Document Title

Summary of the fate and behaviour in the environment Prothioconazole + Spiroxamine EC 460 (160+300 g/L)

Data Requirement(s)

Regulation (EC) No 1107/2009 & Regulation (EU) No 284/2013
Document MCP
Section 9: Fate and behaviour in the environment

According to the Guidance Document SANCO/10181/2013 for applicants on preparing dossiers for the approval of a chemical active substance

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On behalf of Bayer AG
Crop Science Division

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Version history

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

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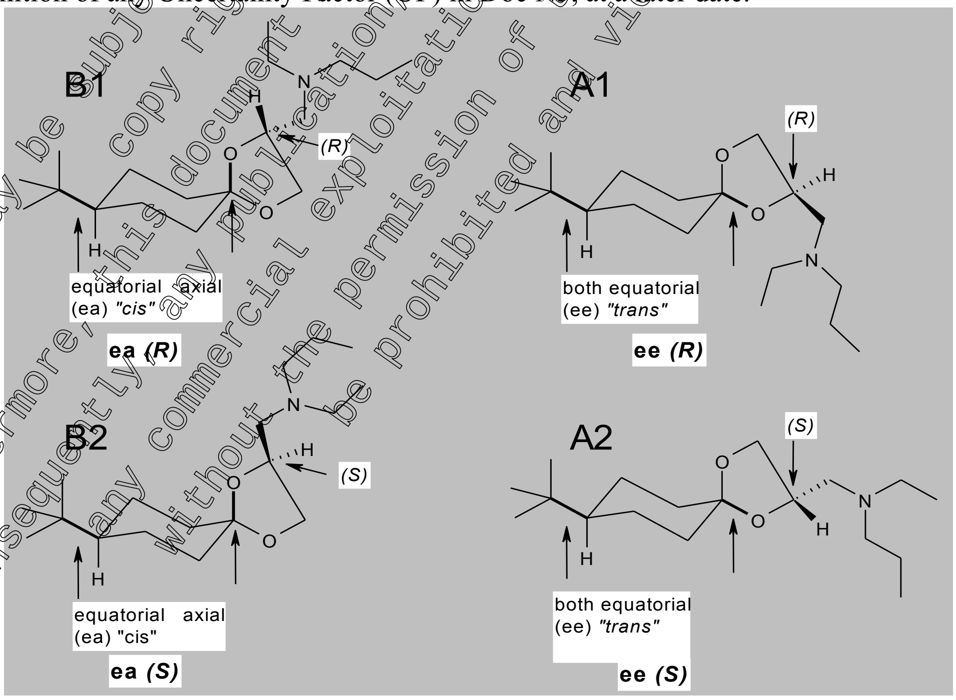
CP 9 FATE AND BEHAVIOUR IN THE ENVIRONMENT

Spiroxamine was included in Annex I to Council Directive 91/414/EEC in 1999 (Directive 1999/73/EC, Entry into Force on 1 September 1999). Spiroxamine was then renewed in 2012; the rapporteur Member State was Germany and the co-rapporteur Member State was Hungary. This Supplementary Dossier contains data which were not submitted at the time of the Annex I inclusion of spiroxamine under Council Directive 91/414/EEC and which were therefore not evaluated during the first EU review. However, all studies submitted for the first approval and subsequent first renewal of spiroxamine have also been summarised according to current guidance and included in the dossier. Where studies meet relevant validity criteria, new robust study summaries are provided in the appropriate dossier section. However, where studies do not meet relevant validity criteria and are not considered acceptable, less detailed summaries may have been provided alongside a discussion of potential study deficiencies. All relied upon study reports are submitted in Document K for this second renewal of approval dossier or in Document K for the first renewal submissions.

All data which were already submitted by Bayer AG (former Bayer CropScience) for the Annex I inclusion and first renewal under Council Directive 91/414/EEC are contained in the draft Re-Assessment Report (RAR) 2010 and its revised RAR 2017, and are included in the Baseline Dossier provided by Bayer AG.

This formulation is registered throughout Europe under trade names such as HELIX, IMPULSE GOLD, INUT 460 EC, INPUT CLASSIC, KROTON, PROLINE MAX 460 EC, Prosaro Plus, ROMBUS POWER, THESORUS, THESORUS 460 EC. Prothioconazole + Spiroxamine EC 460 (160+300 g/L) was already a representative formulation of Bayer AG for the first renewal of spiroxamine under Council Directive 91/414/EEC.

Spiroxamine consists of four isomers (two diastereomers, each with its corresponding two enantiomers which are in a 1:1 ratio) as shown in the schematic below. The isomer nomenclature presented in some historical documentation may differ with respect to the A/B and corresponding trans/cis notation due to a discrepancy in referencing, which is discussed in detail in position paper M-761468-01-1 (see CA 1.7/01). The stereo assignments depicted here, together with the A and B notation will be used exclusively going forward to ensure continuity of information throughout the dossier. The outcome of the chiral analysis of spiroxamine degradation is ongoing at time of submission and will be provided, along with a definition of any Uncertainty Factor (UF) in Doc N5, at a later date.



The representative formulated product Prothioconazole + Spiroxamine EC 460 (160+300 g/L) also contains the active substance prothioconazole. The active substance prothioconazole is not the primary focus of the renewal of the active substance spiroxamine and is the subject of a separate renewal evaluation which is in progress at the time of writing.

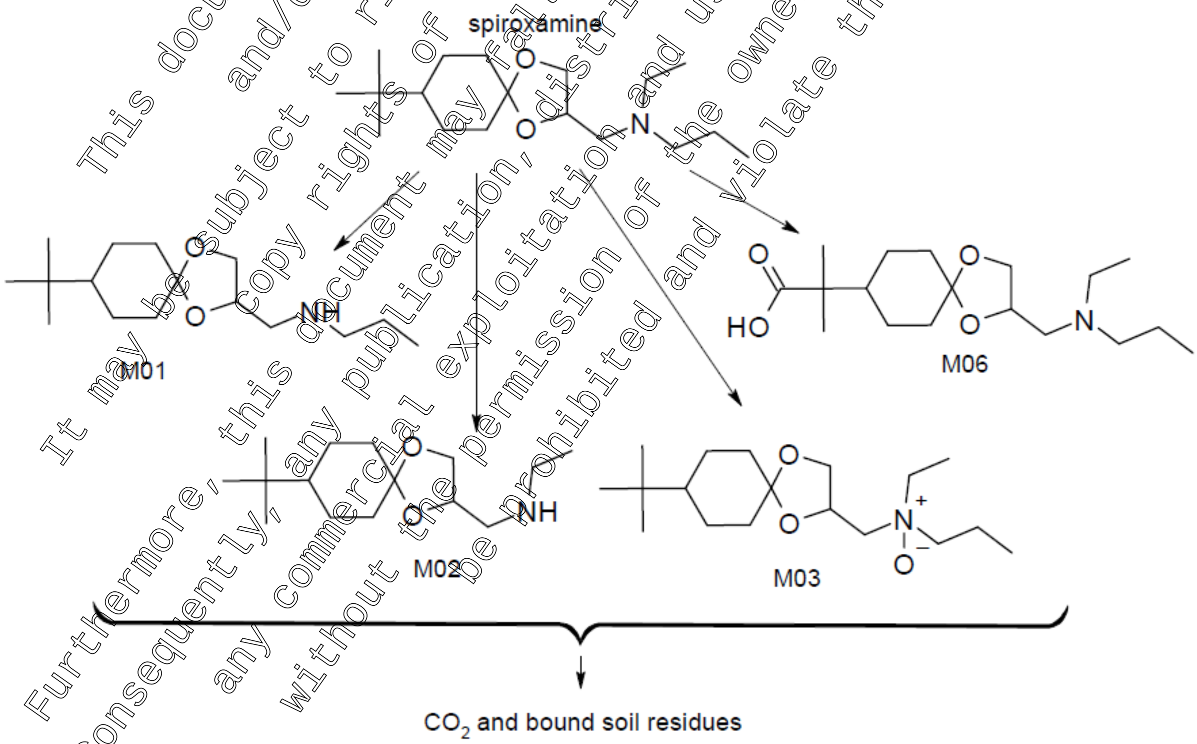
CP 9.1 Fate and behaviour in soil

Use of the representative formulated product Prothioconazole + Spiroxamine EC 460 (160+300 g/L) can potentially lead to measurable amounts reaching soil, therefore, the fate and behaviour in soil of Prothioconazole + Spiroxamine EC 460 (160+300 g/L) is addressed.

The formulated product Prothioconazole + Spiroxamine EC 460 (160+300 g/L), containing the active substance spiroxamine (500 g/L), is applied as a broadcast foliar spray to various crops. Consequently, the fate and behaviour of the active substance resulting from use of the formulated product Prothioconazole + Spiroxamine EC 460 (160+300 g/L) can be extrapolated from the studies on the active substance itself and therefore no additional laboratory studies on the fate and behaviour have been performed on the formulation.

The route of degradation of spiroxamine was consistent in all studies and driven via de-alkylation of the amine moiety and/or oxidation reactions of the alkyl chains resulting in identification of the soil metabolites M01 (spiroxamine-desethyl), M02 (spiroxamine-despropyl) and M03 (spiroxamine-N-oxide; please see Figure 9.1-1). The only notable new observation versus the previous evaluation was that of M06 (spiroxamine-acid), previously M06 was observed only at a maximum of 3.5% previously; the most recent data show M06 at a maximum of 5.3% AR at the final time point in the Refesol-02A soil thus triggering further evaluation and risk assessment. Studies to define the modelling parameters for M06 are currently on-going and conservative endpoints are used to provide a preliminary view of potential M06 exposure but will be updated upon study completion.

Figure 9.1-1: Aerobic soil degradation pathway for Spiroxamine



CP 9.1.1 Rate of degradation in soil

For information on the rate of degradation in soil please refer to Document MCA, Section 7.1.2. An assessment of the statistical difference of the kinetic evaluation of the lab and field studies was performed using the EFSA endpoint XL. This assessment determined that the field studies were statistically different to the lab dataset and as such modelling endpoints are taken from the field studies in isolation

CP 9.1.1.1 Laboratory studies

The rate of degradation in soil of the active substance spiroxamine and its major metabolites, as defined in CA 7.4.1 (i.e. metabolites M01 (spiroxamine-desethyl), M02 (spiroxamine-despropyl), M03 (spiroxamine-N-oxide) and M06 (spiroxamine-acid)), in laboratory studies is evaluated under CA 7.1.2.1 of the corresponding active substance dossier. As it is possible to extrapolate the behaviour of the active substance resulting from use of the formulated product Prothioconazole + Spiroxamine EC 460 (160+300 g/L) from the study on the active substance itself, additional laboratory studies investigating the rate of degradation in soil have not been performed.

A summary of the fate and behaviour of the active substance and associated significant metabolites in laboratory soil degradation studies is presented under CA 7.1.2.

CP 9.1.1.2 Field studies

CP 9.1.1.2.1 Soil dissipation studies

Soil dissipation behaviour of the representative formulation Prothioconazole + Spiroxamine EC 460 (160+300 g/L) can be extrapolated from the studies designed to evaluate the active substance addressed under CA 7.1.2.2.1. The dissipation rate of spiroxamine has been determined in five studies across eighteen European sites. Full details of the studies and derivation of the rate of dissipation according to the latest guidance is available under CA 7.1.2.2.1.

CP 9.1.1.2.2 Soil accumulation studies

Soil accumulation studies with the representative formulation Prothioconazole + Spiroxamine EC 460 (160+300 g/L) have not been conducted as behaviour can adequately addressed in the same manner as for the active substance and relevant metabolites (i.e. metabolites M01 (spiroxamine-desethyl), M02 (spiroxamine-despropyl) and M03 (spiroxamine-N-oxide) as described under CA 7.1.2.2.2.

CP 9.1.2 Mobility in the soil

CP 9.1.2.1 Laboratory studies

Studies investigating the soil sorption properties of the active substance spiroxamine and major metabolites as defined in CA 7.4.1 (i.e. metabolites M01 (spiroxamine-desethyl), M02 (spiroxamine-despropyl), M03 (spiroxamine-N-oxide) and M06 (spiroxamine-acid)), are evaluated under CA 7.1.3.1 of the corresponding active substance dossier. As it is possible to extrapolate the behaviour of the active substance resulting from use of the formulated product Prothioconazole + Spiroxamine EC 460 (160+300 g/L) from the studies on the active substance and metabolites themselves, additional soil sorption studies have not been performed.

The high sorption displayed by spiroxamine and its metabolites is reflected in the outcome of column leaching studies investigating the leaching behaviour of aged residue of spiroxamine in soil. These studies demonstrated that in soil column studies, aged residues of spiroxamine did not significantly leach to the column percolate with only 0.2 %AR being found in the leachate.

A summary of the behaviour of the active substance and its metabolites (addressed under CA 7.1.3.1.1 and CA 7.1.3.1.2, respectively) in soil sorption studies is presented under CA 7.1.3.1

CP 9.1.2.2 Lysimeter studies

Lysimeter studies with the representative formulation Prothioconazole + Spiroxamine EC 460 (160+300 g/L) were not conducted as lysimeter studies with the active substance are not triggered (CA 7.1.4.2).

Adequate soil sorption parameters for the active substance spiroxamine and all major soil metabolites (as defined under Point CA 7.4.1) are provided under Points CA 7.1.3.1.1 and CA 7.1.3.1.2. Furthermore, determination of the predicted environmental concentration in groundwater conducted under Point CP 9.2.4 do not indicate groundwater concentrations exceeding the relevant trigger levels, consequently lysimeter and/or field leaching studies with the active substance or any metabolites are not required.

CP 9.1.2.3 Field leaching studies

Field leaching studies with the representative formulation Prothioconazole + Spiroxamine EC 460 (160+300 g/L) have not been conducted as these have not been triggered (CA 7.1.4.3).

CP 9.1.3 Estimation of concentrations in soil

The Predicted Environmental Concentrations in soil (PECs) have been calculated for the active substance spiroxamine and major metabolite, as defined in CA 7.4.1, along with the intact formulation itself following foliar applications of Prothioconazole + Spiroxamine EC 460 (160+300 g/L) in accordance with the representative GAP.

The critical Good Agricultural Practice (GAP) for the representative formulation Prothioconazole + Spiroxamine EC 460 (160+300 g/L) is presented in document D1, with relevant agronomic parameters are summarised in Table 9.1.3-1.

Table 9.1.3-1: GAP for Prothioconazole + Spiroxamine EC 460 (160+300 g/L)

GAP details			Application timing			
			Early		Late	
Crop	Appln rate (g as/ha)	Growth stage	Crop interception (%)[a]	Effective appln rate (g/ha)[a]	Crop interception (%)[a]	Effective appln rate (g/ha)[a]
Winter cereals (spring appln only)[b]	2x 150-375 (14 d min interval)	30-69[c]	80 (GS30+)	2x 75	90 (GS 40+)	2x 37.5
Spring cereals (spring appln only)[b]	2x 150-375 (14 d min interval)	30-69[c]	80 (GS30+)	2x 75	90 (GS 40+)	2x 37.5

a) Representative of the worst case application rate
b) Barley, oats, wheat, rye, triticale
c) Encompassing barley and oats at GS 30-61

The predicted environmental concentration in soil was calculated using a risk envelope approach based upon the maximum proposed use rate following the recommendations of the FOCUS Soils Group (FOCUS 1997[1]). Calculations assume any substance reaching the soil surface is distributed uniformly to a depth of 5 cm (with no mechanical incorporation). The bulk density of soil is assumed to be 1.5 g/cm^3.

Predicted environmental concentrations in soil (PEC$_S$) – formulation

The initial predicted environmental concentration in soil of the representative formulated product Prothioconazole + Spiroxamine EC 460 (160+300 g/L) is presented in Table 9.1.3-2. Since the formulation components other than the active substance will dissipate rapidly in the environment, it is only necessary to consider the initial concentration for Prothioconazole + Spiroxamine EC 460 (160+300 g/L).

[1] FOCUS (1997). Soil persistence models and EU registration. European Commission Document 7617/VI/96.

Table 9.1.3-2: Worst-case initial PECs for Prothioconazole + Spiroxamine EC 460 (160+300 g/L) needed for environmental risk assessment

Crop	Formulation application rate (L/ha)	Application timing (growth stage)	Crop interception (%)	Soil concentration (mg Prothioconazole + Spiroxamine EC 460 (160+300 g/L)/kg dw soil)
Winter and spring cereals (spring application only)	1.25 L/ha Prothioconazole + Spiroxamine EC 460 (160+300 g/L) (equivalent to 1230 g/ha)[A]	30-69	80 minimum	0.328

A Based on a Prothioconazole + Spiroxamine EC 460 (160+300 g/L) formulation relative density of 0.984 g/mL see CP 2.6

The maximum initial concentration of the formulated product Prothioconazole + Spiroxamine EC 460 (160+300 g/L) in soil following application is 0.328 µg formulation/kg dw soil.

Predicted environmental concentrations in soil (PEC_S) – active substance spiroxamine and metabolites

The predicted environmental concentrations in soil of the active substance and of major metabolites, as defined under Point 7.4.1 (on the basis of the studies investigating the fate and behaviour of the active substance in soil under Point 7.1.1), have been calculated below based on the key endpoints presented in Table 9.1.3-3 and the uses of the representative formulation Prothioconazole + Spiroxamine EC 460 (160+300 g/L) described in Table 9.1.3-4.

