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FENOXAPROP-P-ETHYL

Volume 3 – B.8 (PPP) – Puma S 69 EW (Fenoxaprop-P-ethyl 69 g/L, Mefenpyr-diethyl 75 g/L)

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B.8. ENVIRONMENTAL FATE AND BEHAVIOUR

This summary on 'Fate and Behaviour in the environment' has been prepared to support the AIR submission of fenoxaprop-P-ethyl (AE F046360) which is prepared on behalf of the Regulatory **Task Force Fenoxaprop-P-ethyl**, existing since 2013 and represented by Cheminova A/S and Bayer CropScience. This summary was especially prepared to support the representative formulation **Puma S 69 EW** from Bayer CropScience (FPP + MPR EW 144 (69 + 75 g/L)).

Environmental fate data of fenoxaprop-P-ethyl (AE F046360) and its major metabolites as well as for the formulated product Puma S 69 EW (FPP + MPR EW 144 (69 + 75 g/L)) had been submitted within the EU Dossier (Baseline Dossier), which resulted in the Annex I inclusion under Directive 91/414/EEC. In the Supplementary Dossier for renewal of approval of fenoxaprop-P-ethyl (AE F046360) only those environmental fate studies are described, which had not been submitted within the Baseline Dossier.

Baseline Dossier and Supplementary Dossier have been combined by the RMS AT into one consistent document and were evaluated altogether.

Main part of this summary are modelling calculations which are done according to the currently valid guidance.

Table B.8-1: Fenoxaprop-P-ethyl (AE F046360) and its metabolites considered in the environmental exposure assessment

Compartment	Residue Definition
Soil	Fenoxaprop-P-ethyl (AE F046360), fenoxaprop-P-acid (AE F088406)[(a)], chlorobenzoxazolone (AE F054014), HOPP-acid (AE F096918)
Groundwater	Fenoxaprop-P-ethyl (AE F046360), fenoxaprop-P-acid (AE F088406)[(a)], chlorobenzoxazolone (AE F054014), HOPP-acid (AE F096918)
Surface Water	Fenoxaprop-P-ethyl (AE F046360), fenoxaprop-P-acid (AE F088406)[(a)], chlorobenzoxazolone (AE F054014), HOPP-acid (AE F096918), phenol metabolite (AE F040356), fenoxaprop-P-deschloro-hydroxy (BCS-CY11271)[(b)]
Sediment	Fenoxaprop-P-ethyl (AE F046360), fenoxaprop-P-acid (AE F088406)[(a)], chlorobenzoxazolone (AE F054014), HOPP-acid (AE F096918), phenol metabolite (AE F040356), fenoxaprop-P-deschloro-hydroxy (BCS-CY11271)[(b)]
Air	Fenoxaprop-P-ethyl (AE F046360), fenoxaprop-P-acid (AE F088406)[(a)]

(a) Herbicidal active metabolite
(b) Above 10 % in aquatic photolysis

B.8.1. FATE AND BEHAVIOUR IN SOIL

B.8.1.1. Rate of degradation in soil

Studies on degradation in soil with the formulation were not performed, since it is possible to extrapolate from data obtained with the active substance.

B.8.1.1.1. Laboratory studies

The rate of degradation in soil of fenoxaprop-P-ethyl (AE F046360) and metabolites has been assessed in laboratory studies and is summarised in the tables below.

Table B.8.1.1.1-1 Summary on aerobic degradation rates for fenoxaprop-P-ethyl (AE F046360) in laboratory studies - trigger & modelling endpoints

Soil name	Soil type (USDA)	Label	*p*H ($CaCl_2$)	T (°C)	Water content (% MWHC)	*DegT 50* (d)	*DegT 90* (d)	*DegT50* (d) 20 °C, *p*F2	χ^2 err. (%)	Kinetic model	Reference
LS 2.2	Loamy sand	ClPh	5.8	22	40	0.35	1.2	0.33	12.7	SFO	Stumpf & Dambach (1988)
SL V	Sandy loam	ClPh	5.6	22	40	0.33	1.1	0.28	11.0	SFO	
SL 2	Silt loam	ClPh	5.2	22	40	0.25	3.0	0.70[(a)]	6.5	FOMC	
SL S	Sandy loam	ClPh	5.2	22	40	0.42	5.9	1.4[(a)]	7.7	FOMC	
Pikeville	Sandy loam	ClPh	5.2	20	26	0.32	7.0	1.2[(a)]	5.5	FOMC	Shepherd (2012)
Porterville	Loamy sand	ClPh	6.9	20	57	0.22	0.71	0.20	10.6	SFO	
Sanger	Sandy loam	ClPh	6.2	20	42	0.13	1.2	0.26[(a)]	2.4	FOMC	
Springfield	Silt loam	ClPh	6.6	20	74	0.07	0.24	0.07	7.3	SFO	
Pikeville	Sandy loam	Ph	5.2	20	26	0.35	5.2	0.86[(a)]	12.8	FOMC	Shepherd & Ripperger (2012)
Porterville	Loamy sand	Ph	6.9	20	57	0.14	1.0	0.27[(a)]	6.0	FOMC	
Sanger	Sandy loam	Ph	6.2	20	42	0.24	0.78	0.17	10.8	SFO	
Springfield	Silt loam	Ph	6.6	20	74	0.08	0.25	0.07	8.6	SFO	
					Maximum (n = 8)[(b)]	**0.42**	**5.9**	**-**		FOMC[(c)]	
					Geometric mean (n = 8)[(b)]	**-**	**-**	**0.36**		SFO	
					pH-dependency: y/n	**y[(d)]**					

(a) Based on non-normalized FOMC-DT90 divided by 3.32
(b) Different labels in Shepherd (2012) and Shepherd & Ripperger (2012) averaged (geometric mean) before averaging soils or calculating maximum
(c) FOMC $\alpha = 0.771$, $\beta = 0.305$
(d) Refer to text below

Table B.8.1.1.1-2 Summary on aerobic degradation rates for fenoxaprop-P-acid (AE F088406) – laboratory studies - trigger and modelling endpoints

Soil name	Soil type (USDA)	Label	*p*H ($Ca-Cl_2$)	T (°C)	WC (% MWHC)	*DegT 50* (d)	*DegT 90* (d)	*ff* (-)	*DegT50* (d) 20 °C, *p*F2	χ^2 err. (%)	Kinetic model	Ref.
LS 2.2	Loamy sand	ClPh	5.8	22	40	12.6	41.7	0.95	12.1	13.4	$P_{SFO} \rightarrow M_{SFO}$	1)
SL V	Sandy loam	ClPh	5.6	22	40	4.3	14.1	0.90	3.5	5.0	$P_{SFO} \rightarrow M_{SFO}$	
SL 2	Silt loam	ClPh	5.2	22	40	3.0	9.8	0.66	2.3	6.0	$P_{FOMC} \rightarrow M_{SFO}$	
SL S	Sandy loam	ClPh	5.2	22	40	4.0	13.2	0.79	3.0	12.8	$P_{FOMC} \rightarrow M_{SFO}$	
Pikeville	Sandy loam	ClPh	5.2	20	26	4.5	14.9	0.76	2.5	10.0	$P_{FOMC} \rightarrow M_{SFO}$	2)
Porterville	Loamy sand	ClPh	6.9	20	57	16.7	55.4	0.93	15.5	2.7	$P_{SFO} \rightarrow M_{SFO}$	
Sanger	Sandy loam	ClPh	6.2	20	42	10.0	33.2	0.93	7.3	5.9	$P_{FOMC} \rightarrow M_{SFO}$	
Springfield	Silt loam	ClPh	6.6	20	74	8.1	26.9	0.88	7.5	6.4	$P_{SFO} \rightarrow M_{SFO}$	
Pikeville	Sandy loam	Ph	5.2	20	26	4.4	14.7	0.84	2.4	10.5	$P_{FOMC} \rightarrow M_{SFO}$	3)
Porterville	Loamy sand	Ph	6.9	20	57	16.2	54.0	0.95	15.0	1.5	$P_{FOMC} \rightarrow M_{SFO}$	
Sanger	Sandy loam	Ph	6.2	20	42	7.7	25.5	0.90	5.6	6.7	$P_{SFO} \rightarrow M_{SFO}$	
Springfield	Silt loam	Ph	6.6	20	74	4.5	14.9	0.86	4.2	10.9	$P_{SFO} \rightarrow M_{SFO}$	
					Maximum (n = 8)[(a)]	**16.4**	**54.7**	**-**	**15.2**	**-**		
					Geometric mean (n = 8)[(a)]	**-**	**-**	**-**	**5.0**	**-**		
					Arithmetic mean (n = 8)[(b)]	**-**	**-**	**0.85**	**-**	**-**		
					***p*H-dependency: y/n**	**y[(c)]**						

Ref. 1) Stumpf & Dambach (1988)
Ref. 2) Shepherd (2012)
Ref. 3) Shepherd & Ripperger (2012)
(a) Different labels in Shepherd (2012) and Shepherd & Ripperger averaged (geometric mean) before averaging soils
(b) Different labels in Shepherd (2012) and Shepherd & Ripperger averaged (arithmetic mean) before averaging soils
(c) Refer to text below.

Table B.8.1.1.1-3 Summary on aerobic degradation rates for chlorobenzoxazolone (AE F054014) in laboratory studies - trigger and modelling endpoints

Soil name	Soil type (USDA)	Label	*p*H ($CaCl_2$)	T (°C)	WC (% MWHC)	*DegT 50* (d)	*DegT 90* (d)	*ff* (-)	*DegT50* (d) 20 °C, *p*F2	χ^2 err. (%)	Kinetic model	Ref.
LS 2.2	Loamy sand	ClPh	5.8	22	40	7.7	25.4	na	7.3	17.0	SFO[(a)]	1)
SL V	Sandy loam	ClPh	5.6	22	40	23.8	79.2	na	23.8	24.3	SFO[(a)]	
SL 2	Silt loam	ClPh	5.2	22	40	17.9	59.6	na	14.0	6.0	SFO[(a)]	
SL S	Sandy loam	ClPh	5.2	22	40	8.5	28.1	na	6.5	20.0	SFO[(a)]	
Pikeville	Sandy loam	ClPh	5.2	20	26	56.6	188	na	31.0	4.4	SFO[(a)]	2)
Porterville	Loamy sand	ClPh	6.9	20	57	Low occurrence (< 2 % AR)						
Sanger	Sandy loam	ClPh	6.2	20	42	Low occurrence (< 5 % AR)						
Springfield	Silt loam	ClPh	6.6	20	74	Low occurrence (< 3 % AR)						
					Maximum (n = 5)	**56.6**	**188**	**-**	**-**			
					Geometric mean (n = 5)	**-**	**-**	**-**	**13.7**			
					Arithmetic mean (n = 5)	**-**	**-**	**na**	**-**			
					***p*H-dependency: y/n**	**n[(b)]**						

(a) Decline fit
(b) No *p*H dependent degradation can be deduced from the available degradation rate data set. However, OECD 106 batch studies indicate that chlorobenzoxazolone is less stable under more alkaline conditions (refer to text below)
Ref. 1) Stumpf & Dambach (1988)
Ref. 2) Shepherd & Ripperger (2012)

Table B.8.1.1.1-4 Summary on aerobic degradation rates for HOPP-acid (AE F096918) in laboratory studies - trigger and modelling endpoints

Soil name	Soil type (USDA)	Label	*p*H ($CaCl_2$)	T (°C)	WC (% MWHC)	*DegT 50* (d)	*DegT 90* (d)	*ff* (-)	*DegT50* (d) 20 °C, pF2	χ^2 (%)	Kinetic model	Ref.
Farditch	Loam	Ph	5.8	20	45	0.01	0.03	na	0.01	8.5	SFO[(a)]	1)
Longwoods	Sandy loam	Ph	7.4	20	24	0.01	0.03	na	0.01	4.1	SFO[(a)]	
Lockington	Sandy clay loam	Ph	5.7	20	41	0.01	0.03	na	0.01	3.9	SFO[(a)]	
Wurmwiese	Loam	Ph	5.2	20	34	0.01	0.03	na	0.01	0.3	SFO[(a)]	2)
AXXa	Sandy loam	Ph	6.9	20	29	0.01	0.04	na	0.01	0.9	SFO[(a)]	
Hoefchen	Silt loam	Ph	6.3	20	32	0.01	0.04	na	0.01	0.3	SFO[(a)]	
Dollendorf	Clay loam	Ph	7.3	20	45	0.01	0.04	na	0.01	0.5	SFO[(a)]	
					Maximum (n = 7)	**0.01**	**0.04**	**-**	**-**			
					Geometric mean (n = 7)	**-**	**-**	**-**	**0.01**			
					Arithmetic mean (n = 7)	**-**	**-**	**na**	**-**			
					***p*H-dependency: y/n**	**n**						

(a) Metabolite applied
Ref. 1) Fitzmaurice (2010)
Ref. 2) Stroech & Junge (2014)

The RMS AT notes that with the exception of HOPP-acid (AE F096918) lab degradation studies do not cover alkaline soils at all. This is considered particularly critical in case of fenoxaprop-P-acid (AE F088406) as degradation rates available for acidic and neutral soils (see figure below) as well as data from batch sorption studies conducted with fenoxaprop-P-acid (AE F088406) (Rupprecht, 1999; Voelkel, 2008a) indicate that fenoxaprop-P-acid (AE F088406) is more stable to degradation in alkaline soils. Unless degradation rates are available for alkaline soils as well, the RMS AT therefore recommends applying the worst case *DegT50* of fenoxaprop-P-acid (AE F088406) observed in acidic and neutral soils in the environmental exposure assessment for conservative reasons.

