (Table 11).

Table CA 7.2.2.2- 2: Degradation of mesosulfuron-methyl in natural pond water under aerobic conditions (high concentration, single and mean values expressed as % AR)

Compound	Replicate	DAT							
		0	7	14	20	35	48	62	62 sterile
mesosulfuron-methyl	A	99.0	96.6	95.1	97.2	94.1	92.6	94.3	91.9
	B	99.4	97.1	93.5	98.2	95.7	93.0	92.9	91.8
	Mean	**99.2**	**96.8**	**94.3**	**97.7**	**94.9**	**92.8**	**93.6**	**91.9**

Compound	Replicate	DAT							
		0	7	14	20	35	48	62	62 sterile
AE F092944	A	0.7	1.4	1.3	1.6	5.1	4.7	6.9	7.3
	B	0.6	1.4	1.6	1.7	5.4	5.1	5.7	8.2
	Mean	**0.6**	**1.4**	**1.5**	**1.6**	**5.3**	**4.9**	**6.3**	**7.7**
Z2	A	0.3	0.2	1.1	n.d.	n.d.	n.d.	n.d.	0.4
	B	0.3	n.d.	1.2	n.d.	n.d.	n.d.	n.d.	n.d.
	Mean	**0.3**	**0.1**	**1.2**	**n.d.**	**n.d.**	**n.d.**	**n.d.**	**0.2**
Z3	A	0.8	0.8	0.5	0.6	0.6	0.4	n.d.	n.d.
	B	0.8	0.7	0.6	n.d.	n.d.	0.4	n.d.	n.d.
	Mean	**0.8**	**0.7**	**0.5**	**0.3**	**0.3**	**0.4**	**n.d.**	**n.d.**
Z4	A	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
	B	0.2	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
	Mean	**0.1**	**n.d.**	**n.d.**	**n.d.**	**n.d.**	**n.d.**	**n.d.**	**n.d.**
Z5	A	n.d.	0.2	1.1	n.d.	n.d.	n.d.	n.d.	n.d.
	B	n.d.	0.4	1.1	n.d.	n.d.	0.4	0.3	n.d.
	Mean	**n.d.**	**0.3**	**1.1**	**n.d.**	**n.d.**	**0.2**	**0.2**	**n.d.**
G	A	n.d.	0.4	0.3	0.7	0.8	0.5	n.d.	1.0
	B	n.d.	0.4	0.4	0.9	n.d.	0.6	0.6	1.0
	Mean	**n.d.**	**0.4**	**0.4**	**0.8**	**0.4**	**0.6**	**0.3**	**1.0**
H	A	n.d.	n.d.	0.8	n.d.	n.d.	n.d.	n.d.	n.d.
	B	n.d.	0.3	0.6	n.d.	n.d.	n.d.	n.d.	n.d.
	Mean	**n.d.**	**0.1**	**0.7**	**n.d.**	**n.d.**	**n.d.**	**n.d.**	**n.d.**
I	A	n.d.	n.d.	0.4	n.d.	n.d.	n.d.	n.d.	n.d.
	B	n.d.	n.d.	0.3	n.d.	n.d.	n.d.	n.d.	n.d.
	Mean	**n.d.**	**n.d.**	**0.4**	**n.d.**	**n.d.**	**n.d.**	**n.d.**	**n.d.**
J	A	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
	B	n.d.	n.d.	0.2	n.d.	n.d.	n.d.	n.d.	n.d.
	Mean	**n.d.**	**n.d.**	**0.1**	**n.d.**	**n.d.**	**n.d.**	**n.d.**	**n.d.**
Sum of Unid./Diff. Residues	A	1.0	1.6	4.3	1.3	1.3	1.0	n.d.	1.4
	B	1.3	1.7	4.3	0.9	n.d.	1.4	0.9	1.0
	Mean	**1.2**	**1.7**	**4.3**	**1.1**	**0.7**	**1.2**	**0.4**	**1.2**
Water	A	100.7	99.7	100.7	100.1	100.5	98.3	101.1	100.6
	B	101.2	100.2	99.4	100.8	101.2	99.5	99.5	101.0
	Mean	**101.0**	**99.9**	**100.1**	**100.4**	**100.8**	**98.9**	**100.3**	**100.8**
Carbon Dioxide	A	n.a.	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	B	n.a.	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Mean	**n.a.**	**< 0.1**	**< 0.1**	**< 0.1**	**< 0.1**	**< 0.1**	**< 0.1**	**< 0.1**
Volatile Organic Compounds	A	n.a.	0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	B	n.a.	< 0.1	< 0.1	0.1	0.1	< 0.1	< 0.1	< 0.1
	Mean	**n.a.**	**< 0.1**	**< 0.1**	**< 0.1**	**< 0.1**	**< 0.1**	**< 0.1**	**< 0.1**
Total Recovery	A	100.7	99.8	100.8	100.1	100.6	98.4	101.2	100.7
	B	101.2	100.2	99.5	100.9	101.3	99.6	99.5	101.1
	Mean	**101.0**	**100.0**	**100.1**	**100.5**	**100.9**	**99.0**	**100.3**	**100.9**

n.d.: not detected, n.a.: not analyzed, N/A: not applicable, DAT: days after treatment

Table CA 7.2.2.2- 3: Degradation of mesosulfuron-methyl in natural pond water under aerobic conditions (low concentration, single and mean values expressed as % AR)

Compound	Rep-licate	DAT							
		0	7	14	20	35	48	62	62 sterile
Mesosulfuron-methyl	A	99.7	97.9	99.1	99.7	94.6	92.3	95.8	89.1
	B	99.1	99.2	98.9	99.5	96.2	93.0	91.5	91.0
	Mean	**99.4**	**98.6**	**99.0**	**99.6**	**95.4**	**92.7**	**93.7**	**90.0**
AE F092944	A	n.d.	n.d.	n.d.	n.d.	5.7	5.2	5.8	7.8
	B	n.d.	n.d.	n.d.	n.d.	5.6	5.1	7.1	6.6
	Mean	**n.d.**	**n.d.**	**n.d.**	**n.d.**	**5.6**	**5.1**	**6.5**	**7.2**
Sum of Unid./Diff. Residues	A	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
	B	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
	Mean	**n.d.**	**n.d.**	**n.d.**	**n.d.**	**n.d.**	**n.d.**	**n.d.**	**n.d.**
Water	A	99.7	97.9	99.1	99.7	100.2	97.4	101.6	96.9
	B	99.1	99.2	98.9	99.5	101.8	98.1	98.6	97.6
	Mean	**99.4**	**98.6**	**99.0**	**99.6**	**101.0**	**97.8**	**100.1**	**97.2**
Carbon Dioxide	A	n.a.	0.1	n.d.	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	B	n.a.	0.2	n.d.	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Mean	**n.a.**	**0.1**	**n.d.**	**< 0.1**	**< 0.1**	**< 0.1**	**< 0.1**	**< 0.1**
Volatile Organic Compounds	A	n.a.	0.2	0.8	0.4	0.8	0.1	0.4	0.7
	B	n.a.	0.4	2.9	< 0.1	0.6	0.4	0.1	0.6
	Mean	**n.a.**	**0.3**	**1.8**	**0.2**	**0.7**	**0.2**	**0.2**	**0.7**
Total Recovery	A	99.7	98.2	99.9	100.2	101.2	97.7	102.0	97.7
	B	99.1	99.8	101.8	99.6	102.5	98.6	98.7	98.2
	Mean	**99.4**	**99.0**	**100.8**	**99.9**	**101.8**	**98.1**	**100.4**	**97.9**

n.d.:not detected; DAT: days after treatment

B. MATERIAL BALANCE

Mean material balances were 99.7% AR (range from 97.9 to 101.8% AR) for the low concentration test systems and 100.3% AR (range from 99.0 to 101.0% AR) for the high concentration test systems. The complete material balances found at all sampling intervals for both concentrations demonstrated that there was no significant loss of radioactivity from the test systems or during sample processing.

C. VOLATILES

Formation of carbon dioxide was insignificant as demonstrated by values ≤ 0.1% AR at all sampling intervals and for both concentrations. The maximum amount of volatile organic compounds was 1.8% AR at DAT-14 for low concentration test systems and < 0.1% AR for high concentration test systems.

E. DEGRADATION OF PARENT COMPOUND

The mean radioactivity in water remained constant with values between 97.2 and 101.0% AR in low concentration test systems and values between 98.9 and 101.0% AR in high concentration test systems, except sterile samples of the high concentration with a value of 125.6% AR.. The amount of mesosulfuron-methyl in water decreased from DAT-0 to DAT-62 from 99.4 to 93.7% AR in low concentration test systems and from 99.4 to 93.6% AR in high concentration test systems.

Degradation of mesosulfuron-methyl was accompanied by the formation of the major degradation product AE F092944 with the following maximum amounts: 6.5% AR at DAT-62 in low concentration test systems and 6.3% AR at DAT-62 in high concentration test systems. The total unidentified residues amounted to a maximum of 4.3% AR and no single component exceeded 1.2% AR at any sampling interval for both concentrations (see Table CA 7.2.2.2- 2 to Table CA 7.2.2.2- 3).

The degradation of mesosulfuron-methyl in water followed single first order (SFO) kinetics at the low and high test item concentration according to the lowest chi^2 error values and visual assessments (see Table 7.2.2.2- 4). Results obtained with the two biphasic kinetic models (FOMC and DFOP) were either not statistically reliable or did not give a significant better description of the data.

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

Test System	Best Fit Kinetic Model[1]	SFO[1]			
		DT$_{50}$ [days]	DT$_{90}$ [days]	Chi^2 Error [%]	Visual Assessment[2]
Low dose	SFO	569	> 1000	0.9	o
High dose	SFO	672	> 1000	1.3	o

[1] SFO: single first order

[2] Visual assessment: o moderate

III. CONCLUSIONS

Mesosulfuron-methyl was slowly degraded and not mineralized in surface water under aerobic conditions in the dark in the laboratory. The calculated best fit half-lives were between 569 and 672 days in the tested soils. Formation of carbon dioxide was insignificant (< 0.1% AR at study end).

One major degradation product, AE F092944, was identified with maximum amounts of 6.5 and 6.3% AR at DAT-62 in samples of the low and high concentration, respectively.

