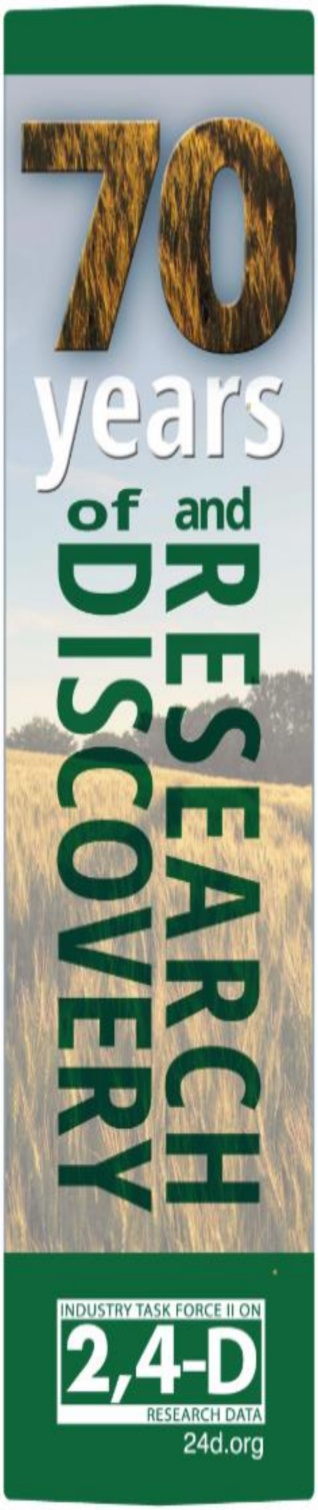


# Conclusion on the Peer Review of the Pesticide Risk Assessment of the Active Substance 2,4-D – 2014 EFSA

**Source Document:**
http://www.efsa.europa.eu/en/efsajournal/doc/3812.pdf

The European Food Safety Authority (EFSA) is the primary agency responsible for food and feed safety risk assessments in the European Union. EFSA describes itself as:

*“an independent European agency funded by the EU budget that operates separately from the European Commission, European Parliament and EU Member States… EFSA provides independent scientific advice and clear communication on existing and emerging risks.”*

**Synopsis**
EFSA reviewed 2,4-D in 2014 and concluded that “2,4-D is not classified or proposed to be classified as carcinogenic Category 2 or toxic for reproduction Category 2.” (pg 8). Moreover, the review finds that “[b]ased on the available data, no chronic or acute concerns were identified for the consumers” (pg 2).

As part of the review of 2,4-D, EFSA conducted a public consultation. In addition to its finding of non-carcinogenicity, a key finding is the review is the importance of ongoing and continued research.

EFSA is the European body responsible for reviewing pesticide data and estimating Acceptable Daily Intakes (ADI). Comprehensive risk assessments look at toxicology data to determine the amount at which no adverse effects are observed in animals. Then, additional safety factors of hundreds or thousands are applied to determine an Acceptable Daily Intake. In addition to the safety factor between toxicology results and the ADI, observed human exposures are typically hundreds of times lower than the ADI.

The EFSA assessment on 2,4-D finding no-evidence of carcinogenicity is also available at this link and below:
http://www.efsa.europa.eu/en/efsajournal/doc/3812.pdf

EFSA Journal 2014;12(9):3812

CONCLUSION ON PESTICIDE PEER REVIEW

# Conclusion on the peer review of the pesticide risk assessment of the active substance 2,4-D[1]

**European Food Safety Authority**[2]

European Food Safety Authority (EFSA), Parma, Italy

*This scientific output, published on 11 March 2015, replaces the earlier version published on 7 August 2014*[3]

## ABSTRACT

The conclusions of the European Food Safety Authority (EFSA) following the peer review of the initial risk assessments carried out by the competent authority of the Rapporteur Member State Greece, for the pesticide active substance 2,4-D are reported. The context of the peer review was that required by Commission Regulation (EU) No 1141/2010 as amended by Commission Implementing Regulation (EU) No 380/2013. The conclusions were reached on the basis of the evaluation of the representative uses of 2,4-D as a herbicide on cereals and maize. The reliable endpoints concluded as being appropriate for use in regulatory risk assessment, derived from the available studies and literature in the dossier peer reviewed, are presented. Missing information identified as being required by the regulatory framework is listed. Concerns are identified.



## KEY WORDS

2,4-D, peer review, risk assessment, pesticide, herbicide

[1] On request from the European Commission, Question No EFSA-Q-2013-00811, approved on 7 August 2014.

[2] Correspondence: pesticides.peerreview@efsa.europa.eu

[3] Clarification is provided regarding the determination of potential endocrine disrupting properties in accordance with the interim provisions of Annex II, Point 3.6.5 of Regulation (EC) No. 1107/2009 and the atmospheric half-life. The original Conclusion is available on request, as is a version showing all the changes that were made.

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## SUMMARY

Commission Regulation (EU) No 1141/2010 (hereinafter referred to as 'the Regulation'), as amended by Commission Implementing Regulation (EU) No 380/2013, lays down the procedure for the renewal of the approval of a second group of active substances and establishes the list of those substances. 2,4-D is one of the active substances listed in the Regulation. The Rapporteur Member State provided its initial evaluation of the dossier on 2,4-D in the Renewal Assessment Report (RAR), which was received by the EFSA on 4 March 2013. The peer review was initiated on 18 March 2013 by dispatching the RAR for consultation of the Member States and the applicant the European Union 2,4-D Task Force 2012.

Following consideration of the comments received on the RAR, it was concluded that additional information should be requested from the applicant and that EFSA should conduct an expert consultation in the areas of mammalian toxicology and ecotoxicology, and EFSA should adopt a conclusion on whether 2,4-D can be expected to meet the conditions provided for in Article 4 of Regulation (EC) No 1107/2009 of the European Parliament and of the Council.

The conclusions laid down in this report were reached on the basis of the evaluation of the representative uses of 2,4-D as a herbicide on cereals and maize, as proposed by the applicant. Full details of the representative uses can be found in Appendix A to this report.

In the area of identity, physical/chemical/technical properties and methods of analysis data gaps were identified for revised specifications for Nufarm and Makhteshim-Agan Agro Poland S.A., further validation of the analytical methods for plants and animals, and further information/data on the surface tension of the active substance.