Degradation rates available for the parent fenoxaprop-P-ethyl (AE F046360) in acidic and neutral soils indicate some *p*H-dependent degradation as well, with possibly faster degradation in more alkaline soils (see figure

below). This observation is somewhat in contrast to results from (abiotic) hydrolysis, where fenoxaprop-P-ethyl (AE F046360) was most stable under neutral conditions (*p*H 7). As degradation of fenoxaprop-P-ethyl (AE F046360) is fast in any case (*DegT50* ≤ 1.4 days) the RMS AT does not consider it necessary applying a more conservative approach in this case.

OECD 106 batch experiments conducted with chlorobenzoxazolone (AE F054014) (Allan, 2004; Voelkel, 2008b) indicate that chlorobenzoxazolone (AE F054014) is less stable under alkaline soil conditions. Thus degradation rates available for acidic soils only (*p*H in $CaCl_2$ ≤ 5.8) are considered sufficiently conservative for the groundwater and aquatic exposure assessment.

Degradation rates (at reference conditions) in relation to the soil *p*H are given in figures below.

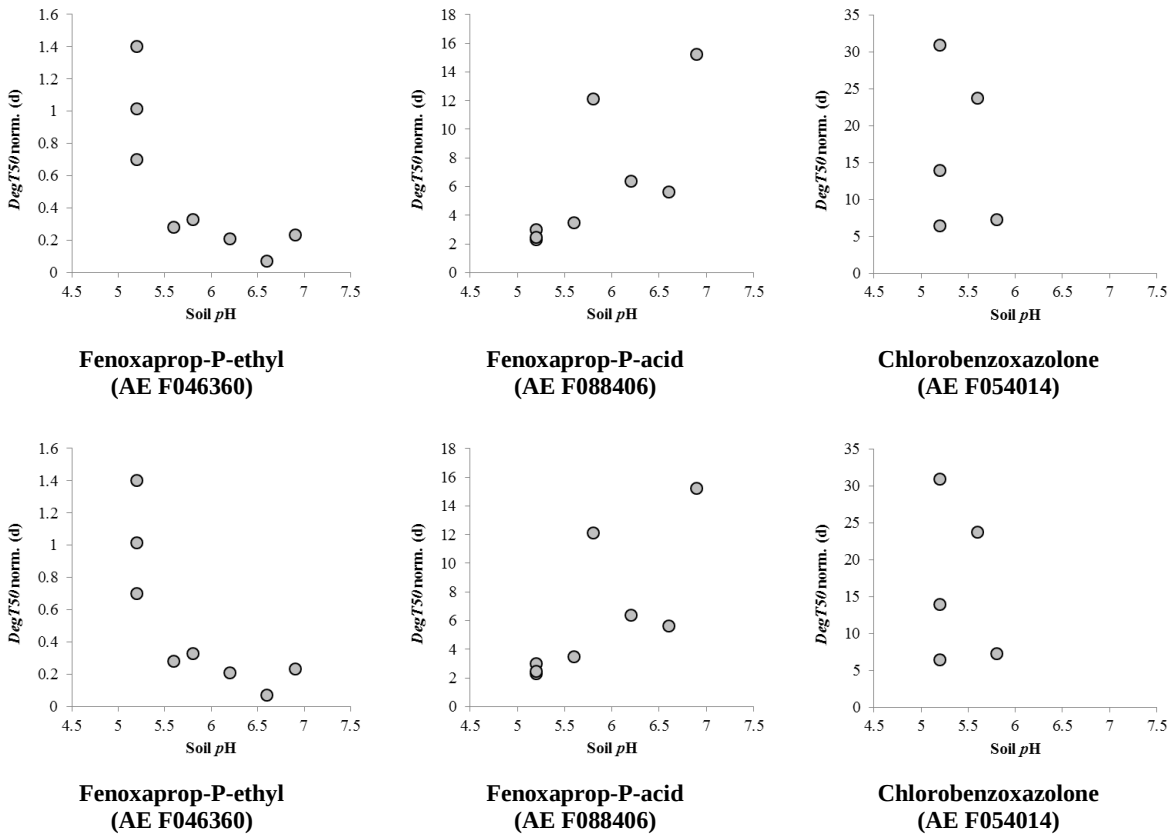


Figure B.8.1.1.1-1: Normalized *DegT50 vs* soil *p*H for fenoxaprop-P-ethyl (AE F046360) and metabolites (different labels from Shepherd, 2012, and Shepherd & Ripperger, 2012, averaged)

The rate of degradation of fenoxaprop-P-ethyl (AE F046360) in anaerobic soil is rapid as well (*DegT50* of 0.35 and 0.37 days in two soils). Degradation of the herbicidal active metabolite fenoxaprop-P-acid (AE F088406) is somewhat lower under anaerobic conditions compared to aerobic conditions (*DegT50* of 35.7 and 43.7 days in two soils).

The rate of degradation of racemic fenoxaprop-ethyl (AE F033171), used as a surrogate for fenoxaprop-P-ethyl (AE F046360), under conditions of photolysis on a (sterile) soil surface is relatively slow (*DegT50* of 62.5 days under environmental conditions, 52 °N). On overall, photolysis is not considered to significantly contribute to the overall dissipation of fenoxaprop-P-ethyl (AE F046360) in terrestrial systems.

B.8.1.1.2. Field studies

B.8.1.1.2.1. Soil dissipation studies

Field dissipation studies with formulated fenoxaprop-P-ethyl (AE F046360) were conducted in the US (two studies) and in Canada (two studies, one of them with repeated application over 3 years). Results from the Canadian field trials are expressed on basis of parent equivalents only, thus these two studies are considered non-reliable. In the two studies conducted in the US (one peanut and one soybean field trial) amounts of fenoxaprop-P-ethyl (AE F046360) in soil close to the LOQ do not allow calculating dissipation half-lives for the parent. Dissipation half-lives for fenoxaprop-P-acid (AE F088406) re-calculated by the RMS AT were 8.8 days in Wilson County, NC (peanut field) and 7.2 days in Iowa (soybeans), thus well in line with observations made in the laboratory studies. Results from these two field studies are considered supplemental information only.

B.8.1.1.2.2. Soil accumulation studies

Laboratory *DisT90* values for fenoxaprop-P-ethyl (AE F046360) and its soil metabolites are all less than one year. Therefore, soil accumulation studies are not required.

B.8.1.1.2.3. Summary on field studies

See above.

B.8.1.2. Mobility in soil

Studies on mobility in soil with the formulation were not performed, since it is possible to extrapolate from data obtained with the active substance.

B.8.1.2.1. Laboratory studies

The adsorption of fenoxaprop-P-ethyl (AE F046360), fenoxaprop-P-acid (AE F088406) and chlorobenzoxazolone (AE F054014) in soil has been assessed in OECD guideline 106 batch studies and is summarised in the tables below. Batch sorption studies with HOPP-acid (AE F096918) failed due to the instability of HOPP-acid (AE F096918) observed in these test systems.

Due to the instability of the test items as well as significant formation of non-extractable residues (NER) observed in batch sorption studies conducted with fenoxaprop-P-ethyl (AE F046360), fenoxaprop-P-acid (AE F088406) and chlorobenzoxazolone (AE F054014) parental mass balances were in most cases below 90 % recommended by OECD guideline 106 in order to allow the *indirect* method to be applied for the determination of Freundlich isotherm constants. Despite of the low mass balance, advanced Freundlich isotherm experiments were conducted by the study authors applying the *indirect* method throughout, thus calculating the mass of test item adsorbed on basis of the test item in the liquid phase only. In view of insufficient test item mass balance the RMS AT considers the obtained results on Freundlich isotherms obtained in these experiments non-reliable.

It may be noted that formation of NER in OECD 106 batch experiments with fenoxaprop-P-ethyl (AE F046360) and its main metabolites is not unexpected to occur, as NER in soil degradation experiments conducted with fenoxaprop-P-ethyl (AE F046360) were generally high accounting for up to 17.3 % AR already one day after application. Applying the *indirect* method, NER are implicitly assumed to equally contribute to the equilibrium sorption, which is not defendable from a scientific point of view.

In contrast to the advanced tests (Freundlich isotherm experiments), the RMS AT considers results from the preliminary experiments (usually conducted at the highest test concentration, only) applying the *direct* method adequate to calculate distribution coefficients (K_d/K_{oc}) on basis of the test item recovered (i.e. in the liquid phase and in the soil extract). As these results are based on one concertation only, linear sorption ($1/n = 1$) is assumed by default.

In Reynolds (1993), investigating fenoxaprop-P-ethyl (AE F046360), fenoxaprop-P-acid (AE F088406) and chlorobenzoxazolone (AE F054014), no pre-equilibrium phase (i.e. shaking of soil with pure $CaCl_2$ solution

overnight) was accounted for. In principle this invalidates this study with respect to recommendations given in OECD guideline 106. However, soil adsorption tests according to OECD guideline 106 with fenoxaprop-P-ethyl (AE F046360) will always be somehow limited due to the instability of fenoxaprop-P-ethyl (AE F046360) in these test systems. In this respect, the RMS AT considers results obtained in Reynolds (1993) sufficiently robust to at least give an estimate of the sorption coefficient of fenoxaprop-P-ethyl (AE F046360) in soils even without pre-equilibrium phase. However, results of Reynolds (1993) are not considered further in case of fenoxaprop-P-acid (AE F088406) and chlorobenzoxazolone (AE F054014) as dedicated batch sorption studies with an adequate pre-equilibration phase are available for these two metabolites. It may be added, that despite missing pre-equilibrium phase, results from Reynolds (1993) are nevertheless well in line with results from valid soil sorption studies.

Table B.8.1.2.1-1: Summary on soil adsorption of fenoxaprop-P-ethyl (AE F046360)

Soil name	Soil type (USDA)	OC (%)	*p*H[(a)]	K_d (L/kg)	K_{oc} (L/kg)	K_f (L/kg)	K_{foc} (L/kg)	1/*n* (-)	Reference
Arizona	Clay	0.23	7.6	12.8	5419	na	na	1.0[(b)]	Reynolds (1993)[(c)]
Mississippi	Silty clay loam	0.81	6.5	212	26207	na	na	1.0[(b)]	
Maryland	Sandy loam	2.55	6.4	443	17352	na	na	1.0[(b)]	
Michigan	Clay loam	2.65	6.8	176	6667	na	na	1.0[(b)]	
		Arithmetic mean (n = 4)		-	-	-	-	**1.0**	
		Geometric mean (n = 4)		**121**	**11322**	-	-	-	
		pH-dependency: y/n		n					

na denotes not applicable (one test concentration only); note that results on Freundlich isotherms are not considered reliable by the RMS AT
(a) Matrix not specified
(b) Default assuming linear adsorption (one test concentration only)
(c) This sorption study was conducted without a pre-equilibration phase thus leaving some uncertainty regarding the reliability of the obtained K_d/K_{oc} values

Table B.8.1.2.1-2: Summary on soil adsorption of fenoxaprop-P-acid (AE F088406)