CA 7.2.2.3 Water/sediment study

The route and rate of degradation of mesosulfuron-methyl in water/sediment systems under aerobic conditions were evaluated during the Annex I inclusion using two radiolabel positions, [2-^{14}C-pyrimidyl] and [phenyl-UL-^{14}C], and were considered acceptable during the original EU review of mesosulfuron (Review Report SANCO/10298/2003-Final, 25 June 2004). The following studies are included in the baseline dossier:

Report:	[redacted]j; [redacted]; [redacted];2000;M-198526-01
Title:	Aerobic Degradation in Two Water/Sediment-Systems at 20°C ^{14}C-AE F130060
Report No:	CB97/082
Document No:	M-198526-01-1
Guidelines:	**SETAC-Europe, March 1995, Section 8.2 Aerobic aquatic degradation Environmental Chemistry and Fate Guidelines for Registration of Pesticides in Canada (1987);Deviation not specified**
GLP/GEP:	**yes**

Reference	Followed guidance	Guidance currently in force	Differences	Critical assessment of the study / Deviations / conclusion about its Reliability
M-198526-01-1	1) SETAC-Europe, March 1995, Section 8.2 Aerobic aquatic degradation 2) Environmental Chemistry and Fate Guidelines for Registration of Pesticides in Canada (1987)	OECD 308	Limit of detection not stated	Although the limit of detection is not reported the smallest detected peak amounted for 0.1% AR, therefore the LOD was sufficient and the study is considered as reliable.

Report:	[redacted]o; [redacted];2000;M-199575-01
Title:	Kinetic evaluation of AE F130060 aerobic water/sediment studies using TopFit 2.0 Code: AE F130060
Report No:	OE00/115
Document No:	M-199575-01-1
Guidelines:	**not applicable (computer modelling report)**
GLP/GEP:	**not applicable (computer modelling report)**

The kinetic evaluation of study KCA 7.2.2.3 /01 was updated to comply with current FOCUS kinetic guidance (2006). Report KCA 7.2.2.3 /02 is therefore replaced by a new evaluation KCA 7.2.2.3 /03 summarised below:

update note Feb. 2015: upon request of the RMS, the below kinetic evaluation of the water/sediment study was revisited to take into accounts the following reviewer comments:

- „A stepwise approach to define the degradation route in aquatic systems is recommended and should be reported in the document.
- For sampling day 0, the initial mass balance should be taken into account in the kinetic fitting for mesosulfuron methyl in the total system.
- For both water/sediment systems, new kinetic modellings are awaiting for the parent.
- Furthermore, only sampling dates ranged from 0 and 141 days should be used in the kinetic modellings."

A new report has been issued replacing KCA 7.2.2.3/04, found filed under KCA 7.2.2.3/06.

~~Report:~~	~~[redacted]; [redacted]; [redacted];2014;M-481043-01~~
~~Title:~~	~~Mesosulfuron-methyl (MSM) and metabolites: Kinetic evaluation of aerobic aquatic metabolism in water-sediment systems according to FOCUS kinetics~~
~~Report No:~~	~~EnSa-14-0223~~
~~Document No:~~	~~M-481043-01-1~~
~~Guidelines:~~	**~~not applicable;not applicable~~**
~~GLP/GEP:~~	**~~no~~**

~~Executive Summary~~

~~A kinetic analysis of residue data from the aerobic water/sediment degradation study KCA 7.2.2.3 /01 (M-198526-01-1) was performed with the software KinGUI 2 according to FOCUS kinetics (2006) to derive half-lives for mesosulfuron-methyl and its degradation products AE F154851, AE F160459, AE F099095, AE F092944, AE F160460, AE F140584 and AE F147447, which are suitable for use as input to environmental exposure simulation models.~~

~~Single first order (SFO) was the most appropriate kinetic model for simulation of the degradation of mesosulfuron-methyl under aerobic conditions in the dark in the laboratory at 20 °C. Except for the total system and water of test system [redacted] (phenyl label) and the sediment of test system [redacted] (phenyl label), where first order multi compartment (FOMC) and double first order in parallel (DFOP), respectively, were more appropriate than SFO, resulting in highly visually and statistically acceptable fit for mesosulfuron-methyl. The single first order kinetic model was used for modelling purpose to describe the degradation of all degradation products.~~

~~The calculated half-live for modelling purpose (geometric mean) for the degradation of mesosulfuron-methyl and its metabolites in water/sediment systems under aerobic conditions in the dark in the laboratory are summarized in Table CA 7.2.2.3- 1.~~

~~Table CA 7.2.2.3- 1: Overall compilation of DT$_{50}$ values for mesosulfuron-methyl and its metabolites derived for use as input in environmental fate models.~~

~~Source~~	~~Mesosulfuron-methyl~~ ~~(days)~~	~~AE F154851~~ ~~(days)~~	~~AE F160459~~ ~~(days)~~	~~AE F160460~~ ~~(days)~~	~~AE F147447~~ ~~(days)~~	~~AE F092944~~ ~~(days)~~
~~Total System~~	~~45.8~~	~~38.6~~	~~47.3~~	~~38.3~~	~~205~~	~~25.9~~
~~Water~~	~~34.6~~	~~28.9~~	~~65.7~~	~~70.6~~	~~n.d.~~	~~n.d.~~
~~Sediment~~	~~97.1~~	~~29.2~~	~~121~~	~~n.d.~~	~~n.d.~~	~~n.d.~~

~~**Table CA 7.2.2.3- 2: Overall compilation of DT$_{90}$ –values for mesosulfuron-methyl and its metabolites derived for use as input in enironmental fate models.**~~

~~Source~~	~~Mesosulfuron-methyl~~ ~~(days)~~	~~AE F154851~~ ~~(days)~~	~~AE F160459~~ ~~(days)~~	~~AE F092944~~ ~~(days)~~	~~AE F160460~~ ~~(days)~~	~~AE F147447~~ ~~(days)~~
~~Total System~~	~~152~~	~~128~~	~~157~~	~~85.9~~	~~127~~	~~682~~
~~Water~~	~~116~~	~~96.2~~	~~218~~	~~n.d.~~	~~235~~	~~n.d.~~
~~Sediment~~	~~223~~	~~97.4~~	~~402~~	~~n.d.~~	~~197~~	~~n.d.~~

~~I. METHODS~~

~~Residue data from the aerobic water/sediment degradation study KCA 7.2.2.3 /01 (M-198526-01-1) were used. In this study, the degradation of mesosulfuron-methyl was studied in water/sediment systems~~ [redacted] ~~and~~ [redacted] ~~under aerobic conditions in the dark in the laboratory for 365 days at 20 °C and a test concentration of 25 µg/L water using two radiolabel positions (phenyl-UL-^{14}C and pyrimidyl-2-^{14}C).~~

~~The kinetic analysis was performed according to FOCUS kinetics (2006) using the software KinGUI 2 with four different kinetic models: single first order, first order multi compartment, hockey stick (double first order sequential) and double first order in parallel. Model input datasets were the residual amounts found in each replicate test system at each sampling interval. The most appropriate kinetic model for modelling purpose and trigger evaluation was selected on the basis of a detailed statistical analysis including visual assessment of the goodness of the fits, chi^2-scaled error criterion, t-test significance, correlation analysis and standard deviation. The DT$_{50}$ value was calculated from the resulting kinetic parameters. The degradation of degradation products was described with the single first order model for modelling purpose.~~

~~II. RESULTS~~

~~Single first order (SFO) was the most appropriate kinetic model for modelling purpose for the degradation of mesosulfuron-methyl in all test systems. Except for the total system and water of test system~~ [redacted] ~~(phenyl label) and the sediment of test system~~ [redacted] ~~(phenyl label), where first order multi compartment (FOMC) and double first order in parallel (DFOP), respectively, were more appropriate than SFO, resulting in highly visually and statistically acceptable fit for mesosulfuron-methyl. The SFO kinetic model was used for modelling purpose to describe the degradation of AE F154851, AE F160459, AE F099095, AE F092944, AE F160460, AE F140584 and AE F147447. Tables CA 7.2.2.3- 7 to -14 are summarizing the results of the kinetic analysis for modelling purpose.~~

~~Table CA 7.2.2.3-3: Kinetic parameters for the degradation of mesosulfuron-methyl in water/sediment system under aerobic conditions for modelling purpose according to FOCUS~~

~~Water/Sediment System~~	~~Kinetic Model [1]~~	~~DT$_{50}$ [days]~~	~~DT$_{90}$ [days]~~	~~Chi^2 Error [%]~~	~~t-test~~	~~Visual Assessment [2]~~
~~Total System~~						
[redacted] ~~(phenyl label)~~	~~SFO~~	~~81.2~~	~~270~~	~~2.6~~	~~< 0.0001~~	~~+~~
[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~70.3~~	~~233~~	~~4.1~~	~~< 0.0001~~	~~+~~
[redacted] ~~(phenyl label)~~	~~FOMC~~	~~33.1 [5]~~	~~110~~	~~6.9~~	~~n.a.~~	~~+~~
[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~23.3~~	~~77.3~~	~~8.4~~	~~<0.0001~~	~~+~~
	~~Endpoint [3]~~	**~~45.8~~**	**~~152~~**			
~~Water~~						
[redacted] ~~(phenyl label)~~	~~SFO~~	~~73.7~~	~~245~~	~~15.5~~	~~< 0.0001~~	~~+~~
[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~65.2~~	~~216~~	~~5.3~~	~~< 0.0001~~	~~+~~
[redacted] ~~(phenyl label)~~	~~FOMC~~	~~20.6 [5]~~	~~68.6~~	~~4.1~~	~~n.a.~~	~~+~~
[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~14.8~~	~~49.1~~	~~7.3~~	~~< 0.0001~~	~~+~~
	~~Endpoint [3]~~	**~~34.6~~**	**~~116~~**			
~~Sediment~~						
[redacted] ~~(phenyl label)~~	~~DFOP~~	~~140.3 [4]~~	~~-~~	~~14.0~~	~~k1:~~ ~~0.0596~~ ~~k2:~~ ~~0.0133~~	~~o~~
[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~67.2~~	~~223~~	~~15.0~~	~~< 0.0001~~	~~o~~
[redacted] ~~(phenyl label)~~	~~SFO~~	~~n.d.~~	~~n.d~~			
[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~n.d.~~	~~n.d.~~			
	~~Endpoint [3]~~	**~~97.1~~**	**~~223~~**			

~~n.a.: not applicable for parameters of FOMC model.~~

~~n.d.: not determined (visual and/or statistical fit not acceptable)~~

~~[1] SFO: single first order, FOMC: first order multi compartment, DFOP: double first order in parallel~~