Data gaps were identified in the mammalian toxicology area for the impurity profile of the batches used in the recently submitted studies (this also triggered a critical area of concern for the compliance of the batches tested with the current specifications), and to address the relevance of the individual impurities in comparison with the toxicity profile of the parent compound. The interim provisions of Annex II, Point 3.6.5 of Regulation (EC) No 1107/2009 concerning human health for the consideration of endocrine disrupting properties are not met. However, considering the uncertainties regarding the potential endocrine disruption potential of 2,4-D, the complete study results from the extended one-generation toxicity study and a steroidogenesis assay should be submitted, noting that further toxicological and ecotoxicological tests might be necessary (issue not finalised).

Based on the available information, the residue definition for monitoring and risk assessment was proposed as "sum of 2,4-D, its salts, esters and conjugates, expressed as 2,4-D" for plant and animal products. MRLs were proposed for some cereal commodities and for ruminant products. Based on the available data, no chronic or acute concerns were identified for the consumers.

In the area of environmental fate and behaviour, data gaps have been identified to investigate the degradation of 2,4-D in acidic soils (pH < 6) and for field dissipation studies under conditions representative of European agricultural scenarios. In addition, the aquatic exposure and risk assessment for the photolysis metabolite 1,2,4-benzenetriol could not be finalised. Furthermore, the risk by the anaerobic metabolite 4-CP to the different environmental compartments would need to be addressed for those situations where anaerobic conditions are expected to occur.

In the area of ecotoxicology, data gaps have been identified to further assess the acute and long-term dietary risk to small herbivorous mammals for the representative use in maize, as well as the risk to aquatic organisms for situations represented by the relevant FOCUS surface water scenarios considering each of the representative uses (this has also been identified as a critical area of concern). Data gaps were also identified for the impurity profile of the batches used in the recently submitted studies (this also triggered a critical area of concern for the compliance of the batches tested with the current specifications) as well as the impurity profile of some of the studies submitted for the original

approval, and to address the relevance of the individual impurities in comparison with the toxicity profile of the parent compound.

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## BACKGROUND

Commission Regulation (EU) No 1141/2010[4] (hereinafter referred to as 'the Regulation'), as amended by Commission Implementing Regulation (EU) No 380/2013[5], lays down the detailed rules for the procedure of the renewal of the approval of a second group of active substances. This regulates for the European Food Safety Authority (EFSA) the procedure for organising the consultation of Member States and the applicant for comments on the initial evaluation in the Renewal Assessment Report (RAR) provided by the Rapporteur Member State (RMS), and the organisation of an expert consultation, where appropriate.

In accordance with Article 16 of the Regulation, if mandated, EFSA is required to adopt a conclusion on whether the active substance is expected to meet the conditions provided for in Article 4 of Regulation (EC) No 1107/2009 of the European Parliament and the Council[6] within 6 months from the receipt of the mandate, subject to an extension of up to 9 months where additional information is required to be submitted by the applicant(s) in accordance with Article 16(3).

In accordance with Article 4 of the Regulation Greece (hereinafter referred to as the 'RMS') received an application from the European Union 2,4-D Task Force 2012 for the renewal of approval of the active substance 2,4-D. Complying with Article 11 of the Regulation, the RMS checked the completeness of the dossier and informed the applicant, the Commission and the EFSA about the admissibility.

The RMS provided its initial evaluation of the dossier on 2,4-D in the RAR (Greece, 2013), which was received by the EFSA on 4 March 2013. The peer review was initiated on 18 March 2013 by dispatching the RAR to Member States and the applicant the European Union 2,4-D Task Force 2012 for consultation and comments. In addition, the EFSA conducted a public consultation on the RAR. The comments received were collated by the EFSA and forwarded to the RMS for compilation and evaluation in the format of a Reporting Table. The applicant was invited to respond to the comments in column 3 of the Reporting Table. The comments and the applicant's response were evaluated by the RMS in column 3.

The need for expert consultation and the necessity for additional information to be submitted by the applicant in accordance with Article 16(3) of the Regulation were considered in a telephone conference between the EFSA, the RMS, and the European Commission on 18 July 2013. On the basis of the comments received, the applicant's response to the comments and the RMS's evaluation thereof it was concluded that additional information should be requested from the applicant and the EFSA should organise an expert consultation in the areas of mammalian toxicology and ecotoxicology. According to Article 16(2) of the Regulation the European Commission decided to consult the EFSA. The mandate was received on 1 October 2013.

The outcome of the telephone conference, together with EFSA's further consideration of the comments is reflected in the conclusions set out in column 4 of the Reporting Table. All points that were identified as unresolved at the end of the comment evaluation phase and which required further consideration, including those issues to be considered in an expert consultation, and the additional information to be submitted by the applicant, were compiled by the EFSA in the format of an Evaluation Table.

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[4] Commission Regulation (EU) No 1141/2010 of 7 December 2010 laying down the procedure for the renewal of the inclusion of a second group of active substances in Annex I to Council Directive 91/414/EEC and establishing the list of those substances. OJ L 322,8.12.2011, p. 10-19.

[5] Commission Implementing Regulation (EU) No 380/2013 of 25 April 2013 amending Regulation (EU) No 1141/2010 as regards the submission of the supplementary complete dossier to the Authority, the other Member States and the Commission. OJ L 116, 26.4.2013, p.4.

[6] Regulation (EC) No 1107/2009 of 21 October 2009 of the European Parliament and of the Council concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC. OJ L 309, 24.11.2009, p. 1-50.

The conclusions arising from the consideration by the EFSA, and as appropriate by the RMS, of the points identified in the Evaluation Table, together with the outcome of the expert consultation where this took place, were reported in the final column of the Evaluation Table.

A final consultation on the conclusions arising from the peer review of the risk assessment took place with Member States via a written procedure in July 2014.

This conclusion report summarises the outcome of the peer review of the risk assessment on the active substance and the representative formulation evaluated on the basis of the representative uses as a herbicide on wheat, barley, oat, rye, triticale and maize, as proposed by the applicant. A list of the relevant end points for the active substance as well as the formulation is provided in Appendix A. In addition, a key supporting document to this conclusion is the Peer Review Report, which is a compilation of the documentation developed to evaluate and address all issues raised in the peer review, from the initial commenting phase to the conclusion. The Peer Review Report (EFSA, 2014) comprises the following documents, in which all views expressed during the course of the peer review, including minority views, can be found:

- the comments received on the RAR,
- the Reporting Table (2 August 2013),
- the Evaluation Table (25 July 2014),
- the report(s) of the scientific consultation with Member State experts (where relevant),
- the comments received on the assessment of the additional information (where relevant),
- the comments received on the draft EFSA conclusion.