Soil name	Soil type (USDA)	OC (%)	*p*H ($CaCl_2$)	K_d (L/kg)	K_{oc} (L/kg)	K_f (L/kg)	K_{foc} (L/kg)	1/*n* (-)	Reference
EFS-6	Sandy loam	2.64	7.3	6.91	262	na	na	1.0[(a)]	Rupprecht (1999)
EFS-8	Sand	0.53	4.7	2.32	438	na	na	1.0[(a)]	
EFS-16	Silty clay loam	1.67	7.1	2.58	154	na	na	1.0[(a)]	
EFS-24	Sand	0.81	6.4	1.20	148	na	na	1.0[(a)]	
EFS-29	Loam	1.43	7.5	3.95	276	na	na	1.0[(a)]	
EFS-38	Clay loam	1.99	7.4	3.14	158	na	na	1.0[(a)]	
EFS-54[(b)]	Sandy loam	2.07	4.5	21.9	1058	na	na	1.0[(a)]	
		Arithmetic mean (all soil, n = 7)		-	-	-	-	**1.0**	
		Geometric mean (all soil, n = 7)		**3.89**	**276**	-	-	-	
		Geometric mean (neutral and alkaline soils, n = 5)		**3.05**	**192**				
		pH-dependency: y/n		y[(c)]					

na denotes not applicable (one test concentration only); note that results on Freundlich isotherms are not considered reliable by the RMS AT
(a) Default assuming linear adsorption (one test concentration only)
(b) Sediment
(c) Refer to text below

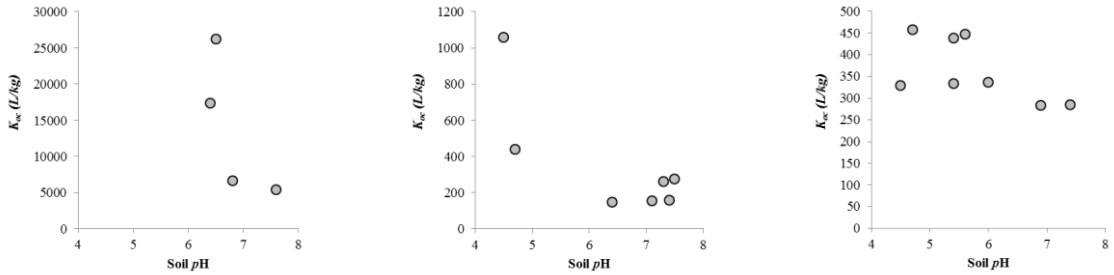
Table B.8.1.2.1-3: Summary on soil adsorption of chlorobenzoxazolone (AE F054014)

Soil name	Soil type (USDA)	OC (%)	*p*H ($CaCl_2$)	K_d (L/kg)	K_{oc} (L/kg)	K_f (L/kg)	K_{foc} (L/kg)	1/*n* (-)	Reference
EFS-8	Loamy sand	0.53	4.7	2.43	458	na	na	1.0[(a)]	Allan (2004)
EFS-25	Sandy loam	1.84	5.4	6.12	333	na	na	1.0[(a)]	
EFS-35	Silty loam	1.52	5.4	6.66	438	na	na	1.0[(a)]	
EFS-54[(b)]	Sandy loam	2.07	4.5	6.84	330	na	na	1.0[(a)]	
EFS-66	Loamy sand	1.95	6.0	6.55	336	na	na	1.0[(a)]	
Attenschwiller	Silt loam	1.10	7.4	3.26	285	na	na	1.0[(a)]	Voelkel (2008b)
Speyer 6S	Clay	1.90	6.9	6.59	284	na	na	1.0[(a)]	
Speyer 2.2	Loamy sand	2.36	5.6	10.8	448	na	na	1.0[(a)]	
		Arithmetic mean (n = 8)		-	-	-		**1.0**	
		Geometric mean (n = 8)		**5.64**	**358**	-	-	-	
		pH-dependency: y/n			n				

na denotes not applicable (one test concentration only), note that results on Freundlich isotherms are not considered reliable by the RMS AT

(a) Default assuming linear adsorption (one test concentration only)
(b) Sediment

The RMS AT investigated a possible relationship between sorption coefficient (K_{oc}) and soil *p*H for fenoxaprop-P-ethyl (AE F046360), fenoxaprop-P-acid (AE F088406) and chlorobenzoxazolone (AE F054014) more in detail (Figure B.8.1.4.4-1). No such relationship was observed for fenoxaprop-P-ethyl (AE F046360) and chlorobenzoxazolone (AE F054014). In case of fenoxaprop-P-acid (AE F088406), sorption in the two fairly acidic soils (*p*H ≤ 4.7) was higher in comparison to the more neutral and alkaline soils. In view of fenoxaprop-P-acid (AE F088406), being an organic acid, *p*H-dependent sorption may *a priori* be expected (depending on the protonation status). For reasons of conservativeness, the RMS AT therefore recommends omitting sorption results of the two rather acidic soils for calculating the average K_{oc} of fenoxaprop-P-acid (AE F088406) to be used in the exposure assessment.



Fenoxaprop-P-ethyl (AE F046360) **Fenoxaprop-p-acid (AE F088406)** **Chlorobenzoxazolone (AE F054014)**

Figure B.8.1.2.1-1: Soil sorption (K_{oc}) *vs* soil *p*H for fenoxaprop-P-ethyl (AE F046360) and metabolites

Data resulting from two soil column leaching studies are regarded as qualitative information on mobility in soil only, broadly reflecting the behaviour of fenoxaprop-P-ethyl (AE F046360) and its metabolites observed in dedicated soil degradation and batch sorption experiments.

B.8.1.2.2. Lysimeter studies

No studies provided.

B.8.1.2.3. Field leaching studies

No studies provided.

B.8.1.3. Estimation of concentrations in soil

Reference:	**Fenoxaprop-P-ethyl (FPP) and metabolites: PECsoil EUR - Use in winter and spring cereals in Europe**
Author(s), year:	Oberdoerster, C., Heruth, D. (2016a)
Report/Doc. Number:	EnSa-16-0142, M-554293-01-1
Guideline(s):	None
GLP:	Not applicable
Deviations:	Not applicable
Validity:	Partly (refer to comment section)
Status:	**New submission**

Methods and Materials:

The predicted environmental concentrations in soil (PEC_{soil}) of fenoxaprop-P-ethyl (AE F046360) and its metabolites were calculated on a first tier approach using a Microsoft® Excel spreadsheet. The use of fenoxaprop-P-ethyl (AE F046360) in cereals was assessed according to Good Agricultural Practice (GAP) under European cropping conditions. Detailed application data used for simulation of PEC_{soil} were compiled in the table below.

Table B.8.1.3-1 Application pattern used for PEC_{soil} calculations of fenoxaprop-P-ethyl (AE F046360)

Individual crop	FOCUS crop used for interception	Rate per season (g a.s./ha)	------- Application ------- Interval (days])	Plant Interception (%)	BBCH Stage	Amount reaching the soil per application (g a.s./ha)
Winter and spring cereals	Winter cereals	1 × 83	-	0	11 - 39	1 × 83

Substance Specific Parameters

PEC_{soil} calculations were based on the *DT50* of 0.424 days (non-normalised worst case of laboratory studies) for the parent compound fenoxaprop-P-ethyl (AE F046360).

Table B.8.1.3-2 Modelling input parameters for fenoxaprop-P-ethyl (AE F046360) and its metabolites

Endpoint	Value used for modelling
Fenoxaprop-P-ethyl (AE F046360)	
Molecular weight [g/mol]	361.8
DT50 soil [days] (worst case lab, non-normalised)	0.424
Chlorobenzoxazolone (AE F054014)	
Molecular weight [g/mol]	169.6
DT50 soil [days] (worst case lab, non-normalised)	56.6
Max. occ. in soil [%]	19.1
Molecular mass correction	0.4688
Fenoxaprop-P-acid (AE F088406)	
Molecular weight [g/mol]	333.7
DT50 soil [days] (worst case lab, non-normalised)	17.8
Max. occ. in soil [%]	87.2
Molecular mass correction	0.9223
HOPP-acid (AE F096918)	
Molecular weight [g/mol]	182.2
DT50 soil [days] (worst case lab, non-normalised)	0.012
Max. occ. in anaerobic soil [%]	74.1
Molecular mass correction	0.5036

PEC_{soil} modelling approach

The predicted environmental concentrations in soil (PEC_{soil}) for the active substance fenoxaprop-P-ethyl (AE F046360) was calculated based on a simple first tier approach (Microsoft® Excel spreadsheet) assuming even distribution of the compound in the upper 0 - 5 cm soil layer. A standard soil density of 1.5 g/cm^3 was assumed.

The use of fenoxaprop-P-ethyl (AE F046360) in winter and spring cereals was assessed according to Good Agricultural Practice (GAP) under European cropping conditions.

Findings

Table B.8.1.3-3 Maximum PEC_{soil} (mg/kg) of fenoxaprop-P-ethyl (AE F046360) and its metabolites for the uses assessed

Use pattern	Fenoxaprop-P-ethyl (AE F046360)	Chlorobenz-oxazolone (AE F054014)	Fenoxaprop-P-acid (AE F088406)	HOPP-acid (AE F096918)
Winter and spring cereals (1 × 83 g a.s./ha)	0.111	0.010	0.089	0.041

The maximum, short-term and long-term PEC_{soil} values and the time weighted average values ($TWAC_{soil}$) of fenoxaprop-P-ethyl (AE F046360) and its metabolites are presented in the table below.

Table B.8.1.3-4 PEC_{soil} and $TWAC_{soil}$ of fenoxaprop-P-ethyl (AE F046360) and its metabolites

Days after maximum		Fenoxaprop-P-ethyl (AE F046360)		Chlorobenzoxazolone (AE F054014)		Fenoxaprop-P-acid (AE F088406)		HOPP-acid (AE F096918)	
		PEC soil [µg/kg]	TWAC soil [µg/kg]	PEC soil [µg/kg]	TWAC soil [µg/kg]	PEC soil [µg/kg]	TWAC soil [µg/kg]	PEC soil [µg/kg]	TWAC soil [µg/kg]
Initial		**0.111**	-	**0.010**	-	**0.089**	-	**0.041**	-
Short term	1	0.022	0.054	0.010	0.010	0.086	0.087	< 0.001	< 0.001
	2	0.004	0.033	0.010	0.010	0.082	0.086	< 0.001	< 0.001
	4	< 0.001	0.017	0.009	0.010	0.076	0.082	< 0.001	< 0.001
Long term	7	< 0.001	0.010	0.009	0.009	0.068	0.078	< 0.001	< 0.001
	14	< 0.001	0.005	0.008	0.009	0.052	0.069	< 0.001	< 0.001
	21	< 0.001	0.003	0.008	0.009	0.039	0.061	< 0.001	< 0.001
	28	< 0.001	0.002	0.007	0.008	0.030	0.054	< 0.001	< 0.001
	42	< 0.001	0.002	0.006	0.008	0.017	0.044	< 0.001	< 0.001
	50	< 0.001	0.001	0.005	0.007	0.013	0.039	< 0.001	< 0.001
	100	< 0.001	< 0.001	0.003	0.006	0.002	0.022	< 0.001	< 0.001

Comments (RMS AT):

- On overall, the PEC soil calculations provided by the applicant are accepted by the RMS AT with the exception of *DegT50* values used for fenoxaprop-P-ethyl (AE F046360) and fenoxaprop-P-acid (AE F088406), and the maximum occurrence of fenoxaprop-P-acid (AE F088406) selected by the applicant:
    - Worst case degradation of fenoxaprop-P-ethyl (AE F046360) observed in laboratory degradation experiments follows FOMC kinetics with a *DegT50* of 0.42 days and a *DegT90* of 5.9 days ($\alpha = 0.771$, $\beta = 0.305$).
    - Worst-case *DegT50* of fenoxaprop-P-acid (AE F088406) is 16.4 days (17.8 days used by the applicant).
    - Unless it can be clearly demonstrated that anaerobic conditions in soil are unlikely to occur in case of the proposed GAP, the RMS AT considers that the maximum occurrence of metabolites observed in *anaerobic* soil degradation studies should be used for the terrestrial exposure assessment if it is higher than in *aerobic* soil degradation studies. This was followed by the applicant in case of HOPP-acid (AE F096918) but not in case of fenoxaprop-P-acid (AE F088406). The maximum occurrence of fenoxaprop-P-acid (AE F088406) in the anaerobic soil degradation study was 94.8 % AR.
- Subsequently, PEC soil values for fenoxaprop-P-ethyl (AE F046360) and fenoxaprop-P-acid (AE F088406) were re-calculated by the RMS AT.