~~[2] visual assessment: + = good, o = moderate~~

~~[3] geomean for more than 1 value~~

~~[4] pseudo SFO DT$_{50}$ calculated from kinetic rate of slow DFOP compartment (= ln(2)/k2)~~

~~[5] pseudo SFO DT$_{50}$ calcualted from DT$_{90}$/3.32~~

~~Table CA 7.2.2.3- 4: Kinetic parameters for the degradation of AE F154851 in water/sediment system under aerobic conditions for modelling purpose according to FOCUS~~

~~Water/Sediment System~~	~~Kinetic Model~~[1]	~~DT_{50} [days]~~	~~Chi^2 Error [%]~~	~~t-test~~	~~Visual Assessment~~[2]
~~**Total System**~~					
[redacted] ~~(phenyl label)~~	~~SFO~~	~~255~~	~~16.5~~	~~0.2797~~	~~o~~
[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~98.5~~	~~8.2~~	~~0.0114~~	~~o~~
[redacted] ~~(phenyl label)~~	~~SFO~~	~~10.8~~	~~32.0~~	~~< 0.0001~~	~~o~~
[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~8.2~~	~~26.6~~	~~< 0.0001~~	~~o~~
	~~**Endpoint**~~[3]	~~**38.6**~~			
~~**Water**~~					
[redacted] ~~(phenyl label)~~	~~SFO~~	~~n.d.~~			
[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~n.d.~~			
[redacted] ~~(phenyl label)~~	~~SFO~~	~~33.1~~	~~13.1~~	~~0.0017~~	~~o~~
[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~25.3~~	~~6.8~~	~~0.0062~~	~~+~~
	~~**Endpoint**~~[3]	~~**28.9**~~			
~~**Sediment**~~					
[redacted] ~~(phenyl label)~~	~~SFO~~	~~n.d.~~			
[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~n.d.~~			
[redacted] ~~(phenyl label)~~	~~SFO~~	~~28.1~~	~~13.3~~	~~0.0005~~	~~o~~
[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~30.3~~	~~18.2~~	~~0.0240~~	~~o~~
	~~**Endpoint**~~[3]	~~**29.2**~~			

~~n.d.: not determined (visual and/or statistical fit not acceptable)~~

[1] ~~SFO: single first order~~

[2] ~~visual assessment: + = good, o = moderate~~

[3] ~~geomean for more than 1 value~~

~~Table CA 7.2.2.3- 5: Kinetic parameters for the degradation of AE F160459 in water/sediment system under aerobic conditions for modelling purpose according to FOCUS~~

~~Water/Sediment System~~	~~Kinetic Model~~ [1]	~~DT$_{50}$ [days]~~	~~Chi^2 Error [%]~~	~~t-test~~	~~Visual Assessment~~ [2]
~~**Total System**~~					
[redacted] ~~(phenyl label)~~	~~SFO~~	~~114~~	~~10.7~~	~~0.0147~~	~~o~~
[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~64.8~~	~~6.7~~	~~0.0002~~	~~o~~
[redacted] ~~(phenyl label)~~	~~SFO~~	~~40.4~~	~~10.2~~	~~< 0.0001~~	~~o~~
[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~16.8~~	~~23.1~~	~~0.0007~~	~~o~~
	~~**Endpoint**~~ [3]	~~**47.3**~~			
~~**Water**~~					
[redacted] ~~(phenyl label)~~	~~SFO~~	~~n.d.~~			
[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~n.d.~~			
[redacted] ~~(phenyl label)~~	~~SFO~~	~~83.9~~	~~5.3~~	~~0.0006~~	~~o~~
[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~51.4~~	~~14.6~~	~~0.0194~~	~~o~~
	~~**Endpoint**~~ [3]	~~**65.7**~~			
~~**Sediment**~~					
[redacted] ~~(phenyl label)~~	~~SFO~~	~~n.d.~~			
[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~121~~	~~16.5~~	~~0.1610~~	~~o~~
[redacted] ~~(phenyl label)~~	~~SFO~~	~~n.d.~~			
[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~n.d.~~			
	~~**Endpoint**~~ [3]	~~**121**~~			

~~n.d.: not determined (visual and/or statistical fit not acceptable)~~

[1] ~~SFO: single first order~~

[2] ~~visual assessment: o = moderate~~

[3] ~~geomean for more than 1 value~~

~~Table CA 7.2.2.3- 6: Kinetic parameters for the degradation of AE F099095 in water/sediment system under aerobic conditions for modelling purpose according to FOCUS~~

~~Water/Sediment System~~	~~Kinetic Model~~ [1]	~~DT_{50} [days]~~	~~Chi^2 Error [%]~~	~~t-test~~	~~Visual Assessment~~
~~Total System~~					
[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~–~~[2]			
[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~–~~[2]			

~~Water~~

[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~–~~[2]			
[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~–~~[2]			
	~~Endpoint~~	~~n.d.~~			

~~Sediment~~

[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~–~~[2]			
[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~–~~[2]			
	~~Endpoint~~	~~n.d.~~			

~~n.d.: no reliable value determinable~~

[1] ~~SFO: single first order~~

[2] ~~data did not allow to determine a reliable value (1-2 measured residues were available)~~

~~Table CA 7.2.2.3- 7: Kinetic parameters for the degradation of AE F092944 in water/sediment system under aerobic conditions for modelling purpose according to FOCUS~~

~~Water/Sediment System~~	~~Kinetic Model~~[1]	~~DT$_{50}$ [days]~~	~~Chi^2 Error [%]~~	~~t-test~~	~~Visual Assessment~~[2]
~~Total System~~					
[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~25.9~~	~~8.2~~	~~0.0004~~	~~o~~
[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~–~~[4]			
	~~Endpoint~~[3]	~~25.9~~			
~~Water~~					
[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~–~~[5]			
[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~–~~[5]			
	~~Endpoint~~[3]	~~n.d.~~			
~~Sediment~~					
[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~–~~[5]			
[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~–~~[5]			
	~~Endpoint~~[3]	~~n.d.~~			

~~n.d.: no reliable value determinable~~

[1] ~~SFO: single first order~~

[2] ~~visual assessment: o ≙ moderate~~

[3] ~~geomean for more than 1 value~~

[4] ~~not determined (visual and/or statistical fit not acceptable)~~

[5] ~~data did not allow to determine a reliable value (1-2 measured residues were available)~~

~~Table CA 7.2.2.3- 8: Kinetic parameters for the degradation of AE F160460 in water/sediment system under aerobic conditions for modelling purpose according to FOCUS~~

~~Water/Sediment System~~	~~Kinetic Model~~ [1]	~~DT_{50} [days]~~	~~Chi^2 Error [%]~~	~~t-test~~	~~Visual Assessment~~ [2]
~~Total System~~					
[redacted] ~~(phenyl label)~~	~~SFO~~	~~47.1~~	~~10.5~~	~~0.4268~~	~~o~~
[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~25.3~~	~~6.5~~	~~0.1631~~	~~o~~
[redacted] ~~(phenyl label)~~	~~SFO~~	~~16.2~~	~~18.7~~	~~< 0.0001~~	~~o~~
[redacted] ~~(pyrimidyl label)~~ [4]	~~SFO~~	~~111~~	~~6.1~~	~~0.0101~~	~~+~~
	~~Endpoint~~ [3]	**~~38.3~~**			
~~Water~~					
[redacted] ~~(phenyl label)~~	~~SFO~~	~~–~~ [5]			
[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~–~~ [5]			
[redacted] ~~(phenyl label)~~	~~SFO~~	~~n.d.~~			
[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~70.6~~	~~2.6~~	~~0.0057~~	~~+~~
	~~Endpoint~~ [3]	**~~70.6~~**			
~~Sediment~~					
[redacted] ~~(phenyl label)~~	~~SFO~~	~~–~~ [5]			
[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~n.d.~~			
[redacted] ~~(phenyl label)~~	~~SFO~~	~~59.2~~	~~16.2~~	~~0.0040~~	~~o~~
[redacted] ~~(pyrimidyl label)~~	~~SFO~~	~~n.d.~~			
	~~Endpoint~~ [3]	**~~59.2~~**			

~~n.d.: not determined (visual and/or statistical fit not acceptable)~~

[1] ~~SFO: single first order~~

[2] ~~visual assessment: + = good, o = moderate~~

[3] ~~geomean for more than 1 value~~

[4] ~~decline fit~~

[5] ~~data did not allow to determine a reliable value (1-2 measured residues were available)~~

~~Table CA 7.2.2.3- 9: Kinetic parameters for the degradation of AE F140584 in water/sediment system under aerobic conditions for modelling purpose according to FOCUS~~

~~Water/Sediment System~~	~~Kinetic Model~~ ~~[1]~~	~~DT$_{50}$ [days]~~	~~Chi^2 Error [%]~~	~~t-test~~	~~Visual Assessment~~
~~Total System~~					
[redacted] ~~(phenyl label)~~	~~SFO~~	~~–~~ ~~[2]~~			
[redacted] ~~(phenyl label)~~	~~SFO~~	~~–~~ ~~[2]~~			
	~~Endpoint~~	**~~n.d.~~**			
~~Water~~					
[redacted] ~~(phenyl label)~~	~~SFO~~	~~–~~ ~~[2]~~			
[redacted] ~~(phenyl label)~~	~~SFO~~	~~–~~ ~~[2]~~			
	~~Endpoint~~	**~~n.d.~~**			
~~Sediment~~					
[redacted] ~~(phenyl label)~~	~~SFO~~	~~–~~ ~~[2]~~			
[redacted] ~~(phenyl label)~~	~~SFO~~	~~–~~ ~~[2]~~			
	~~Endpoint~~	**~~n.d.~~**			

~~n.d.: no reliable value determinable~~

~~[1] SFO: single first order~~

~~[2] data did not allow to determine a reliable value (1-2 measured residues were available)~~

~~Table CA 7.2.2.3- 10: Kinetic parameters for the degradation of AE F147447 in water/sediment system under aerobic conditions for modelling purpose according to FOCUS~~

~~Water/Sediment System~~	~~Kinetic Model~~ [1]	~~DT$_{50}$ [days]~~	~~Chi^2 Error [%]~~	~~t-test~~	~~Visual Assessment~~ [2]
~~Total System~~					
[redacted] ~~(phenyl label)~~	~~SFO~~	~~205~~	~~6.4~~	~~0.0097~~	~~+~~
[redacted] ~~(phenyl label)~~	~~SFO~~	~~–~~[3]			
	~~Endpoint~~	**~~205~~**			