Table 9.1.3-3: Summary of parameters used for determination of PECs

Component	Endpoint	Value	Comment
Spiroxamine (mw 297.5 g/mol),	Aerobic DT_{50} / DT_{90} soil (days)	56.6 / 393 (FOMC: α=1.297; β=80.06)	Worst case persistence field DT values from KCA 7.1.2.2.1/12 see Table 7.1.2.2
	$DT_{90field}$ > 1 year	Yes	i.e. PECs accumulation required
Metabolite M01 (spiroxamine-desethyl, (mw 269.4 g/mol, molar ratio 0.906))	Aerobic DT_{50} / DT_{90} soil (days)	223 / 742 (SFO)	Worst case persistence field DT values from KCA 7.1.2.2.1/12 see Table 7.1.2.2.1-71
	Maximum occurrence in soil (%)	12.0	See Table 7.4.1-1
	$DT_{90field}$ > 1 year	Yes	i.e. PECs accumulation required
Metabolite M02 (spiroxamine- despropyl, (mw 255.4 g/mol, molar ratio 0.858))	Aerobic DT_{50} / DT_{90} soil (days)	161 / 533 (SFO)	Worst case persistence field DT values from KCA 7.1.2.2.1/12 see Table 7.1.2.2.1-71
	Maximum occurrence in soil (%)	9.2	See Table 7.4.1-1
	$DT_{90field}$ > 1 year	Yes	i.e. PECs accumulation required
Metabolite M03 (spiroxamine- N-oxide, (mw 313.5 g/mol, molar ratio 1.054))	Aerobic DT_{50} / DT_{90} soil (days)	107 / 358 (SFO)	Worst case persistence lab DT values from KCA 7.1.2.1.1/09 see Table 7.1.2.1.1-1
	Maximum occurrence in soil (%)	7.9	See Table 7.4.1-1
	$DT_{90field}$ > 1 year	Yes	i.e. PECs accumulation required
Metabolite M06 (spiroxamine-acid, (mw 327.5 g/mol, molar ratio 1.101))	Aerobic DT_{50} / DT_{90} soil (days)	1000 / 3320 (SFO)	Worst case persistence lab DT values from KCA 7.1.2.1.1/09 see Table 7.1.2.1.1-1
	Maximum occurrence in soil (%)	5.3	See Table 7.4.1-1
	$DT_{90field}$ > 1 year	Yes	i.e. PECs accumulation required

The predicted environmental concentrations in soil of each metabolite was calculated using a pseudo application rate per crop using the following equation:

$$A_{metabolite}(g/ha) = A_{parent} \times \frac{\text{maximum metabolite observed (\%)}}{100} \times \text{molar correction factor}$$

Where:

A_{parent} = Total loading of the parent to soil (g a.s./ha)

$A_{metabolite}$ = Equivalent application rate of the metabolite (g a.s./ha)

The calculation of pseudo application rates for the metabolites for each use are shown in Table 9.1.3-4. The application rate that represents the worst case scenario for spiroxamine is an application to cereals at 375 g a.s./ha.

Table 9.1.3-4: Pseudo application rates for metabolites of spiroxamine used in the PEC_{SOIL} calculations

Crop / application rate	Metabolite	Max. soil load per application (g a.s./ha)	Maximum observed in soil (%)	Molar correction factor	Pseudo application rate per application (g a.s./ha)
Cereal/ 375 g a.s./ha	M01	75	12.0	0.906	8.15
Cereal/ 375 g a.s./ha	M02	75	9.2	0.858	5.92
Cereal/ 375 g a.s./ha	M03	75	7.9	1.054	6.24
Cereal/ 375 g a.s./ha	M06	75	5.3	1.101	4.38

The initial predicted environmental concentration for parent in soil after application was calculated using the following equation, assuming the soil deposit is uniformly distributed in the top 5 cm soil layer and that the soil bulk density is 1.5 g/cm³ (FOCUS 1997):

$$PEC_{SOIL}\ (mg/kg) = \frac{A \times (1 - F)}{100 \times d \times \rho}$$

Where:

A	=	Application rate (g a.s./ha)
F	=	Fraction intercepted by crop
d	=	Depth of field soil layer (5 cm)
ρ	=	Dry bulk density (1.5 g/cm³)

For the metabolites, the effective dose was calculated accounting for molecular weight and maximum observed occurrence in soil. Short and long-term (seasonal) predicted concentrations in soil of the active substance spiroxamine metabolites were calculated using SFO kinetics based on worst-case persistence DT50 values (see Table 9.1.3-3) using the following equation:

$$PEC_{actual)t} = \text{Initial } PEC_{SOIL} \text{ after application } \times e^{-kt}$$

Where:

Initial PEC_{SOIL}	=	Soil PEC immediately after application
k	=	first order degradation/dissipation rate constant (ln(2)/half-life)
t	=	specified time point after application (days)

For the active substance Spiroxamine, short and long-term (seasonal) predicted concentrations in soil were calculated using FOMC kinetics based on worst-case persistence DT_{50} values (see Table 9.1.3-3) using the following equation:

$$M = \frac{M_0}{\left(\frac{t}{\beta} + 1\right)^{\alpha}}$$

where

M	=	total amount of chemical present at time t
M_0	=	total amount of chemical present at time $t = 0$
α	=	shape parameter determined by coefficient of variation of k values
β	=	location parameter

For metabolite concentrations, degradation between applications was not taken into account (worst-case).

PECs$_{accumulation}$

In addition to the seasonal PEC_S calculations, the potential accumulation ($PEC_{S,accumulation}$) in soil following repeated annual applications was calculated for metabolite where $DT_{90field}$ > 1 year i.e. the active substance spiroxamine and metabolites M01 (spiroxamine-desethyl), M02 (spiroxamine-despropyl), M03 (spiroxamine-N-oxide) and M06 (spiroxamine-acid).

For parent spiroxamine, accumulation calculations were based on application every year as a worst case. The decay of each annual application was modelled on a daily basis for up to 100 years from first application using FOMC degradation kinetics. The total daily residue was the sum of the individual residues from each application. The calculation was carried out for 100 years, assuming incorporation to 5 cm depth and with tillage to 20 cm depth. Although soil residues are technically still increasing due to the use of FOMC kinetics, a 100 years of repeated annual applications is considered sufficiently worst-case.

For parent spiroxamine metabolites M01 (spiroxamine-desethyl), M02 (spiroxamine-despropyl), M03 (spiroxamine-N-oxide) and M06 (spiroxamine-acid), accumulation calculations were similarly conducted but using SFO kinetics and a shorter time period. Accumulation PECs for M06 are provided based on the default DT_{50} and is considered worst case; an ongoing OECD307 study is being conducted to provide realistic DT_{50} and refine the presented conservative assessment.

$PEC_{S,accumulation}$ was calculated as the sum of the $PEC_{S,plateau}$ concentration before the first annual application in the last year and the $PEC_{S,ini}$ (calculated for 5 cm soil depth) immediately after the last application:

$$PEC_{S,ini} = \frac{\max_{n \in \{1,\ldots,365\}} L_n}{100 d_{inc} \rho}$$

$$PEC_{S,accumulation} = PEC_{S,plateau} + PEC_{S,ini}$$

Where:

d_{inc} Depth of the field soil layer for incorporation (5 cm)

ρ Dry bulk density (1.5 g/cm^3)

The resulting worst-case predicted environmental concentrations in soil of the active substance are presented in Table 9.1.3-5 and for the metabolites in Table 9.1.3-6 to Table 9.1.3-9.

Table 9.1.3-5: Worst-case PECs (initial, short/long-term and TWA) for spiroxamine following application of Prothioconazole + Spiroxamine EC 460 (160+300 g/L) to cereals

Time		Concentration in soil (mg as/kg soil dw)			
		1 x 375g a.s./ha		2 x 375 g a.s./ha [A]	
		Actual	TWA	Actual	TWA
Initial (after last appln)		0.100	-	0.181	-
Short term	24h	0.098	0.099	0.178	0.180
	2d	0.097	0.098	0.176	0.178
	4d	0.094	0.097	0.171	0.176
Long term	7d	0.090	0.095	0.164	0.172
	14d	0.081	0.090	0.149	0.164
	21d	0.074	0.086	0.136	0.157
	28d	0.068	0.082	0.126	0.151
	50d	0.053	0.072	0.100	0.134
	100d	0.035	0.058	0.067	0.111
Plateau concentration (20 cm)		0.010	-	0.019	-
$PEC_{accumulation}$ (PEC_{act} +$PEC_{soil\ plateau}$)		0.110 (after 100 yrs)	-	0.200 (after 100 yrs)	-

A For concentrations of the active substance, degradation between applications was taken into account.

Table 9.1.3-6: Worst-case PECs (initial, short/long-term and TWA) for metabolite M01 following application of Prothioconazole + Spiroxamine EC 460 (160+300 g/L) to cereals

Time		Concentration in soil (mg as/kg soil dw)			
		1 x 375g a.s./ha		2 x 375 g a.s./ha [A]	
		Actual	TWA	Actual	TWA
Initial		0.011	-	0.022	-
Short term	24h	0.011	0.011	0.022	0.022
	2d	0.011	0.011	0.022	0.022
	4d	0.011	0.011	0.021	0.022
Long term	7d	0.011	0.011	0.021	0.021
	14d	0.010	0.011	0.021	0.021
	21d	0.010	0.011	0.020	0.021
	28d	0.010	0.010	0.020	0.021
	50d	0.009	0.010	0.019	0.020
	100d	0.008	0.009	0.016	0.019
Plateau concentration (20 cm)		0.004	-	0.008	-
$PEC_{accumulation}$ (PEC_{act} +$PEC_{soil\ plateau}$)		0.015 (after 4th yr)	-	0.030 (after 4th yr)	-

A For metabolite concentrations, degradation between applications was not taken into account (worst-case).

Table 9.1.3-7: Worst-case PECs (initial, short/long-term and TWA) for metabolite M02 following application of Prothioconazole + Spiroxamine EC 460 (160+300 g/L) to cereals

Time		Concentration in soil (mg as/kg soil dw)			
		1 x 375g a.s./ha		2 x 375 g a.s./ha [A]	
		Actual	TWA	Actual	TWA
Initial		0.008	-	0.016	-
Short term	24h	0.008	0.008	0.016	0.016
	2d	0.008	0.008	0.016	0.016
	4d	0.008	0.008	0.016	0.016
Long term	7d	0.008	0.008	0.015	0.016
	14d	0.007	0.008	0.015	0.015
	21d	0.007	0.008	0.014	0.015
	28d	0.007	0.007	0.014	0.015
	50d	0.006	0.007	0.013	0.014
	100d	0.005	0.006	0.010	0.013
Plateau concentration (5 cm)		0.003	-	0.005	-
$PEC_{accumulation}$ (PEC_{act} +$PEC_{soil\ plateau}$)		0.011 (after 2nd yr)	-	0.021 (after 3rd yr)	-

A For metabolite concentrations, degradation between applications was not taken into account (worst-case).

Table 9.1.3-8: Worst-case PECs (initial, short/long-term and TWA) for metabolite M03 following application of Prothioconazole + Spiroxamine EC 460 (160+300 g/L) to cereals

Time		Concentration in soil (mg as/kg soil dw)			
		1 x 375g a.s./ha		2 x 375 g a.s./ha [A]	
		Actual	TWA	Actual	TWA
Initial		0.008	-	0.017	-
Short term	24h	0.008	0.008	0.017	0.017
	2d	0.008	0.008	0.016	0.017
	4d	0.008	0.008	0.016	0.016
Long term	7d	0.008	0.008	0.016	0.016
	14d	0.008	0.008	0.015	0.016
	21d	0.007	0.008	0.015	0.016
	28d	0.007	0.008	0.014	0.015
	50d	0.006	0.007	0.012	0.014
	100d	0.004	0.006	0.009	0.012
Plateau concentration (20 cm)		0.002	-	0.005	-
$PEC_{accumulation}$ (PEC_{act} +$PEC_{soil\ plateau}$)		0.010 (after 2nd yr)	-	0.022 (after 2nd yr)	-

A For metabolite concentrations, degradation between applications was not taken into account (worst-case).

Table 9.1.3-9: Worst-case PECs (initial, short/long-term and TWA) for metabolite M06 following application of Prothioconazole + Spiroxamine EC 460 (160+300 g/L) to cereals

Time		Concentration in soil (mg as/kg soil dw)			
		1 x 375g a.s./ha		2 x 375 g a.s./ha [A]	
		Actual	TWA	Actual	TWA
Initial		0.006	-	0.012	-
Short term	24h	0.006	0.006	0.012	0.012
	2d	0.006	0.006	0.012	0.012
	4d	0.006	0.006	0.012	0.012
Long term	7d	0.006	0.006	0.012	0.012
	14d	0.006	0.006	0.012	0.012
	21d	0.006	0.006	0.012	0.012
	28d	0.006	0.006	0.011	0.012
	50d	0.006	0.006	0.011	0.011
	100d	0.005	0.006	0.011	0.011
Plateau concentration (20 cm)		0.007	-	0.013	-
$PEC_{accumulation}$ (PEC_{act} + $PEC_{soil\ plateau}$)		0.013 (after 15 yrs)	-	0.025 (after 15 yrs)	-

A For metabolite concentrations, degradation between applications was not taken into account (worst-case).

Table 9.1.3-10: Overview of initial PECs following single (1x 375 g/ha), multiple (2x 375 g/ha) and repeated annual applications for a period of 100 years of 2x 375 g/ha to cereals

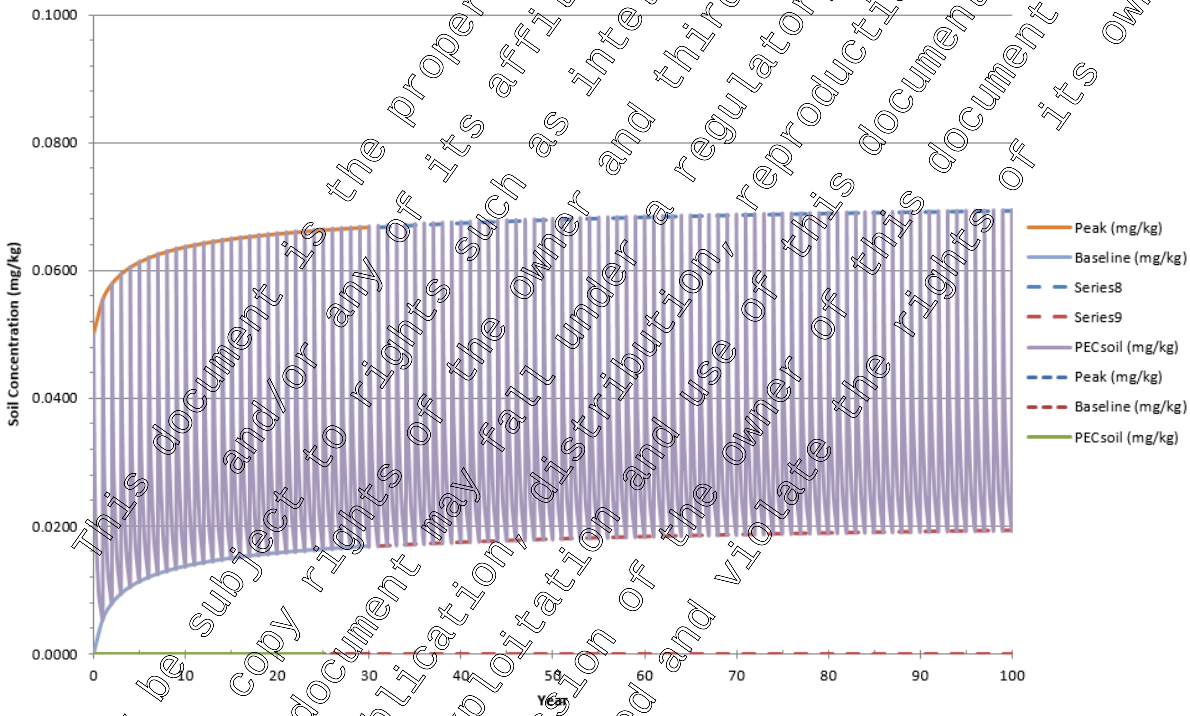
Substance	Concentration in soil (mg as/kg soil dw)		
	1x 375 g/ha	2 x 375 g a.s./ha [A,B]	Repeated annual application of 2x 375 g/ha
Spiroxamine	0.100	0.1810	0.019 (background) 0.069 (peak) after 100 yrs annual use
M01 (spiroxamine-desethyl)	0.011	0.022	0.008 (background) 0.030 (peak) plateau after 4 yrs annual use
M02 (spiroxamine-despropyl),	0.008	0.016	0.005 (background) 0.021 (peak) plateau after 3 yrs annual use
M03 (spiroxamine-N-oxide)	0.008	0.017	0.005 (background) 0.022 (peak) plateau after 3 yrs annual use

Substance	Concentration in soil (mg as/kg soil dw)		
	1x 375 g/ha	2 x 375 g a.s./ha A,B	Repeated annual application of 2x 375 g/ha
M06 (spiroxamine-acid)	0.006	0.012	0.013 (background) 0.025 (peak) plateau after 20 yrs annual use

A For concentrations of the active substance, degradation between applications was taken into account.
B For metabolite concentrations, degradation between applications was not taken into account (worst-case).

The predicted accumulation of spiroxamine in soil over a 100-year period after application to cereals is illustrated in Figure 9.1.3-1.

Figure 9.1.3-1: Accumulation of spiroxamine in soil following repeated annual application to winter or spring cereals (2x 375 g/ha annually)



Following application of 2x 375 g/ha to cereals, worst-case PEC in soil of the active substance spiroxamine and metabolites M01 (spiroxamine-desethyl), M02 (spiroxamine-despropyl), M03 (spiroxamine-N-oxide) and M06 (spiroxamine-acid) were 0.181, 0.022, 0.016, 0.017 and 0.012 mg/kg soil dw respectively. Following worst-case repeated annual applications to cereals (i.e. 2x 375 g/ha annually), worst-case peak accumulated PEC in soil were 0.069, 0.030, 0.021, 0.022 and 0.025 mg/kg soil dw respectively.

Predicted environmental concentrations in soil (PEC$_S$) – active substance prothioconazole and metabolites

The representative formulated product Prothioconazole + Spiroxamine EC 460 (160+300 g/L) also contains the active substance prothioconazole. The active substance prothioconazole is not the primary focus of the renewal of the active substance spiroxamine and is the subject of a separate renewal evaluation which is in progress at the time of writing.

According to the current evaluation documents for the active substance prothioconazole (i.e. EFSA 2007[2], p.77/98), the definition of the residue for environmental risk assessment in soil lists prothioconazole and metabolites M01 (prothioconazole-S-methyl) and M04 (prothioconazole-desthio).