Table B.8.1.3-5 PEC_{soil} and $TWAC_{soil}$ of fenoxaprop-P-ethyl (AE F046360) and fenoxaprop-P-acid (AE F088406) - RMS AT assessment

Days after maximum	Fenoxaprop-P-ethyl (AE F046360)		Fenoxaprop-P-acid (AE F088406)	
	PEC soil [µg/kg]	TWAC soil [µg/kg]	PEC soil [µg/kg]	TWAC soil [µg/kg]
0	**0.111**	**-**	**0.097**	**-**
1	0.036	0.060	0.093	0.095
2	0.023	0.044	0.089	0.093
4	0.014	0.031	0.082	0.089
7	0.010	0.023	0.072	0.084
14	0.006	0.015	0.054	0.073
21	0.004	0.012	0.040	0.064
28	0.003	0.010	0.030	0.057
50	0.002	0.007	0.012	0.040
100	0.001	0.004	0.001	0.023

B.8.2. FATE AND BEHAVIOUR IN WATER AND SEDIMENT

B.8.2.1. Aerobic mineralisation in surface water

Studies on degradation in aerobic water with the formulation were not performed, since it is possible to extrapolate from data obtained with the active substance.

The rate of degradation of fenoxaprop-P-ethyl (AE F046360) and fenoxaprop-P-acid (AE F088406) in aerobic water has been assessed in a laboratory study and is summarized in the tables below.

Table B.8.2.1-1: Summary on degradation of fenoxaprop-P-ethyl (AE F046360) in aerobic surface water at 20 °C

Water/dose	*p*H	Label	*DegT50* water (d)	*DegT90* water (d)	χ^2 (%)	Kinetic model	Reference
Wiehltalsperre/low dose	8.0	ClPh	0.4	1.4	5.1	SFO	Telscher & Junge, 2016a
Wiehltalsperre/high dose	8.0	ClPh	0.4	1.2	2.6	SFO	
Wiehltalsperre/low dose	9.2	Ph	0.2	0.6	4.6	SFO	Telscher & Junge, 2016b
Wiehltalsperre/high dose	9.2	Ph	0.2	0.8	3.3	SFO	

Table B.8.2.1-2: Summary on degradation of fenoxaprop-P-acid (AE F088406) in aerobic surface water at 20 °C

Water/dose	*p*H	Label	*DegT50* water (d)	*DegT90* water (d)	χ^2 (%)	Kinetic model	Reference
Wiehltalsperre/low dose	8.0	ClPh	107	354	2.5	SFO[(a)]	Telscher & Junge, 2016a
Wiehltalsperre/high dose	8.0	ClPh	432	> 1000	1.2	SFO[(a)]	
Wiehltalsperre/low dose	9.2	Ph	39.4	131	5.5	SFO[(a)]	Telscher & Junge, 2016b
Wiehltalsperre/high dose	9.2	Ph	134	444	2.4	SFO[(a)]	

(a) Decline fit

B.8.2.2. Water/sediment studies

Studies on degradation in water/sediment with the formulation were not performed, since it is possible to extrapolate from data obtained with the active substance.

The rate of degradation in of fenoxaprop-P-ethyl (AE F046360) and its metabolites in water/sediment systems has been assessed in a laboratory study and is summarised in the tables below.

Table B.8.2.2-1: Summary on degradation and dissipation of fenoxaprop-P-ethyl (AE F046360) in the total water/sediment system as well as in the water and sediment phase (aerobic, 20 °C) - trigger & modelling endpoints

Water / sediment system	*p*H wat. / sed.[(a)]	Label	*DegT50* system (d)	*DegT90* system (d)	Kinetic model	*DissT50* water (d)	Kinetic model	*DissT50* sed. (d)	Kinetic model	Reference
Rhine River	7.3 / 7.3	ClPh	0.12	0.40	SFO	0.11	SFO	nr	-	Tarara, 2000
Nidda River	6.8 / 5.1	ClPh	0.11	0.36	SFO	0.09	SFO	0.27	SFO	
Clayton Pond	6.6 / 4.4	Ph	0.17	0.58	SFO	0.17	SFO	na	-	Fitzmaurice, 2004
Roding River	8.0 / 7.2	Ph	0.38	1.2	SFO	0.38	SFO	na	-	
Goose River	8.3 / 7.9	ClPh	0.11	0.38	SFO	0.06	SFO	0.20	SFO	Xu, 2012
		Ph	0.11	0.35	SFO	0.06	SFO	0.13	SFO	
Lawrence Pond	7.8 / 7.4	ClPh	0.05	0.18	SFO	0.04	SFO	nr	-	
		Ph	0.07	0.23	SFO	0.06	SFO	0.05	SFO	
Rhine River	8.0 / 7.4[(b)]	ClPh	< 1	< 1	-	< 1	-	< 1	-	Mamouni, 2008
		Ph	< 1	< 1	-	< 1	-	< 1	-	
Fröschweiher Pond	7.8 / 7.2[(b)]	ClPh	< 1	< 1	-	< 1	-	< 1	-	
		Ph	< 1	< 1	-	< 1	-	< 1	-	
Geometric mean (n = 8)[(c)]			**0.13**	**0.44**		**0.11**		**0.14**		

nr denotes no reliable fit

na denotes not applicable (not observed)
(a) Measure in $CaCl_2$
(b) Matrix not specified
(c) Labels in Xu (2012) and Mamouni (2008) averaged (geometric mean) before averaging different water/sediment systems

Table B.8.2.2-2: Summary on degradation and dissipation of fenoxaprop-P-acid (AE F088406) in the total water/sediment system as well as in the water and sediment phase (aerobic, 20 °C) - trigger & modelling endpoints

Water / sediment system	*p*H wat. / sed.[a]	Label	*DegT50* system (d)	*DegT90* system (d)	Kinetic model	*ff*	*DissT50* water (d)	Kinetic model	*DissT50* sed. (d)	Kinetic model	Reference
Rhine River	7.3 / 7.3	ClPh	13.9	46.2	SFO[b]	1.0	10.7	SFO[c]	16.8	SFO[c]	Tarara, 2000
Nidda River	6.8 / 5.1	ClPh	8.0	26.5	SFO[b]	0.99	4.3	SFO[c]	8.7	SFO[c]	
Clayton Pond	6.6 / 4.4	Ph	39.6	132	SFO[b]	0.96	33.9	SFO[c]	nr	-	Fitzmaurice, 2004
Roding River	8.0 / 7.2	Ph	41.9	139	SFO[b]	1.0	40.5	SFO[c]	nr	-	
Goose River	8.3 / 7.9	ClPh	17.2	57.0	SFO[b]	0.88	7.2[d]	DFOP[c]	19.7	SFO[c]	Xu, 2012
		Ph	17.4	57.8	SFO[b]	0.97	6.7	SFO[c]	19.9	SFO[c]	
Lawrence Pond	7.8 / 7.4	ClPh	18.6	62.0	SFO[b]	0.98	8.4	SFO[c]	9.9	SFO[c]	
		Ph	15.3	50.9	SFO[b]	1.0	8.3	SFO[c]	7.7	SFO[c]	
Rhine River	8.0 / 7.4[e]	ClPh & Ph	13.5	44.7	SFO[c]	na	9.0	SFO[c]	17.7[h]	SFO[c]	Mamouni, 2008
Fröschweiher Pond	7.8 / 7.2[e]	ClPh & Ph	15.6	51.9	SFO[c]	na	10.2	SFO[c]	16.6[h]	SFO[c]	
Geometric mean (n = 8)[f]			**18.1**	**60.0**		**-**	**11.6**		**14.0**		
Arithmetic mean (n = 6)[g]			**-**	**-**		**0.98**	**-**		**-**		

nr denotes no reliable fit
(a) Measure in $CaCl_2$
(b) $P_{SFO} \rightarrow M_{SFO}$ pathway fit
(c) Decline fit
(d) DFOP *DT90* / 3.32
(e) Matrix not specified
(f) Labels in Xu (2012) averaged (geometric mean) before averaging different water/sediment systems
(g) Labels in Xu (2012) averaged (arithmetic mean) before averaging different water/sediment systems
(h) Geometric mean of individual decline fits for both replicates

Table B.8.2.2-3: Summary on degradation and dissipation of HOPP-acid (AE F096918) in the total water/sediment system as well as in the water and sediment phase (aerobic, 20 °C) - trigger & modelling endpoints

Water / sediment system	*p*H wat. / sed.[a]	Label	*DegT50* system (d)	*DegT90* system (d)	Kinetic model	*DissT50* water (d)	Kinetic model	*DissT50* sed. (d)	Kinetic model	Reference
Clayton Pond	6.6 / 5.8	Ph	9.8	32.6	SFO[b]	9.9	SFO[b]	nr	na	Fitzmaurice, 2004
Roding River	8.0 / 7.7	Ph	No reliable fit (data scatter)							

(a) Measure in $CaCl_2$
(b) Decline fit

B.8.2.3. Irradiation studies

Studies on degradation in irradiated water/sediment systems with the formulation were not performed. Water/sediment studies under influence of a light/dark regime may additionally be submitted as a higher tier option, however, the studies submitted are considered sufficient to meet the current data requirements.

B.8.2.4. Estimation of concentrations in groundwater

B.8.2.4.1. Calculation of concentrations in groundwater

Reference:	**Fenoxaprop-P-ethyl (FPP) and metabolites: PECgw FOCUS: PEARL, PELMO, MACRO EUR - Use in winter and spring cereals in Europe**
Author(s), year:	Oberdoerster, C., Heruth, D. (2016b)
Report/Doc. Number:	EnSa-16-0143, M-554299-01-1
Guideline(s):	FOCUS, 2000: FOCUS groundwater scenarios in the EU pesticide registration process. Report of the FOCUS Ground Water Scenarios Workshop. EC Document Reference: Sanco/321/2000 rev. 2, 202 pp FOCUS, 2009: 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 1, 604 pp FOCUS, 2014a: Generic Guidance for Tier 1 FOCUS Groundwater Assessments, Version 2.2 FOCUS, 2014b: Assessing Potential for Movement of Active Substances and their Metabolites to Ground Water in the EU: The Final Report of the Ground Water Work Group of FOCUS. EC Document Reference: Sanco/13144/2010 version 3, 613 pp
GLP:	Not applicable
Deviations:	Not applicable
Validity:	Partly
Status:	**New submission**

Methods and Materials:

Predicted environmental concentrations of the active substance fenoxaprop-P-ethyl (AE F046360) and its major soil degradation products in groundwater recharge (PEC_{gw}) were calculated for the use in Europe, using the simulation models FOCUS PEARL 4.4.4, FOCUS PELMO 5.5.3 and FOCUS MACRO 5.5.4. PEC_{gw} were evaluated as the 80th percentile of the mean annual leachate concentration at 1 m soil depth. Model parameters and scenarios consisting of weather, soil, and crop data were used as proposed by FOCUS (2009, 2014).

Typically, a leaching assessment is carried out considering aerobic conditions as a common agricultural situation. Therefore, observed major aerobic metabolites were taken into account, implementing their amounts and behaviour as observed under aerobic conditions.

However, in anaerobic soil, a further fast degrading major metabolite, HOPP-acid (AE F096918), was identified (74.1 %, day 120, soil Speyer 2.2), which did not occur under aerobic conditions. Based on these observations, a conservative anaerobic leaching assessment was carried out for this metabolite. The aerobic degradation behaviour of this metabolite was studied separately in two laboratory studies (Fitzmaurice, 2010; Stroech & Junge, 2014). The anaerobic metabolite is assumed to be applied directly to the soil by pseudo application. Hence, no "pathway"-calculation was done in which the parent is applied. This is considered the only plausible but conservative way to account for the anaerobic formation (expressed by the maximum occurrence) and the aerobic degradation of the anaerobic metabolite. Applying the aerobic pathway for groundwater calculations may disregard the formation under anaerobic conditions. The pseudo-application rate (A_{Met}) is calculated by multiplying the application amount of the parent (A_{Parent}) after 1 day degradation with a parent *DT50* of 0.34 d.

$$A_{Met} = A_{Parent} \cdot \exp\left(-\frac{\ln 2}{DT_{50,parent}} \cdot t\right) \cdot f_{max\,occ} \cdot f_{mol}$$

A_{Met}	pseudo application rate of metabolite
A_{Parent}	application rate of parent
$DT_{50,parent}$	degradation half-life = 0.34 d
t	time = 1 d
f_{maxocc}	correction factor for maximum occurrence = 0.741
f_{mol}	correction factor for molar correction = 0.5036

The use of fenoxaprop-P-ethyl (AE F046360) in cereals was assessed according to Good Agricultural Practice (GAP) under European cropping conditions. Detailed application data used for simulation of PEC_{gw} were compiled in the following table.