~~Water~~

[redacted] ~~(phenyl label)~~	~~SFO~~	~~–~~[4]			
[redacted] ~~(phenyl label)~~	~~SFO~~	~~–~~[4]			
	~~Endpoint~~	**~~n.d.~~**			

~~Sediment~~

[redacted] ~~(phenyl label)~~	~~SFO~~	~~–~~[4]			
[redacted] ~~(phenyl label)~~	~~SFO~~	~~–~~[4]			
	~~Endpoint~~	**~~n.d.~~**			

~~n.d.: not determined (visual and/or statistical fit not acceptable)~~

[1] ~~SFO: single first order~~

[2] ~~visual assessment: + = good~~

[3] ~~not determined (visual and/or statistical fit not acceptable)~~

[4] ~~data did not allow to determine a reliable value (1-2 measured residues were available)~~

~~III. CONCLUSIONS~~

~~The calculated half-life for modelling purpose (geometric mean) for the degradation of mesosulfuron-methyl in water/sediment systems under aerobic conditions in the dark in the laboratory was 34.6 days in the water, 97.1 days in the sediment, and 45.8 days in the total system. The half-life of AE F154851 for modelling purpose (geometric mean) was 28.9 days in the water, 29.2 days in the sediment and 38.6 days in the total system. The half life of AE F160459 for modelling purpose (geometric mean) was 65.7 days in water and 47.3 days in the total system. In sediment the half life of AE F160459 could be determined in only one system and was 121 days. The half life of AE F092944 for modelling purpose could be determined in only one total system and was 25.9 days. In all other total systems, water and sediments the half life of AE F092944 could not be determined. The half life of AE F160460 for modelling purpose (geometric mean) was 38.3 days in the total system and could not be determined in sediment. In water the half life of AE F160460 could be determined in only one system and was 70.6 days. The half life of AE F147447 for modelling purpose could be determined in only one total system and was 205 days. In all other total systems, water and sediments the half life of AE F147447 could not be determined. The half life of AE F099095 and AE F140584 could not be determined in the water, sediment and total system.~~

Report:	KCA 7.2.2.3 /06; [redacted] .;2015;
Title:	Mesosulfuron-methyl (MSM) and metabolites: Kinetic evaluation of aerobic aquatic metabolism in water-sediment systems according to FOCUS kinetics
Report No:	EnSa-15-0139
Document No:	M-511142-02-1
Guidelines:	**not applicable;not applicable**
GLP/GEP:	**no**

Executive summary

A kinetic analysis of residue data from the aerobic water/sediment degradation study KCA 7.2.2.3 /01 (M-198526-01-1) was performed with the software KinGUI 2 according to the FOCUS kinetics methodology to derive half-lives for mesosulfuron-methyl and its degradation products AE F154851, AE F160459, AE F099095, AE F092944, AE F160460, AE F140584 and AE F147447, which are suitable for use as input to environmental exposure simulation models. According to the recommendations of FOCUS (2006), (Level I) dissipation half-lives of mesosulfuron-methyl and its metabolites for water and sediment were determined as well as the degradation DT50 for the total systems. An overview over the obtained DT50 values for use as inputs in environmental fate models is given in the summary tables below. For minor metabolites AE F099095 (max. 0.9% in total system) and AE F140584 (max. 1.9% in total system), the data does not allow for determination of any kinetic parameters.

Table CA 7.2.2.3- 11: **Total system DT50 values** derived for use as input in environmental fate models.

Test system	Mesosulfuron-methyl (days)	AE F154851 (days)	AE F160459 (days)	AE F160460 (days)	AE F147447 (days)	AE F092944 (days)
[redacted] (phenyl label)	81.2	n.d.	114	n.d.	205	- [b]
[redacted] (pyrimidyl label)	68.9	100	77.4	n.d.	- [b]	26.1
[redacted] (phenyl label)	34.1	11.0	44.0	101.6	n.d.	- [b]
[redacted] (pyrimidyl label)	22.8	8.1	17.5	111	- [b]	n.d.
Endpoint [a]	45.7	20.7	51.1	106.2	205	26.1

a) geomean for more than 1 value
b) component not traced by radiolabel position
n.d.: no reliable value determinable

Table CA 7.2.2.3- 12: **DT50 values for dissipation from water**
derived for use as input in environmental fate models.

Test system	Mesosulfuron-methyl (days)	AE F154851 (days)	AE F160459 (days)	AE F160460 (days)	AE F147447 (days)	AE F092944 (days)
[redacted] (phenyl label)	72.7	n.d.	n.d.	n.d.	n.d.	- [b]
[redacted] (pyrimidyl label)	61.7	n.d.	n.d.	n.d.	- [b]	n.d.
[redacted] (phenyl label)	20.5	33.1	83.9	n.d.	n.d.	- [b]
[redacted] (pyrimidyl label)	14.4	25.3	51.4	70.6	- [b]	n.d.
Endpoint [a]	**33.9**	**28.9**	**65.7**	**70.6**	**n.d.**	**n.d.**

a) geomean for more than 1 value
b) component not traced by radiolabel position
n.d.: no reliable value determinable

Table CA 7.2.2.3- 13: **DT50 values for dissipation from sediment**
derived for use as input in environmental fate models.

Test system	Mesosulfuron-methyl (days)	AE F154851 (days)	AE F160459 (days)	AE F160460 (days)	AE F147447 (days)	AE F092944 (days)
[redacted] (phenyl label)	48.5	n.d.	n.d.	n.d.	n.d.	- [b]
[redacted] (pyrimidyl label)	62.8	n.d.	153	n.d.	- [b]	n.d.
[redacted] (phenyl label)	n.d.	28.1	n.d.	59.2	n.d.	- [b]
[redacted] (pyrimidyl label)	n.d.	30.3	n.d.	n.d.	- [b]	n.d.
Endpoint [a]	**55.2**	**29.2**	**153**	**59.2**	**n.d.**	**n.d.**

a) geomean for more than 1 value
b) component not traced by radiolabel position
n.d.: no reliable value determinable

I Methods

Data pre-processing

Measured and reported replicates were taken into account separately. Data for non-extractable residues (NER) and CO_2 were not explicitly considered in the evaluation (open system).

For the residues in the total system which were evaluated using a compartmental kinetic model describing the whole degradation pathway, the following procedure was applied:

- For day 0, the whole amount of radioactivity of metabolites, non-extractable residues (NER) and CO_2 were attributed to the parent compound and respectively metabolite concentrations on day 0 were set to 0 %. Also, parent compound on day 0 was completely attributed to the water phase and its amount in the sediment phase was set to 0 %, as the application was conducted to the water phase.

Kinetic Analysis

Four kinetic models, the Single First-Order (SFO), first-order multiple-compartment (FOMC, Gustafson-Holden), the hockey-stick model (HS, DFOS = double first order sequential), and the bi-exponential model (DFOP = double first order parallel) may be used to describe the experimental residue values of the applied parent substance. The selection of a kinetic model is done on a step by step decision process based on statistic criteria:

Step 1: Because of the general need of the most exposure models it was defined that the preferred model is SFO. If the SFO fit is visually acceptable, ε does not significantly exceed 15%, and t-test for the degradation rate is less than 0.05 for parent and 0.10 for metabolite, the SFO fit and parameters are accepted.

Step 2: If ε is significantly greater than 15%, model parameters may be fixed based on available information (e.g. initial amount).

Step 3: If ε is still significantly greater than 15%, then bi-phasic models can be tested on a case by case basis. The standard biphasic models recommended by FOCUS (201) are Gustafson and Holden (FOMC) model, Double First Order in Parallel (DFOP) and Hockey Stick (HS). However, the FOMC model is only used, if residues reach 10% of the initial concentration by the end of the study and the worst case DT50 value is calculated as DT90(FOMC)/3.32. In the other cases, the DT50 is calculated from the slow k-rate of DFOP or HS model.

Step 4: If none of the bi-phasic models leads to a significantly improved fit, the SFO model is chosen, if it is visually acceptable. The purpose of this rule is to avoid an over-parameterised model based on a marginally better fit only.

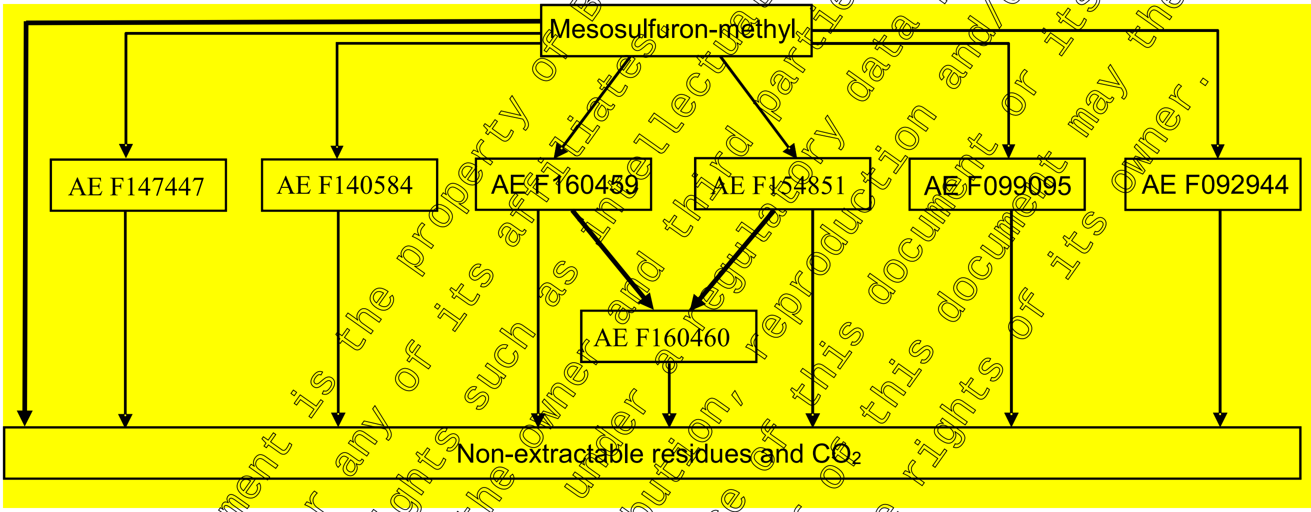
The model fit as well as the statistical evaluation of the results was carried out with the in-house developed software KinGUI version 2.1. In this software the fitting algorithms as well as the statistical evaluation of the results is implemented on the basis of the statistical computing language R. For the optimization the implemented algorithm Iteratively Reweighted Nonlinear Least Squares (IRLS) was used.