The predicted environmental concentration in soil of prothioconazole and metabolites M01 (prothioconazole-S-methyl) and M04 (prothioconazole-desthio) are addressed by reference to the existing RAR for spiroxamine, volume 3, Annex B.9 (8-Aug-2017) which provides the following Table 9.1.3-11 (from page 324; Table B.9.7-14) showing PECs following 2x 200 g prothioconazole/ha applications to cereals using existing parameters as needed for environmental risk assessment:

Table 9.1.3-11: PECsoil values for Prothioconazole and Spiroxamine EC 460

Compound	maximum (mg/kg soil)	21d-TWA (mg/kg soil)	Reference
Cereals:2x 1.25 L product/ha (2 x 0.200 kg Prothioconazole, 2 x 0.375 kg Spiroxamine)			
Prothioconazole	0.081	0.028	Schad & Zerbe, 2008, MEF-08/147 (scenario #8)
Prothioconazole-desthio	0.075	0.066	
Prothioconazole-S-methyl	0.021	0.008	
Spiroxamine	0.288	0.272	Roepke & Füllner, 2008, MEF-08/274
KWG 4168-desethyl	~~0.023~~ 0.118**	0.021	
KWG 4168-despropyl	~~0.014~~ 0.116**	0.013	

** According to Open Point 4.27 of the Evaluation Table initial PECs values for the metabolites M01 (-desethyl) and M02 (-despropyl) were recalculated.

Using the existing list of endpoints (LoEP) for prothioconazole, following 2x 200 g prothioconazole/ha applications to cereals the maximum initial predicted environmental concentration in soil of prothioconazole and metabolites M01 (prothioconazole-S-methyl) and M04 (prothioconazole-desthio) are 0.081, 0.075 and 0.021 mg/kg soil, respectively.

For procedural reasons studies listed in the Table CP 9.1.3-1 below are included in the current dossier as available data or information previously submitted but not necessarily evaluated. However, these reports have been fully superseded by newer studies. Consequently, no summaries of the reports have been included in the dossier.

Table CP 9.1.3-1: Studies previously submitted and not relied upon for the risk assessment

Data Point	Document No.	Date	Title
KCP 9.1.3/01	M-304009-02-1	2008	Predicted environmental concentrations of spiroxamine in soil (PECsoil) - Use in cereals in Europe

CP 9.2 Fate and behaviour in water and sediment

Use of the representative formulated product Prothioconazole + Spiroxamine EC 460 (160+300 g/L) can potentially lead to amounts reaching surface water during treatments by spray drift or *via* soil drainage and run-off, therefore the fate and behaviour in water and sediment of Prothioconazole + Spiroxamine EC 460 (160+300 g/L) is addressed.

[2] EFSA Scientific Report (2007) 106, 1-98, Conclusion on the peer review of prothioconazole.

The representative formulated product Prothioconazole + Spiroxamine EC 460 (160+300 g/L) also contains the active substance prothioconazole. The active substance prothioconazole is not the primary focus of the renewal of the active substance spiroxamine and is the subject of a separate renewal evaluation which is in progress at the time of writing.

CP 9.2.1 Aerobic mineralisation in surface water

As it is possible to extrapolate the behaviour of the active substance resulting from use of the formulated product Prothioconazole + Spiroxamine EC 460 (160+300 g/L) from the study on the active substance itself, additional laboratory studies investigating the aerobic mineralisation in surface water of Prothioconazole + Spiroxamine EC 460 (160+300 g/L) have not been performed.

CP 9.2.2 Water/sediment study

As it is possible to extrapolate the behaviour of the active substance resulting from use of the formulated product Prothioconazole + Spiroxamine EC 460 (160+300 g/L) from the study on the active substance itself, additional laboratory studies investigating the behaviour of Prothioconazole + Spiroxamine EC 460 (160+300 g/L) in water/sediment studies have not been performed.

CP 9.2.3 Irradiated water/sediment study

As it is possible to extrapolate the behaviour of the active substance resulting from use of the formulated product Prothioconazole + Spiroxamine EC 460 (160+300 g/L) from the study on the active substance itself, additional laboratory studies investigating the behaviour of Prothioconazole + Spiroxamine EC 460 (160+300 g/L) in irradiated water/sediment studies have not been performed.

CP 9.2.4 Estimation of concentrations in groundwater

CP 9.2.4.1 Calculation of concentrations in groundwater

The Predicted Environmental Concentrations in groundwater (PEC_{GW}) following foliar applications of Prothioconazole + Spiroxamine EC 460 (160+300 g/L) have been calculated for the active substance spiroxamine and major metabolites, as defined in CA 7.4.1, in accordance with the representative GAP.

The representative formulated product Prothioconazole + Spiroxamine EC 460 (160+300 g/L) also contains the active substance prothioconazole. The active substance prothioconazole is not the primary focus of the renewal of the active substance spiroxamine and is the subject of a separate renewal evaluation which is in progress at the time of writing.

The predicted environmental concentration of the active substance spiroxamine and significant metabolite in groundwater (PEC_{GW}) is determined using the standardised recommendations of the FOCUS working group on surface water scenarios (FOCUS 2000[3], 2014[4] and EC 2014[5]). The PECs are provided in one existing modelling study included in the last evaluation which is therefore included for completeness but which has been superseded by a new modelling report conducted to modern requirements CP 9.2.4.1/02 (M-763143-01-1).

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3 FOCUS (2000). FOCUS groundwater scenarios in the EU review of active substances. Report of the FOCUS groundwater scenarios workgroup, EC Document Reference Sanco/321/2000 rev. 2.

4 FOCUS (2014). Generic guidance for Tier 1 FOCUS groundwater assessments, version 2.2. FOCUS groundwater scenarios working group.

5 EC (2014). Assessing Potential for Movement of Active Substances and their Metabolites to Ground Water in the EU, Report of the FOCUS Ground Water Work Group, EC Document Reference Sanco/13144/2010 version 3, 613 pp.

Substance	Report reference	Document no.	Comment
Spiroxamine	KCP 9.2.4.1/01	M-304049-01-1	Submitted for first renewal of spiroxamine, 2010. Reviewed under UP. Considered valid and acceptable.
Spiroxamine	KCP 9.2.4.1/02	M-763143-01-1	New data not yet reviewed under UP.

PECgw FOCUS (spiroxamine)

Data Point:	KCP 9.2.4.1/01
Report Author:	[redacted]; [redacted]
Report Year:	2008
Report Title:	Predicted environmental concentrations of spiroxamine in groundwater recharge (PECgw) based on calculations with FOCUS-PEARL and FOCUS-PELMO - Use in cereals in Europe
Report No:	MEF-08/272
Document No:	M-304049-01-1
Guideline(s) followed in study:	not applicable
Deviations from current test guideline:	None
Previous evaluation:	yes, evaluated and accepted RAR (2010)
GLP/Officially recognised testing facilities:	No, not conducted under GLP/Officially recognised testing facilities
Acceptability/Reliability:	Yes

Executive summary

This study was previous considered during the evaluation of spiroxamine (RAR (2010)) and is therefore included again for completeness. This study presents the PEC modelling conducted on the representative for the last evaluation, however, the PEC modelling reported in this study is superseded by the new PEC modelling performed in study KCP1 9.2.4.1/02 (M-763143-01-1).

Data Point:	KCP 9.2.4.1/02
Report Author:	[redacted]
Report Year:	2021
Report Title:	A modelling assessment of spiroxamine and its Mmetabolites in groundwater
Report No:	0471836-GW2
Document No:	M-763143-01-1
Guideline(s) followed in study:	FOCUS (2000, 2014), EFSA (2014)
Deviations from current test guideline:	None
Previous evaluation:	No, not previously submitted
GLP/Officially recognised testing facilities:	not applicable
Acceptability/Reliability:	Yes

Executive summary

The leaching behaviour of spiroxamine and its metabolites M01 (spiroxamine-desethyl), M02 (spiroxamine-despropyl) and M03 (spiroxamine-N-oxide) following application of Prothioconazole + Spiroxamine EC 460 (160+300 g/L) formulation applied as a foliar spray to winter and spring cereal crops was examined in accordance with the FOCUS groundwater scenarios workshop guidelines (FOCUS, 2000 and 2014) and the EFSA guidance for protected crops (EFSA, 2014).

The following field uses were simulated in accordance with the supported uses of the Prothioconazole+ Spiroxamine EC 460 (160+300 g/L) formulation:

- Two applications (BBCH 30 onwards) at a rate of 375 g a.s./ha to winter cereals
- Two applications (BBCH 30 onwards) at a rate of 375 g a.s./ha to spring cereals

Simulations for the field uses were conducted using the FOCUS groundwater scenarios in the FOCUS PEARL (version 4.4.4), FOCUS PELMO (version 5.5.3) and FOCUS MACRO (version 5.5.4) models.

The input parameters for the calculations are defined in Table 9.2.4.1-1 and were selected based on recommendations from FOCUS (FOCUS, 2000 and 2014).

These results demonstrate that spiroxamine can be used safely as proposed without the risk of spiroxamine and its metabolites M01 (spiroxamine-desethyl), M02 (spiroxamine-despropyl) and M03 (spiroxamine-N-oxide) exceeding acceptable levels in groundwater.

The predicted 80th percentile average annual concentrations for spiroxamine following application to winter and spring cereals were lower than the 0.1 µg/L regulatory threshold in groundwater at 1 m depth for all crop / scenario combinations. The PEC_{GW} values for metabolites M01 (spiroxamine-desethyl), M02 (spiroxamine-despropyl) and M03 (spiroxamine-N-oxide) following annual application spiroxamine to crops were <0.001 µg/L, which is expected due to the high K_{OC} of spiroxamine and its metabolites, as well as being in accordance to values submitted previously. All values are below the 0.1 µg/L regulatory threshold in groundwater at 1 m depth for all the available crop / scenario combinations.

Study design

The purpose of this study was to assess the potential for leaching of spiroxamine and its metabolites M01, M02 and M03 following application of the Prothioconazole + Spiroxamine EC 460 (160+300 g/L) formulation to winter and spring cereals, in accordance with the EU representative GAP.

The predicted environmental concentrations in groundwater (PEC_{GW}) for the field uses were determined using the FOCUS PEARL (version 4.4.4), FOCUS PELMO (version 5.5.3) and FOCUS MACRO (version 5.5.4) groundwater models and scenarios in accordance with the FOCUS groundwater scenarios workgroup guidelines (FOCUS, 2000 and 2014).

The input parameters used in the modelling for spiroxamine and its metabolites are summarised in Table 9.2.4.1-1 to Table 9.2.4.1-2. The representative use is summarised in Table 9.2.4.1-3.

Table 9.2.4.1-1: Physico-chemical parameters used in modelling for spiroxamine

Parameter	Value	Remarks
Physico-chemical		
Molecular weight (g/mol)	297.5	MCA Renewal of Approval dossier, see CA 1.7
Water solubility at 20°C (mg/L)	470	MCA Renewal of Approval dossier, see CA 2.5
Vapour pressure at 20°C (Pa)	4.5 x 10^{-3}	MCA Renewal of Approval dossier, see CA 2.2
Molar enthalpy of vaporization (kJ/mol)	95	FOCUS recommendation
Diffusion coefficient in water (m²/d) (m²/s)	4.3 x 10-5 (20°C) (PEARL)	
Diffusion coefficient in gas (m²/d)	0.43 (20°C)	
Degradation in soil		
DT_{50} soil (d)	43.8	Geometric mean of uncropped field data (n= 8), submitted in MCA Renewal of Approval dossier, see data point CA 7.1.2.1.1, Table 7.1.2.2.1-72
Temperature correction function Reference temperature (°C) PELMO: Q10 (-) PEARL: (kJ/mol)	 20 2.58 65.4	FOCUS recommendation
Moisture correction function Reference moisture (-) PEARL/PELMO: moisture exponent (-)	pF 2 0.7 0.49	
Sorption to soil		
K_{FOC} (mL/g)	4111	Geometric mean (n= 8) calculated from individual values, see data point CA 7.1.3.1, Table 7.1.3.1-1
K_{FOM} (mL/g)	2384	Calculated K_{FOC} / 1.724
Freundlich exponent 1/n (-)	0.892	Arithmetic mean (n=8) calculated from individual values submitted in MCA Renewal of Approval dossier see CA 7.1.3.1
Crop/management related parameters		
Crop uptake factor (-)	0.47	Crop uptake factor calculated by Briggs equation, see Appendix 2
Washoff Factor (1/m) (PEARL)	0.0001	Default
Washoff Factor (1/m) (MACRO)	0.05	Default
Foliar DT_{50} (d)	10	Default

Table 9.2.4.1-2: Input parameters used in groundwater modelling for the metabolites of spiroxamine

Parameter	M01 (spiroxamine-desethyl)		M02 (spiroxamine-despropyl)		M03 (spiroxamine-N-oxide)	
	Value	**Remarks**	**Value**	**Remarks**	**Value**	**Remarks**
Molecular weight (g/mol)	269.4	Based on structure	269.4	Based on structure	313.5	Based on structure
Water solubility at 20°C (mg/L)	14.8	MCA Renewal of Approval dossier, see CA 2.5	46.6	MCA Renewal of Approval dossier, see CA 2.5	1000	MCA Renewal of Approval dossier, see CA 2.5
Vapour pressure at 20°C (Pa)	0	Default value (FOCUS, 2014)	0	Default value (FOCUS, 2014)	0	Default value (FOCUS, 2014)
K_{FOC} (mL/g)	3271	Geometric mean (n=4) submitted in MCA Renewal of Approval dossier, see data point CA 7.1.3.1.2, Table 7.1.3.1.2-1	2695	Geometric mean (n=4) submitted in MCA Renewal of Approval dossier, see data point CA 7.1.3.1.2, Table 7.1.3.1.2-1	1677	Geometric mean (n=4), submitted in MCA Renewal of Approval dossier, see data point CA 7.1.3.1.2, Table 7.1.3.1.2-1
1/n	0.848	Arithmetic mean (n=4), submitted in MCA Renewal of Approval dossier see CA 7.1.3.1	0.878	Arithmetic mean (n=4) submitted in MCA Renewal of Approval dossier see CA 7.1.3.1	0.900	Arithmetic mean (n=4), submitted in MCA Renewal of Approval dossier see CA 7.1.3.1
DT_{50} soil @ 20°C & pF2 (days)	168.6	Geometric mean (n=10) of laboratory values, submitted in MCA Renewal of Approval dossier, see data point CA 7.1.2.1.1, Table 7.1.2.1.1-2	219.1	Geometric mean (n=10) of laboratory values submitted in MCA Renewal of Approval dossier, see data point CA 7.1.2.1.1, Table 7.1.2.1.1-2	46.4	Geometric mean (n=7) of laboratory values submitted in MCA Renewal of Approval dossier, see data point CA 7.1.2.1.1, Table 7.1.2.1.1-2

Parameter	M01 (spiroxamine-desethyl)		M02 (spiroxamine-despropyl)		M03 (spiroxamine-N-oxide)	
	Value	**Remarks**	**Value**	**Remarks**	**Value**	**Remarks**
Plant uptake factor	0	Default value	0	Default value	0	Default value
Formation fraction	0.183	Arithmetic mean (n=10), of laboratory values; submitted in MCA Renewal of Approval dossier, see CA 7.1.2	0.138	Arithmetic mean (n=10), of laboratory values;) submitted in MCA Renewal of Approval dossier see CA 7.1.2	0.149	Arithmetic mean (n=7), of laboratory values; submitted in MCA Renewal of Approval dossier see CA 7.1.2
MACRO conversion fraction	0.1657	0.183 (ff x (MWmetabolite/ MWparent)	1.185×10^{-3}	0.138 (ff x (MWmetabolite/ MWparent)	0.157	0.149 (ff x (MWmetabolite/ MWparent)
Washoff Factor (1/m) (PEARL)	0.0001	Default	0.0001	Default	0.0001	Default
Foliar DT_{50} (d)	10	Default	10	Default	10	Default

Table 9.2.4.1-3: Supported use of Prothioconazole+ Spiroxamine EC 460 (160+300 g/L) formulation

GAP details			Early application		Late application	
Crop	Appln rate (g as/ha)	Growth stage (PHI)	Int. (%)	Effective appln rate (g as/ha)	Int. (%)	Effective appln rate (g as/ha)
Winter sown cereals [b]	2x 150-375 (14 d min interval)	30-69	80 (GS30+)	2x 75	90 (GS 40+)	2x 37.5
Spring sown cereals [b]	2x 150-375 (14 d min interval)	30-69	80 (GS30+)	2x 75	90 (GS 40+)	2x 37.5

Applications made to winter and spring cereals were simulated using the relevant FOCUS scenarios in FOCUS PEARL (version 4.4.4) and FOCUS PELMO (version 5.5.3). In FOCUS MACRO (version 5.5.4), simulations were performed using the Châteaudun scenario.

The groundwater models account for crop interception using different methods. For consistency, the internal interception routines of the models were disabled and the application rates were manually adjusted for crop interception, in accordance with FOCUS recommendation (FOCUS, 2000 and 2014).

The calculation of the adjusted application rates is shown in Table 9.2.4.1-4.

Table 9.2.4.1-4: Calculation of exposure to soil for use in groundwater simulations

Scenario	FOCUS dates for emergence/ harvest	Application timing	
		Early	Late
Winer cereals (FOCUS winter cereals), 2x 375 g as/ha (14 d min interval) GS30-69			
Châteaudun (C)	26-Oct/15-Jul	15-Apr (105), 29-Apr (119)	31-May (151), 14-Jun (165)
Hamburg (H)	1-Nov/10-Aug	4-May (124), 18-May (138)	08-Jun (159), 22-Jun (173)
Jokioinen (J)	20-Sep/15-Aug	14-May (134), 28-May (148)	26-Jun (177), 10-Jul (191)
Kremsmünster (K)	5-Nov/10-Aug	24-Apr (114), 8-May (128)	11 Jun (162), 25-Jun (176)
Okehamption (N)	17-Oct/1-Aug	21-Apr (111), 5-May (125)	24-May (144), 7-Jun (158)
Piacenza (P)	1-Dec/1-Jul	19-Mar (78), 2-Apr (92)	12-May (132), 26-May (146)
Porto (O)	30-Nov/30-Jun	30-Jan (30), 13-Feb (44)	04-May (124), 18-May (138)
Sevilla (S)	30-Nov/31-May	6-Jan (6), 20-Jan (20)	14-Mar (73), 28-Mar (87)
Thiva (T)	30-Nov/30-Jun	18-Jan (18), 1-Feb (32)	13-Apr (103), 27-Apr (117)
		Earliest appln @GS30 with 2nd appln 14 days later	2nd appln @GS69 with 1st appln 14 days prior
Spring cereals (FOCUS spring cereals), 2x 375 g as/ha (14 d min interval) GS30-69			
Châteaudun (C)	10-Mar/20-Jul	16-Apr (106), 30-Apr (120)	12-Jun (159), 22-Jun (173)
Hamburg (H)	1-Apr/20-Aug	28-Apr (118), 12-May (132)	18-Jun (165), 28-Jun (179)
Jokioinen (J)	18-May/25-Aug	5-Jun (156), 19-Jun (170)	07-Jul (184), 17-Jul (198)
Kremsmünster (K)	1-Apr/20-Aug	27-Apr (117), 11-May (131)	18-Jun (165), 28-Jun (179)
Okehamption (N)	1-Apr/20-Aug	22-Apr (112), 6-May (125)	08-Jun (155), 18-Jun (169)
Porto (O)	10-Mar/20-Jul	16-Apr (106), 30-Apr (120)	12-Jun (159), 22-Jun (173)
		Earliest appln @GS30 with 2nd appln 14 days later	2nd appln @GS69 with 1st appln 14 days prior

Results and discussion

The PEC_{GW} (80th percentile annual average leachate concentration at 1 m soil depth) values, modelled using FOCUS PEARL, PELMO and MACRO for spiroxamine and its metabolites M01 (spiroxamine-desethyl), M02 (spiroxamine-despropyl) and M03 (spiroxamine-N-oxide) following application of the Prothioconazole+ Spiroxamine EC 460 (160+300 g/L) formulation to winter and spring cereals, are provided in Table 9.2.4.1-5 to Table 9.2.4.1-9.