Table B.8.2.4.1-1 Application pattern used for PEC_{gw} calculations of fenoxaprop-P-ethyl (AE F046360)

Individual crop	FOCUS crop used for interception	Application				Amount reaching the soil per application (g a.s./ha)
		Rate per season (g a.s./ha)	Interval (days)	Plant interception (%)	BBCH stage (-)	
Winter cereals (autumn)	Winter cereals	1 × 83	-	0	11 - 39	1 × 83
Winter cereals (spring)	Winter cereals	1 × 83	-	0	11 - 39	1 × 83
Spring cereals	Spring cereals	1 × 83	-	0	11 - 39	1 × 83

For the anaerobic metabolite HOPP-acid (AE F096918) the pseudo application rates which were taken into account are summarised below.

Table B.8.2.4.1-2 Pseudo application amount for anaerobic metabolite HOPP-acid (AE F096918)

Individual crop	FOCUS crop used for interception	Application				Amount reaching the soil per application (g a.s./ha)
		Rate per season (g a.s./ha)	Interval (days)	Plant interception (%)	HOPP-acid (AE F096918) pseudo application (g a.s./ha)	
Winter cereals (autumn)	Winter cereals	1 × 83	-	0	4.033	1 × 4.033
Winter cereals (spring)	Winter cereals	1 × 83	-	0	4.033	1 × 4.033
Spring cereals	Spring cereals	1 × 83	-	0	4.033	1 × 4.033

Input parameters for fenoxaprop-P-ethyl (AE F046360) and its metabolites were used as summarised in the table below.

Table B.8.2.4.1-3 Compound input parameters for fenoxaprop-P-ethyl (AE F046360) and its metabolites

Parameter	Unit	Fenoxaprop-P-ethyl (AE F046360)	Fenoxaprop-P-acid (AE F088406)	Chlorobenz-oxazolone (AE F054014)	HOPP-acid (AE F096918) (anaerobic)
Common parameters					
Molar mass	(g/mol)	361.8	333.7	169.6	182.2
Water solubility (20 °C)	(mg/L)	0.42	55400	248	135000
Vapour pressure (20 °C)	(Pa)	6.50E-06	1.00E-10	1.00E-10	1.00E-10
Freundlich exponent	(-)	0.900	0.842	0.887	0.900
Plant uptake factor	(-)	0.0	0.0	0.0	0.0
Walker exponent	(-)	0.7	0.7	0.7	0.7
PEARL parameters					
Substance code	(-)	FPP	M03	M02	M04
DT50	(days)	0.34	5.7	13.7	0.1
Molar activ. energy	(kJ/mol)	65.4	65.4	65.4	65.4
K_{om}	(mL/g)	5478.6	145.5	191.8	0.0
K_f	(mL/g)	-	-	-	-
PELMO parameters					
Substance code	(-)	AS[(a)]	A1	A2	AS[(b)]
Rate constant	(1/day)	2.03867	0.12161	0.05060	6.93147
Q_{10}	(-)	2.58	2.58	2.58	2.58
K_{oc}	(mL/g)	9445.1	250.8	330.7	0.0
MACRO parameters					
Substance code	(-)	FPP	M03	M02	M04
Exponent moisture	(-)	0.49	0.49	0.49	0.49
Exponent temperature	(1/K)	0.0948	0.0948	0.0948	0.0948

(a) Pathway 1
(b) Pathway 2; calculated as parent (pseudo application)

Table B.8.2.4.1-4 Degradation pathway related parameters for fenoxaprop-P-ethyl and its metabolites

Degradation fraction from → to (-) (FOCUS PEARL)	FPP → M03: 0.86 M03 → M02: 1
Degradation rate from → to (1/day) (FOCUS PELMO)[(a)]	pathway 1: Active Substance → A1: 1.7532550 Active Substance → BR/CO2: 0.2854140 A1 → A2: 0.1216050 A2 → BR/CO2: 0.0505950 pathway 2: Active Substance → BR/CO2: 6.9314720
Conversion factor from → to (-) (FOCUS MACRO)[(b)]	FPP → M03: 0.79321 M03 → M02: 0.50824 FPP → M02 (= (FPP → M03) × (M03 → M02)): 0.40314

(a) Calculated as *ln(2) / DT50 × formation fraction*
(b) Calculated as *molar mass / molar mass predecessor × formation fraction*

Application dates for the simulation runs were defined following the crop event dates of the respective crop and scenario as given by FOCUS (2009). Crop interception was taken into account according to the BBCH growth stage, as recommended by FOCUS (2014).

Table B.8.2.4.1-5 First application dates and related information for fenoxaprop-P-ethyl (AE F046360) as used for the simulation runs; offset is relevant only for relative application dates, two sets of data are provided for crops with two seasons

Individual crop	Winter cereals (autumn)	Winter cereals (spring)	Spring cereals
Repeat interval for app. events	Every Year	Every Year	Every Year
Application technique	Spray	Spray	Spray
Absolute / Relative to	Emergence	Absolute	Emergence
Scenario	1st app. date (Julian day) Offset	1st app. date (Julian day) Offset	1st app. date (Julian day) Offset
Chateaudun	27 Oct (300) 1	24 Feb (55) -	11 Mar (70) 1
Hamburg	02 Nov (306) 1	24 Feb (55) -	02 Apr (92) 1
Jokioinen	21 Sep (264) 1	04 May (124) -	19 May (139) 1
Kremsmuenster	06 Nov (310) 1	24 Feb (55) -	02 Apr (92) 1
Okehampton	18 Oct (291) 1	01 Mar (60) -	02 Apr (92) 1
Piacenza	02 Dec (336) 1	06 Mar (65) -	- - -
Porto	01 Dec (335) 1	14 Feb (45) -	11 Mar (70) 1
Sevilla	01 Dec (335) 1	15 Feb (46) -	- - -
Thiva	01 Dec (335) 1	15 Feb (46) -	- - -

Findings:

PEC_{gw} were evaluated as the 80th percentile of the mean annual leachate at 1 m soil depth PEC_{gw} values for fenoxaprop-P-ethyl (AE F046360) and its metabolite are given in the following tables.

Table B.8.2.4.1-6 FOCUS PEARL, PELMO and MACRO PECgw results of fenoxaprop-P-ethyl (AE F046360) and its metabolites in µg/L (winter cereals, autumn), 1 × 83 g a.s./ha, 0 % interception)

Crop	Scenario	80th percentile PECgw at 1 m soil depth (µg/L)							
		Fenoxaprop-P-ethyl (AE F046360)		Fenoxaprop-P-acid (AE F088406)		Chlorobenz-oxazolone (AE F054014)		HOPP-acid (AE F040356) (anaerobic)	
		PEARL	PELMO	PEARL	PELMO	PEARL	PELMO	PEARL	PELMO
Winter cereals (autumn)	Chateaudun	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	Hamburg	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	Jokioinen	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	Kremsmuenster	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	Okehampton	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	Piacenza	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	Porto	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	Sevilla	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	Thiva	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
		MACRO		MACRO		MACRO		MACRO	
Winter cereals (autumn)	Chateaudun	< 0.001		< 0.001		< 0.001		< 0.001	

Table B.8.2.4.1-7 FOCUS PEARL, PELMO and MACRO PECgw results of fenoxaprop-P-ethyl (AE F046360) and its metabolites in µg/L (winter cereals, spring), 1 × 83 g a.s./ha, 0 % interception)

Crop	Scenario	80th percentile PECgw at 1 m soil depth (µg/L)							
		Fenoxaprop-P-ethyl (AE F046360)		Fenoxaprop-P-acid (AE F088406)		Chlorobenz-oxazolone (AE F054014)		HOPP-acid (AE F040356) (anaerobic)	
		PEARL	PELMO	PEARL	PELMO	PEARL	PELMO	PEARL	PELMO
Winter cereals (spring)	Chateaudun	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	Hamburg	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	Jokioinen	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	Kremsmuenster	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	Okehampton	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	Piacenza	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	Porto	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	Sevilla	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	Thiva	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
		MACRO		MACRO		MACRO		MACRO	
Winter cereals (spring)	Chateaudun	< 0.001		< 0.001		< 0.001		< 0.001	

Table B.8.2.4.1-8 FOCUS PEARL, PELMO and MACRO PECgw results of fenoxaprop-P-ethyl (AE F046360) and its metabolites in µg/L (spring cereals), 1 × 83 g a.s./ha, 0 % interception)

Crop	Scenario	80th percentile PECgw at 1 m soil depth (µg/L)							
		Fenoxaprop-P-ethyl (AE F046360)		Fenoxaprop-P-acid (AE F088406)		Chlorobenz-oxazolone (AE F054014)		HOPP-acid (AE F040356) (anaerobic)	
		PEARL	PELMO	PEARL	PELMO	PEARL	PELMO	PEARL	PELMO
Spring cereals	Chateaudun	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	Hamburg	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	Jokioinen	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	Kremsmuenster	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	Okehampton	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	Porto	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
		MACRO		MACRO		MACRO		MACRO	
Spring cereals	Chateaudun	< 0.001		< 0.001		< 0.001		< 0.001	

Conclusion:

There are no concerns for groundwater from the active substance fenoxaprop-P-ethyl (AE F046360) and its metabolites in accordance with the use pattern for the current formulation.

Comments (RMS AT):

- The RMS AT proposes deviating substance properties to be used for the groundwater exposure assessment:
  - Fenoxaprop-P-acid (AE F088406) is likely to show *p*H dependent degradation in soil with faster degradation under more acidic soil conditions (also refer to Vol. 3CA). However, degradation rates are only available for acidic and neutral soils. Unless data are available on alkaline soils as well, the RMS AT recommends applying the worst case *DegT50* of 15.3 days from acidic and neutral soils for conservative reasons.
  - In view of insufficient test item mass balance in soil sorption batch experiments due to significant formation of non-extractable residues, the RMS AT considers results on Freundlich isotherms (K_{foc}, 1/*n*), obtained by the *indirect* method, non-reliable. Instead, sorption coefficients (K_{oc}) on basis of extractable amounts in soil (excluding NER), observed in preliminary and screening experiments applying the *direct* method, have been calculated by the RMS AT. As these results are based on one test concentration only, linear sorption (1/*n* = 1.0) is assumed.
  - In view of fenoxaprop-P-acid (AE F088406), being an organic acid, *p*H-dependent sorption may *a priori* be expected (depending on the protonation status). For reasons of conservativeness, the RMS AT therefore recommends omitting sorption results of two rather acidic soils for calculating the average K_{oc} of fenoxaprop-P-acid (AE F088406) to be used in the exposure assessment.

- The RMS AT agreed substance properties are given in the table below. Based on these data the RMS AT recalculated PEC_{GW} values taking into account the application scheme proposed by the applicant, applying PEARL 4.4.4 and PELMO 5.5.3. In view of PEC_{GW} results << 0.1 µg/L obtained with PEARL 4.4.4 and PELMO 5.5.3, the applicant's results obtained with MACRO 5.5.4 have not been recalculated by the RMS AT.

- Note that PEC_{GW} values for the extremely fast degrading metabolite HOPP-acid (AE F096918) (following pseudo application) were not re-calculated by the RMS-AT at all.