Dissipation kinetics

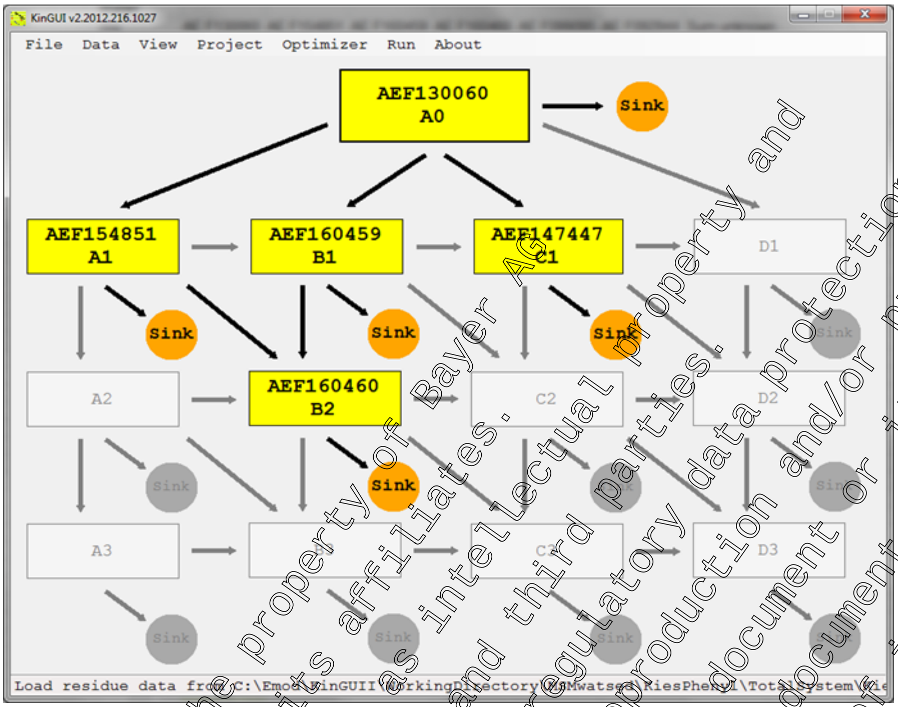
Dissipation half-lives were determined by fitting a one compartment model to the data from the decline phase of a time course. For this approach, all data points taken before the residues reached a maximum were disregarded. Generally, the initial amount at time zero, M0, was fitted as a parameter.

Degradation kinetics – Level-I degradation

For inferring the kinetic parameters of the degradation of mesosulfuron-methyl in the total system the proposed metabolic route was converted into multi-compartment model as shown below:

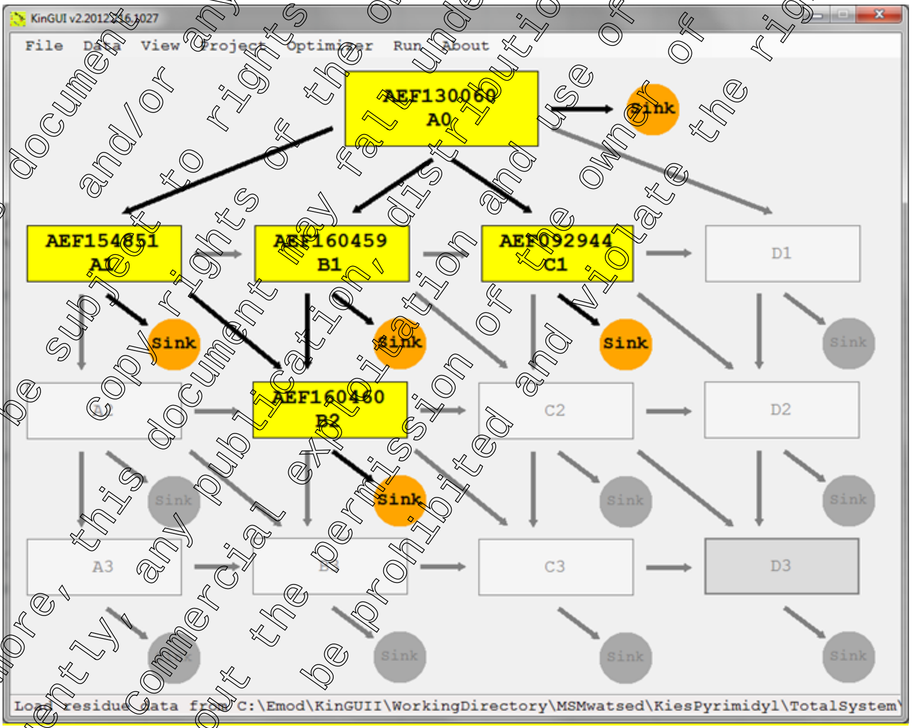


A detailed description of the stepwise approach for the development of the model structure was provided in the soil kinetic report and is found discussed there (cf. CA 7.1.2.1.1). For the water-sediment system the same model pathway as derived for the soil degradation was assumed and tested. The model showed a very good fit to the residue data and thus no additional testing was performed for the water sediment kinetics. The models as defined for the individual test systems (due to different labelling positions) are graphically represented in the following screenshots:



Load residue data from C:\Emod\KinGUII\WorkingDirectory\MSMwatsed\KiesPhenyl\TotalSystem\Kie

Compartment model for degradation of mesosulfuron-methyl in total water-sediment system (phenyl label)



Load residue data from C:\Emod\KinGUII\WorkingDirectory\MSMwatsed\KiesPyrimidyl\TotalSystem\

Compartment model for degradation of mesosulfuron-methyl in total water-sediment system (pyrimidyl label)

Generally, the initial amount M0 of the parent substance was fitted while M0 for metabolites was fixed to zero. All kinetic rates and formation fractions were optimised for achieving a best fit of the model to the observed residue data.

II. Results

a) Total system evaluations (Level I)

For all four trials considered in this evaluation, parent data could be fitted very well using SFO kinetics. In addition to the very low Chi2-errors there was also no sign of systematic variations of the residuals. Therefore, further testing of other kinetic models for the derivation of end points was not considered necessary.

DT50 values for mesosulfuron-methyl and its metabolites and results of statistical evaluation of the model fits for total systems are provided in the tables below. Values printed in bold were considered for further evaluation.

[redacted] system (phenyl label) – Total System

Substance	DT50 days	ε %	t-test probability	visual acceptability a)
Mesosulfuron-methyl	**81.2**	2.6	<0.0001	+
AE F154851	255	16.5	0.2797	o
AE F160459	**114**	10.7	0.0147	o
AE F140584	b)			
AE F160460	47.1	10.5	0.4268	o
AE F147447	**205**	6.4	0.0097	+

a) visual acceptability: + good, o medium, - bad
b) data did not allow to determine a reliable value (no measured residues)

[redacted] system (pyrimidyl label) – Total System

Substance	DT50 days	ε %	t-test probability	visual acceptability a)
Mesosulfuron-methyl	**68.9**	3.0	<0.0001	+
AE F154851	**100.0**	8.2	0.0090	o
AE F160459	**77.4**	6.9	0.0008	o
AE F099095	b)			
AE F160460	19.6	7.0	0.2788	o
AE F092944	**26.1**	8.3	0.0003	o

a) visual acceptability: + good, o medium, - bad
b) data did not allow to determine a reliable value (1-2 measured residues were available)

[redacted] system (phenyl label) – Total System

Substance	**DT50** days	**ε** %	**t-test probability**	**visual acceptability** [d]
Mesosulfuron-methyl (SFO)	26.8	9.7	<0.0001	o
Mesosulfuron-methyl (FOMC)	**34.1**[a]	6.6	n.a.	+
AE F154851	**11.0**	33.3	0.0065	o
AE F160459	**44.0**	10.5	<0.0001	o
AE F140584	[b]			
AE F160460	17.5	18.3	0.3100	o
	101.6[c]	4.4	0.0253	+
AE F147447	>1000	19.9	0.5	o

a) pseudo-SFO DT50 calculated from DT90/3.32
b) data did not allow to determine a reliable value (1-2 measured residues were available)
c) determined from decline fit
d) visual acceptability: + good, o medium, - bad
n.a.: not applicable for parameters of FOMC model

[redacted] system (pyrimidyl label) – Total System

Substance	**DT50** days	**ε** %	**t-test probability**	**visual acceptability** [a]
Mesosulfuron-methyl	**22.8**	8.1	<0.0001	+
AE F154851	**8.1**	27.0	0.0017	o
AE F160459	**17.5**	23.1	0.0007	o
AE F099095	[b]			
AE F160460	29.1	22.7	0.2851	-
	111 [c]	6.1	0.0101	+
AE F092944	>1000 [c]	45.4	0.5	-

a) visual acceptability: + good, o medium, - bad
b) data did not allow to determine a reliable value (no measured residues)
c) determined from decline fit

b) Water phase evaluations (Level I)

The dissipation of mesosulfuron-methyl and its metabolites in the water was evaluated starting from the observed maximum onwards until end of the study. Where appropriate for mesosulfuron-methyl, different kinetic models were fitted to the residue data for determining the best fitting model that was then used to derive persistence endpoints. In the case of the metabolites, mostly only a few data points were available, not allowing reliable fits with non-SFO models.
DT50 values for mesosulfuron-methyl and its metabolites and results of statistical evaluation of the model fits for the water systems are provided in the tables below. Values printed in bold were considered for further evaluation.