Table 9.2.4.1-5: PEC_{GW} following annual application of spiroxamine in accordance with the GAP, using the FOCUS PEARL model and early application

Crop	Scenario	80th Percentile PEC_{GW} at 1 m Soil Depth (µg/L)			
		Spiroxamine	M01 (spirox-amine-desethyl)	M02 (spirox-amine-despro-pyl)	M03 (spirox-amine-N-oxide)
Winter cereals (early applica-tion)	Châteaudun	<0.001	<0.001	<0.001	<0.001
	Hamburg	<0.001	<0.001	<0.001	<0.001
	Jokioinen	<0.001	<0.001	<0.001	<0.001
	Kremsmünster	<0.001	<0.001	<0.001	<0.001
	Okehampton	<0.001	<0.001	<0.001	<0.001
	Piacenza	<0.001	<0.001	<0.001	<0.001
	Porto	<0.001	<0.001	<0.001	<0.001
	Sevilla	<0.001	<0.001	<0.001	<0.001
	Thiva	<0.001	<0.001	<0.001	<0.001
Spring cereals (early applica-tion)	Châteaudun	<0.001	<0.001	<0.001	<0.001
	Hamburg	<0.001	<0.001	<0.001	<0.001
	Jokioinen	<0.001	<0.001	<0.001	<0.001
	Kremsmünster	<0.001	<0.001	<0.001	<0.001
	Okehampton	<0.001	<0.001	<0.001	<0.001
	Porto	<0.001	<0.001	<0.001	<0.001

Table 9.2.4.1-6: PEC_{GW} following annual application of spiroxamine in accordance with the GAP, using the FOCUS PEARL model and late application

Crop	Scenario	80th Percentile PEC_{GW} at 1 m Soil Depth (µg/L)			
		Spiroxamine	M01 (spirox-amine-desethyl)	M02 (spirox-amine-despro-pyl)	M03 (spirox-amine-N-oxide)
Winter cereals (early applica-tion)	Châteaudun	<0.001	<0.001	<0.001	<0.001
	Hamburg	<0.001	<0.001	<0.001	<0.001
	Jokioinen	<0.001	<0.001	<0.001	<0.001
	Kremsmünster	<0.001	<0.001	<0.001	<0.001
	Okehampton	<0.001	<0.001	<0.001	<0.001
	Piacenza	<0.001	<0.001	<0.001	<0.001
	Porto	<0.001	<0.001	<0.001	<0.001
	Sevilla	<0.001	<0.001	<0.001	<0.001
	Thiva	<0.001	<0.001	<0.001	<0.001
Spring cereals (early applica-tion)	Châteaudun	<0.001	<0.001	<0.001	<0.001
	Hamburg	<0.001	<0.001	<0.001	<0.001
	Jokioinen	<0.001	<0.001	<0.001	<0.001
	Kremsmünster	<0.001	<0.001	<0.001	<0.001
	Okehampton	<0.001	<0.001	<0.001	<0.001
	Porto	<0.001	<0.001	<0.001	<0.001

Table 9.2.4.1-7: PEC_{GW} following annual application of spiroxamine in accordance with the GAP, using the FOCUS PELMO model and early application

Crop	Scenario	80th Percentile PEC_{GW} at 1 m Soil Depth (µg/L)			
		Spiroxamine	M01 (spiroxamine-desethyl)	M02 (spiroxamine-despropyl)	M03 (spiroxamine-N-oxide)
Winter cereals (early application)	Châteaudun	<0.001	<0.001	<0.001	<0.001
	Hamburg	<0.001	<0.001	<0.001	<0.001
	Jokioinen	<0.001	<0.001	<0.001	<0.001
	Kremsmünster	<0.001	<0.001	<0.001	<0.001
	Okehampton	<0.001	<0.001	<0.001	<0.001
	Piacenza	<0.001	<0.001	<0.001	<0.001
	Porto	<0.001	<0.001	<0.001	<0.001
	Sevilla	<0.001	<0.001	<0.001	<0.001
	Thiva	<0.001	<0.001	<0.001	<0.001
Spring cereals (early application)	Châteaudun	<0.001	<0.001	<0.001	<0.001
	Hamburg	<0.001	<0.001	<0.001	<0.001
	Jokioinen	<0.001	<0.001	<0.001	<0.001
	Kremsmünster	<0.001	<0.001	<0.001	<0.001
	Okehampton	<0.001	<0.001	<0.001	<0.001
	Porto	<0.001	<0.001	<0.001	<0.001

Table 9.2.4.1-8: PEC_{GW} following annual application of spiroxamine in accordance with the GAP, using the FOCUS PELMO model and late application

Crop	Scenario	80th Percentile PEC_{GW} at 1 m Soil Depth (µg/L)			
		Spiroxamine	M01 (spiroxamine-desethyl)	M02 (spiroxamine-despropyl)	M03 (spiroxamine-N-oxide)
Winter cereals (late application)	Châteaudun	<0.001	<0.001	<0.001	<0.001
	Hamburg	<0.001	<0.001	<0.001	<0.001
	Jokioinen	<0.001	<0.001	<0.001	<0.001
	Kremsmünster	<0.001	<0.001	<0.001	<0.001
	Okehampton	<0.001	<0.001	<0.001	<0.001
	Piacenza	<0.001	<0.001	<0.001	<0.001
	Porto	<0.001	<0.001	<0.001	<0.001
	Sevilla	<0.001	<0.001	<0.001	<0.001
	Thiva	<0.001	<0.001	<0.001	<0.001
Spring cereals (late application)	Châteaudun	<0.001	<0.001	<0.001	<0.001
	Hamburg	<0.001	<0.001	<0.001	<0.001
	Jokioinen	<0.001	<0.001	<0.001	<0.001
	Kremsmünster	<0.001	<0.001	<0.001	<0.001
	Okehampton	<0.001	<0.001	<0.001	<0.001
	Porto	<0.001	<0.001	<0.001	<0.001

Table 9.2.4.1-9: PEC$_{GW}$ following annual application of spiroxamine in accordance with the GAP, using the FOCUS MACRO model application to Châteaudun

Crop	Application window	80th Percentile PEC$_{GW}$ at 1 m Soil Depth (µg/L)			
		Spirox-amine	M01 (spi-roxamine-desethyl)	M02 (spirox-amine-despropyl)	M03 (spirox-amine-N-oxide)
Winter cereals	Early	<0.01	<0.01	<0.01	<0.01
	Late	<0.01	<0.01	<0.01	<0.01
Spring cereals	Early	<0.01	<0.01	<0.01	<0.01
	Late	<0.01	<0.01	<0.01	<0.01

Conclusions

Predicted environmental concentrations of spiroxamine and its metabolites M01 (spiroxamine-desethyl), M02 (spiroxamine-despropyl) and M03 (spiroxamine-N-oxide) in groundwater have been generated in accordance with FOCUS guidelines FOCUS (2000 and 2014) and in accordance with the EU representative uses of the spiroxamine Prothioconazole + Spiroxamine EC 460 (160+300 g/L) on winter and spring cereals.

The predicted 80th percentile average annual concentrations for spiroxamine following application to winter and spring cereals were lower than the 0.1 µg/L regulatory threshold in groundwater at 1 m depth for all crop / scenario combinations. The PEC$_{GW}$ values for metabolites M01, M02 and M03 following annual application spiroxamine to crops were also lower than the 0.1 µg/L regulatory threshold in groundwater at 1 m depth for all the available crop / scenario combinations.

These results demonstrate that spiroxamine can be used safely as proposed without the risk of spiroxamine and its metabolites M01, M02 and M03 exceeding acceptable levels in groundwater.

Assessment and conclusion by applicant:

The study was conducted to guideline(s) FOCUS (2000, 2014) and EFSA (2014) (required guidelines). The study is considered valid for use in the risk assessment.

PEC$_{GW}$ calculations for M06 have not been presented as critical studies to define modelling inputs are currently on-going. In studies investigating the route of degradation of the active substance spiroxamine in soil (presented under CA 7.1.1.1), the metabolite M06 is only observed >5% AR in one out of ten soils and only at the very last sampling point (in all other soils and all other sampling points the observed level of metabolite M06 was <5%). Due to the low levels of M06 observed, it was difficult to obtained reliable degradation rate constants from the parent applied studies. Consequently, estimated PEC$_{GW}$ from conservative input parameters were found to be provide unreasonable estimates of leaching when compared to the outcome of the soil column studies (see KCA 7.1.4.1) where only 0.2% of AR were observed in leachate. PEC$_{GW}$ for M06 will be provided upon completion of the studies.

PECgw FOCUS (prothioconazole)

The representative formulated product Prothioconazole + Spiroxamine EC 460 (160+300 g/L) also contains the active substance prothioconazole. The active substance prothioconazole is not the primary focus of the renewal of the active substance spiroxamine and is the subject of a separate renewal evaluation which is in progress at the time of writing.

According to the current evaluation documents for the active substance prothioconazole (i.e. EFSA

2007[6], p.77/98), the definition of the residue for environmental risk assessment in groundwater lists prothioconazole and metabolites M01 (prothioconazole-S-methyl) and M04 (prothioconazole-desthio).

The predicted environmental concentration in groundwater of prothioconazole and metabolites M01 (prothioconazole-S-methyl) and M04 (prothioconazole-desthio) are addressed by reference to the existing LoEP (EFSA 2007, p.75-76/98) which considered 3x 200 g prothioconazole/ha applications to cereals using existing parameters and gave PECgw <0.001 µg/L for prothioconazole and metabolites M01 (prothioconazole-S-methyl) and M04 (prothioconazole-desthio) at all nine FOCUS scenario locations.

CP 9.2.4.2 Additional field tests

Based on the results of the FOCUS groundwater modelling assessment (Document M-CP, Section 9.2.4.1), additional field testing is not required.

CP 9.2.5 Estimation of concentrations in surface water and sediment

The Predicted Environmental Concentrations in surface water (PEC_{SW}) have been calculated for the active substance spiroxamine and major metabolites, as defined in CA 7.4.1, along with the formulation following foliar applications of Prothioconazole + Spiroxamine EC 460 (160+300 g/L) in accordance with the representative GAP.

The predicted environmental concentration of the formulated product Prothioconazole + Spiroxamine EC 460 (160+300 g/L), the active substance spiroxamine and significant metabolite in surface water (PECsw) is determined using the standardised recommendations of the FOCUS working group on surface water scenarios (FOCUS 2001[7], 2007[8], 2011[9], 2012[10] and 2015[11]). The PECs are provided in one existing modelling study included in the last evaluation and is included here for completeness but which has been superseded by two new modelling reports conducted to modern requirements CP 9.2.5/02 (M-763144-01-1) and CP 9.2.5/03 (M-763146-01-1).

Substance	Report reference	Document no.	Comment
Spiroxamine	KCP 9.2.5/01	M-304053-01-1	Submitted for first renewal of spiroxamine, 2010. Reviewed under UP. Considered valid and acceptable.
Spiroxamine	KCP 9.2.5/02	M-763144-01-1	New data not yet reviewed under UP.
Spiroxamine	KCP 9.2.5/03	M-763146-01-1	

PECsw formulation

The initial predicted environmental concentration in surface water of the representative formulated product Prothioconazole + Spiroxamine EC 460 (160+300 g/L) is presented in Table 9.2.5-1. Since the formulation components other than the active substance are assumed to dissipate rapidly in the environment, it is only necessary to consider the initial concentration for Prothioconazole + Spiroxamine EC

6 EFSA Scientific Report (2007) 106, 1-98, Conclusion on the peer review of prothioconazole.
7 FOCUS (2001). FOCUS Surface Water Scenarios in the EU Evaluation Process under 91/414/EEC. Report of the FOCUS Working Group on Surface Water Scenarios, EC Document Reference SANCO/4802/2001-rev.2. 245 pp.
8 FOCUS (2007). Landscape and Mitigation Factors in Aquatic Ecological Risk Assessment. Volume 1. Extended Summary and Recommendations. SANCO/10422/2005, version 2.0, September 2007.
9 FOCUS (2011). Generic Guidance for FOCUS surface water Scenarios. Version 1. January 2011.
10 FOCUS (2012). Generic guidance for FOCUS surface water scenarios, ver 1.2, December 2012.
11 FOCUS (2015). Generic Guidance for FOCUS surface water Scenarios. Version 1.4. May 2015.

460 (160+300 g/L).

Table 9.2.5-1: Worst-case initial PECsw for Prothioconazole + Spiroxamine EC 460 (160+300 g/L) needed for environmental risk assessment

Crop	Formulation application rate	Mitigation distance (m)	PECsw (µg Prothioconazole + Spiroxamine EC 460 (160+300 g/L)/L)[A]		
			Water body type Ditch	Water body type Pond	Water body type Stream
Winter and spring cereals (spring application only)	1.25 L/ha Prothioconazole + Spiroxamine EC 460 (160+300 g/L) (equivalent to 1230 g/ha)[B]	Default	7.902	0.2694	5.865
		5	2.142	0.2332	2.142
		10	1.136	0.1676	1.136

A Calculated using the FOCUS drift calculator (v.1 Apr 2001) with the cereals, winter and cereals, spring applns drift loadings and considering a worst-case single application

B Based on a Prothioconazole + Spiroxamine EC 460 (160+300 g/L) formulation relative density of 0.984 g/ml, see CP 2.6

The maximum initial concentration of the formulated product Prothioconazole + Spiroxamine EC 460 (160+300 g/L) in surface water following application with no applied mitigation and in consideration of no spray buffer zones of 5 and 10 m is 7.902, 2.142 and 1.136 µg/L, respectively.

PECsw FOCUS steps 1-2 (spiroxamine)

Data Point:	KCP 9.2.5/01
Report Author:	[redacted]; [redacted]
Report Year:	2008
Report Title:	Predicted environmental concentrations of spiroxamine in surface water and sediment (PECsw, PECsed) based on the tiered FOCUSsw approach - Use in cereals in Europe
Report No:	MEF-08/273
Document No:	M-304053-01-1
Guideline(s) followed in study:	not applicable
Deviations from current test guideline:	None
Previous evaluation:	yes, evaluated and accepted RAR (2010)
GLP/Officially recognised testing facilities:	No, not conducted under GLP/Officially recognised testing facilities
Acceptability/Reliability:	Yes

Executive summary

This study was previous considered during the evaluation of spiroxamine (RAR (2010)) and is therefore included again for completeness. This study presents the PEC modelling conducted on the representative for the last evaluation, however, this PEC modelling is superseded by the new PEC modelling performed in study KCP1 9.2.5/02 (M-763144-01-1) and KCP1 9.2.5/03 (M-763146-01-1).

Data Point:	KCP 9.2.5/02
Report Author:	[redacted]
Report Year:	2021
Report Title:	A modelling assessment of spiroxamine and its metabolites in surface water using FOCUS surface water steps 1 & 2
Report No:	0471836-SW1
Document No:	M-763144-01-1
Guideline(s) followed in study:	FOCUS (2000, 2014), EFSA (2014)
Deviations from current test guideline:	None
Previous evaluation:	No, not previously submitted
GLP/Officially recognised testing facilities:	not applicable
Acceptability/Reliability:	Yes

Executive summary

The potential for spiroxamine and its metabolites M01 (spiroxamine-desethyl), M02 (spiroxamine-despropyl), M03 (spiroxamine-N-oxide) and M06 (spiroxamine-acid) to reach surface water and sediment, following application to winter and spring cereals was investigated. Reported below are PEC values relating to cereals only.

The following open field uses were simulated in accordance with the supported uses of the Prothioconazole + Spiroxamine EC 460 (160+300 g/L) formulation:

- Two applications (BBCH 30 onwards) at a rate of 375 g a.s./ha to winter cereals
- Two applications (BBCH 30 onwards) at a rate of 375 g a.s./ha to spring cereals

Simulations for the open field uses of the Prothioconazole + Spiroxamine EC 460 (160+300 g/L) formulation were conducted using Steps 1-2 in FOCUS in accordance with the FOCUS guidance for surface water modelling (FOCUS, 2001 and 2015). A refinement of the values generated at Steps 1-2 to more realistic concentrations was performed for spiroxamine using FOCUS Step 3 and Step 4 in another study (see CP 9.2.5/03).

The input parameters for the calculations were selected based on recommendations from FOCUS (FOCUS 2001, 2007, 2011, 2012, 2015) and EFSA (2004), and studies submitted with the MCA 7 renewal of approval dossier.

The global maximum PEC_{SW} and PEC_{SED} values for spiroxamine and its metabolites at Step 2 are provided in Table 9.2.5-2. Detailed values and time weighted averages (TWA) are provided in the surface water report (M-763144-01-1).

The maximum PECSW values for the metabolites at Step 2 for cereals were 0.826 µg/L for M01 (spiroxamine-desethyl), 0.699 µg/L for M02 (spiroxamine-despropyl), 1.882 µg/L for M03 (spiroxamine-N-oxide), and 16.988 µg/L for M06 (spiroxamine-acid).