Given the importance of the RAR including its final addendum (compiled version of March 2014 containing all individually submitted addenda and revisions to the RAR (Greece, 2014)) and the Peer Review Report, both documents are considered respectively as background documents A and B to this conclusion.

It is recommended that this conclusion report and its background documents would not be accepted to support any registration outside the EU for which the applicant has not demonstrated to have regulatory access to the information on which this conclusion report is based.

## THE ACTIVE SUBSTANCE AND THE FORMULATED PRODUCT

2,4-D is the ISO common name for (2,4-dichlorophenoxy)acetic acid (IUPAC).

The representative formulated product for the evaluation was '2,4-D DMA 600 SL', a soluble concentrate (SL) containing 600 g/L 2,4-D.

The representative uses evaluated are as a foliar spray to wheat, barley, oats, rye, triticale and maize for the control of broad-leaved weeds. Full details of the GAP can be found in the list of end points in Appendix A.

## CONCLUSIONS OF THE EVALUATION

## 1. Identity, physical/chemical/technical properties and methods of analysis

The following guidance documents were followed in the production of this conclusion: SANCO/3030/99 rev.4 (European Commission, 2000), SANCO/10597/2003 – rev. 10.1 (European Commission, 2012) and SANCO/825/00 rev. 8.1 (European Commission, 2010).

Dioxins and furans, considered as relevant impurities in 2,4-D if formed (see section 2), were not detected in the batches at a LOQ of 10 µg/kg (ppb). The minimum purity of the active substance as manufactured is 960 g/kg. The Dow AgroSciences specification is fully accepted. For Nufarm a revised specification is needed to include one additional significant impurity, and the Makhteshim-Agan Agro Poland S.A. source needs a revised specification where the significant phenols are specified separately.

It was noted that there was an unexplained difference between the surface tension of the pure active substance and the technical active substance and this results in a data gap.

The main data regarding the identity of 2,4-D and its physical and chemical properties are given in Appendix A.

LC-MS/MS methods are available for the analysis of materials of plant and animal origin. However, the validation of these methods with regard to extraction efficiency and validation of the hydrolysis step are lacking, therefore a data gap has been identified. LC-MS/MS and GC-MS methods are available for soil and water, and an LC-MS/MS method is available for air. An LC-MS/MS method is available for blood and urine.

## 2. Mammalian toxicity

The following guidance documents were followed in the production of this conclusion: SANCO/221/2000 rev. 10 - final (European Commission, 2003), SANCO/222/2000 rev. 7 (European Commission, 2004) and SANCO/10597/2003 – rev. 10.1 (European Commission, 2012).

2,4-D was discussed at the Pesticides Peer Review Experts' Meeting 109 in January 2014.

The batches used in the key toxicological studies do not fully support the currently proposed technical specifications as it appears that some impurities have not been tested at an appropriate level; furthermore the batches used in the recent toxicological studies (2008 to 2013) were not provided and therefore a data gap and a critical area of concern has been identified. The relevance of the impurities present in the technical specifications has not been addressed. It is noted that if formed as manufacturing by-products, both dioxins and furans would be relevant impurities.

2,4-D is rapidly and almost completely absorbed after oral administration. Higher levels of the substance are found in the kidneys and liver, but increased levels of the substance are also detected in the brain and cerebrospinal fluid upon repeated dosing, suggesting that the blood-brain barrier function may be impaired by 2,4-D exposure. The active substance is poorly metabolised and eliminated rapidly, mainly via urine excretion. Toxicokinetic and metabolism data in dogs were distinct from other species; dogs were found to have a reduced capacity for urinary excretion of weak organic acids, such as 2,4-D, that lead to a higher plasma half-life and higher sensitivity of dogs to the toxic effects of 2,4-D in comparison with other species, including humans (European Commission, 2001). This conclusion was confirmed in more recent pharmacokinetic investigations and therefore the dog is not considered the most relevant species to extrapolate 2,4-D toxicity to humans.

Moderate to low acute toxicity has been observed when 2,4-D was administered via the oral, dermal or inhalation routes. The substance was not found to be acutely irritant to skin or to have the potential for skin sensitisation according to a newly submitted LLNA study, which was considered to overrule the equivocal results obtained in a previous study. However, 2,4-D produced severe irritation to rabbit eyes, and respiratory tract irritation in a repeated dose toxicity study by inhalation in rats. Furthermore, upon repeated dermal exposure, 2,4-D produced erythema and epidermal scaling and the peer review suggested that the classification as EUH066 'repeated exposure may cause skin dryness or cracking' may be appropriate[7].

The target organs of 2,4-D upon short-term and long-term exposure are primarily the kidneys (increased weight, early chronic progressive nephropathy (CPN), tubular changes), the thyroid (increased weight, reduced $T_4$ and $T_3$ levels, increased TSH) and the liver (clinical chemistry changes). The relevant short-term NOAEL is 15 mg/kg bw per day from the oral 90-day toxicity studies in rats and mice, excluding the dog NOAELs as they are considered less relevant to humans. The relevant long-term NOAEL is 5 mg/kg bw per day from the 2-year studies in rats and mice. It is noted that positive genotoxic effects were reported in the public domain and an increased incidence of brain astrocytomas was observed in an older 2-year rat study (1986), which was not reproduced in a more recent study from 1994 using higher dose levels. These effects could reasonably be explained by the possible presence of dioxins in the previous technical specification, while dioxins are not detected in the current technical specification (see section 1). It was therefore agreed that 2,4-D, as currently manufactured, is unlikely to have a genotoxic potential or pose a carcinogenic risk to humans.

Reproductive effects (reduced fertility indices and offspring's survival, increased gestational length) and offspring's toxicity (increased incidence of skeletal and visceral variations, reduced body weight, clinical signs and increased mortality) were noted in the presence of excessive parental toxicity (reduced body weight and kidney toxicity) in the multigeneration studies, which showed some limitations in the conduct and reporting of the studies. The parental toxicity was reproduced in an extended one-generation study at slightly lower dose levels that did not cause reproductive effects. In the rat developmental toxicity study, fetotoxicity (increased incidence of skeletal variations) was observed in the presence of maternal toxicity (decreased body weight gain); no developmental findings were noted in the rabbit study.

In an acute neurotoxicity study in rats, the NOAEL was set at 75 mg/kg bw based on the observation of clinical signs, such as abnormal gait, incoordinated movements and reduced motor activity; this study as well as a repeated dose neurotoxicity study presented limited validity due to the lack of histopathological examinations at the lower dose levels tested and extensive neurological findings observed also in the control animals in the repeated dose study.