[redacted] system (phenyl label) – Water Phase

Substance	DT50 days	ε %	t-test probability	visual acceptability a)
Mesosulfuron-methyl	**72.7**	3.2	<0.0001	+
AE F154851	b)			
AE F160459	b)			
AE F140584	b)			
AE F160460	b)			
AE F147447	b)			

a) visual acceptability: + good, o medium, - bad
b) data did not allow to determine a reliable value (1-2 measured residues were available)

[redacted] system (pyrimidyl label) – Water Phase

Substance	DT50 days	ε %	t-test probability	visual acceptability a)
Mesosulfuron-methyl	**61.7**	2.5	<0.0001	+
AE F154851	b)			
AE F160459	b)			
AE F099095	b)			
AE F160460	b)			
AE F092944	b)			

a) visual acceptability: + good, o medium, - bad
b) data did not allow to determine a reliable value (1-2 measured residues were available)

[redacted] system (phenyl label) – Water Phase

Substance	DT50 days	ε %	t-test probability	visual acceptability a)
Mesosulfuron-methyl (SFO)	16.1	9.7	<0.0001	o
Mesosulfuron-methyl (FOMC)	**20.5** e)	4.5	n.a. d)	+
AE F154851	**33.1**	13.1	0.0017	o
AE F160459	**83.9**	5.3	0.0006	o
AE F140584	b)			
AE F160460	165.3 c)	7.1	0.1124	-
AE F147447	b)			

a) visual acceptability: + good, o medium, - bad
b) data did not allow to determine a reliable value (1-2 measured residues were available)
c) not determined (visual and/or statistical fit not acceptable)
d) n.a.: not applicable for parameters of FOMC model
e) pseudo-SFO DT50 calculated from DT90/3.32

[redacted] system (pyrimidyl label) – Water Phase

Substance	**DT50** days	**ε** %	**t-test probability**	**visual acceptability** [a]
Mesosulfuron-methyl	**14.4**	7.9	<0.0001	+
AE F154851	**25.3**	6.8	0.0062	+
AE F160459	**51.4**	14.6	0.0194	o
AE F099095	b)			
AE F160460	**70.6**	2.6	0.0057	+
AE F092944	b)			

a) visual acceptability: + good, o medium, - bad
b) data did not allow to determine a reliable value (1-2 measured residues were available)

c) Sediment phase evaluations (Level I)

The dissipation of mesosulfuron-methyl and its metabolites in the sediment was evaluated starting from the observed maximum onwards until end of the. Where appropriate for mesosulfuron-methyl, different kinetic models were fitted to the residue data for determining the best fitting model that was then used to derive persistence endpoints. In the case of the metabolites, mostly only a few data points were available, not allowing reliable fits with non-SFO models.DT50 values for mesosulfuron-methyl and its metabolites and results of statistical evaluation of the model fits for the water systems are provided in the tables below. Values printed in bold were considered for further evaluation.
DT50 values for mesosulfuron-methyl and its metabolites and results of statistical evaluation of the model fits for the sediment systems are provided in the tables below. Values printed in bold were considered for further evaluation.

[redacted] system (phenyl label) – Sediment Phase

Substance	DT50 days	ε %	t-test probability	visual acceptability [a]
Mesosulfuron-methyl	**48.5**	14.3	0.0459	o
AE F154851	[b]			
AE F160459	182.4 [c]	13.4	0.2077	o
AE F140584	[b]			
AE F160460	[b]			
AE F147447	[b]			

[redacted] system (pyrimidyl label) – Sediment Phase

Substance	DT50 days	ε %	t-test probability	visual acceptability [a]
Mesosulfuron-methyl (SFO)	**62.8**	8.7	0.0044	o
AE F154851	306 [c]	15.6	0.3250	-
AE F160459	**153**	2.5	0.0112	o
AE F099095	[b]			
AE F160460	[b]			
AE F092944	[b]			

a) visual acceptability: + good, o medium, - bad

b) data did not allow to determine a reliable value (1-2 measured residues were available)

c) not determined (visual and/or statistical fit not acceptable)

[redacted] system (phenyl label) – Sediment Phase

Substance	DT50 days	ε %	t-test probability	visual acceptability [a]
Mesosulfuron-methyl	79.3 [c]	22.1	0.0151	-
AE F154851	**28.1**	13.3	0.0005	o
AE F160459	57.1 [c]	18.2	0.0672	o
AE F140584	[b]			
AE F160460	**59.2**	16.2	0.0040	o
AE F147447	[b]			

[a] visual acceptability: + good, o medium, - bad

[b] data did not allow to determine a reliable value (1-2 measured residues were available)

[c] not determined (visual and/or statistical fit not acceptable)

[redacted] system (pyrimidyl label) – Sediment Phase

Substance	DT50 days	ε %	t-test probability	visual acceptability [a]
Mesosulfuron-methyl	44.5 [c]	23.2	0.0074	o
AE F154851	**30.3**	18.2	0.0240	o
AE F160459	47.4 [c]	13.6	0.1251	o
AE F099095	[b]			
AE F160460	53.0 [c]	17.0	0.0658	o
AE F092944	[b]			

a) visual acceptability: + good, o medium, - bad
b) data did not allow to determine a reliable value (1-2 measured residues were available)
c) not determined (visual and/or statistical fit not acceptable)

III. Conclusions

The total system DT50 values derived from the kinetic evaluations of the different tested systems for use as input values in environmental fate models are compiled in Table CA 7.2.2.3- 14.

Table CA 7.2.2.3- 13 and Table CA 7.2.2.3- 14 show the values for dissipation values in water and sediment, respectively.

For minor metabolites AE F099095 (max. 0.9% in total system) and AE F140584 (max. 1.9% in total system), the data does not allow for determination of any kinetic parameters.

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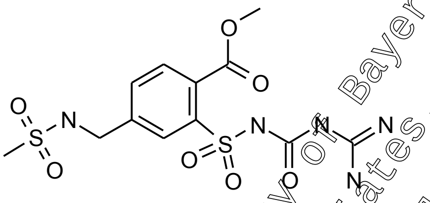
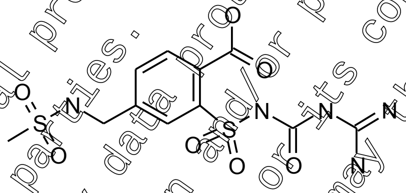
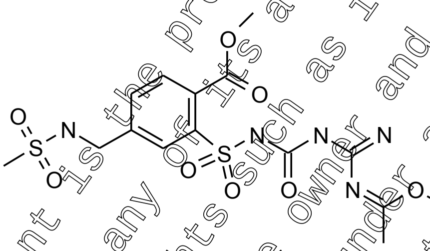
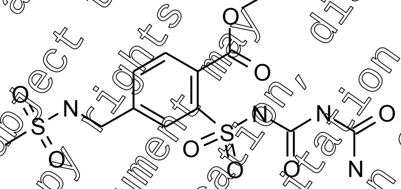
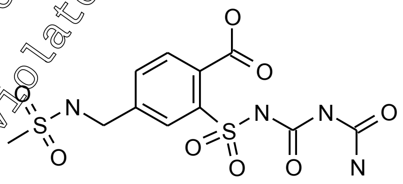
Aquatic degradates BCS-CO60720, BCS-CV14885, BCS-CO60721, BCS-CY51284 – supplementary information

In the water / sediment study KCA 7.2.2.3/01 a number of degradates observed in the water phase at advanced incubation times of a study extension period were reported as a sum fraction, misleadingly designated "unknown metabolites" in the original study report. This designation referred to the fact that these components were not identical to any of the available reference materials at the time of study conduct, which in contrary were referred to as "known metabolites".

This fraction was observed for both radiolabels and could be separated into up to five individual substances. Their chemical structures were established based on liquid chromatography / mass spectrometry within study KCA 7.2.2.3 /01, revealing for all a derivation from an opening of the pyrimidine ring moiety. Hereby, the pyrimidine system was found converted into open-chain derivatives that can be categorized into two structural classes:

carbamoyl-guanidine type:	BCS-CO60720, BCS-CV14885, (U4).
biuret type:	BCS-CO60721, BCS-CY51284.

Within both classes, the components either retain an intact methyl ester function at the phenyl ring as present in the parent substance, or are corresponding carboxylic acid variants resulting from ester hydrolysis:

	methyl ester variants	carboxylic acid variants
carbamoyl-guanidine-type	BCS-CO60720 *designation in study: D (U3)* 	BCS-CV14885 *designation in study: A (U1)* 
	no BCS code assigned *designation in study: E (U4)* 	*(no carboxylic acid variant observed)*
biuret-type	BCS-CO60721 *designation in study: G (U5)* 	BCS-CY51284 *designation in study: C (U2)* 

Maximum formation of these components occurred in the "[redacted]" water/sediment system, in particular at very late sampling times of a study extension phase far beyond the OECD GD308 recommended period of 100 days. The abundances in these samples are shown in Table CA 7.2.2.3- 11 below.

Table CA 7.2.2.3- 15: Maximum abundances of additional aquatic degradates observed in KCA 7.2.2.3 /01, water phase of "[redacted]" system, study extension phase (in % AR).

DAT	BCS-CV14885 U1 (A)		BCS-CY51284 U2 (C)		BCS-CO60720 U3 (D)		[no BCS code] U4 (E)		BCS-CO60721 U5 (G)	
	Phenyl	Pyrim.	Phenyl	Pyrim.	Phenyl	Pyrim.	Phenyl	Pyrim.	Phenyl	Pyrim.
196	6.9	14.4	nd	2.2	6.2	7.3	1.7	nd	1.9	1.0
224	14.8	12.5	nd	1.7	7.5	9.4	nd	nd	nd	1.9
251	11.7	10.7	nd	3.1	10.2	6.3	1.6	1.5	1.9	1.7
309	10.9	22.0	nd	3.2	6.8	9.9	nd	nd	nd	0.9
365	11.2	12.2	1.2	4.2	8.4	13.1	1.4	1.5	nd	nd

[Table compiles data for 1x application rate, reported in Tables XVIII and XIX of the original study report.]

The two most abundant of these components, BCS-CV14885 (U1) and BCS-CO60720 (U3), were discussed in a statement KCA 7.2.2.3 /04, which was previously submitted to EU review for Annex I inclusion of mesosulfuron-methyl:

Report:	**[redacted]; [redacted];2002;M-211638-01**
Title:	Statement on the relevance of unknown metabolites in a water / sediment study with 14C-AE F130060
Report No:	C021672
Document No:	M-211638-01-1
Guidelines:	**Deviation not specified**
GLP/GEP:	**no**

Based on

a) their late formation in a study extension phase that significantly exceeded the recommended OECD GD 308 study runtime of 100 days, and

b) the fact that the higher level formation in sediment "[redacted]" (a meagre gravel pit type system) coincided with clear signs of decrase in microbial viability from day 60 onwards, and complete loss of microbial biomass at the end of the 1 year study extension period,

it was concluded that these components should not be considered as major metabolites.

The case and statement were EU reviewed upon the Annex I inclusion of mesosulfuron-methyl, the evaluation concluded that these metabolites are thought to be not relevant. Since they are expected to occur under particular conditions only and to have no biological activity, the components were not included in the residue definition (cf. Addendum to DAR Annex B - B8 Environmental fate and behaviour, April 2003).