Table B.8.2.4.1-9: Substance properties of fenoxaprop-P-ethyl (AE F046360) and its metabolites for PEC_{GW} calculation - RMS AT assessment

Parameter	Fenoxaprop-P-ethyl (AE F046360)	Fenoxaprop-P-acid (AE F088406)	Chlorobenzoxazolone (AE F054014)	HOPP acid (AE F096918)

Mol weight (g/mol)	361.8	333.7	169.6	182.2
Vapour pressure (Pa)	6.5×10^{-6} (20 °C)	0.0[(a)]	0.0[(a)]	0.0[(a)]
Water solubility (mg/L)	0.42 (20 °C)	55400 (20 °C)	248 (20 °C)	135000
K_{oc} / K_{om} (L/kg)	11322 / 6567	192 / 111	358 / 208	0.0[(a)]
1/n (-)	1.0[(b)]	1.0[(b)]	1.0[(b)]	1.0[(b)]
DegT50 (d)	0.36	15.2[(c)]	13.7	0.01
Plant uptake	0.0	0.0	0.0	0.0
Formation fraction	na	0.85[(d)]	1.0[(e)]	na

na denotes not applicable
(a) No data, default value
(b) Linear sorption assumed, default value
(c) Worst case from acidic and neutral soils (no data available on alkaline soils)
(d) From parent
(e) From fenoxaprop-P-acid (AE F088406), no data, default value

Table B.8.2.4.1-10: Predicted 80th percentile concentrations of fenoxaprop-P-ethyl (AE F046360), fenoxaprop-P-acid (AE F088406), chlorobenzoxazolone (AE F054014) and HOPP-acid (AE F096918) in shallow groundwater (PEC_{GW}) following application of fenoxaprop-P-ethyl (AE F046360) to winter and spring cereals (PEARL 4.4.4) - RMS AT assessment

Use	Scenario	Fenoxaprop-P-ethyl (AE F046360)	Fenoxaprop-P-acid (AE F088406)	Chlorobenz-oxazolone (AE F054014)	HOPP-acid (AE F096918)
Winter cereals (autumn application)	Châteaudun	< 0.001	< 0.001	< 0.001	Not re-calculated by RMS AT
	Hamburg	< 0.001	0.002	0.001	
	Jokioinen	< 0.001	< 0.001	< 0.001	
	Kremsmünster	< 0.001	< 0.001	< 0.001	
	Okehampton	< 0.001	0.003	0.001	
	Piacenza	< 0.001	0.001	0.001	
	Porto	< 0.001	0.001	< 0.001	
	Sevilla	< 0.001	< 0.001	< 0.001	
	Thiva	< 0.001	< 0.001	< 0.001	
Winter cereals (spring application)	Châteaudun	< 0.001	< 0.001	< 0.001	Not re-calculated by RMS AT
	Hamburg	< 0.001	< 0.001	< 0.001	
	Jokioinen	< 0.001	< 0.001	< 0.001	
	Kremsmünster	< 0.001	< 0.001	< 0.001	
	Okehampton	< 0.001	0.001	< 0.001	
	Piacenza	< 0.001	< 0.001	< 0.001	
	Porto	< 0.001	< 0.001	< 0.001	
	Sevilla	< 0.001	< 0.001	< 0.001	
	Thiva	< 0.001	< 0.001	< 0.001	
Spring cereals (spring application)	Châteaudun	< 0.001	< 0.001	< 0.001	Not re-calculated by RMS AT
	Hamburg	< 0.001	< 0.001	< 0.001	
	Jokioinen	< 0.001	< 0.001	< 0.001	
	Kremsmünster	< 0.001	< 0.001	< 0.001	
	Okehampton	< 0.001	< 0.001	< 0.001	
	Porto	< 0.001	< 0.001	< 0.001	

Table B.8.2.4.1-11: Predicted 80th percentile concentrations of fenoxaprop-P-ethyl (AE F046360), fenoxaprop-P-acid (AE F088406), chlorobenzoxazolone (AE F054014) and HOPP-acid (AE F096918) in shallow groundwater (PEC_{GW}) following application of fenoxaprop-P-ethyl (AE F046360) to winter and spring cereals (PELMO 5.5.3) - RMS AT assessment

Use	Scenario	Fenoxaprop-P-ethyl (AE F046360)	Fenoxaprop-P-acid (AE F088406)	Chlorobenz-oxazolone (AE F054014)	HOPP-acid (AE F096918)
Winter cereals (autumn application)	Châteaudun	< 0.001	< 0.001	< 0.001	Not re-calculated by RMS AT
	Hamburg	< 0.001	0.003	0.001	
	Jokioinen	< 0.001	< 0.001	< 0.001	
	Kremsmünster	< 0.001	0.001	< 0.001	
	Okehampton	< 0.001	0.004	0.002	

	Piacenza	< 0.001	0.002	0.001	
	Porto	< 0.001	0.004	0.001	
	Sevilla	< 0.001	< 0.001	< 0.001	
	Thiva	< 0.001	< 0.001	< 0.001	
Winter cereals (spring application)	Châteaudun	< 0.001	< 0.001	< 0.001	Not re-calculated by RMS AT
	Hamburg	< 0.001	< 0.001	< 0.001	
	Jokioinen	< 0.001	< 0.001	< 0.001	
	Kremsmünster	< 0.001	< 0.001	< 0.001	
	Okehampton	< 0.001	0.001	< 0.001	
	Piacenza	< 0.001	< 0.001	< 0.001	
	Porto	< 0.001	< 0.001	< 0.001	
	Sevilla	< 0.001	< 0.001	< 0.001	
	Thiva	< 0.001	< 0.001	< 0.001	
Spring cereals (spring application)	Châteaudun	< 0.001	< 0.001	< 0.001	Not re-calculated by RMS AT
	Hamburg	< 0.001	< 0.001	< 0.001	
	Jokioinen	< 0.001	< 0.001	< 0.001	
	Kremsmünster	< 0.001	< 0.001	< 0.001	
	Okehampton	< 0.001	< 0.001	< 0.001	
	Porto	< 0.001	< 0.001	< 0.001	

- In order to cover the groundwater exposure assessment for the anaerobic soil metabolite HOPP-acid (AE F096918), the applicant suggested the following two scenarios with anaerobic conditions likely to occur:

  - Not more than 10 % area of an agricultural field becomes anaerobic, every year shortly after application (→ PEC_{GW} divided by 10).
  - Calculation base for dimension of levees, dykes and flood plains along rivers are 100-year-floodings. Hence, ponding on larger areas can be assumed to occur in average every 100 years (→ application of the anaerobic metabolite every 10 years).

  Additionally the following assumptions were made by the applicant:

  - Farmer will not apply on saturated and ponded fields. Therefore, it is assumed, that parent compound degrades 1 day under aerobic conditions before anaerobic conditions occur.
  - Anaerobic conditions usually will not last for longer than 1 week. Maximum occurrence of metabolite might not yet be reached at this time.
  - After an anaerobic period, normal aerobic agricultural conditions may dominate in soil again. Thus, aerobic degradation of the anaerobic metabolite is assessed.

  In general, the RMS AT suggests staying with the first scenario mentioned above, as this is the scenario which is most likely to cover large agricultural areas/situations. However, assuming 10 % of the field becoming anaerobic is a rather arbitrary number with no sound scientific background. Nevertheless, the RMS AT supports the assumption that the parent compound degrades at least 1 day under aerobic conditions before anaerobic conditions occur, as well as the fact that after anaerobic periods aerobic soil conditions dominate (thus applying the aerobic degradation rate in the modelling). Finally it may be noted that, thanks to the extremely fast degradation of HOPP-acid (AE F096918) under aerobic conditions, division of the PEC_{gw} after modelling by 10 (following scenario 1) is not necessary at all.

B.8.2.4.2. Additional field tests

None

B.8.2.5. Estimation of concentrations in surface water and sediment

Reference:	**Fenoxaprop-P-ethyl (FPP) and metabolites: PECsw,sed FOCUS EUR - Use in winter and spring cereals in Europe**
Author(s), year:	Oberdoerster, C., Heruth, D. (2016c)
Report/Doc. Number:	EnSa-16-0144, M-555311-01-1
Guideline(s):	FOCUS, 2001: FOCUS Surface Water Scenarios in the EU Evaluation Process under 91/414/EC. Report of the FOCUS Working Group on Surface Water Scenarios. EC Document Reference SANCO/4802/2001-rev2. 245 pp FOCUS, 2015: Generic guidance for FOCUS surface water Scenarios, version 1.4, May 2015. EU Document, 367 pp
GLP:	Not applicable
Deviations:	Not applicable
Validity:	Partly
Status:	**Submitted for renewal**

Methods and Materials:

Predicted environmental concentrations of the active substance fenoxaprop-P-ethyl (AE F046360) and its phenol metabolite (AE F040356), chlorobenzoxazolone (AE F054014), fenoxaprop-P-acid (AE F088406), HOPP-acid (AE F096918), fenoxaprop-deschloro-hydroxy (BCS-CY11271) and hydroxybenzoxazolone (AE 0316854) in surface water (PEC_{sw}) and sediment (PEC_{sed}) were calculated for the use in Europe, employing the tiered FOCUS Surface Water (SW) approach (FOCUS 2003). All relevant entry routes of a compound into surface water (principally a combination of spray drift and runoff/erosion or drain flow) were considered in these calculations.

The use of fenoxaprop-P-ethyl (AE F046360) in cereals was assessed according to the Good Agricultural Practice (GAP) in Europe. Detailed application parameters are presented in the table below.

Table B.8.2.5-1 General and FOCUS-specific data on the use pattern of fenoxaprop-P-ethyl (AE F046360) in Europe (for FOCUS Step 1 & 2)

Crop	BBCH stage	Interval (days)	Rate (g a.s./ha)	FOCUS crop (crop group)	Season	Crop cover (crop interception)
Spring and winter cereals	11-39	-	1 × 83	Cereals, winter	Autumn (Oct. - Feb.)	Minimum crop cover (0 %)
			1 × 83	Cereals, winter	Spring (Mar. - May)	Minimum crop cover (0 %)
			1 × 83	Cereals, spring	Spring (Mar. - May)	Minimum crop cover (0 %)

Substance input parameter are summarized in the following table.

Table B.8.2.5-2 Substance parameters used for fenoxaprop-P-ethyl (AE F046360) and its metabolites at Steps 1-2 level

Parameter	Unit	Fenoxaprop-P-ethyl (AE F046360)	Phenol metabolite (AE F040356)	Chlorobenz-oxazolone (AE F054014)	Fenoxaprop-P-acid (AE F088406)	HOPP-acid (AE F096918)
Molar mass	(g/mol)	361.8	261.7	169.6	333.7	182.2
Water solubility	(mg/L)	0.42	2	248	55400	135000
K_{oc}	(mL/g)	9445.1	1E-10	330.7	250.8	1E-10
Degradation (*DT50*)						
Soil	(days)	0.34	1000	13.7	5.7	0.01
Total system	(days)	0.16	1000	1000	18	62.1
Water	(days)	0.16	1000	1000	18	62.1
Sediment	(days)	0.16	1000	1000	18	62.1
Max occurrence						
Water/sediment	(%)	100	13.1	36.8	99.7	26.3
Soil	(%)	100	1E-10	19.1	87.2	74.1

Table B.8.2.5-3 Substance parameters used for fenoxaprop-P-ethyl and its metabolites at Steps 1-2 level (*continued*)

Parameter	Unit	Fenoxaprop-P-deschloro-hydroxy (BCS-CY11271)	Hydroxybenzoxazolone (AE 0316854)
Molar mass	(g/mol)	315.3	151.1
Water solubility	(mg/L)	14	150
K_{oc}	(mL/g)	1E-10	1E-10
Degradation (*DT50*)			
Soil	(days)	1000	1000
Total system	(days)	1000	1000
Water	(days)	1000	1000
Sediment	(days)	1000	1000
Max occurrence			
Water/sediment	(%)	17.7	22.9
Soil	(%)	1E-10	1E-10

Findings:

FOCUS Step 1 and 2: The maximum PEC_{sw} and PEC_{sed} values for FOCUS Step 1 and 2 are given in the tables below for fenoxaprop-P-ethyl and its metabolites.

Table B.8.2.5-4 FOCUS Step 1-2 results for fenoxaprop-P-ethyl (AE F046360), winter cereals (autumn)

Scenario FOCUS	Waterbody	Max PEC_{sw} (µg/L)*		Dominant entry route	7 d-$PEC_{sw,twa}$ (µg/L)**	21 d-$PEC_{sw,twa}$ (µg/L)**	Max PEC_{sed} (µg/kg)*	
Step 1	-	2.7986	-	RunOff/Drain.	0.2028	0.0676	192.24	-
Step 2								
N-Europe	Oct. - Feb.	0.7633	*	Spraydrift	0.0551	0.0184	0.0465	*
S-Europe	(Autumn)	0.7633	*	Spraydrift	0.0551	0.0184	0.0465	*

* Single applications marked
** TWA-interval as required by ecotox

Table B.8.2.5-5 FOCUS Step 1-2 results for fenoxaprop-P-ethyl (AE F046360), winter cereals (spring)

Scenario FOCUS	Waterbody	Max PEC_{sw} (µg/L)*		Dominant entry route	7 d- $PEC_{sw,twa}$ (µg/L)**	21 d- $PEC_{sw,twa}$ (µg/L)**	Max PEC_{sed} (µg/kg)*	
Step 1	-	2.7986	-	RunOff/Drain.	0.2028	0.0676	192.24	-
Step 2								
N-Europe	Mar. - May	0.7633	*	Spraydrift	0.0551	0.0184	0.0465	*
S-Europe	(Spring)	0.7633	*	Spraydrift	0.0551	0.0184	0.0465	*

* Single applications marked
** TWA-interval as required by ecotox

Table B.8.2.5-6 FOCUS Step 1-2 results for fenoxaprop-P-ethyl (AE F046360), spring cereals

Scenario FOCUS	Waterbody	Max PEC_{sw} (µg/L)*		Dominant entry route	7 d-$PEC_{sw,twa}$ (µg/L)**	21 d-$PEC_{sw,twa}$ (µg/L)**	Max PEC_{sed} (µg/kg)*	
Step 1	-	2.7986	-	RunOff/Drain.	0.2028	0.0676	192.24	-
Step 2								
N-Europe	Mar. - May	0.7633	*	Spraydrift	0.0551	0.0184	0.0465	*
S-Europe	(Spring)	0.7633	*	Spraydrift	0.0551	0.0184	0.0465	*