2,4-D is not classified or proposed to be classified as carcinogenic category 2 or toxic for reproduction category 2, in accordance with the provisions of Regulation (EC) No 1272/2008, and therefore the conditions of the interim provisions of Annex II, Point 3.6.5 of Regulation (EC) No 1107/2009 concerning human health for the consideration of endocrine disrupting properties are not met. However, many *in vivo* studies provide evidence for endocrine effects produced by 2,4-D exposure on the thyroid hormone system, i.e. decreased levels of $T_4$ and $T_3$ and increased TSH levels, correlated

[7] It should be noted that classification is formally proposed and decided in accordance with Regulation (EC) No 1272/2008. Proposals for classification made in the context of the evaluation procedure under Regulation (EC) No 1107/2009 are not formal proposals.

with increased thyroid weight and macroscopic observation of (thyroid) masses at higher dose levels (150 mg/kg bw per day), and histopathological findings (increased incidence of parafollicular cell nodular hyperplasia). There was no indication of potential androgenic, anti-androgenic, oestrogenic or correlated adverse effects on the reproduction and reproductive organs in an extended one-generation study (the results of which were however not completely available to the peer review). Considering the known correlation of the thyroid hormone concentrations with adverse effects on other organ systems, such as the brain development (WHO/UNEP, 2013) and its relevance to humans, a data gap is identified for the complete set of measurements included in the extended one-generation study. It is further noted that increased adrenal weight and cortical hypertrophy were observed in a 90-day study in rats treated with 100 mg/kg bw per day and higher dose levels, which may indicate an effect on the HPA axis, however the current state of science is limited regarding possible effects in *in vivo* studies that are not tailored to test the adrenal function. Therefore a data gap for a steroidogenesis assay (OECD, 2011) has been identified.

Toxicological studies have been submitted on **2,4-DCP**; no short-term or long-term toxicity NOAEL could be derived due to inadequate presentation of the data in the submitted studies. In addition, based on the available equivocal data no firm conclusion could be drawn on the genotoxic or carcinogenic potential of metabolite 2,4-DCP. 2,4-DCP caused embryotoxicity (reduced intrauterine survival, foetal weight and ossification) in rats at maternally toxic doses (mortality and reduced body weight gain). It is noted that the exposure conditions to this metabolite have been assessed based on an application rate of max. 0.75 kg a.s./ha; however, as in the EU several other uses are currently approved at doses up to 2 kg a.s./ha, the possibility of a consumer exposure to 2,4-DCP should be carefully checked and further toxicological studies might be necessary (see also section 3).

The acceptable daily intake (**ADI**) of 2,4-D is 0.05 mg/kg bw per day, based on the NOAEL of 5 mg/kg bw per day from the 2-year studies in rats and mice, applying a standard uncertainty factor (UF) of 100. The acceptable operator exposure level (**AOEL**) is 0.15 mg/kg bw per day, based on the NOAEL of 15 mg/kg bw per day from the 90-day studies in rats and mice, 100 UF applied, and with no correction regarding oral absorption being necessary. The acute reference dose (**ARfD**) is 0.75 mg/kg bw, based on the NOAEL of 75 mg/kg bw from the acute neurotoxicity study in rats, applying the standard UF of 100.

Dermal absorption is 0.1 % when handling the concentrate formulation and 4 % when handling the in-use spray dilution (1.5 g/L). The estimated operator exposure is below the AOEL even when no personal protective equipment (PPE) is worn according to the German model; the estimated exposure of unprotected workers represents 3 % of the AOEL while bystander and resident exposure is calculated to be less than 1 % of the AOEL.

## 3. Residues

The assessment in the residue section below is based on the guidance documents listed in the document 1607/VI/97 rev.2 (European Commission, 1999) and the JMPR recommendations on livestock burden calculations stated in the JMPR reports (JMPR, 2004, 2007).

Metabolism in plants was investigated in cereals (wheat) and root/tuber crops (potato) using foliar applications and in fruit crops (apple) following soil applications. The studies on apple and wheat were conducted with a total application rate of 4260 and 1680 g a.s./ha, respectively, but limited to a maximum of 560 g a.s./ha on potato, due to phototoxic effects. Studies by stem injection (maize, soya bean) or cell cultures (soya bean) provided additional information on the metabolism of 2,4-D in plants.

Due to the low residue level at harvest (0.009 mg/kg), no identification of residues was attempted in apple. In wheat forage and straw, most of the radioactive residues were extractable and identified as the parent 2,4-D (72 to 77 % TRR), mostly as conjugated. In contrast, in grain, 2,4-D accounted for 6 % TRR only and the majority of the residues (*ca.* 50 % TRR) were associated with natural products (protein, starch and cellulose fractions). Other components were less than 9 % TRR and identified as 2,4-DCP or as hydroxylated metabolites (4-OH-2,5-D; 4-OH-2,3-D; 5-OH-2,4-D). 2,4-D was also identified as the major component in potato tuber, up to 0.15 mg/kg, while 2,4-DCP amounted for less than 0.01 mg/kg. Stem injection and cell cultures conducted on maize and soya bean confirmed that 2,4-D and hydroxylated metabolites, mainly as amino acid conjugates, are the major components of the residues in plants. Based on these studies, it was concluded that the metabolic pathway is expected to be similar in all crop categories and the residue definition for monitoring and risk assessment was proposed as "*sum of 2,4-D, its salts, esters and conjugates, expressed as 2,4-D*".

A sufficient number of residue trials were provided to propose MRLs of 0.05* mg/kg on wheat, rye, triticale, barley, oats and maize. Overdosed trials were considered to derive these MRLs, since residues in grain were all below the LOQ. The residue trials data are supported by storage stability studies, where 2,4-D residues were shown to be stable at least 18 months in high water-, high starch- and dry matrices, when stored at -18 °C, and at least 12 months in high oil matrices when stored at -23 °C to -27 °C. Considering the mean $DT_{90}$ estimated to be less than 15 days, rotational crop studies were not provided and are not required. As residues in cereal grains were all below the LOQ, processing studies were not required.