New supplementary information submitted for approval renewal:

Aiming to validate the above assumption on absence of biological acticity of the components of the water/sediment study extension phase, the notifier has chosen the approach of testing one representative component per substance class, in guideline-conform Lemna and Algae growth inhibition bioassays, limit-dose test design. Based on a known structure-activity relationship, the two components considered 'representative' (in the sense of worst case) were selected as BCS-CO60720 and BCS-CO60721, i.e. the methyl ester variants of a "carbamoyl-guanidine" and a "biuret" type structure. Typically, within the class of sulfonylurea herbicides, effect on vascular plant is highly dependent on intactness of the methyl ester function at the phenyl ring moiety[9].

Based on the results obtained, a screening level risk assessment was established.

The following new supplementary information has been generated by the notifier:

- KCA 7.2.2.3 /05: a worst case PECsw calculation for components BCS-CO60720, BCS-CV14885, BCS-CO60721, and BCS-CY51284 based on the maximum abundances observed in the water/sediment study extension period, and considering as well a worst case assumption for formation of BCS-CV14885 in soil (cf. Point CA 7.1.4.2).
- KCA 8.2.6.1/07, KCA 8.2.6.1/08, KCA 8.2.7/13, KCA 8.2.7/14: aquatic ecotoxicity testing [species: green algae and *Lemna*] on components BCS-CO60720, and BCS-CO60721. Both substances were found biologically inactive at the limit doses tested. [See study summaries provided in the ecotoxicological section of this MCA document.]

A screening level aquatic risk assessment based on these supplementary data was conducted, and is provided in Table CA 7.2.2.3- 11. The assessment clearly confirms that a very large margin of safety exists, with TER values exceeding the applicable trigger by at least 3-5 orders of magnitude, even when based on lowest tier FOCUS Step 1 PECsw.

The new information therefore validates the conclusion made at first EU review, i.e. for reason of their only sporadic occurrence under particular conditions in combination with a very large margin of safety, the additional aquatic degradates do not require further consideration and inclusion into the residue definition.

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[9] see e.g. the large difference in herbicidal activity and effect on *Lemna* between mesosulfuron-methyl (methyl ester intact; highly active) and AE F154851 (carboxylic acid metabolite; orders of magnitude less active). Similar structure-activity relationship is also known from related methyl ester sulfonlyurea active substances and their carboxylic acid metabolites, e.g. Iodosulfuron-methyl-sodium vs. metabolite AE F145740 / Metsulfuron-methyl vs. metabolite AE 0014966 / Bensulfuron.methyl vs. metabolite IN-R9419 / Ethametsulfuron-methyl vs. metabolite A8768, and others.

Table CA 7.2.2.3- 16: Exemplary risk assessment for components of late or irregular occurrence in water/sediment study: TER calculations for Lemna and algae based on FOCUS Step 1 values

Compound	PEC_{sw} FOCUS Step 1 [µg/L]	Species	Endpoint [µg/L]	TER	TER trigger
BCS-CV14885	0.215	*Lemna gibba*	E_rC_{50} = NOErC >10000 [1]	> 4.7 ×10^4	10
		P. subcapitata	E_rC_{50} = NOErC >11800 [1]	> 5.5 ×10^4	
BCS-CO60720	0.015	*Lemna gibba*	E_rC_{50}= NOErC >10000	> 6.7 ×10^5	
		P. subcapitata	E_rC_{50}= NOErC >11800	> 7.9 ×10^5	
BCS-CY51284	0.005	*Lemna gibba*	E_rC_{50} = NOErC >10000 [2]	> 2.0 ×10^5	
		P. subcapitata	E_rC_{50}= NOErC >10000 [2]	> 2.0 ×10^5	
BCS-CO60721	0.002	*Lemna gibba*	E_rC_{50}= NOErC >10000	> 5.0 ×10^6	
		P. subcapitata	E_rC_{50}= NOErC >10000	> 5.0 ×10^6	

[1]) for risk assessment, endpoints for BCS-CV14885 considered identical to measured endpoints for BCS-CO60720

[2]) for risk assessment, endpoints for BCS-CY51284 considered identical to measured endpoints for BCS-CO60721

Report:	[redacted] [redacted];2014;M-481615-01
Title:	Mesosulfuron-methyl (MSM) and metabolites: PECsw,sed FOCUS EUR (U-metabolites) - Use in winter cereals in Europe
Report No:	EnSa-14-0225
Document No:	M-481615-01-1
Guidelines:	**not applicable;not applicable**
GLP/GEP:	**no**

Materials and Methods: PEC_{sw} and PEC_{sed} were simulated according to the FOCUS surface water approach, for components BCS-CO60720, BCS-CV14885, BCS-CO60721, BCS-CY51284.

This simulation is intended to supplement the evaluation of findings of these degradates in the non-guideline extension period of water/sediment study KCA 7.2.2.3 /01, via providing an analysis of hypothetical maximum surface exposure for envisaged mesosulfuron-methyl uses. Although the modelling report includes simulations up to FOCUS Step 2 for several use patterns, for the purpose of the present document only the lowest tier overall worst case will be summarised as a 'risk envelope', i.e. FOCUS Step 1 for the maximum intended use rate of 15 g/ha active substance. These figures are independent of seasonal influence and degradation half-lives of the substances concerned.

Table CA 7.2.2.3- 17: Calculated use pattern in FOCUS surface water simulations

	winter cereals, **spring or autumn application**
Indicative crop	Winter cereals
Application rate	1 x 15 g a.s./ha
Growth stage	minimal crop interception (25%)

Application timing: not relevant at FOCUS Step 1.

Substance parameters: The calculation was based on the maximum abundances observed for these components in the extension period of water/sediment study KCA 7.2.2.3/01, and also considered a possible formation of BCS-CV14885 in soil (cf. KCA 7.1.4.2 /05). Worst case default settings were used where no study information was available; degradation half-lives are however not used by the model at FOCUS Step 1.

Table CA 7.2.2.3- 18: Substance parameters used in FOCUS surface water simulations

Parameter	Unit	Mesosulfuron-methyl	BCS-CV14885	BCS-CY51284	BCS-CO60720	BCS-CO60721
Molar Mass	g/mol	503.5	393.4	394.4	407.4	408.4
Water Solubility	mg/L	483	2000	1000	1000	1000
Koc	mL/g	48	17.9	0	0	0
Degradation						
Soil	days	31.9	166.5	0.001	0.001	0.001
Total System	days	45.8	1000	1000	1000	1000
Water	days	45.8	1000	1000	1000	1000
Sediment	days	45.8	1000	1000	1000	1000
Max Occurrence						
Water / Sediment	%	100	22	4.2	13.1	1.9
Soil	%	100	5	0.001	0.001	0.001

Findings: The PECsw and PECsed values for the degradates of concern are compiled in Table 7.2.2.3-15 below. As FOCUS Step 1 figures, these PEC values are worst case values, independent of seasonal influence and degradation half-lives of the substances concerned.

Table CA 7.2.2.3- 19: PECsw and PECsed of metabolites of mesosulfuron-methyl, FOCUS Step 1, 15 g a.s./ha

	BCS-CO60720	BCS-CV14885	BCS-CO60721	BCS-CY51284
PECsw [µg/L]	0.015	0.215	0.002	0.005
PECsed [µg/kg]	<0.001	0.034	<0.001	<0.001

Alternative PECsw simulation for components BCS-CO60720, BCS-CV14885, BCS-CO60721, BCS-CY51284, based on RMS requested modelling parameters:

Report:	[redacted].;[redacted];2015;M-517449-01
Title:	Mesosulfuron-methyl (MSM) and metabolites: PECsw,sed FOCUS EUR (U-metabolites) - Use in winter cereals in Europe
Report No:	EnSa-15-0317
Document No:	M-517449-01-1
Guidelines:	**not applicable;not applicable**
GLP/GEP:	**no**

The document reports an alternative calculation of predicted environmental concentrations in surface water and sediment, following the methodology presented under KCA 7.2.2.3/05, but based on a set of kinetic and soil adsorption input parameters for mesosulfuron-methyl and BCS-CV14885 requested by the RMS:

Table CA 7.2.2.3- 20: Substance parameters used in FOCUS surface water simulations, considering RMS proposed data for mesosulfuron-methyl and BCS-CV14885

Parameter	Unit	Mesosulfuron-methyl	BCS-CV14885	BCS-CY51284	BCS-CO60720	BCS-CO60721
Molar Mass	g/mol	503.5	393.4	394.4	407.4	408.4
Water Solubility	mg/L	483	2000	1000	1000	1000
Koc	mL/g	**64**	**17.7**	0	0	0
Degradation						
Soil	days	**42.4**	**151.2**	0.001	0.001	0.001
Total System	days	**45.7**	1000	1000	1000	1000
Water	days	**45.7**	1000	1000	1000	1000
Sediment	days	**45.7**	1000	1000	1000	1000
Max Occurrence						
Water / Sediment	%	100	22	4.2	13.1	1.9
Soil	%	100	5	0.001	0.001	0.001

bold: modified parameters

This simulation is intended to supplement the evaluation of findings of these degradates in the non-guideline extension period of water/sediment study KCA 7.2.2.3/01, via providing an analysis of hypothetical maximum surface exposure for envisaged mesosulfuron-methyl uses. Although the modelling report includes simulations up to FOCUS Step 2 for different use patterns, for the purpose of the present document only the lowest tier overall worst case will be summarised as a 'risk envelope', i.e. FOCUS Step 1 for the maximum intended use rate of 15 g/ha active substance.

Findings: The PECsw and PECsed values at FOCUS Step 1 for the degradates of concern are compiled in Table 7.2.2.3-21 below. Since worst case FOCUS Step 1 figures are independent of degradation half-live and soil adsorption constant, these PECsw and PECsed values are identical to those reported under KCA 7.2.2.3/05 before. No update to the risk assessment based on these PEC values is therefore required.