Table 9.2.5-2: Global maximum PEC_{SW} and PEC_{SED} for spiroxamine and its metabolites

Crop	Compound	Global maximum at Step 2	
		PEC_{SW} (µg/L)	PEC_{SED} (µg/kg)
Cereals 2x 375 g/ha, GS30-69	Spiroxamine	5.194	197.213
	M01 (spiroxamine-de-sethyl)	0.826	26.462
	M02 (spiroxamine-despropyl)	0.699	18.480
	M03 (spiroxamine-N-ox-ide)	1.882	60.404
	M06 (spiroxamine-acid)	16.988	0.542

Study design

The purpose of this study was to predict the environmental concentrations of spiroxamine and its metabolites M01 (spiroxamine-desethyl), M02 (spiroxamine-despropyl), M03 (spiroxamine-N-oxide) and M06 (spiroxamine-acid) in surface water and sediment following application to winter and spring cereals, made in accordance with the EU representative GAP.

Conservative predicted environmental concentrations for spiroxamine and its metabolites in surface water and sediment (PEC_{SW} and PEC_{SED}) following application to open field crops were simulated using Steps 1-2 in FOCUS (version 3.2). A refinement of these values generated at Steps 1-2 to more realistic concentrations were calculated for spiroxamine using the FOCUS Step 3 surface water scenarios with the FOCUS suite of surface water models was performed in in another study (see CP 9.2.4.1/02). The modelling simulations were carried out in accordance with the FOCUS guidance for surface water modelling (FOCUS, 2001 and 2015).

The input parameters used in the modelling for spiroxamine and its metabolites are summarised in Table 9.2.5-3 to Table 9.2.5-4.

Table 9.2.5-3: Physico-chemical parameters used in modelling for spiroxamine

Parameter	Value	Remarks
Physico-chemical		
Molecular weight (g/mol)	297.5	MCA Renewal of Approval dossier, see CA 1.7
Water solubility (mg/L)	470	MCA Renewal of Approval dossier, see CA 2.5
Vapour pressure (Pa)	2.84×10^{-9} (20°C)	MCA Renewal of Approval dossier, see CA 2.2
Degradation in soil		
DT_{50} soil (d)	43.8	Geometric mean of uncropped field data (n= 8), submitted in MCA Renewal of Approval dossier, see data point CA 7.1.2.1.1, Table 7.1.2.2.1-72

Parameter	Value	Remarks
Sorption to soil		
K_{FOC} (mL/g)	4111	Geometric mean (n= 8) calculated from individual values, see data point CA 7.1.3.1, Table 7.1.3.1-1
K_{FOM} (mL/g)	2384	Calculated K_{Foc} / 1.724
Degradation in aquatic systems		
DT_{50} whole system (Step 1)	157.9	Geometric mean (n=6) submitted in MCA Renewal of Approval dossier, see data point CA 7.2.2.3, Table 7.2.2.3-23.
DT_{50} water (d) (Step 2)	1000	FOCUS recommendation, water set to conservative assumption
DT_{50} sediment (d) (Step 2)	157.9	FOCUS recommendation, sediment set to whole system degradation value.

Table 9.2.5-4: Input parameters used in STEPs 1-2 for the metabolites of spiroxamine

Parameter	M01 (spiroxamine-desethyl)		M02 (spiroxamine-despropyl)		M03 (spiroxamine-N-oxide)		M06 (spiroxamine-acid)	
	Value	Remarks	Value	Remarks	Value	Remarks	Value	Remarks
Molecular weight (g/mol)	269.4	Based on structure	255.4	Based on structure	313.5	Based on structure	327.5	Based on structure
Water solubility (mg/L)	14.8	MCA Renewal of Approval dossier, see CA 2.5	46.6	MCA Renewal of Approval dossier, see CA 2.5	1000	Default value	1000	Default value
K_{FOC} (mL/g)	3271	Geometric mean (n=4) submitted in MCA Renewal of Approval dossier, see data point CA 7.1.3.1.2, Table 7.1.3.1.2-1	2695	Geometric mean (n=4) submitted in MCA Renewal of Approval dossier, see data point CA 7.1.3.1.2, Table 7.1.3.1.2-1	1677	Geometric mean (n=4), submitted in MCA Renewal of Approval dossier, see data point CA 7.1.3.1.2, Table 7.1.3.1.2-1	3.2	Preliminary value, submitted in MCA Renewal of Approval dossier see CA 7.1.3.1
DT_{50} soil @ 20°C & pF2 (days)	168.6	Geometric mean (n=10) of laboratory values submitted in MCA Renewal of Approval dossier, see data point CA 7.1.2.1.1, Table 7.1.2.1.1-2	219.1	Geometric mean (n=10) of laboratory values submitted in MCA Renewal of Approval dossier, see data point CA 7.1.2.1.1, Table 7.1.2.1.1-2	46.4	Geometric mean (n=7) of laboratory values submitted in MCA Renewal of Approval dossier, see data point CA 7.1.2.1.1, Table 7.1.2.1.1-2	479.6	Geometric mean (n=4) of laboratory values submitted in MCA Renewal of Approval dossier, see CA 7.1.2.1.1
Max % observed in soil	12.0	From MCA Renewal of Approval dossier, see Table 7.4.1-1	9.2	From MCA Renewal of Approval dossier, see Table 7.4.1-1	7.2	From MCA Renewal of Approval dossier, see Table 7.4.1-1	5.3 (aerobic)	From MCA Renewal of Approval dossier, see Table 7.4.1-1

Parameter	M01 (spiroxamine-desethyl)		M02 (spiroxamine-despropyl)		M03 (spiroxamine-N-oxide)		M06 (spiroxamine-acid)	
	Value	Remarks	Value	Remarks	Value	Remarks	Value	Remarks
DT_{50} water (d)	1000	FOCUS default value (worst-case)	1000	FOCUS default value (worst-case)	1000	FOCUS default value (worst-case)	293.6	FOCUS recommendation, water set to whole system degradation value
DT_{50} sediment (d)	1000		1000		1000		1000	FOCUS recommendation, sediment set to conservative assumption
DT_{50} total system (d)	1000		1000		1000		293.6	Geometric mean (n=5) submitted in MCA Renewal of Approval dossier, see data point CA 7.2.2.3, Table 7.2.2.3-23
Max % observed in water/sediment	4.3	From MCA Renewal of Approval dossier, see Table 7.4.1-1	3.2	From MCA Renewal of Approval dossier, see Table 7.4.1-1	11.3	From MCA Renewal of Approval dossier, see Table 7.4.1-1	44.5	From MCA Renewal of Approval dossier, see Table 7.4.1-1

Table 9.2.5-5: Supported use of Prothioconazole + Spiroxamine EC 460 (160+300 g/L)

Crop	Application rate (g a.s./ha)	Number of applications	Interval between applications	BBCH growth stage at application
Winter cereals	375	2	14 days	30-69
Spring cereals	375	2	14 days	30-69

At Step 2, seasons of application were estimated based on the earliest and latest likely dates that applications would be made, in accordance with the BBCH growth ranges proposed in the EU representative GAP. In accordance with FOCUS guidance (FOCUS, 2001 and 2015), where there are multiple applications, Step 2 simulations were performed based on both the multiple and the respective single application rates and the worst-case PEC_{SW} and PEC_{SED} values were selected for input into the environmental risk assessment. The regions of use and seasons for application used in the Step 2 modelling are presented in Table 9.2.5-6.

Table 9.2.5-6: Model parameters used in FOCUS Step 2 surface water modelling for winter and spring cereals

Crop	Zone (Step 2)	Season	Interception
Winter cereals	North Europe	Mar-May	Full (70%)
		Jun-Sep	Full (70%)
	South Europe	Oct-Feb	Full (70%)
		Mar-May	Full (70%)
Spring cereals	North Europe	Mar-May	Full (70%)
		Jun-Sep	Full (70%)
	South Europe	Oct-Feb	Full (70%)
		Mar-May	Full (70%)

Results and discussion

Summaries of the maximum PEC_{SW} and PEC_{SED} values for spiroxamine and its metabolites M01 (spiroxamine-desethyl), M02 (spiroxamine-despropyl), M03 (spiroxamine-N-oxide) and M06 (spiroxamine-acid) at FOCUS Steps 1 and 2, as calculated by the FOCUS surface water models, are provided in Table 9.2.5-7 and Table 9.2.5-8 for PEC_{SW} and PEC_{SED} values, respectively. Detailed values and time weighted averages (TWA) are provided in the surface water report (M-763144-01-1).

Table 9.2.5-7: Maximum PEC_{SW} for spiroxamine and its metabolites - FOCUS Step 1-2

FOCUS Step	Area	Application timing	Multiple appln (µg/L)					Single appln (µg/L)				
			spx	M01	M02	M03	M06	spx	M01	M02	M03	M06
Winter cereals, 2x 375 g/ha, GS30-69 (spring applications only)												
1			45.470	7.151	5.983	16.452	139.851	-	-	-	-	-
2	N	Mar-May, full int. (70%)	3.673	0.444	0.374	1.086	9.945	3.449	0.236	0.198	0.606	5.536
2	N	Jun-Sep, full int. (70%)	3.673	0.444	0.374	1.086	9.945	3.449	0.236	0.198	0.606	5.536
2	S	Oct-Feb, full int. (70%)	5.194	0.826	0.699	1.882	16.988	3.449	0.436	0.367	1.047	9.403
2	S	Mar-May, full int. (70%)	5.194	0.826	0.699	1.882	16.988	3.449	0.436	0.367	1.047	9.403
		Maximum (step 2)	**5.194**	**0.826**	**0.699**	**1.882**	**16.988**	**3.449**	**0.436**	**0.367**	**1.047**	**9.403**
Spring cereals, 2x 375 g/ha, GS30-69												
1			45.470	7.151	5.983	16.452	139.851	-	-	-	-	-
2	N	Mar-May, full int. (70%)	3.673	0.444	0.374	1.086	9.945	3.449	0.236	0.198	0.606	5.536
2	N	Jun-Sep, full int. (70%)	3.673	0.444	0.374	1.086	9.945	3.449	0.236	0.198	0.606	5.536
2	S	Oct-Feb, full int. (70%)	5.194	0.826	0.699	1.882	16.988	3.449	0.436	0.367	1.047	9.403
2	S	Mar-May, full int. (70%)	5.194	0.826	0.699	1.882	16.988	3.449	0.436	0.367	1.047	9.403
		Maximum (step 2)	**5.194**	**0.826**	**0.699**	**1.882**	**16.988**	**3.449**	**0.436**	**0.367**	**1.047**	**9.403**

Table 9.2.5-8: Maximum PEC_{SED} for spiroxamine and its metabolites - FOCUS Step 1-2

FO-CUS Step	Area	Application timing	Multiple appln (µg/kg)					Single appln (µg/kg)				
			spx	M01	M02	M03	M06	spx	M01	M02	M03	M06
Winter cereals, 2x 375 g/ha, GS30-69 (spring applications only)												
1			1620.000	226.618	157.147	266.202	4.464	-	-	-	-	-
2	N	Mar-May, full int. (70%)	117.133	13.949	9.727	17.067	0.317	65.950	7.376	5.117	9.508	0.177
2	N	Jun-Sep, full int. (70%)	117.133	13.949	9.727	17.067	0.317	65.950	7.376	5.117	9.508	0.177
2	S	Oct-Feb, full int. (70%)	197.213	26.462	18.480	30.404	0.542	110.408	13.935	9.681	16.895	0.300
2	S	Mar-May, full int. (70%)	197.213	26.462	18.480	30.404	0.542	110.408	13.935	9.681	16.895	0.300
		Maximum (step 2)	**197.213**	**26.462**	**18.480**	**30.404**	**0.542**	**11.0408**	**13.935**	**9.681**	**16.895**	**0.300**
Spring cereals, 2x 375 g/ha, GS30-69												
1			1620.000	226.618	157.147	266.202	4.464	-	-	-	-	-
2	N	Mar-May, full int. (70%)	117.133	13.949	9.727	17.067	0.317	65.950	7.376	5.117	9.508	0.177
2	N	Jun-Sep, full int. (70%)	117.133	13.949	9.727	17.067	0.317	65.950	7.376	5.117	9.508	0.177
2	S	Oct-Feb, full int. (70%)	197.213	26.462	18.480	60.404	0.542	110.408	13.935	9.681	16.895	0.300
2	S	Mar-May, full int. (70%)	197.213	26.462	18.480	60.404	0.542	110.408	13.935	9.681	16.895	0.300
		Maximum (step 2)	**197.213**	**26.462**	**18.480**	**60.404**	**0.542**	**110.408**	**13.935**	**9.681**	**16.895**	**0.300**

Conclusions

Predicted environmental concentrations of spiroxamine and its metabolites M01 (spiroxamine-desethyl), M02 (spiroxamine-despropyl), M03 (spiroxamine-N-oxide) and M06 (spiroxamine-acid) in surface water and sediment have been generated in accordance with FOCUS and EFSA guidance, for the use of formulation Prothioconazole + Spiroxamine EC 460 (160+300 g/L) on winter and spring cereals.

The maximum PEC_{SW} values for the metabolites at Step 2 for cereals were 0.826 µg/L for M01 (spiroxamine-desethyl), 0.699 µg/L for M02 (spiroxamine-despropyl), 1.882 µg/L for M03 (spiroxamine-N-oxide), and 16.988 µg/L for M06 (spiroxamine-acid).

The global maximum PEC_{SW} and PEC_{SED} values for spiroxamine and its metabolites at Step 2 are provided in Table 9.2.5-9.

Table 9.2.5-9: Global maximum PEC_{SW} and PEC_{SED} for spiroxamine and its metabolites - FOCUS Step 2

Crop	Compound	Global maximum at Step 2[a]	
		PEC_{SW} (µg/L)	PEC_{SED} (µg/kg)
Cereals 2x 375 g/ha, GS30-69	Spiroxamine	5.194	197.213
	M01 (spiroxamine-desethyl)	0.826	26.462
	M02 (spiroxamine-despropyl)	0.699	18.480
	M03 (spiroxamine-N-oxide)	1.882	60.404
	M06 (spiroxamine-acid)	16.988	0.542

[a] Maximum value resulted from duplicate application

Assessment and conclusion by applicant:

The study was conducted to guideline(s) FOCUS 2001, 2015 (required guideline). The study is considered valid for use in the risk assessment.

PECsw FOCUS steps 3-4 (spiroxamine)

Data Point:	KCP 9.2.5/03
Report Author:	[redacted]
Report Year:	2021
Report Title:	A modelling assessment of spiroxamine using FOCUS surface water steps 3 & 4 - Application of PTZ + SPX EC 460 (160+300 g/L) to cereals
Report No:	0471836-SW3
Document No:	M-763146-01-1
Guideline(s) followed in study:	FOCUS (2000, 2014), EFSA (2014)
Deviations from current test guideline:	None
Previous evaluation:	No, not previously submitted
GLP/Officially recognised testing facilities:	not applicable
Acceptability/Reliability:	Yes

Executive summary

The potential to refine values generated at Step 1-2 (see CP 9.2.5/02) for spiroxamine to more realistic concentrations was performed using FOCUS Step 3 and Step 4.

The following open field uses were simulated in accordance with the supported uses of the Prothioconazole + Spiroxamine EC 460 (160+300 g/L) formulation:

- Two applications (BBCH 30 - 69) at a rate of 375 g a.s./ha to winter cereals
- Two applications (BBCH 30 - 69) at a rate of 375 g a.s./ha to spring cereals

The input parameters for the calculations were selected based on recommendations from FOCUS (FOCUS 2001, 2007, 2011, 2012, 2015) and EFSA (2004), and studies submitted in the appropriate section of the MCA 7.

The global maximum PEC_{SW} and PEC_{SED} values for spiroxamine at Step 3 and 4 are provided in Table 9.2.5-10.

Table 9.2.5-10: Global maximum PEC_{SW} and PEC_{SED} for spiroxamine – FOCUS Step 3

Use	Maximum PEC_{SW} (µg/L)
Winter cereals, early, 2 x 375 g a.s./ha	2.370[a)]
Winter cereals, late, 2 x 375 g a.s./ha	2.994
Spring cereals, early, 2 x 375 g a.s./ha	3.139
Spring cereals, late, 2 x 375 g a.s./ha	2.834

[a)] Maximum value resulted from single application

The maximum PEC_{SW} values for spiroxamine at FOCUS Step 4 are presented in Table 9.2.5-11.

Table 9.2.5-11: Global maximum PEC_{SW} and PEC_{SED} for spiroxamine – FOCUS Step 4

Use	Mitigation	Maximum PEC_{SW} (µg/L)
Winter cereals, early, 2 x 375 g a.s./ha	20 m VFS + 20 m SDBZ + 0% SDRT	0.397
	20 m VFS + 30 m SDBZ + 0% SDRT	0.397
Winter cereals, late, 2 x 375 g a.s./ha	20 m VFS + 20 m SDBZ + 0% SDRT	0.303
	20 m VFS + 30 m SDBZ + 0% SDRT	0.241
Spring cereals, early, 2 x 375 g a.s./ha	20 m VFS + 20 m SDBZ + 0% SDRT	0.372
	20 m VFS + 30 m SDBZ + 0% SDRT	0.372
Spring cereals, late, 2 x 375 g a.s./ha	20 m VFS + 20 m SDBZ + 0% SDRT	0.275
	20 m VFS + 30 m SDBZ + 0% SDRT	0.227

VFS = vegetated filter strip, SDBZ = spray drift buffer zone, SDRT = spray drift reduction technology

Study design

The purpose of this study was to predict the environmental concentrations of spiroxamine and its metabolites M01 (spiroxamine-desethyl), M02 (spiroxamine-despropyl), M03 (spiroxamine-N-oxide) and M06 (spiroxamine-acid) in surface water and sediment following application to winter and spring cereals, made in accordance with the EU representative GAP.

A refinement of values generated at Steps 1-2 to more realistic concentrations were calculated for spiroxamine using the FOCUS Step 3 surface water scenarios with the FOCUS suite of surface water models (MACRO version 5.5.4, PRZM version 4.3.1, SPIN version 2.2 and TOXSWA version 5.5.3) in the SWASH version 5.3 shell. Mitigation was added at Step 4 using the SWAN version 5.0.0 tool. The modelling simulations were carried out in accordance with the FOCUS guidance for surface water modelling (FOCUS, 2001 and 2015).

The input parameters used in the modelling for spiroxamine are summarised in Table 9.2.5-12.