Animal metabolism studies conducted on lactating goat dosed at 24 mg/kg bw per day over three consecutive days and laying hens at 1.4 mg/kg bw per day over seven days were submitted, corresponding approximately to a 150N and 300N dose rate study, respectively. These exaggerated dose rates result from the fact that limited application rates on cereals were supported by the applicant in the framework of the renewal procedure and overall, the use of 2,4-D on pasture, the main contributor to the ruminant residue burden, was voluntarily withdrawn from the representative uses. In both goat and poultry, 2,4-D was extensively excreted in urine and faeces and less than 0.1 % of the administered radioactivity was recovered in milk, eggs and tissues, resulting in TRRs below 0.2 mg/kg in all animal matrices, except in kidney (0.7 and 1.4 mg/kg, for poultry and goat, respectively). The parent 2,4-D, free and conjugated, was identified as the major compound in milk (47 % TRR), eggs (23 % TRR), chicken liver, fat and kidney (18, 25 and 76 % TRR). In addition, 4-chlorophenoxyacetic acid was observed in milk (6.9 % TRR) and 2,4-DCP in milk, eggs and chicken liver, up to 7.3 % TRR. Considering that 2,4-D conjugates were identified in animal matrices, the same residue definitions as for plant commodities were proposed for products of animal origin. MRLs for ruminant products were derived from a livestock feeding study conducted on lactating cow at four feeding levels, in the range of 53 to 312 mg/kg bw per day. Based on the low expected intakes estimated on the representative uses voluntarily limited to 750 g a.s./ha and excluding the uses on pasture, 2,4-DCP is not expected to be present in significant levels in ruminant matrices. No MRLs were proposed for poultry and pig products.

Based on the representative uses, no consumer intake concerns were identified. Using the EFSA PRIMo model and the MRLs proposed for cereals and ruminant products, the highest TMDI was estimated to be less than 2 % of the ADI (DK child) and the highest IESTI is less than 1% of the ARfD (milk, UK infant). It should be highlighted that this consumer risk assessment was based on an application rate limited to 750 g a.s./ha and excluding the uses on pasture. Possible consumer exposure to 2,4-DCP would need to be reassessed, considering all additional uses and application rates registered in the EU.

## 4. Environmental fate and behaviour

The route and rate of degradation under aerobic conditions was investigated in four soils (pH [$H_2O$]: 6.2 - 7.8) at 20 °C and in one soil (pH [$H_2O$]: 7.4) at 25 °C (submitted for the first EU approval). 2,4-D exhibited low to moderate persistence in these studies. The degradation of 2,4-D resulted in the formation of a major metabolite, **2,4-DCA** (max 15 % AR), and a minor non-transient metabolite, **2,4-DCP**, that need to be addressed for potential groundwater contamination. These metabolites

* MRL is proposed at the LOQ.

exhibited moderate or low to moderate persistence in soil (FOCUS, 2006). Non-extractable residues amounted to 58 % AR and the amount of volatiles collected in alkaline trap (presumed to be $CO_2$) accounted for a maximum of 49 % AR.

During the peer review a data requirement was identified to investigate the degradation of 2,4-D in acidic soils (pH < 6) as some results reported in scientific peer reviewed literature indicated that the degradation of 2,4-D is pH dependent in soil, with 2,4-D being more persistent in acidic soils. The applicant submitted a study performed in four soils with the variant 2,4-D 2-EHE, which is converted to 2,4-D in soil. However, the four soils are in the neutral-alkaline range (pH [$H_2O$]: 7.0 – 7.4)[8] and therefore the data requirement cannot be considered addressed. Additionally, the number of data points after the maximum of 2,4-D in soil is reached is too low to derive reliable half-lives, therefore the endpoints derived from this study were not further considered for the assessment of 2,4-D. A data gap has been identified for studies investigating the degradation of 2,4-D under aerobic conditions in soils with an acidic pH (pH < 6).

The degradation of 2,4-D under anaerobic conditions (pH 5.8 – 8.1) was investigated in four soils. Under these conditions 2,4-D exhibited moderate persistence ($DT_{50}$ = 22 – 38 days) and two major metabolites were formed: 2,4-DCP (max. 38 % AR) and 4-CP (max. 33 % AR). A data gap has been identified to assess the exposure and risk by the anaerobic metabolite 4-CP to the different environmental compartments in those situations where anaerobic conditions are expected to occur. This has also been indicated as an issue that could not be finalised. Photolysis is not expected to contribute to the environmental degradation of 2,4-D in soil according to the available studies.

The available field dissipation studies from the original dossier are not according to GLP and should not be considered further. Field dissipation studies are however required on the basis of the normalised half-life observed in the laboratory degradation experiment with the Mississippi (silt loam) soil, therefore a data gap for field dissipation studies has been identified.

Batch soil adsorption / desorption studies were performed with 2,4-D and the metabolites 2,4-DCA and 2,4-DCP in seven soils. According to these studies 2,4-D may be expected to exhibit very high mobility in soil, while its metabolites 2,4-DCA and 2,4-DCP may be expected to exhibit low and low to medium mobility in soil, respectively. Aged column leaching studies in two soils are available and considered as supplementary information. A lysimeter study was already available in the original dossier submitted for first approval. A single application of 750 g a.s./ha of 2,4-D resulted in exceedance of the limit of 0.1 µg/L for the concentration of the unidentified metabolite M1. It is noted that in this study metabolites 2,4-DCP and 4-CP were analysed, but not 2,4-DCA.

2,4-D is stable to hydrolysis at 50 °C in the range of pH 4 - 9. According to the available studies, aqueous photolysis of 2,4-D, under normal environmental conditions, will usually take place at a slower rate than the biological degradation in water. However, in an aqueous photolysis study, presented in the dossier submitted for the first approval, a major photolysis metabolite, 1,2,4-benzenetriol (max. 31.7 % AR at the end of the study), was identified. Since it is not possible to completely exclude the formation of this metabolite in the environment, an aquatic exposure and risk assessment for this metabolite is triggered and a data gap has been identified. 2,4-D is readily biodegradable according to the available study (OECD 301F; OECD, 1992).

The fate and behaviour of 2,4-D in dark water sediment was investigated in three systems (two of them are presented in the renewal dossier) under aerobic conditions. Most of the applied 2,4-D remained in the aqueous phase. 2,4-D exhibited low to moderate persistence in the three systems ($DT_{50\ \text{whole system}\ 20\ C}$ = 6 – 52 days). No major metabolites were found in the water phase. Metabolite 2,4-DCP exceeded 10 % AR in the sediment (max. 31.8 % AR after 13 days). Mineralisation as $CO_2$

[8] It was noted that for one soil a pH of 5.5 was claimed to have been measured in 0.01 M $CaCl_2$ (as reported in the RAR by the RMS). However for this particular soil the pH measurement in 0.01 M $CaCl_2$ had been reported by the soil supplier and not by the laboratory performing the soil degradation study (as it was for other soils). No claim has been made by this laboratory on the compliance status of this measurement.

amounted to up to 63.9 % AR and the unextractable residue in the sediment increased up to a maximum of 26.2 % AR. The fate of 2,4-D was also investigated in three anaerobic water sediment systems. Under anaerobic conditions metabolite 4-CP was observed as a major metabolite in one of the systems. $PEC_{SW}$ were calculated for the parent and the major aerobic soil and surface water metabolites 2,4-DCP and 2,4-DCA with FOCUS SW tools up to step 2 for the metabolites and up to step 3 for the parent compound (FOCUS, 2001).