Table CA 7.2.2.3- 21: PECsw and PECsed of metabolites of mesosulfuron-methyl, FOCUS Step 1, 15 g a.s./ha
– note all PEC values are identical to those of the previous simulation KCA7.2.2.3/05

	BCS-CO60720	BCS-CV14885	BCS-CO60721	BCS-CY51284
PECsw [µg/L]	0.015	0.215	0.002	0.005
PECsed [µg/kg]	<0.001	0.034	<0.001	<0.001

CA 7.2.2.4 Irradiated water/sediment study

The route and rate of degradation of mesosulfuron-methyl in water and sediment were comprehensively studied in sections CA 7.2.1.1 to CA 7.2.1.3 and CA 7.2.2.1 to CA 7.2.2.3. Therefore, the route and rate of degradation of mesosulfuron-methyl in irradiated water/sediment systems were not separately studied.

CA 7.2.3 Degradation in the saturated zone

The degradation of mesosulfuron-methyl in the saturated zone was not studied since mesosulfuron-methyl is not expected to reach the saturated zone after its use according to good agricultural practices.

Model calculations and the results of the lysimeter study demonstrate that the risk of groundwater contamination by mesosulfuron-methyl is very unlikely. Therefore studies of the degradation in the saturated zone are not required.

CA 7.3 Fate and behaviour in air

CA 7.3.1 Route and rate of degradation in air

The degradation rate of mesosulfuron-methyl in air was evaluated during the Annex I inclusion using the Atkinson method, and was considered acceptable during the original EU review of mesosulfuron (Review Report SANCO/10298/2003-Final, 25 June 2004). The following study is included in the baseline dossier:

Report:	**[redacted];[redacted];1999;M-192037-01**
Title:	Estimation of the reaction with photochemically produced hydroxyl radicals in the atmosphere Code: AE F130060
Report No:	OE99/109
Document No:	M-192037-01-1
Guidelines:	**not applicable (computer modelling report)**
GLP/GEP:	**not applicable (computer modelling report)**

EU agreed endpoint according to the DAR evaluation of mesosulfuron-methyl:

DT_{50} in air was estimated to be 1.8 h or 0.075 d (EU conditions).

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Additional new information has been generated to investigate the atmospheric degradation potential of two soil metabolites of mesosulfuron-methyl, triggered by their vapour pressures exceeding the indicator value of 10^{-5} Pa at 20°C for possible volatility from soil.

Report:	[redacted];[redacted];2014;M-486423-01
Title:	AE F099095: calculation of the chemical half-life in the troposphere
Report No:	EnSa-14-0626
Document No:	M-486423-01-1
Guidelines:	**not specified;not specified**
GLP/GEP:	**no**

Executive Summary

The half-life in air of AE F099095, a degradation product of mesosulfuron-methyl, was estimated according to structure-activity relationship (SAR) methods developed by Atkinson *et al.*

The half-life in air was estimated with 0.079 days (long-term scenario) assuming the typical OH radical concentration averaged over 24 hours (0.5 x 10^6 radicals/cm^3).

It is concluded that AE F099095 will be rapidly degraded in air, thereby excluding a potential for long-range transport in the atmosphere.

I. METHODS

The half-life of AE F099095 in air was estimated according to structure-activity relationship (SAR) methods developed by Atkinson *et al.* The approach of Atkinson *et al.* was based on a comprehensive set of experimental data to result in a quantitative structure-activity relationship (QSAR) mathematic model that allows for estimation by calculation, starting from the molecular structure of a compound. The calculation procedure has been transferred into the personal computer program "Atmospheric Oxidation Program" (AOP) by Meylan & Howard. The current version AOPWIN^{TM} 1.92a (U.S. EPA, 2008) was used for the calculations being part of the EPI SuiteTM set of programs.

Considering the chemical structure of AE F099095, it can be concluded that reactions with photochemically produced hydroxyl radicals will mainly determine its degradation rate in air. The typical OH radical concentration of 0.5 x 10^6 radicals/cm^3 per day (24 hours) was taken for the long-term estimation.

II. RESULTS AND DISCUSSION

The overall reaction rate of AE F099095 with hydroxyl radicals is estimated to be 202.6592 x 10^{-12} cm^3 x $molecule^{-1}$ x s^{-1}. This rate is derived mainly from incremental reactions like hydrogen abstraction (1.6592 x 10^{-12} cm^3 x molecule-1 x s^{-1}), reaction with N, S and –OH (assumed value of 1.0000 x 10^{-12} cm^3 x molecule-1 x s^{-1}) and an addition reaction to the aromatic ring (assumed value of 200.0000 x 10^{-12} cm^3 x molecule-1 x s^{-1}).

Based on the overall hydroxyl radical reaction rate constant in combination with the long-term concentration of these radicals in the atmosphere, i.e. 0.5 x 10^6 radicals/cm^3, the half-life of AE F099095 in air was estimated with 0.079 days. This estimate should be regarded as worst-case assumption as the approach does not consider the contribution of any other reactive species to the overall atmospheric degradation of AE F099095 in air.

III. CONCLUSIONS

AE F099095, a degradation product of mesosulfuron-methyl, will be degraded in air with an estimated half-life of 0.079 days.

Report:	[redacted]:;[redacted];2014;M-486422-01
Title:	AE F092944: calculation of the chemical half-life in the troposphere
Report No:	EnSa-14-0625
Document No:	M-486422-01-1
Guidelines:	**Commission Regulation (EU) No 283/2013 in accordance with Regulation (EC) No 1107/2009; US EPA OCSPP Test Guideline: N/A;not specified**
GLP/GEP:	**no**

Executive Summary

The half-life in air of AE F092944, a degradation product of mesosulfuron-methyl, was estimated according to structure-activity relationship (SAR) methods developed by Atkinson *et al.*

The half-life in air was estimated with 0.080 days (long-term scenario) assuming the typical OH radical concentration averaged over 24 hours (0.5 x 10^6 radicals/cm^3).

It is concluded that AE F092944 will be rapidly degraded in air, thereby excluding a potential for long-range transport in the atmosphere.

I. METHODS

The half-life of AE F092944 in air was estimated according to structure-activity relationship (SAR) methods developed by Atkinson *et al.* The approach of Atkinson *et al.* was based on a comprehensive set of experimental data to result in a quantitative structure-activity relationship (QSAR) mathematic model that allows for estimation by calculation, starting from the molecular structure of a compound. The calculation procedure has been transferred into the personal computer program "Atmospheric Oxidation Program" (AOP) by Meylan & Howard. The current version AOPWIN™ 1.92a (U.S. EPA, 2008) was used for the calculations being part of the EPI SuiteTM set of programs.

Considering the chemical structure of AE F092944, it can be concluded that reactions with photochemically produced hydroxyl radicals will mainly determine its degradation rate in air. The typical OH radical concentration of 0.5 × 10^6 radicals/cm^3 per day (24 hours) was taken for the long-term estimation.

II. RESULTS AND DISCUSSION

The overall reaction rate of AE F092944 with hydroxyl radicals is estimated to be 201.6592 x 10^{-12} cm^3 x molecule^{-1} x s^{-1}. This rate is derived mainly from incremental reactions like hydrogen abstraction (1.6592 x 10^{-12} cm^3 x molecule-1 x s^{-1}), reaction with N, S and –OH (assumed value of 1.0000 x 10^{-12} cm^3 x molecule-1 x s^{-1}) and an addition reaction to the aromatic ring (assumed value of 200.0000 x 10^{-12} cm^3 x molecule-1 x s^{-1}).

Based on the overall hydroxyl radical reaction rate constant in combination with the long-term concentration of these radicals in the atmosphere, i.e. 0.5 x 10^6 radicals/cm^3, the half-life of AE F092944 in air was estimated with 0.080 days. This estimate should be regarded as worst-case assumption as the approach does not consider the contribution of any other reactive species to the overall atmospheric degradation of AE F092944 in air.

III. CONCLUSIONS

AE F092944, a degradation product of mesosulfuron-methyl, will be degraded in air with an estimated half-life of 0.080 days.

CA 7.3.2 Transport via air

Based on its very low vapour pressure (3.5×10^{-12} Pa, 20 °C) mesosulfuron-methyl is virtually non-volatile. Therefore, significant exposure to air is not to be expected. Any mesosulfuron-methyl that might nevertheless enter the atmosphere would not be subject to gas phase transport over large distances, due to rapid indirect photochemical degradation; DT50air = 0.075 days (1.8 hours) for hydroxyl radical reaction.

Vapour pressure of two soil metabolites, AE F099095 and AE F092944, exceeds the indicator value of 10^{-5} Pa at 20°C for possible volatility from soil (AE F099095: 1.9×10^{-5} Pa, AE F092944: 2.6×10^{-2} Pa, at 20°C). Both components are, however highly susceptible for gas phase reaction with photoinduced hydroxyl radicals, and were predicted to be short-lived in air with degradation half-lives of only 0.079 days and 0.080 days, respectively. Therefore, a risk for atmospheric long-range transport is clearly not given.

CA 7.3.3 Local and global effects

Local and global effects of mesosulfuron-methyl were not estimated since no significant exposure of mesosulfuron-methyl is expected.

CA 7.4 Definition of the residue

CA 7.4.1 Definition of the residue for risk assessment

The residue definitions relevant for risk assessment for each compartment are the following:

Compartment	Residue Definition	Major Metabolite in
Soil, Groundwater	Mesosulfuron-methyl	*(parent substance)*
	AE F154851	Aerobic soil
	AE F160459	Aerobic soil, anaerobic soil
	AE F099095	Aerobic soil
	AE F092944	Aerobic soil
	AE F160460	Aerobic soil, anaerobic soil
	AE F140584	Aerobic soil
	AE F147447	Aerobic soil, anaerobic Soil
Surface Water	Mesosulfuron-methyl	*(parent substance)*
	AE F154851	Water/sediment, aerobic soil
	AE F160459	Water/sediment, Aerobic soil, anaerobic soil
	AE F099095	Aerobic soil
	AE F092944	Aerobic mineralisation in surface water, Aerobic soil
	AE F160460	Water/sediment, Aerobic soil, anaerobic soil
	AE F140584	Aerobic soil
	AE F147447	Water/sediment, Aerobic soil, anaerobic soil
Air	Mesosulfuron-methyl	*(parent substance)*

CA 7.4.2 Definition of the residue for monitoring

The residue definition for monitoring is mesosulfuron-methyl only for compartments soil and water and air.

CA 7.5 Monitoring data

Laboratory, lysimeter, and field data demonstrated the degradability of mesosulfuron-methyl 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, no monitoring studies under outdoor conditions were conducted by the notifier.

In required literature searches of the peer reviewed open literature (cf. Document MCA Section 9), no relevant and reliable results on mesosulfuron-methyl monitoring activites by third party conduct were identified.