* Single applications marked
** TWA-interval as required by ecotox

Table B.8.2.5-7 FOCUS Step 1-2 results for the phenol metabolite (AE F040356), winter cereals (autumn)

Scenario FOCUS	Waterbody	Max PEC_{sw} (µg/L)*		Dominant entry route	7 d-$PEC_{sw,twa}$ (µg/L)**	21 d-$PEC_{sw,twa}$ (µg/L)**	Max PEC_{sed} (µg/kg)*	
Step 1	-	2.6939	-	RunOff/Drain.	2.6874	2.6744	< 0.001	-

Step 2								
N-Europe	Oct. - Feb.	0.0725	*	Spraydrift	0.0723	0.0720	< 0.0001	*
S-Europe	(Autumn)	0.0724	*	Spraydrift	0.0723	0.0719	< 0.0001	*

* Single applications marked
** TWA-interval as required by ecotox

Table B.8.2.5-8 FOCUS Step 1-2 results for the phenol metabolite (AE F040356), winter cereals (spring)

Scenario FOCUS	Waterbody	Max PEC_{sw} (µg/L)*		Dominant entry route	7 d-$PEC_{sw,twa}$ (µg/L)**	21 d-$PEC_{sw,twa}$ (µg/L)**	Max PEC_{sed} (µg/kg)*	
Step 1	-	2.6939	-	RunOff/Drain.	2.6874	2.6744	< 0.001	-
Step 2								
N-Europe	Mar. - May	0.0723	*	Spraydrift	0.0722	0.0719	< 0.0001	*
S-Europe	(Spring)	0.0724	*	Spraydrift	0.0723	0.0719	< 0.0001	*

* Single applications marked
** TWA-interval as required by ecotox

Table B.8.2.5-9 FOCUS Step 1-2 results for the phenol metabolite (AE F040356), spring cereals

Scenario FOCUS	Waterbody	Max PEC_{sw} (µg/L)*		Dominant entry route	7 d-$PEC_{sw,twa}$ (µg/L)**	21 d-$PEC_{sw,twa}$ (µg/L)**	Max PEC_{sed} (µg/kg)*	
Step 1	-	2.6939	-	RunOff/Drain.	2.6874	2.6744	< 0.001	-
Step 2								
N-Europe	Mar. - May	0.0723	*	Spraydrift	0.0722	0.0719	< 0.0001	*
S-Europe	(Spring)	0.0724	*	Spraydrift	0.0723	0.0719	< 0.0001	*

* Single applications marked
** TWA-interval as required by ecotox

Table B.8.2.5-10 FOCUS Step 1-2 results for chlorobenzoxazolone (AE F054014), winter cereals (autumn)

Scenario FOCUS	Waterbody	Max PEC_{sw} (µg/L)*		Dominant entry route	7 d-$PEC_{sw,twa}$ (µg/L)**	21 d-$PEC_{sw,twa}$ (µg/L)**	Max PEC_{sed} (µg/kg)*	
Step 1	-	5.1630	-	RunOff/Drain.	5.1132	5.0866	16.929	-
Step 2								
N-Europe	Oct. - Feb.	0.8040	*	RunOff/Drain.	0.7925	0.7882	2.6229	*
S-Europe	(Autumn)	0.6635	*	RunOff/Drain.	0.6523	0.6487	2.1585	*

* Single applications marked
** TWA-interval as required by ecotox

Table B.8.2.5-11 FOCUS Step 1-2 results for chlorobenzoxazolone (AE F054014), winter cereals (spring)

Scenario FOCUS	Waterbody	Max PEC_{sw} (µg/L)*		Dominant entry route	7 d-$PEC_{sw,twa}$ (µg/L)**	21 d-$PEC_{sw,twa}$ (µg/L)**	Max PEC_{sed} (µg/kg)*	
Step 1	-	5.1630	-	RunOff/Drain.	5.1132	5.0866	16.929	-
Step 2								
N-Europe	Mar. - May	0.3825	*	RunOff/Drain.	0.3720	0.3697	1.2298	*
S-Europe	(Spring)	0.6635	*	RunOff/Drain.	0.6523	0.6487	2.1585	*

* Single applications marked
** TWA-interval as required by ecotox

Table B.8.2.5-12 FOCUS Step 1-2 results for chlorobenzoxazolone (AE F054014), spring cereals

Scenario FOCUS	Waterbody	Max PEC_{sw} (µg/L)*		Dominant entry route	7 d-$PEC_{sw,twa}$ (µg/L)**	21 d-$PEC_{sw,twa}$ (µg/L)**	Max PEC_{sed} (µg/kg)*	
Step 1	-	5.1630	-	RunOff/Drain.	5.1132	5.0866	16.929	-
Step 2								
N-Europe	Mar. - May	0.3825	*	RunOff/Drain.	0.3720	0.3697	1.2298	*
S-Europe	(Spring)	0.6635	*	RunOff/Drain.	0.6523	0.6487	2.1585	*

* Single applications marked
** TWA-interval as required by ecotox

Table B.8.2.5-13 FOCUS Step 1-2 results for fenoxaprop-P-acid (AE F088406), winter cereals (autumn)

Scenario FOCUS	Waterbody	Max PEC_{sw} (µg/L)*		Dominant entry route	7 d-$PEC_{sw,twa}$ (µg/L)**	21 d-$PEC_{sw,twa}$ (µg/L)**	Max PEC_{sed} (µg/kg)*	
Step 1	-	36.443	-	RunOff/Drain.	31.803	24.875	89.639	-
Step 2								
N-Europe	Oct. - Feb.	5.6210	*	RunOff/Drain.	4.8946	3.8279	13.686	*
S-Europe	(Autumn)	4.5952	*	RunOff/Drain.	3.9953	3.1244	11.113	*

* Single applications marked
** TWA-interval as required by ecotox

Table B.8.2.5-14 FOCUS Step 1-2 results for fenoxaprop-P-acid (AE F088406), winter cereals (spring)

Scenario FOCUS	Waterbody	Max PEC_{sw} (µg/L)*		Dominant entry route	7 d-$PEC_{sw,twa}$ (µg/L)**	21 d-$PEC_{sw,twa}$ (µg/L)**	Max PEC_{sed} (µg/kg)*	
Step 1	-	36.443	-	RunOff/Drain.	31.803	24.875	89.639	-
Step 2								
N-Europe	Mar. - May	2.5436	*	RunOff/Drain.	2.1968	1.7173	6.0392	*
S-Europe	(Spring)	4.5952	*	RunOff/Drain.	3.9953	3.1244	11.113	*

* Single applications marked
** TWA-interval as required by ecotox

Table B.8.2.5-15 FOCUS Step 1-2 results for fenoxaprop-P-acid (AE F088406), spring cereals

Scenario FOCUS	Waterbody	Max PEC_{sw} (µg/L)*		Dominant entry route	7 d-$PEC_{sw,twa}$ (µg/L)**	21 d-$PEC_{sw,twa}$ (µg/L)**	Max PEC_{sed} (µg/kg)*	
Step 1	-	36.443	-	RunOff/Drain.	31.803	24.875	89.639	-
Step 2								
N-Europe	Mar. - May	2.5436	*	RunOff/Drain.	2.1968	1.7173	6.0392	*
S-Europe	(Spring)	4.5952	*	RunOff/Drain.	3.9953	3.1244	11.113	*

* Single applications marked
** TWA-interval as required by ecotox

Table B.8.2.5-16 FOCUS Step 1-2 results for HOPP-acid (AE F096918), winter cereals (autumn)

Scenario FOCUS	Waterbody	Max PEC_{sw} (µg/L)*		Dominant entry route	7 d-$PEC_{sw,twa}$ (µg/L)**	21 d-$PEC_{sw,twa}$ (µg/L)**	Max PEC_{sed} (µg/kg)*	
Step 1	-	14.090	-	RunOff/Drain.	13.553	12.560	< 0.001	-
Step 2								
N-Europe	Oct. - Feb.	0.1011	*	Spraydrift	0.0975	0.0905	< 0.0001	*
S-Europe	(Autumn)	0.1011	*	Spraydrift	0.0975	0.0905	< 0.0001	*

* Single applications marked
** TWA-interval as required by ecotox

Table B.8.2.5-17 FOCUS Step 1-2 results for HOPP-acid (AE F096918), winter cereals (spring)

Scenario FOCUS	Waterbody	Max PEC_{sw} (µg/L)*		Dominant entry route	7 d-$PEC_{sw,twa}$ (µg/L)**	21 d-$PEC_{sw,twa}$ (µg/L)**	Max PEC_{sed} (µg/kg)*	
Step 1	-	14.090	-	RunOff/Drain.	13.553	12.560	< 0.001	-
Step 2								
N-Europe	Mar. - May	0.1011	*	Spraydrift	0.0974	0.0903	< 0.0001	*
S-Europe	(Spring)	0.1011	*	Spraydrift	0.0975	0.0905	< 0.0001	*

* Single applications marked
** TWA-interval as required by ecotox

Table B.8.2.5-18 FOCUS Step 1-2 results for HOPP-acid (AE F096918), spring cereals

Scenario FOCUS	Waterbody	Max PEC_{sw} (µg/L)*		Dominant entry route	7 d-$PEC_{sw,twa}$ (µg/L)**	21 d-$PEC_{sw,twa}$ (µg/L)**	Max PEC_{sed} (µg/kg)*	
Step 1	-	14.090	-	RunOff/Drain.	13.553	12.560	< 0.001	-
Step 2								
N-Europe	Mar. - May	0.1011	*	Spraydrift	0.0974	0.0903	< 0.0001	*
S-Europe	(Spring)	0.1011	*	Spraydrift	0.0975	0.0905	< 0.0001	*

* Single applications marked
** TWA-interval as required by ecotox

Table B.8.2.5-19 FOCUS Step 1-2 results for fenoxaprop-deschloro-hydroxy (BCS-CY11271), winter cereals (autumn)

Scenario FOCUS	Waterbody	Max PEC_{sw} (µg/L)*		Dominant entry route	7 d-$PEC_{sw,twa}$ (µg/L)**	21 d-$PEC_{sw,twa}$ (µg/L)**	Max PEC_{sed} (µg/kg)*	
Step 1	-	4.3854	-	RunOff/Drain.	4.3747	4.3536	< 0.001	-
Step 2								
N-Europe	Oct. - Feb.	0.1180	*	Spraydrift	0.1177	0.1172	< 0.0001	*
S-Europe	(Autumn)	0.1179	*	Spraydrift	0.1176	0.1171	< 0.0001	*

* Single applications marked
** TWA-interval as required by ecotox

Table B.8.2.5-20 FOCUS Step 1-2 results for fenoxaprop-deschloro-hydroxy (BCS-CY11271), winter cereals (spring)

Scenario FOCUS	Waterbody	Max PEC_{sw} (µg/L)*		Dominant entry route	7 d-$PEC_{sw,twa}$ (µg/L)**	21 d-$PEC_{sw,twa}$ (µg/L)**	Max PEC_{sed} (µg/kg)*	
Step 1	-	4.3854	-	RunOff/Drain.	4.3747	4.3536	< 0.001	-
Step 2								
N-Europe	Mar. - May	0.1177	*	Spray drift	0.1176	0.1171	< 0.0001	*
S-Europe	(Spring)	0.1179	*	Spray drift	0.1176	0.1171	< 0.0001	*

* Single applications marked
** TWA-interval as required by ecotox

Table B.8.2.5-21 FOCUS Step 1-2 results for fenoxaprop-deschloro-hydroxy (BCS-CY11271), spring cereals

Scenario FOCUS	Waterbody	Max PEC_{sw} (µg/L)*		Dominant entry route	7 d-$PEC_{sw,twa}$ (µg/L)**	21 d-$PEC_{sw,twa}$ (µg/L)**	Max PEC_{sed} (µg/kg)*	
Step 1	-	4.3854	-	RunOff/Drain.	4.3747	4.3536	< 0.001	-
Step 2								
N-Europe	Mar. - May	0.1177	*	Spray drift	0.1176	0.1171	< 0.0001	*
S-Europe	(Spring)	0.1179	*	Spray drift	0.1176	0.1171	< 0.0001	*

* Single applications marked
** TWA-interval as required by ecotox

Table B.8.2.5-22 FOCUS Step 1-2 results for hydroxybenzoxazolone (AE 0136854), winter cereals (autumn)