The potential for groundwater exposure by 2,4-D and its soil metabolites 2,4-DCA and 2,4-DCP was assessed by calculation of the $80^{th}$ percentile annual average concentrations moving below 1m depth for the representative uses in cereals and maize with FOCUS GW PEARL 4.4.4 model (FOCUS, 2009). The parametric drinking water limit of 0.1 μg/L was not exceeded for any of the representative uses and relevant scenarios. In any future simulations the $PEC_{GW}$ for the parent 2,4-D would need to be updated with the degradation rate endpoint derived during the peer review. However, it is not expected that the change in the half-life will significantly change the conclusion for the parent compound in relation to the representative uses assessed.

## 5. Ecotoxicology

The risk assessment was based on the following documents: European Commission (2002a,b,c), SETAC (2001) and EFSA (2009).

The batches used in the ecotoxicological studies do not fully support the currently proposed technical specifications as it appears that some impurities have not been tested at an appropriate level; furthermore the batches used in the recent (eco)toxicological studies (2008 to 2013) and some of the batches used for the original approval were not provided and therefore a data gap has been identified. The issue has also been indicated as a critical area of concern. The relevance of the impurities present in the technical specifications has not been addressed (see also section 2).

Based on the first-tier assessment a low acute and long-term risk to **birds** was concluded.

On the basis of the available first-tier assessment, a low acute risk to **mammals** was concluded for the representative uses in spring and winter cereals, while a high risk was indicated for the representative use in maize for small herbivorous mammals. A risk assessment refinement based on measured RUDs (residue unit dose) was proposed, however, in general, this kind of refinement is not considered appropriate (see paragraph 6.1.4; EFSA, 2009). Therefore a data gap was identified to further address the acute risk to mammals for the representative use in maize. The endpoint to be used for the long-term reproductive risk assessment was agreed by the experts at the Pesticides Peer Review Experts' Meeting 111 (February 2013). The first-tier assessment indicated a high long-term risk for the large herbivorous mammal scenario for the representative use in cereals and for small herbivorous mammals for the representative use in maize. A refinement based on residue decline was proposed and a low long-term risk was indicated for large herbivorous mammals for the representative use in cereals. However, this refinement was not sufficient to conclude a low risk to small herbivorous mammals for the representative use in maize.

To further address the risk to small herbivorous mammals, a higher tier study (field study) was submitted. The purpose of this study was to monitor the potential for acute and long-term effects on small herbivorous mammal populations with the common vole *Microbus avails*. The study was not considered suitable for the risk assessment because of a number of shortcomings: the mean trapping efficiency between the selected sites is significantly different (19.4 captures/100 trap nights for Southern France *vs* 89.1 captures/100 trap nights for Germany in the treated plots); it is unclear whether the number of tagged individuals per plot (~7 per treated plot and 5 - 6 per control plot) can be considered representative of the whole population; carcasses examination was not performed; after 7 days radio-tracking signals could not be obtained maybe due to the battery life of the tags; in the treated plots a 50 % survival in Southern France (80 % in the control) and 79 % survival in Germany (84 % in the control) was recorded one week after the treatment and for a period of 2 weeks, and it was not clear whether the 50 % loss was treatment-related because the status of the missing individuals remained unknown. As any of the available refinements were considered reliable, a data gap was identified for further assessments of the long-term dietary risk to small herbivorous mammals for the representative use in maize.

2,4-D has a log $P_{ow}$ value of 0.18 at pH 5 and -0.82 at pH 7, while the pertinent metabolites 2,4-DCP and 2,4-DCA have a log $P_{ow}$ value of 3.06 and 3.36, respectively. Therefore, based on the log $P_{ow}$ values, the risk assessment from bioaccumulation to fish and earthworm-eating mammals was only triggered for the metabolites. A low risk of secondary poisoning to earthworm and fish-eating birds and mammals was indicated for the pertinent metabolites 2,4-DCA and 2,4-DCP.

Toxicity studies were available on fish, aquatic invertebrates, algae and macrophytes with the active substance, the formulated product and the pertinent metabolite 2,4-DCA. For the metabolite 2,4-DCP toxicity studies were only available for aquatic invertebrates, algae and plants. A low risk to **fish, aquatic invertebrates** and **algae** from 2,4-D was concluded based on the available FOCUS step 1/2 $PEC_{sw}$. A low risk to all aquatic organisms from the pertinent metabolites 2,4-DCA and 2,4-DCP was concluded with FOCUS step 1 $PEC_{sw}$. However, the aquatic risk assessment for the major photolysis metabolite 1,2,4-benzenetriol was not addressed and therefore a data gap was identified. Furthermore, no data were available for the metabolite 4-CP (relevant for all representative uses evaluated, however only for those situations and Member States where anaerobic soil conditions are expected to occur), therefore a data gap was identified. A high risk to rooted **aquatic plants** from 2,4-D was indicated for all the available FOCUS step 3 scenarios for all representative uses. No further assessments or assessments considering risk mitigation measures (i.e. FOCUS step 4) were available. Therefore a data gap was identified to further assess the risk to aquatic organisms for situations represented by the relevant FOCUS surface water scenarios for all the representative uses.

The risk was assessed as low to **honey bees** and **non-target arthropods** based on first-tier risk assessments for all representative uses.

A set of laboratory studies on **earthworms**, **soil mites**, **collembolan** and **soil microorganisms** was available for 2,4-D and the metabolites 2,4-DCP and 2,4-DCA, but not for the metabolite 4-CP. Based on the results of these studies, the risk to earthworms and non-target soil macro- and microorganisms was assessed as low for the representative uses in cereals and maize. A data gap was identified to address the risk for the major metabolite 4-CP for those situations where anaerobic conditions are expected to occur.