Table 9.2.5-12: Physico-chemical parameters used in modelling for spiroxamine

Parameter	Value	Remarks
Physico-chemical		
Molecular weight (g/mol)	297.5	From CA 1.7
Water solubility (mg/L)	470	From CA 2.25
Vapour pressure (Pa)	0.0047 (20°C)	From CA 2.2
Degradation in soil		
DT_{50} soil (d)	43.8	Geometric mean of uncropped field data (n=8), under CA 7.1.2.2.1/12, see Table 7.1.2.2.1-72
Temperature correction function Reference temperature (°C) MACRO: (K^{-1}) PRZM: Q_{10} (-)	 20 0.095 2.58	FOCUS recommendation
Moisture correction function Reference moisture (-) PRZM/MACRO: moisture exponent (-)	 pF 2 0.7	
Sorption to soil		
K_{FOC} (mL/g)	4110	Geometric mean (n=8) calculated from individual values summarised under CA 7.1.3.1, See Table 7.1.3.1.1-1
K_{FOM} (mL/g)	2384	Calculated K_{FOC} / 1.724
Freundlich exponent 1/n (-)	0.892	Arithmetic mean (n=8) calculated from individual values summarised under CA 7.1.3.1, see Table 7.1.3.1.1-1
Degradation in aquatic systems		
DT_{50} whole system	157.9	Geometric mean (n=6) under CA 7.2.2.2/08, see Table 7.2.2.3-23
DT_{50} water (d)	1000	FOCUS recommendation, water set to conservative assumption
DT_{50} sediment (d)	157.9	FOCUS recommendation, sediment set to whole system degradation value
DT_{50} crop (d)	10	
Temperature correction function Reference temperature (°C) TOXSWA: activation energy (J/mol)	 20 65400	FOCUS recommendation
Crop uptake factor (-)	0.47	Based on Briggs equation and measured $logK_{OW}$ [A]
Wash off coefficient PRZM: (cm^{-1}) MACRO: (mm^{-1})	 0.5 0.05	FOCUS recommendation

[A] According to EFSA (2013), European Commission (2014) and FOCUS (2014), the Briggs relation can be used to derive the Plant Uptake Factor (PUF) from experimentally measured $logK_{OW}$ values at neutral pH:

$$PUF = 0.784 \exp\left(-\frac{(\log(Kow) - 1.78)^2}{2.44}\right)$$

For spiroxamine, $\log(K_{OW})$ values of 2.79 (diastereomer A) and 2.98 (diastereomer B) were determined at pH 7 (Krohn, 1995). Using Briggs' relation, this corresponds to a PUF of 0.52 (diastereomer A) and 0.43 (diastereomer B). As the molar

masses are identical for both isomers, the mole fractions are 0.53 for diastereomer A and 0.46 for diastereomer B (Krohn, 1994). Therefore: PUF_{SPX} = 0.53 * 0.52 + 0.43 * 0.46 = 0.47.
A PUF of 0.47 is used for spiroxamine in the risk assessment.

Table 9.2.5-13: Supported use of the PTZ + SPX EC 460 (460g/L) formulation

Crop	F G or I [a)]	Number of applications	Application rate (g a.s./ha)	Interval between applications (days)	Range of growth stages / season	PHI
Winter cereals	F	2	375	14	BBCH 30-69	n.a
Spring cereals	F	2	375	14	BBCH 30-69	n.a

[a)] Outdoor of field use (F), greenhouse application (G) or indoor application (I)
n.a = not applicable

The foliar application method was selected so that a crop interception value would be determined by the model based on the growth stage.

In accordance with FOCUS guidance, where there are multiple applications, Step 3 simulations were performed based on both the multiple and the respective single application rates and the worst-case PEC_{SW} and PEC_{SED} values were selected for input into the environmental risk assessment.

Due to the wide range of BBCH stages within the requested GAP, several potential application periods have been used for modelling, based on timings from AppDate v3.06 (2019). In accordance with guidance, an application window starting at various growth stages was therefore set up for each scenario, as specified in Table 9.2.5-14. The actual application dates were then determined automatically in PRZM and MACRO using the Pesticide Application Timing calculator (PAT).

The application timings for selected for the beginning (early) and end (late) of the application windows relative to emergence and harvest are provided in Table 9.2.5-14.

Table 9.2.5-14: Application timings for uses on winter and spring cereals in surface water simulations

Scenario details		FOCUS default dates		SWASH application window (start date)											
				Early season						Late season					
				Window 1 (a)		Window 2 (b)		Window 3 (c)		Window 1 (d)		Window 2 (e)		Window 3 (f)	
Scenario	Crop no.	Emer-gence	Harvest	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End
Winter sown cereals (FOCUS winter cereals), 2x 375 g as/ha (14 d min int) GS30-69															
D1	n.a.	25-Sep	26-Aug	25-Mar (84)	8-May (128)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	8-Jun (159)	22-Jul (203)	12-Jul (193)	25-Aug (237)
D2	n.a.	25-Oct	7-Aug	4-Apr (94)	18-May (138)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	16-Jun (167)	30-Jul (211)	11-Jul (192)	24-Aug (236)
D3	n.a.	21-Nov	15-Aug	16-Apr (106)	30-May (150)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	8-Jul (189)	21-Aug (233)	31-Jul (212)	13-Sep (256)
D4	n.a.	22-Sep	21-Aug	18-Mar (77)	1-May (121)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	5-Jun (156)	19-Jul (200)	9-Jul (190)	22-Aug (234)
D5	n.a.	10-Nov	15-Jul	15-Mar (74)	28-Apr (118)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	5-May (125)	18-Jun (169)	2-Jun (153)	16-Jul (197)
D6	n.a.	30-Nov	30-Jun	16-Feb (47)	1-Apr (91)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	23-Mar (82)	6-May (126)	27-Apr (117)	10-Jun (161)
R1	n.a.	12-Nov	31-Jul	24-Apr (114)	7-Jun (158)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	2-Jun (153)	16-Jul (197)	25-Jun (176)	8-Aug (220)
R3	n.a.	1-Dec	1-Jul	19-Mar (78)	2-May (122)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	1-May (121)	14-Jun (165)	25-May (146)	9-Jul (190)
R4	n.a.	10-Nov	15-Jul	24-Jan (24)	9-Mar (106)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	27-Apr (117)	10-Jun (161)	2-Jun (153)	16-Jul (197)

Notes: 2x 375 g a.s./ha (14d min interval), appln method groundspray, PRZM input (CAM2, appln foliar linear, depth incorporated 4 cm)
t2 : 2x 375 g/ha (code used within modelling runs)
Application windows started on (AppDate 3.06):
Early season – window 1/GS30
Late season – window 2/GS55; window 3/GS69. Using the minimum application window (30 days + (no. of applications – 1) x minimum appln interval, i.e. 44 days). Treatments were conducted every year
n.a.: not applicable

Scenario details		FOCUS default dates		SWASH application window (start date)											
				Early season						Late season					
				Window 1 (a)		Window 2 (b)		Window 3 (c)		Window 1 (d)		Window 2 (e)		Window 3 (f)	
Scenario	Crop no.	Emer-gence	Harvest	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End
Spring sown cereals (FOCUS spring cereals), 2x 375 g as/ha (14 d min int) GS30-69															
D1	1	5-May	4-Sep	27-May (147)	10-Jul (191)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	23-Jun (174)	6-Aug (218)	18-Jul (199)	31-Aug (243)
D3	1	1-Apr	20-Aug	28-Apr (118)	11-Jun (162)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	30-May (150)	13-Jul (194)	28-Jun (179)	11-Aug (223)
D4	2	26-Apr	26-Aug	18-May (138)	1-Jul (182)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	14-Jun (165)	28-Jul (209)	9-Jul (190)	22-Aug (234)
D5	1	15-Mar	20-Jul	9-Apr (99)	23-May (143)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	9-May (129)	22-Jun (173)	4-Jun (155)	18-Jul (199)
R4	1	15-Mar	20-Jul	9-Apr (99)	23-May (143)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	9-May (129)	22-Jun (173)	4-Jun (155)	18-Jul (199)

Notes: 2x 375 g a.s./ha (14d min interval), appln method groundspray, PRZM input (CAM2, appln foliar linear, depth incorporated 4 cm)
t3 : 2x 375 g/ha (code used within modelling runs)
Application windows started on (AppDate 3.06):
Early season – window 1/GS30
Late season – window 2/GS55; window 3/GS69. Using the minimum application window (30 days + (no. of applications – 1) x minimum appln interval, i.e. 44 days). Treatments were conducted every year
n.a. not applicable

The length of the application windows were calculated using the equation below:

$$\text{Length of window (days)} = 30 + \big((n - 1) \times \text{interval between applications (days)}\big)$$

Where:
n = number of applications

Step 4 – application of mitigation measures

The Swan (version 5.0.0) tool was used to apply mitigation measures in the form of vegetative filter strips (VFS) and no spray buffer zones (NSBZ).

Results and discussion

Summaries of the maximum PEC_{SW} and PEC_{SED} values for spiroxamine at FOCUS Step 3 and 4, as calculated by the FOCUS surface water models, are provided in Table 9.2.5-15 to Table 9.2.5-18.

Table 9.2.5-15: Maximum PEC_{SW} and PEC_{SED} for following application of 2 x 375 g a.s./ha spiroxamine to winter cereals – FOCUS Step 3

Scenario	Water body	PEC_{SW} (µg/L)							
		Early application (GS30-55)				Late application (GS55-69)			
		Initial	Main route of entry	21-day TWA	Maximum PEC_{SED} (µg/kg)	Initial	Main route of entry	21-day TWA	Maximum PEC_{SED} (µg/kg)
Multiple application 2x 375 g/ha									
D1	Ditch	2.370	Spray drift	0.765	8.203	2.967	Spray drift	1.791	18.040
D1	Stream	1.843	Spray drift	0.022	0.366	2.091	Spray drift	0.153	1.708
D2	Ditch	2.392	Spray drift	0.621	7.449	2.994	Spray drift	1.884	19.800
D2	Stream	2.113	Spray drift	0.308	6.312	2.619	Spray drift	1.591	16.000
D3	Ditch	2.361	Spray drift	0.208	2.276	2.372	Spray drift	0.374	3.751
D4	Pond	0.100	Spray drift	0.080	1.231	0.113	Spray drift	0.092	1.333
D4	Stream	1.745	Spray drift	0.003	0.075	2.043	Spray drift	0.048	0.584
D5	Pond	0.113	Spray drift	0.092	1.332	0.112	Spray drift	0.092	1.326
D5	Stream	1.885	Spray drift	0.011	0.163	2.204	Spray drift	0.069	0.804
D6	Ditch	2.334	Spray drift	0.252	3.054	2.383	Spray drift	1.075	9.824
R1	Pond	0.184	Runoff	0.157	3.042	0.296	Runoff	0.255	4.042
R1	Stream	1.555	Spray drift	0.086	9.733	1.562	Spray drift	0.093	23.260
R3	Stream	2.185	Spray drift	0.078	7.340	2.203	Spray drift	0.081	2.434
R4	Stream	1.666	Runoff	0.099	9.325	1.562	Spray drift	0.117	8.281

Scenario	Water body	PEC$_{SW}$ (µg/L)							
		Early application (GS30-55)				Late application (GS55-69)			
		Initial	Main route of entry	21-day TWA	Maximum PEC$_{SED}$ (µg/kg)	Initial	Main route of entry	21-day TWA	Maximum PEC$_{SED}$ (µg/kg)
Single application 1x 375 g/ha									
D1	Ditch	2.370	Spray drift	0.200	2.523	2.391	Spray drift	1.286	10.490
D1	Stream	1.843	Spray drift	0.005	0.078	2.091	Spray drift	0.089	1.300
D2	Ditch	2.392	Spray drift	0.621	7.267	2.393	Spray drift	1.303	11.440
D2	Stream	2.113	Spray drift	0.508	6.312	2.129	Spray drift	1.145	9.527
D3	Ditch	2.361	Spray drift	0.114	1.613	2.372	Spray drift	0.206	2.625
D4	Pond	0.081	Spray drift	0.060	0.757	0.081	Spray drift	0.063	0.820
D4	Stream	1.745	Spray drift	0.003	0.052	2.043	Spray drift	0.028	0.442
D5	Pond	0.081	Spray drift	0.062	0.824	0.081	Spray drift	0.063	0.826
D5	Stream	1.885	Spray drift	0.003	0.055	2.204	Spray drift	0.040	0.623
D6	Ditch	2.334	Spray drift	0.051	0.757	2.383	Spray drift	0.731	6.705
R1	Pond	0.081	Spray drift	0.066	1.363	0.169	Runoff	0.144	2.213
R1	Stream	1.555	Spray drift	0.029	3.637	1.562	Spray drift	0.061	13.670
R3	Stream	2.185	Spray drift	0.029	3.510	2.203	Spray drift	0.051	1.392
R4	Stream	1.562	Spray drift	0.037	4.276	1.562	Spray drift	0.113	6.618

Table 9.2.5-16: Maximum PEC_{SW} and PEC_{SED} following application of 2 x 375 g a.s./ha spiroxamine to spring cereals - FOCUS Step 3

Scenario	Water body	PEC_{SW} (µg/L)							
		Early application (GS30-55)				Late application (GS55-69)			
		Initial	Main route of entry	21-day TWA	Maximum PEC_{SED} (µg/kg)	Initial	Main route of entry	21-day TWA	Maximum PEC_{SED} (µg/kg)
Multiple application 2x 375 g/ha									
D1	Ditch	3.139	Spray drift	2.029	17.920	2.834	Spray drift	1.805	16.340
D1	Stream	2.096	Spray drift	0.156	2.930	2.096	Spray drift	0.090	1.912
D3	Ditch	2.369	Spray drift	0.227	2.257	2.375	Spray drift	0.264	2.730
D4	Pond	0.111	Spray drift	0.091	1.134	0.114	Spray drift	0.093	1.258
D4	Stream	1.937	Spray drift	0.020	0.260	2.048	Spray drift	0.049	0.567
D5	Pond	0.106	Spray drift	0.088	1.180	0.114	Spray drift	0.094	1.186
D5	Stream	1.989	Spray drift	0.007	0.147	2.209	Spray drift	0.069	0.775
R4	Stream	3.063	Runoff	0.309	7.286	1.961	Runoff	0.287	6.842
Single application 1x 375 g/ha									
D1	Ditch	2.417	Spray drift	1.400	9.988	2.414	Spray drift	1.396	9.939
D1	Stream	2.096	Spray drift	0.094	1.686	2.096	Spray drift	0.090	1.688
D3	Ditch	2.369	Spray drift	0.129	1.728	2.375	Spray drift	0.172	2.171
D4	Pond	0.081	Spray drift	0.063	0.712	0.081	Spray drift	0.063	0.724
D4	Stream	1.937	Spray drift	0.008	0.135	2.048	Spray drift	0.028	0.441
D5	Pond	0.082	Spray drift	0.063	0.747	0.082	Spray drift	0.064	0.744
D5	Stream	1.989	Spray drift	0.005	0.086	2.209	Spray drift	0.040	0.619
R4	Stream	1.566	Spray drift	0.207	5.437	1.810	Runoff	0.272	6.819

Summaries of the PE_{SW} and PEC_{SED} values for spiroxamine following application of mitigation measures at Step 4 are provided in Table 9.2.5-17 to Table 9.2.5-18.

Table 9.2.5-17: Maximum PEC_{SW} and PEC_{SED} following application of 2 x 375 g a.s./ha spiroxamine to winter cereals - FOCUS Step 4

Scenario	Water body	PEC_{SW} (µg/L)							
		Early application (GS30-55)				Late application (GS55-69)			
		Initial	Main route of entry	21-day TWA	Maximum PEC_{SED} (µg/kg)	Initial	Main route of entry	21-day TWA	Maximum PEC_{SED} (µg/kg)
Multiple application 2x 375 g/ha; 20 m VFS + 20 m SDBZ + 0% SDRT									
D1	Ditch	0.208	Drainage	0.082	0.968	0.299	Drainage	0.187	2.105
D1	Stream	0.190	Spray drift	0.003	0.055	0.211	Spray drift	0.023	0.263
D2	Ditch	0.244	Drainage	0.067	0.852	0.303	Drainage	0.196	2.274
D2	Stream	0.213	Spray drift	0.053	0.699	0.253	Spray drift	0.170	2.054
D3	Ditch	0.179	Spray drift	0.023	0.264	0.205	Drainage	0.041	0.440
D4	Pond	0.058	Drainage	0.048	0.754	0.066	Drainage	0.055	0.814
D4	Stream	0.179	Spray drift	0.001	0.011	0.209	Spray drift	0.007	0.089
D5	Pond	0.066	Drainage	0.055	0.815	0.066	Drainage	0.055	0.811
D5	Stream	0.193	Spray drift	0.002	0.024	0.224	Spray drift	0.010	0.123
D6	Ditch	0.193	Drainage	0.028	0.351	0.243	Drainage	0.116	1.166
R1	Pond	0.065	Runoff	0.059	1.033	0.092	Runoff	0.079	1.214
R1	Stream	0.239	Runoff	0.019	0.668	0.241	Runoff	0.021	1.379
R3	Stream	0.237	Runoff	0.016	0.554	0.229	Spray drift	0.014	0.193
R4	Stream	0.397	Runoff	0.022	0.832	0.166	Spray drift	0.027	0.584