Scenario FOCUS	Waterbody	Max PEC_{sw} (µg/L)*		Dominant entry route	7 d-$PEC_{sw,twa}$ (µg/L)**	21 d-$PEC_{sw,twa}$ (µg/L)**	Max PEC_{sed} (µg/kg)*	
Step 1	-	2.7190	-	RunOff/Drain.	2.7124	2.6993	< 0.001	-
Step 2								
N-Europe	Oct. - Feb.	0.0732	*	Spray drift	0.0730	0.0727	< 0.0001	*
S-Europe	(Autumn)	0.0731	*	Spray drift	0.0729	0.0726	< 0.0001	*

* Single applications marked
** TWA-interval as required by ecotox

Table B.8.2.5-23 FOCUS Step 1-2 results for hydroxybenzoxazolone (AE 0136854), winter cereals (spring)

Scenario FOCUS	Waterbody	Max PEC_{sw} (µg/L)*		Dominant entry route	7 d-$PEC_{sw,twa}$ (µg/L)**	21 d-$PEC_{sw,twa}$ (µg/L)**	Max PEC_{sed} (µg/kg)*	
Step 1	-	2.7190	-	RunOff/Drain.	2.7124	2.6993	< 0.001	-
Step 2								
N-Europe	Mar. - May	0.0730	*	Spray drift	0.0729	0.0726	< 0.0001	*
S-Europe	(Spring)	0.0731	*	Spray drift	0.0729	0.0726	< 0.0001	*

* Single applications marked
** TWA-interval as required by ecotox

Table B.8.2.5-24 FOCUS Step 1-2 results for hydroxybenzoxazolone (AE 0136854), spring cereals

Scenario FOCUS	Waterbody	Max PEC_{sw} (µg/L)*		Dominant entry route	7 d-$PEC_{sw,twa}$ (µg/L)**	21 d-$PEC_{sw,twa}$ (µg/L)**	Max PEC_{sed} (µg/kg)*	
Step 1	-	2.7190	-	RunOff/Drain.	2.7124	2.6993	< 0.001	-
Step 2								
N-Europe	Mar. - May	0.0730	*	Spray drift	0.0729	0.0726	< 0.0001	*
S-Europe	(Spring)	0.0731	*	Spray drift	0.0729	0.0726	< 0.0001	*

* Single applications marked
** TWA-interval as required by ecotox

Comments RMS AT:

- The RMS AT considers the substance input dataset proposed by the applicant for the aquatic exposure assessment not fully appropriate for the following reasons:
  - The mol mass of fenoxaprop-P-deschloro-hydroxy (BCS-CY11271) was erroneously set 315.3 g/mol instead of 343.3 g/mol
  - In case of fenoxaprop-P-acid (AE F088406) and chlorobenzoxazolone (AE F054014) the maximum occurrence observed in the *aerobic mineralisation in surface water* was used by the applicant for the aquatic exposure assessment, as these values are found to be higher than those observed in the water/sediment studies. However, the RMS AT considers water/sediment studies to overrule aerobic mineralisation in surface water and therefore more appropriate for estimating the maximum occurrence in water/sediment systems for the aquatic exposure assessment.
  - The applicant included hydroxybenzoxazolone (AE 0316854) in the aquatic risk assessment as it is considered to reach 22.9 % AR in the *indirect photochemical degradation* study conducted in surface water (*p*H 9) by Schwab (1993). However, there seems to be a misinterpretation of highly polar residues called 'M2' (relative retention time of 0.06) observed in this study as hydroxybenzoxazolone (AE 0316854) was indeed not identified in this particular experiment. Hydroxybenzoxazolone (AE 0316854) was only identified in the acetate buffer (*p*H 5) experiment (relative retention time of 0.24) with a maximum occurrence of 5.5 % AR, thus not triggering an aquatic exposure assessment in relation to Regulation (EU) No 283/2013.
  - Unless it can be clearly demonstrated that anaerobic conditions in soil are unlikely to occur in case of the proposed GAP, the RMS AT considers that the maximum occurrence of metabolites observed in the *anaerobic* soil degradation studies should be used for the aquatic exposure assessment if they are higher than in the *aerobic* soil degradation studies. This approach was followed by the applicant in case of HOPP-acid (AE F096918) but not in case of fenoxaprop-P-acid (AE F088406) and the phenol metabolite (AE F040356).
  - Maximum occurrence of the phenol metabolite (AE F040356) in (anaerobic) soil is 2.2 % AR (set to 0.0 % by the applicant).

- As there are also some proposed changes with respect to degradation rates in soil and water as well as soil adsorption (see table below), the RMS AT re-calculated $PEC_{sw/sed}$ values with the following revised substance properties dataset.

Table B.8.2.5-25: Revised substance parameter of fenoxaprop-P-ethyl (AE F046360) and its metabolites for FOCUS surface water Step 1 & 2 calculation - RMS AT assessment

Substance property	Fenoxa-prop-P-ethyl (AE F046360)	Fenoxa-prop-P-acid (AE F088406)	Chloro-benz-oxazolone (AE F054014)	HOPP-acid (AE F096918)	Phenol meta-bolite (AE F040356)	Fenoxa-prop-dechloro-hydroxy (BCS-CY11271)	Hydroxy-benz-oxazolone (AE 0316854)
Molecular weight (g/mol)	361.8	333.7	169.6	182.2	261.7	343.3	No aquatic exposure assessment triggered
Water solubility (mg/L) (20 °C)	0.42	55400	248	135000	2	14	
K_{oc} (L/kg)	11322	192[(a)]	358	0 / 1000[(b)]	0 / 1000[(b)]	0 / 1000[(b)]	
Max. in water/sediment (%)	-	97.2	8.5	26.3	13.1	17.7[(c)]	

Max. in soil (%)	-	94.8[d]	19.1	74.1[e]	2.2[f]	1E-10[g]	(refer to text above)
DegT50 soil (days)	0.36	15.2[h]	13.7	0.01	1000[i]	1000[i]	
DegT50 water (days)	0.13	18.1	1000[i]	9.8[j]	1000[i]	1000[i]	
DegT50 sediment (days)	1000	1000	1000[i]	1000	1000[i]	1000[i]	
DegT50 water/sediment (days)	0.13	18.1	1000[i]	9.8[j]	1000[i]	1000[i]	

(a) Conservative assessment taking into account neutral and alkaline soils only (assuming *p*H dependent sorption)
(b) No data available, default worst-case K_{oc} of 0 L/kg for water, K_{oc} of 1000 L/kg for the sediment
(c) Aquatic photolysis
(d) Anaerobic soil (max. 85.8 % AR in aerobic soils)
(e) Racemic mixture (AE F020686) of HOPP-acid (AE F096918) observed after application of racemic fenoxaprop-ethyl (AE F033171); HOPP acid (AE F096918) max. 49.2 % of AR in one study with non-racemic fenoxaprop-P-ethyl (AE F046360) applied
(f) Anaerobic soil (max. 1.4 % AR in aerobic soils)
(g) Not observed (default value)
(h) Worst case from acidic and neutral soils as no data are available for alkaline soils (faster degradation in acidic soils)
(i) No data (default value)
(j) One reliable value available only

Table B.8.2.5-26 FOCUS Step 1-2 results for fenoxaprop-P-ethyl (AE F046360) and its metabolites - RMS AT assessment

Scenario	Substance	STEP 1		STEP 2	
		PEC_{sw} (µg/L)	PEC_{sed} (µg/kg)	PEC_{sw} (µg/L)	PEC_{sed} (µg/kg)
Winter cereals, North-EU, Oct.-Feb.	Fenoxaprop-P-ethyl (AE F046360)	2.48	195	0.76	3.58
	Fenoxaprop-P-acid (AE F088406)	39.7	74.9	8.54	16.32
	Chlorobenzoxazolone (AE F054014)	2.45	8.74	0.71	2.52
	HOPP-acid (AE F096918)	14.1	60.0	0.10	0.37
	Phenol metabolite (AE F040356)	3.13	13.4	0.29	1.25
	Fenoxaprop-P-ethyl-deschloro-hydroxy (BCS-CY11271)	4.77	20.5	0.13	0.55
Winter cereals, South-EU, Oct.-Feb.	Fenoxaprop-P-ethyl (AE F046360)	2.48	195	0.76	3.58
	Fenoxaprop-P-acid (AE F088406)	39.7	74.9	6.93	13.24
	Chlorobenzoxazolone (AE F054014)	2.45	8.74	0.57	2.03
	HOPP-acid (AE F096918)	14.1	60.0	0.10	0.37
	Phenol metabolite (AE F040356)	3.13	13.4	0.25	1.06
	Fenoxaprop-P-ethyl -deschloro-hydroxy (BCS-CY11271)	4.77	20.5	0.13	0.55
Spring & winter cereals, North-EU, March-May.	Fenoxaprop-P-ethyl (AE F046360)	2.48	195	0.76	3.58
	Fenoxaprop-P-acid (AE F088406)	39.7	74.9	3.72	7.08
	Chlorobenzoxazolone (AE F054014)	2.45	8.74	0.30	1.05
	HOPP-acid (AE F096918)	14.1	60.0	0.10	0.37
	Phenol metabolite (AE F040356)	3.13	13.4	0.16	0.69
	Fenoxaprop-P-ethyl -deschloro-hydroxy (BCS-CY11271)	4.77	20.5	0.13	0.55
Spring & winter cereals, South-EU, March-May.	Fenoxaprop-P-ethyl (AE F046360)	2.48	195	0.76	3.58
	Fenoxaprop-P-acid (AE F088406)	39.7	74.9	6.93	13.24
	Chlorobenzoxazolone (AE F054014)	2.45	8.74	0.57	2.03
	HOPP-acid (AE F096918)	14.1	60.0	0.10	0.37
	Phenol metabolite (AE F040356)	3.13	13.4	0.25	1.06
	Fenoxaprop-P-ethyl -deschloro-hydroxy (BCS-CY11271)	4.77	20.5	0.13	0.55

B.8.3. FATE AND BEHAVIOUR IN AIR

B.8.3.1. Route and rate of degradation in air and transport via air

In view of values for vapour pressure measured being below the triggers of 10^{-4} Pa for soil and of 10^{-5} Pa for plants (FOCUS, 2008) no study on transport of the active substance fenoxaprop-P-ethyl (AE F046360) *via* air is regarded as necessary. The combination of a water solubility of 0.43 mg/L with a vapour pressure of 6.5×10^{-6} Pa (at 20 °C) resulted in a low value for the Henry constant (5.5×10^{-3} Pa × m^3 / mol at 20 °C), indicating non-volatility. Once in the air, half-life in the atmosphere (0.16 days according to Atkinson) is low at all. Consequently, fenoxaprop-P-ethyl (AE F046360) is estimated not to be subject to transport via air.

B.8.4. PREDICTED ENVIRONMENTAL CONCENTRATIONS FROM OTHER ROUTES OF EXPOSURE

There are no other routes of exposure if the product is used according to good agricultural practice. Therefore no further estimations are considered necessary.

B.8.5. REFERENCES RELIED ON

Data point	Author(s)	Year	Title Company Report No. Source (where different from company) GLP or GEP status Published or not	Verte-brate study Y/N	Data protection claimed Y/N	Justification if data protection is claimed Reason for submission and justification for vertebrate studies art 62 1107/2009 (if applicable)	Owner	Previous evaluation
KCP 9.1.3 /01	Oberdoerster, C.; Heruth, D.	2016a	Fenoxaprop-P-ethyl (FPP) and metabolites: PECsoil EUR - Use in winter and spring cereals in Europe TF- BCS-CHA, Report No.: EnSa-16-0142, Edition Number: M-554293-01-1 Date: 2016-05-08 GLP/GEP: no, unpublished	N	N		TF- BCS-CHA	N
KCP 9.2.4.1 /01	Oberdoerster, C.; Heruth, D.	2016b	Fenoxaprop-P-ethyl (FPP) and metabolites: PECgw FOCUS: PEARL, PELMO, MACRO EUR - Use in winter and spring cereals in Europe TF- BCS-CHA, Report No.: EnSa-16-0143, Edition Number: M-554299-01-1 Date: 2016-05-09 GLP/GEP: no, unpublished	N	N		TF- BCS-CHA	N
KCP 9.2.5 /01	Oberdoerster, C.; Heruth, D.	2016c	Fenoxaprop-P-ethyl (FPP) and metabolites: PECsw,sed FOCUS EUR - Use in winter and spring cereals in Europe TF- BCS-CHA, Report No.: EnSa-16-0144, Edition Number: M-555311-01-1 Date: 2016-05-24 GLP/GEP: no, unpublished	N	N		TF- BCS-CHA	N