For **terrestrial non-target plants**, the effects of 2,4-D in the formulated product on vegetative vigour and seedling emergence were investigated in tests with ten dicotyl and three monocotyl plant species. Since data on 13 species were available, both the deterministic and the probabilistic approach could be conducted. Based on the probabilistic risk assessment a low risk was concluded for non-target terrestrial plants without risk mitigation measures.

A low risk could be concluded to organisms involved in **biological methods for sewage treatment** on the basis of the available data and assessments.

With regard to the potential endocrine activity of 2,4-D, no specific concerns have been identified in birds and fish. However no firm conclusion can be drawn regarding the scientific assessment of potential endocrine disrupting properties. Furthermore, pending on the outcome of the data gap in section 2, further ecotoxicological tests might be necessary to address the potential endocrine disrupting properties of 2,4-D.

# 6. Overview of the risk assessment of compounds listed in residue definitions triggering assessment of effects data for the environmental compartments

## 6.1. Soil

| Compound (name and/or code) | Persistence | Ecotoxicology |
|---|---|---|
| 2,4-D | Low to moderate ($DT_{50}$ = 2.0 – 58.9 days) | Low risk to earthworms and other soil organisms |
| 2,4-DCA | Moderate ($DT_{50}$ = 10.9 – 16.3 days) | Low risk to earthworms and other soil organisms |
| 4-CP (anaerobic conditions) | No data available | No data available, data gap. |

## 6.2. Ground water

| Compound (name and/or code) | Mobility in soil | >0.1 µg/L 1m depth for the representative uses (at least one FOCUS scenario or relevant lysimeter) | Pesticidal activity | Toxicological relevance | Ecotoxicological activity |
|---|---|---|---|---|---|
| 2,4-D | Very high mobile<br>($K_{Foc}$ = 12 - 42 mL / g) | FOCUS GW: No<br>Lysimeter: No | Yes | Yes | The risk to aquatic organisms in surface water was assessed as high for all the FOCUSsw step 3 scenarios for all representative uses. |
| 2,4-DCP | Low to medium<br>($K_{Foc}$ = 244 – 765 mL / g) | FOCUS GW: No<br>Lysimeter: No | No data | Limited database (uncertainty on genotoxicity and carcinogenicity).<br>Not needed | See Section 6.3 |

| Compound (name and/or code) | Mobility in soil | >0.1 µg/L 1m depth for the representative uses (at least one FOCUS scenario or relevant lysimeter) | Pesticidal activity | Toxicological relevance | Ecotoxicological activity |
|---|---|---|---|---|---|
| 2,4-DCA | Low<br><br>($K_{Foc}$ = 622- 1630 mL / g) | FOCUS GW: No<br><br>Lysimeter: Not analysed | No data | No data, not needed | See Section 6.3 |
| 4-CP (anaerobic conditions) | No data available. | FOCUS GW: Not calculated. Data gap<br><br>Lysimeter: Not analysed. | No data | No data, not needed | See Section 6.3 |

### 6.3. Surface water and sediment

| Compound (name and/or code) | Ecotoxicology |
|---|---|
| 2,4-D | The risk to aquatic organisms was assessed as high for all the FOCUS step 3 scenarios for all the representative uses. |
| 2,4-DCP | The risk to aquatic organisms was assessed as low |
| 2,4-DCA (from soil) | The risk to aquatic organisms was assessed as low |
| 1,2,4-benzenetriol (photolysis metabolite) | No data available, data gap |
| 4-CP (from soil, anaerobic conditions) | No data available, data gap |

## 6.4. Air

| Compound (name and/or code) | Toxicology |
|---|---|
| 2,4-D | Rat $LC_{50}$ inhalation > 1.79 mg/L air/4 h (whole body, highest attainable air concentration); no classification required |

## 7. List of studies to be generated, still ongoing or available but not peer reviewed

This is a list of data gaps identified during the peer review process, including those areas where a study may have been made available during the peer review process but not considered for procedural reasons (without prejudice to the provisions of Article 56 of Regulation (EC) No 1107/2009 of the European Parliament and of the Council concerning information on potentially harmful effects).

- Revised specification to include one additional significant impurity (relevant for Nufarm; submission date proposed by the applicant: unknown; see section 1).
- Revised specification with significant phenols specified separately (relevant for Makhteshim-Agan Agro Poland S.A.; submission date proposed by the applicant: unknown; see section 1).
- Explanation of the difference between the surface tension values of the pure active substance and the technical active substance (relevant for all representative uses evaluated; submission date proposed by the applicant: unknown; see section 1).
- Further data on the hydrolysis step and extraction efficiency for the animal and plant analytical methods (relevant for all representative uses evaluated; submission date proposed by the applicant: unknown; see section 1).
- Impurity profile of the batches used in the recent (eco)toxicological studies (2008-2013) and for some of the batches used in the ecotoxicology studies included in the DAR for the original approval of 2,4-D (relevant for all representative uses evaluated; submission date proposed by the applicant: unknown; see sections 2 and 5).
- Relevance of individual impurities present in the technical specifications compared with the toxicological profile of the parent compound 2,4-D (relevant for all representative uses evaluated; submission date proposed by the applicant: unknown; see sections 2 and 5).
- Considering the uncertainties regarding the endocrine disruption potential of 2,4-D, the complete study results from the extended one-generation and a steroidogenesis assay study should be submitted, noting that further toxicological and ecotoxicological tests might be necessary (relevant for all representative uses evaluated; submission date proposed by the applicant: unknown; see sections 2 and 5).
- Studies investigating the degradation of 2,4-D under aerobic conditions in soils with an acidic pH (pH < 6) (relevant for all representative uses evaluated; submission date proposed by the applicant: unknown; see section 4).
- Data to assess the exposure and risk to the different environmental compartments from the formation of the major anaerobic metabolite in soil (4-CP) (relevant for all representative uses evaluated, however only for those situations and Member States where anaerobic soil conditions are expected to occur; submission date proposed by the applicant: unknown; see sections 4 and 5).
- Reliable field dissipation studies for 2,4-D are required (relevant for all representative uses evaluated; submission date proposed by the applicant: unknown; see section 4).
- Aquatic exposure and risk assessment for the aquatic photolysis metabolite 1,2,4-benzenetriol needs to be performed, including calculation of relevant PEC SW (relevant for all representative uses evaluated; submission date proposed by the applicant: unknown; see sections 4 and 5).
- Further information is required to address the risk to aquatic organisms in situations represented by the FOCUS step 3 scenarios (relevant for all representative uses evaluated; submission date proposed by the applicant: unknown; see section 5).