Scenario	Water body	PECsw (µg/L)							
		Early application (GS30-55)				Late application (GS55-69)			
		Initial	Main route of entry	21-day TWA	Maximum PECSED (µg/kg)	Initial	Main route of entry	21-day TWA	Maximum PECSED (µg/kg)
Single application 1x 375 g/ha; 20 m VFS + 20 m SDBZ + 0% SDRT									
D1	Ditch	0.200	Drainage	0.023	0.293	0.244	Drainage	0.137	1.233
D1	Stream	0.190	Spray drift	0.001	0.012	0.211	Spray drift	0.013	0.193
D2	Ditch	0.244	Drainage	0.067	0.833	0.244	Drainage	0.139	1.323
D2	Stream	0.213	Spray drift	0.053	0.699	0.214	Spray drift	0.121	1.227
D3	Ditch	0.179	Spray drift	0.013	0.182	0.205	Drainage	0.023	0.300
D4	Pond	0.046	Drainage	0.035	0.446	0.046	Drainage	0.036	0.483
D4	Stream	0.179	Spray drift	0.000	0.008	0.209	Spray drift	0.004	0.065
D5	Pond	0.046	Drainage	0.036	0.486	0.046	Drainage	0.036	0.487
D5	Stream	0.193	Spray drift	0.001	0.008	0.224	Spray drift	0.006	0.092
D6	Ditch	0.174	Spray drift	0.006	0.086	0.243	Drainage	0.079	0.788
R1	Pond	0.046	Runoff	0.035	0.544	0.057	Runoff	0.048	0.682
R1	Stream	0.265	Spray drift	0.007	0.253	0.166	Spray drift	0.013	0.801
R3	Stream	0.229	Spray drift	0.006	0.259	0.229	Spray drift	0.009	0.147
R4	Stream	0.171	Runoff	0.009	0.374	0.166	Spray drift	0.025	0.583
Multiple application 2x 375 g/ha; 20 m VFS + 20 m SDBZ + 0% SDRT									
D1	Ditch	0.167	Drainage	0.065	0.775	0.239	Drainage	0.147	1.684
D1	Stream	0.130	Spray drift	0.003	0.044	0.143	Spray drift	0.018	0.210
D2	Ditch	0.192	Drainage	0.052	0.678	0.241	Drainage	0.155	1.816
D2	Stream	0.144	Spray drift	0.037	0.489	0.174	Spray drift	0.122	1.565
D3	Ditch	0.133	Spray drift	0.018	0.211	0.163	Drainage	0.033	0.352
D4	Pond	0.049	Drainage	0.040	0.634	0.055	Drainage	0.046	0.685
D4	Stream	0.122	Spray drift	0.001	0.011	0.145	Spray drift	0.006	0.071
D5	Pond	0.055	Drainage	0.046	0.686	0.055	Drainage	0.046	0.682
D5	Stream	0.132	Spray drift	0.001	0.020	0.155	Spray drift	0.008	0.098
D6	Ditch	0.156	Drainage	0.022	0.280	0.192	Drainage	0.092	0.934
R1	Pond	0.057	Runoff	0.051	0.922	0.084	Runoff	0.072	1.106
R1	Stream	0.239	Runoff	0.019	0.666	0.241	Runoff	0.020	1.373
R3	Stream	0.237	Runoff	0.015	0.539	0.160	Spray drift	0.012	0.180

Scenario	Water body	PEC_{SW} (µg/L)							
		Early application (GS30-55)				Late application (GS55-69)			
		Initial	Main route of entry	21-day TWA	Maximum PEC_{SED} (µg/kg)	Initial	Main route of entry	21-day TWA	Maximum PEC_{SED} (µg/kg)
R4	Stream	0.397	Runoff	0.022	0.829	0.165	Runoff	0.026	0.581
Single application 1x 375 g/ha; 20 m VFS + 20 m SDBZ + 0% SDRT									
D1	Ditch	0.160	Drainage	0.018	0.232	0.192	Drainage	0.107	0.972
D1	Stream	0.130	Spray drift	0.001	0.009	0.143	Spray drift	0.010	0.151
D2	Ditch	0.192	Drainage	0.052	0.654	0.192	Drainage	0.108	1.042
D2	Stream	0.144	Spray drift	0.037	0.489	0.146	Spray drift	0.084	0.923
D3	Ditch	0.133	Spray drift	0.010	0.143	0.163	Drainage	0.018	0.236
D4	Pond	0.038	Drainage	0.029	0.372	0.038	Drainage	0.030	0.402
D4	Stream	0.122	Spray drift	0.000	0.006	0.145	Spray drift	0.003	0.051
D5	Pond	0.038	Drainage	0.029	0.405	0.038	Drainage	0.030	0.406
D5	Stream	0.132	Spray drift	0.000	0.006	0.155	Spray drift	0.005	0.072
D6	Ditch	0.118	Spray drift	0.005	0.069	0.192	Drainage	0.062	0.621
R1	Pond	0.038	Runoff	0.029	0.474	0.051	Runoff	0.043	0.614
R1	Stream	0.115	Spray drift	0.007	0.251	0.133	Runoff	0.012	0.797
R3	Stream	0.159	Spray drift	0.006	0.252	0.160	Spray drift	0.008	0.137
R4	Stream	0.171	Runoff	0.009	0.372	0.163	Runoff	0.025	0.580

VFS = vegetative filter strip, SDBZ = spray drift buffer zone, SDRT = spray drift reduction technology

Table 9.2.5-18: Maximum PEC_{SW} and PEC_{SED} following application of 2 x 375 g a.s./ha spiroxamine to spring cereals - FOCUS Step 4

Scenario	Water body	PEC_{SW} (µg/L)							
		Early application (GS30-55)				Late application (GS55-69)			
		Initial	Main route of entry	21-day TWA	Maximum PEC_{SED} (µg/kg)	Initial	Main route of entry	21-day TWA	Maximum PEC_{SED} (µg/kg)
Multiple application 2x 375 g/ha; 20 m VFS + 20 m SDBZ + 0% SDRT									
D1	Ditch	0.297	Drainage	0.185	2.077	0.275	Drainage	0.171	2.086
D1	Stream	0.211	Spray drift	0.023	0.261	0.211	Spray drift	0.013	0.240
D3	Ditch	0.182	Spray drift	0.025	0.281	0.194	Drainage	0.029	0.343
D4	Pond	0.065	Drainage	0.053	0.775	0.066	Drainage	0.055	0.784
D4	Stream	0.200	Spray drift	0.003	0.040	0.210	Spray drift	0.007	0.089
D5	Pond	0.062	Drainage	0.051	0.800	0.066	Drainage	0.055	0.808
D5	Stream	0.205	Spray drift	0.001	0.022	0.224	Spray drift	0.010	0.123
R4	Stream	0.372	Runoff	0.039	0.828	0.227	Runoff	0.038	0.776
Single application 1x 375 g/ha; 20 m VFS + 20 m SDBZ + 0% SDRT									
D1	Ditch	0.244	Drainage	0.137	1.233	0.244	Drainage	0.137	1.231
D1	Stream	0.211	Spray drift	0.013	0.193	0.211	Spray drift	0.013	0.193
D3	Ditch	0.182	Spray drift	0.014	0.201	0.194	Drainage	0.019	0.257
D4	Pond	0.046	Drainage	0.036	0.463	0.046	Drainage	0.036	0.469
D4	Stream	0.200	Spray drift	0.001	0.020	0.210	Spray drift	0.004	0.065
D5	Pond	0.046	Drainage	0.036	0.481	0.046	Drainage	0.036	0.484
D5	Stream	0.205	Spray drift	0.001	0.013	0.224	Spray drift	0.006	0.092
R4	Stream	0.173	Runoff	0.027	0.615	0.224	Runoff	0.035	0.772
Multiple application 2x 375 g/ha; 20 m VFS + 20 m SDBZ + 0% SDRT									
D1	Ditch	0.236	Drainage	0.146	1.661	0.219	Drainage	0.135	1.668
D1	Stream	0.143	Spray drift	0.018	0.208	0.143	Spray drift	0.010	0.192
D3	Ditch	0.138	Drainage	0.020	0.225	0.154	Drainage	0.023	0.274
D4	Pond	0.054	Drainage	0.045	0.652	0.055	Drainage	0.046	0.659
D4	Stream	0.138	Spray drift	0.002	0.032	0.145	Spray drift	0.006	0.071
D5	Pond	0.051	Drainage	0.043	0.673	0.055	Drainage	0.046	0.680
D5	Stream	0.140	Spray drift	0.001	0.018	0.155	Spray drift	0.008	0.098
R4	Stream	0.372	Runoff	0.039	0.820	0.227	Runoff	0.037	0.772

Scenario	Water body	PECSW (µg/L)							
		Early application (GS30-55)				Late application (GS55-69)			
		Initial	Main route of entry	21-day TWA	Maximum PECSED (µg/kg)	Initial	Main route of entry	21-day TWA	Maximum PECSED (µg/kg)
Single application 1x 375 g/ha; 20 m VFS + 20 m SDBZ + 0% SDRT									
D1	Ditch	0.192	Drainage	0.107	0.972	0.192	Drainage	0.107	0.971
D1	Stream	0.143	Spray drift	0.010	0.151	0.143	Spray drift	0.010	0.151
D3	Ditch	0.138	Drainage	0.011	0.158	0.154	Drainage	0.015	0.202
D4	Pond	0.038	Drainage	0.030	0.386	0.038	Drainage	0.030	0.391
D4	Stream	0.138	Spray drift	0.001	0.016	0.145	Spray drift	0.003	0.051
D5	Pond	0.038	Drainage	0.030	0.401	0.038	Drainage	0.030	0.403
D5	Stream	0.140	Spray drift	0.001	0.010	0.155	Spray drift	0.005	0.072
R4	Stream	0.173	Runoff	0.027	0.612	0.224	Runoff	0.035	0.768

VFS = vegetative filter strip, SDBZ = spray drift buffer zone, SDRT = spray drift reduction technology

Conclusions

Predicted environmental concentrations of spiroxamine in surface water and sediment have been generated in accordance with FOCUS and EFSA guidance, for the use of PTZ + SPX EC 460 (460 g/L) on winter and spring cereals.

The global maximum PEC_{SW} and PEC_{SED} values for spiroxamine and its metabolites at Step 3 are provided in Table 9.2.5-19, and Step 4 are presented in Table 9.2.5-20.

Table 9.2.5-19: Global maximum PEC_{SW} and PEC_{SED} for spiroxamine - FOCUS Step 3

Use	Maximum PEC_{SW} (µg/L)
Winter cereals, early, 2 x 375 g a.s./ha	2.370 [a]
Winter cereals, late, 2 x 375 g a.s./ha	2.994
Spring cereals, early, 2 x 375 g a.s./ha	3.139
Spring cereals, late, 2 x 375 g a.s./ha	2.834

[a] Maximum value resulted from single application

Table 9.2.5-20: Maximum PEC_{SW} and PEC_{SED} for spiroxamine - FOCUS Step 4

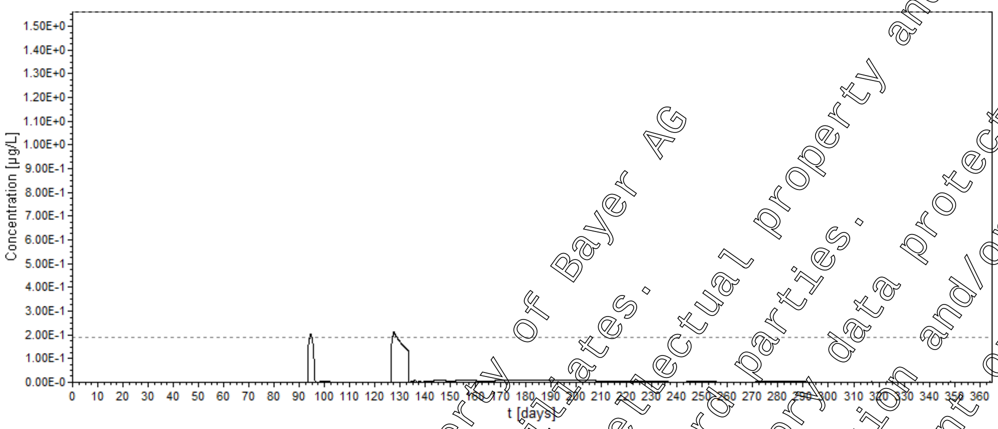
Use	Mitigation	Maximum PEC_{SW} (µg/L)
Winter cereals, early, 2 x 375 g a.s./ha	20 m VFS + 20 m SDBZ + 0% SDRT	0.397
	20 m VFS + 30 m SDBZ + 0% SDRT	0.397
Winter cereals, late, 2 x 375 g a.s./ha	20 m VFS + 20 m SDBZ + 0% SDRT	0.303
	20 m VFS + 30 m SDBZ + 0% SDRT	0.241
Spring cereals, early, 2 x 375 g a.s./ha	20 m VFS + 20 m SDBZ + 0% SDRT	0.372
	20 m VFS + 30 m SDBZ + 0% SDRT	0.372
Spring cereals, late, 2 x 375 g a.s./ha	20 m VFS + 20 m SDBZ + 0% SDRT	0.275
	20 m VFS + 30 m SDBZ + 0% SDRT	0.227

VFS = vegetated filter strip, SDBZ = spray drift buffer zone, SDRT = spray drift reduction technology

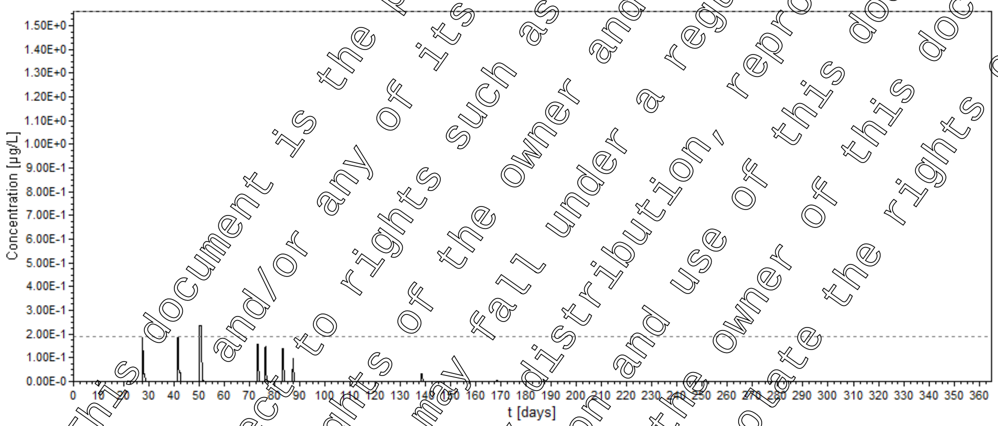
In order to provide further refinement to Step 3 and 4 SW modelling, EPAT profiles can be considered. Example EPAT profiles for are shown in Figure 9.2.5-1 below which show the exposure profile for drainage (D) and run-off (R) scenario are mainly driven by spray drift. A more detailed evaluation of the exposure profiles can be conducted, on request.

Figure 9.2.5-1: Example exposure profile following 2x 375 g/ha to winter cereals with mitigation of 20 m VFS + 20 m SDBZ (application window a)

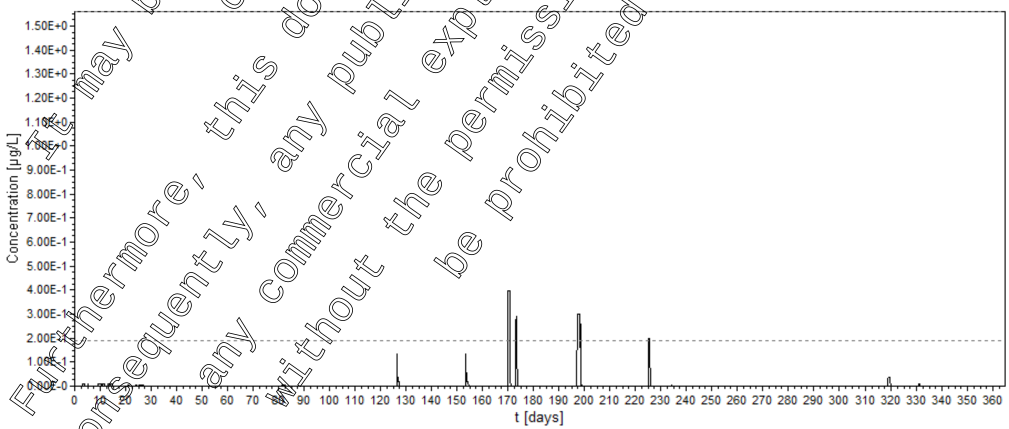
Drainage scenario (D2)



Run-off scenario (R3)



Run-off scenario (R4)



Assessment and conclusion by applicant:

The study was conducted to guideline(s) FOCUS 2001, 2015 (required guideline). The study is considered valid for use in the risk assessment.

PECsw FOCUS (prothioconazole)

The representative formulated product Prothioconazole + Spiroxamine EC 460 (160+300 g/L) also contains the active substance prothioconazole. The active substance prothioconazole is not the primary focus of the renewal of the active substance spiroxamine and is the subject of a separate renewal evaluation which is in progress at the time of writing.

According to the current evaluation documents for the active substance prothioconazole (i.e. EFSA 2007[12], p.77/98), the definition of the residue for environmental risk assessment in soil lists prothioconazole and metabolites M01 (prothioconazole-S-methyl) and M04 (prothioconazole-desthio) and in surface water lists prothioconazole and metabolites M04 (prothioconazole-desthio) and M13 (prothioconazole-124 triazole).

The predicted environmental concentration in surface water of prothioconazole and metabolites M01 (prothioconazole-S-methyl), M04 (prothioconazole-desthio) and M13 (prothioconazole-124 triazole) are addressed by reference to the existing RAR for spiroxamine, volume 3, Annex B.9 (8-Aug-2017) which provides the following tables (from pages 199-200) showing PECsw according to FOCUS step-2 for prothioconazole and metabolites M01 (prothioconazole-S-methyl), M04 (prothioconazole-desthio) and M13 (prothioconazole-124 triazole) with additional PECsw according to FOCUS steps 3 and 4 (considering no spray buffer distances of 5 m and implementation of vegetative filter strips of 5, 10 and 20 m) based on the existing LoEP for prothioconazole as needed for environmental risk assessment:

Table 9.2.5-21: Maximum and 21d-TWA aquatic PEC values according to FOCUS STEP 2 for application of prothioconaxole on cereals between March and May (Schad & Zerbe, 2008, MEF-08/252)

Scenario [a]	Prothioconazole		Prothioconazole-desthio		Prothioconazole-S-methyl		Prothioconazole-triazole	
	PEC_{sw} (µg/L)	21d-twa PEC_{sw} (µg/L)	PEC_{sw} (µg/L)	21d-twa PEC_{sw} (µg/L)	PEC_{sw} (µg/L)	21d-twa PEC_{sw} (µg/L)	PEC_{sw} (µg/L)	21d-twa PEC_{sw} (µg/L)
NE	2.048	0.979	4.138	-	0.382	0.300	0.262	0.243
SE	2.048	1.263	7.361	-	0.670	0.542	0.262	0.243

[a] NE: Northern Europe, SE: Southern Europe

12 EFSA Scientific Report (2007) 106, 1-98, Conclusion on the peer review of prothioconazole.

Table 9.2.5-22: Prothioconazole-desthio: Maximum concentration of FOCUS STEP 3 and FOCUS STEP 4, with non-sprayed buffer zone at 5 m (Schad & Zerbe, 2008, MEF-08/252(

Scenario	Water Body	FOCUS STEP 3 max. PEC_{sw} (µg/L)		FOCUS STEP 4 5 m PEC_{sw} (µg/L)
Spring cereals				
D1 (Lanna)	ditch	0.483		0.124
D1 (Lanna)	stream	0.278		0.098
D3 (Vredepeel)	ditch	0.318		0.083
D4 (Skousbo)	pond	0.017		0.015
D4 (Skousbo)	stream	0.271		0.096
D5 (La Jaillière)	pond	0.017		0.015
D5 (La Jaillière)	stream	0.274		0.097
R4 (Roujan)	stream	0.736		0.736
Winter cereals				
D1 (Lanna)	ditch	0.482		0.124
D1 (Lanna)	stream	0.278		0.098
D2 (Brimstone)	ditch	0.326		0.086
D2 (Brimstone)	stream	0.283		0.100
D3 (Vredepeel)	ditch	0.318		0.083
D4 (Skousbo)	pond	0.017		0.014
D4 (Skousbo)	stream	0.271		0.096
D5 (La Jaillière)	pond	0.017		0.015
D5 (La Jaillière)	stream	0.275		0.097
D6 (Thiva)	ditch	0.319		0.083
R1 (Weiherbach)	pond	0.111		0.110
R1 (Weiherbach)	stream	1.098		1.098
R3 (Bologna)	stream	1.104		1.104
R4 (Roujan)	stream	1.244		1.244

Table 9.2.5-23: Desthio: Maximum PEC_{SW} concentration at FOCUS STEP 4, with run-off re-ductuins (Schad & Zerbe, 2008, MEF-08/252)

Scenario	Distance (m)	Reduction (%)	PEC_{sw} (µg/L)
spring cereals			
R4 Roujan - stream	5	60/85	0.335
	10	60/85	0.335
	10	80/95	0.176
winter cereals			
R1 Weiherbach - stream	5	60/85	0.499
	10	60/85	0.499
	10	80/95	0.261
R3 Bologna - stream	5	60/85	0.504
	10	60/85	0.504
	10	80/95	0.264
R4 Roujan - stream	5	60/85	0.562
	10	60/85	0.562
	10	80/95	0.294

Note – possible typo in table above. It is assumed the third entry for each scenario corresponds to a VFS distance of 20 m (rather than a duplicate entry of 10 m)

Using the existing LoEP for prothioconazole and with the step 4 mitigation levels applied above, the maximum initial predicted environmental concentration in surface water of prothioconazole and metabolites M01 (prothioconazole-S-methyl), M04 (prothioconazole-desthio) and M13 (prothioconazole-124 triazole) are 2.048, 0.670, 0.294 and 0.262 µg/L, respectively.

CP 9.3 Fate and behaviour in air

CP 9.3.1 Route and rate of degradation in air and transport via air

The fate and behaviour in air of the representative formulation Prothioconazole + Spiroxamine EC 460 (160+300 g/L) can be extrapolated from the active substance studies addressed under CA 7.3.

Based on an overall vapour pressure value for the whole active substance (i.e. combined A and B isomers) of 4.7×10^{-3} Pa (20°) and individual vapour pressure values of 3.0×10^{-3} and 6.0×10^{-3} Pa (20°C) for the A and B diastereoisomers (see Point CA 2.2), respectively and calculated Henry's law constant for the whole active substance of 4×10^{-3} Pa m^3/mol (pH7, 20°C) and individual Henry's law constants of 2.5×10^{-3} and 5.0×10^{-3} Pa m^3/mol (pH7, 20°C) for the A and B diastereoisomers (see Point CA 2.2), respectively, spiroxamine is semi-volatile and may have a potential to volatilise from plant, soil and water surfaces.

However, experimentally in studies investigating the amount of active substance volatilised under field conditions, it was shown that the amount volatilised was *ca.* 2% after 24 hrs. Any volatilisation of the active substance from the laboratory soil studies under Point CA 7.1.1. was also very low (<1% AR), although some volatilisation was observed from water surfaces in the water/sediment study (under Point CA 7.2.2.3). However, the estimated photochemical oxidative degradation half-life (using the Atkinson equation) in air of the active substance spiroxamine is <3 hours and therefore, if present, spiroxamine will not persist in the atmosphere.

Consequently, the predicted environmental concentration of the active substance in air is expected to be negligible and is not calculated.

CP 9.4 Estimation of concentrations for other routes of exposure

Use of the representative formulated product Prothioconazole + Spiroxamine EC 460 (160+300 g/L) can potentially lead to amounts reaching surface water during treatments by spray drift or *via* soil drainage and run-off, and therefore potentially reaching Water Treatment Plants (WTPs) where disinfection processes have the potential to modify the active substance or metabolites during treatment. In order to address the potential for harmful compounds being formed during the disinfection process, an assessment of potential exposure at WTPs is presented.

Impact of WTP Exposure

Data Point:	KCP 9.4/01
Report Author:	[redacted]
Report Year:	2021
Report Title:	Spiroxamine: Effects of water treatment on parent and metabolites in drinking water
Report No:	0471836-WT1
Document No:	M-764010-01-1
Guideline(s) followed in study:	None
Deviations from current test guideline:	None
Previous evaluation:	No, not previously submitted
GLP/Officially recognised testing facilities:	not applicable
Acceptability/Reliability:	Yes

Executive Summary

Under Regulation (EC) No 1107/2009, it is necessary to show that active substances for use in plant protection products have no harmful effect on human or animal health through drinking water. The presence and potential levels of active substance and any metabolites in drinking water should therefore be investigated to assess the risk of formation of harmful substances such as nitrosamines, dioxins and furans during drinking water disinfection processes.

In this paper, the potential for formation of such substances resulting from treatment of water containing spiroxamine and its metabolites has been looked at. A review of the degradation pathways of spiroxamine in water and soil has been performed. Spiroxamine degrades to major metabolites M01 (spiroxamine-desethyl), M02 (spiroxamine-desthyl), M03 (spiroxamine-N-oxide) and M06 (spiroxamine-acid), minor metabolites, bound residues and carbon dioxide in soil, either via microbial processes. In water/sediment spiroxamine degrades to major metabolites M06 (spiroxamine-acid), minor metabolites, bound residues and carbon dioxide, via microbial processes.

Groundwater and surface water are the most common sources of drinking water in Europe. The predicted environmental concentrations (PECs) of spiroxamine and its major metabolites in surface water and groundwater have been estimated and were found to be present at very low levels. In addition, the concentrations of spiroxamine and its metabolites in surface water are estimated for small edge of field water bodies. Drinking water is abstracted from much larger waterbodies so a dilution factor for typical large waterbodies has been estimated and drinking water concentrations calculated.

Based on these concentrations and the various steps in the drinking water treatment process, an assessment has been made on the likelihood of water treatment by-products of spiroxamine or its metabolites being present in drinking water.

It is very likely that during the drinking water treatment processes prior to disinfection (sand filtration, coagulation/sedimentation/filtration and carbon filtration), spiroxamine and its metabolites will be removed due to their very high propensity to adsorb to organic material.

Since levels of spiroxamine and its metabolites will be negligible in drinking water prior to disinfection processes, it is very unlikely that disinfection by-products of spiroxamine and its metabolites will be present in drinking water.

Predicted environmental concentrations in drinking water (PEC_{DW}) and its sources

The main sources of drinking water in Europe are groundwater and surface water, with surface water combined with artificial recharge and river bank filtration only accounting for a very minor contribution. This paper has therefore focussed on groundwater and surface water as sources of drinking water.

Groundwater (PEC_{GW})

The leaching behaviour of spiroxamine and its metabolites, was examined in accordance with the FOCUS groundwater scenarios workshop guidelines (FOCUS, 2000 and 2014).

Simulations of spiroxamine and its metabolites, M01 (spiroxamine-desethyl), M02 (spiroxamine-despropyl) and M03 (spiroxamine-N-oxide) following application to field crops were conducted with the FOCUS groundwater scenarios in FOCUS PEARL (version 4.4.4), FOCUS PELMO (version 5.5.3) and FOCUS MACRO (version 5.5.4) in accordance with the FOCUS groundwater scenarios workshop guidelines (FOCUS, 2000 and 2014).

The following uses were simulated in accordance with the supported uses of the spiroxamine, see Table 9.4-1:

Table 9.4-1: Modelled uses for Spiroxamine

Crop	FOCUS Scenario	BBCH range	Application rate per application (g a.s./ha)	Crop interception (%)	Soil loading per application (g a.s./ha)
Winter cereals	Winter cereals	BBCH 30 onwards	375	90	37.5
Spring cereals	Spring cereals	BBCH 30 onwards	375	90	37.5

The predicted 80th percentile average annual concentrations in groundwater at 1 m depth for spiroxamine and its metabolites M01 (spiroxamine-desethyl), M02 (spiroxamine-despropyl) and M03 (spiroxamine-N-oxide) were <0.001 µg/L for all uses and all scenarios; therefore, are all significantly below the 0.1 µg/L regulatory threshold. In studies investigating the route of degradation of the active substance spiroxamine in soil (presented under CA 7.1.1.1), the metabolite M06 is only observed >5% AR in one out of ten soils and only at the very last sampling point (in all other soils and all other sampling points the observed level of metabolite M06 was <5%). Due to the low levels of M06 observed, it was difficult to obtain reliable degradation rate constants from the parent applied studies. Consequently, estimated PEC_{GW} from conservative input parameters were found to be provide unreasonable estimates of leaching when compared to the outcome of the soil column studies (see KCA 7.1.4.1) where only 0.2% of AR were observed in leachate. Potential inputs via groundwater for metabolite M06 (spiroxamine-acid) are currently being defined as the studies required to define the modelling input parameters are underway and modelling using conservative assumptions result in unrealistic estimates of PEC_{GW}. It should be noted that exposure of spiroxamine and its metabolite via groundwater are not expected and that exposure of the WTP with residues would be predominantly via surface water.

Surface water (PEC_{SW})

The potential for spiroxamine and its metabolites M01 (spiroxamine-desethyl), M02 (spiroxamine-despropyl), M03 (spiroxamine-N-oxide) and M06 (spiroxamine-acid) to reach surface water, was examined in accordance with FOCUS guidance for surface water modelling (FOCUS (2001 and 2015)).

Applications made to the winter and spring cereals were simulated using Steps 1-2 in FOCUS in accordance with FOCUS guidance for surface water modelling (FOCUS (2001 and 2015)). A refinement of the values generated at Steps 1-2 to more realistic concentrations were calculated for spiroxamine only using FOCUS Step 3. FOCUS Step 4 was used to apply mitigation measures.

The maximum PEC_{SW} values for spiroxamine at FOCUS Step 4 are presented in CP 9.2.5/03 but represented in Table 9.4-2.

Table 9.4-2: Maximum PEC_{SW} values for spiroxamine – FOCUS Step 4

Use	Mitigation	Maximum PEC_{SW} (µg/L)
Winter cereals 2 x 375 g a.s./ha	20 m VFS + 20 m NSBZ + 0% SDRT	0.397
	20 m VFS + 30 m NSBZ + 0% SDRT	0.397
Spring cereals 2 x 375 g a.s./ha	20 m VFS + 20 m NSBZ + 0% SDRT	0.372
	20 m VFS + 30 m NSBZ + 0% SDRT	0.372

a) Maximum value resulted from single application
VFS = vegetated filter strip, SDBZ = spray drift buffer zone, SDRT = spray drift reduction technology

The overall maximum PEC_{SW} values for the metabolites at Step 2 for the field uses are presented in CP 9.2.5/02 but re-presented in Table 9.4- 3:

Table 9.4- 3: Overall maximum PECSW values for the metabolites of spiroxamine for field uses – FOCUS Step 2

Compound	Overall maximum PEC_{SW} (µg/L)
M01 (spiroxamine-desethyl)	0.826
M02 (spiroxamine-despropyl)	0.699
M03 (spiroxamine-N-oxide)	1.882
M06 (spiroxamine-acid)	16.99

Please note that assumptions at Step 2 are extremely conservative and that further reductions in PEC_{SW} would be expected at Step 3 and 4 (not presented).

Drinking water abstracted from surface water

PEC_{SW} values have been assessed with the standard FOCUS scenarios. These calculations are performed with receiving water bodies, such as ditches, ponds and streams (Table 9.4-4), however, these types of water body are generally not used as a source of drinking water in Europe. Therefore, a dilution will take place, before the substance of interest reaches major rivers or lakes serving as drinking water supplies. Characteristics of some typical European rivers and lakes are shown in Table 9.4-5.

Table 9.4-4: Water volume of small water bodies in model scenarios

Scenario	Dimensions	Volume
Ditch	Length: 100 m Depth: 0.3 m Width: 1 m	30000 L (30 m3)
Pond	Depth: 1 m Diameter: 30 m	706858 L (707 m3)
Stream	Length: 100 m Depth: 0.3 m Width: 1 m	30000 L (30 m3)

Table 9.4-5: Characteristics of European rivers and lakes

Name of waterbody	Outflow (m3/s)	Volume
Danube	6700	-
Rhine	2300	-
Elbe	870	-
Loire	930	-
Average river outflow	2700	-
Lake Constance	-	4.8 x 1010 m3

Dilution factors of 10^7 and 10^9 can be applied to PEC_{SW} for the pond scenarios and the ditch or stream scenarios, respectively if a major lake (e.g. Lake Constance) is used as a drinking water supply, as follows:

Pond scenarios dilution factor = 4.8 x 10^{10} m^3 / 707 m^3 = 6.8 x 10^7

Ditch/stream dilution factor = 4.8 x 10^{10} m^3 / 30 m^3 = 1.6 x 10^9

A dilution factor of 10^5 and 10^6 can be applied to PEC_{SW} for the pond scenarios and the ditch or stream scenarios, respectively if a river with an average outflow is used as a drinking water supply. These dilution factors are calculated as follows:

Total outflow over 7 hours = 2700 m^3/s x 7 hours x 3600 s = 6.8 x 10^7 m^3

Pond scenarios dilution factor = 6.8 x 10^7 m^3 / 707 m^3 = 9.6 x 10^5

Ditch/stream scenarios dilution factor = 6.8 x 10^7 m^3 / 30 m^3 = 2.3 x 10^6

Thus a dilution factor of 10^5 can be applied as a worst case assumption. However, considering the original estimated concentrations of spiroxamine or its metabolites in surface water, any consideration of dilution demonstrates an extremely low risk that transformation products of spiroxamine could cause adverse effects as they are considerably below the maximum drinking water limit of 0.1 µg/L.

Drinking water treatment processes

In Europe, groundwater generally undergoes the following treatment prior to use as drinking water:

No treatment or treatment without disinfection (*ca* 10 % all drinking water)

Treatment with disinfection (*ca* 40 % all drinking water)

When groundwater is disinfected, the most common treatment methods before disinfection are aeration with rapid sand filtration or carbon filtration.

Only 40% of drinking water from disinfected groundwater (*ca* 16% of all drinking water) is chlorine disinfected.

Almost all surface water (*ca* 45% all drinking water) is disinfected prior to use as drinking water. Surface water is most likely to undergo coagulation/sedimentation/filtration or carbon filtration prior to disinfection.

A total of 62% of drinking water from disinfected surface water (*ca* 28% of all drinking water) is chlorine disinfected

Disinfection is most commonly performed with chlorine and hypochlorite with chlorine dioxide and chloramine each accounting for less than 5% of disinfection methods.

UV treatment accounts for ca 10% of disinfection methods and only 2% of disinfection methods use ozone.

Removal of spiroxamine and its metabolites before disinfection

The K_{FOC} values for spiroxamine and its metabolites (please see CP 9.1.2) are as follows:

Table 9.4-6: K_{FOC} values for spiroxamine and its metabolites

Compound	K_{FOC} (mL/g)
Spiroxamine	4111
M01 (spiroxamine-desethyl)	3271
M02 (spiroxamine-despropyl)	2695
M03 (spiroxamine-N-oxide)	1677
M06 (spiroxamine-acid)	Study ongoing

Based on these K_{FOC} values it can be seen that all of these compounds are slightly mobile or immobile from the McCall classification. It is therefore very likely that spiroxamine and its metabolites will be removed from drinking water through the sand filtration, coagulation/sedimentation/filtration or carbon filtration process. Studies on the sorption behaviour of M06 (spiroxamine-acid) are ongoing, however, this affinity is also expected to hold true for this compound. Nevertheless, even if the experimentally derived K_{FOC} value is low, dilution and degradation will occur as discussed previously, yielding concentrations so low that any transformation products from disinfection will not pose a risk to human health.

The overall predicted concentration of spiroxamine and its metabolites in ground water and surface water indicate an overall very low risk to human health irrespective of what reaction processes occur during water treatment.

Conclusions

An assessment has been made on the likelihood of water treatment by-products of spiroxamine or its metabolites being present in drinking water. The most common sources of drinking water in Europe are groundwater and surface water.

Spiroxamine degrades to major metabolites M01 (spiroxamine-desethyl), M02 (spiroxamine-despropyl), M03 (spiroxamine-N-oxide), M06 (spiroxamine-acid), minor metabolites, bound residues and carbon dioxide in soil, either via microbial or photolytic processes. In pelagic and water/sediment systems spiroxamine degrades to major metabolites M01 (spiroxamine-desethyl), M02 (spiroxamine-despropyl), M03 (spiroxamine-N-oxide), M06 (spiroxamine-acid), minor metabolites, bound residues and carbon dioxide, either via microbial or photolytic processes.

The PECs of spiroxamine and its major metabolites in surface water and groundwater have been estimated and were found to be present at very low levels. It is also very likely that during the drinking water treatment processes prior to disinfection (sand filtration, coagulation/sedimentation/filtration or carbon filtration), spiroxamine and its metabolites will be removed due to their relatively high propensity to adsorb to organic material. For those metabolites which have a low K_{FOC}, dilution and degradation will occur to levels so low that any transformation products from disinfection will not pose a risk to human health.

Since levels of spiroxamine and its metabolites will be negligible in drinking water prior to disinfection processes, it is very unlikely that disinfection by-products of spiroxamine and its metabolites will be present in drinking water.

Assessment and conclusion by applicant:
The study is considered valid for use in the risk assessment.