- Further information is required to address the acute and long-tem dietary risk to small herbivorous mammals (relevant for the representative use in maize; submission date proposed by the applicant: unknown; see section 5).

## 8. Particular conditions proposed to be taken into account to manage the risk(s) identified

- None.

## 9. Concerns

### 9.1. Issues that could not be finalised

An issue is listed as an issue that could not be finalised where there is not enough information available to perform an assessment, even at the lowest tier level, for the representative uses in line with the Uniform Principles in accordance with Article 29(6) of Regulation (EC) No 1107/2009 of the European Parliament and of the Council and as set out in Commission Regulation (EU) No 546/2011[9], and where the issue is of such importance that it could, when finalised, become a concern (which would also be listed as a critical area of concern if it is of relevance to all representative uses).

An issue is also listed as an issue that could not be finalised where the available information is considered insufficient to conclude on whether the active substance can be expected to meet the approval criteria provided for in Article 4 of Regulation (EC) No 1107/2009.

1. 2,4-D is not classified or proposed to be classified as carcinogenic category 2 or toxic for reproduction category 2, in accordance with the provisions of Regulation (EC) No 1272/2008, and therefore the conditions of the interim provisions of Annex II, Point 3.6.5 of Regulation (EC) No 1107/2009 concerning human health for the consideration of endocrine disrupting properties are not met. However, adverse effects on endocrine organs have been observed in apical studies that may be endocrine-mediated, which should be further clarified to assess their relevance on the developing offspring.

2. Assessment of exposure and risk posed by the anaerobic metabolite 4-CP to the different environmental compartments for those situations where anaerobic conditions cannot be excluded.

3. Aquatic exposure and risk assessment for the aqueous photolysis metabolite 1,2,4-benzenetriol cannot be finalised.

### 9.2. Critical areas of concern

An issue is listed as a critical area of concern where there is enough information available to perform an assessment for the representative uses in line with the Uniform Principles in accordance with Article 29(6) of Regulation (EC) No 1107/2009 of the European Parliament and of the Council and as set out in Commission Regulation (EU) No 546/2011, and where this assessment does not permit to conclude that for at least one of the representative uses it may be expected that a plant protection product containing the active substance will not have any harmful effect on human or animal health or on groundwater or any unacceptable influence on the environment.

An issue is also listed as a critical area of concern where the assessment at a higher tier level could not be finalised due to a lack of information, and where the assessment performed at the lower tier level does not permit to conclude that for at least one of the representative uses it may be expected that a plant protection product containing the active substance will not have any harmful effect on human or animal health or on groundwater or any unacceptable influence on the environment.

[9] Commission Regulation (EU) No 546/2011 of 10 June 2011 implementing Regulation (EC) No 1107/2009 of the European Parliament and of the Council as regards uniform principles for evaluation and authorisation of plant protection products. OJ L 155, 11.6.2011, p. 127-175

An issue is also listed as a critical area of concern where the active substance is not expected to meet the approval criteria provided for in Article 4 of Regulation (EC) No 1107/2009.

4. The batches used in the key toxicological and ecotoxicological studies do not fully support the currently proposed technical specifications as it appears that some impurities have not been tested at an appropriate level..

5. High risk to aquatic organisms based on the available data (the risk assessment was driven by the aquatic plants).

### 9.3. Overview of the concerns identified for each representative use considered

(If a particular condition proposed to be taken into account to manage an identified risk, as listed in section 8, has been evaluated as being effective, then 'risk identified' is not indicated in this table.)

In addition to the concerns identified, all columns are grey as the technical material specification proposed was not shown to be fully comparable to the material used in the testing that was used to derive the toxicological reference values.

| **Representative use** | | **Winter wheat, barley, oats, rye & triticale** | **Spring wheat, barley, oats, rye & triticale** | **Maize** |
|---|---|---|---|---|
| **Operator risk** | Risk identified | | | |
| | Assessment not finalised | | | |
| **Worker risk** | Risk identified | | | |
| | Assessment not finalised | | | |
| **Bystander risk** | Risk identified | | | |
| | Assessment not finalised | | | |
| **Consumer risk** | Risk identified | | | |
| | Assessment not finalised | | | |
| **Risk to wild non target terrestrial vertebrates** | Risk identified | | | X |
| | Assessment not finalised | | | |
| **Risk to wild non target terrestrial organisms other than vertebrates** | Risk identified | | | |
| | Assessment not finalised | X[2] | X[2] | X[2] |
| **Risk to aquatic organisms** | Risk identified | 9/9 $FOCUS_{sw}$ scenarios[5] | 5/5 $FOCUS_{sw}$ scenarios[5] | 8/8 $FOCUS_{sw}$ scenarios[5] |
| | Assessment not finalised | X[2,3] | X[2,3] | X[2,3] |
| **Groundwater exposure active substance** | Legal parametric value breached | | | |
| | Assessment not finalised | | | |
| **Groundwater exposure metabolites** | Legal parametric value breached[(a)] | | | |
| | Parametric value of 10µg/L[(b)] breached | | | |
| | Assessment not finalised | | | |
| **Comments/Remarks** | | | | |

The superscript numbers in this table relate to the numbered points indicated in Sections 9.1 and 9.2. Where there is no superscript number see Sections 2 to 6 for further information.

(a): When the consideration for classification made in the context of this evaluation under Regulation (EC) No 1107/2009 is confirmed under Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008.

(b): Value for non relevant metabolites prescribed in SANCO/221/2000-rev 10-final, European Commission, 2003.

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# APPENDICES

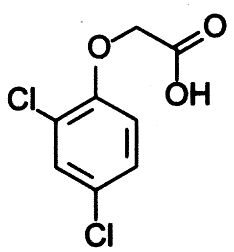
## APPENDIX A – LIST OF END POINTS FOR THE ACTIVE SUBSTANCE AND THE REPRESENTATIVE FORMULATION

## Identity, Physical and Chemical Properties, Details of Uses, Further Information

| | |
|---|---|
| Active substance (ISO Common Name) ‡ | 2,4-D |
| Function (*e.g.* fungicide) | Herbicide |

| | |
|---|---|
| Rapporteur Member State | Greece |
| Co-rapporteur Member State | Poland |

### Identity (Annex IIA, point 1)

| | |
|---|---|
| Chemical name (IUPAC) ‡ | (2,4-dichlorophenoxy)acetic acid |
| Chemical name (CA) ‡ | (2,4-dichlorophenoxy)acetic acid |
| CIPAC No ‡ | 1 |
| CAS No ‡ | 94-75-7 |
| EC No (EINECS or ELINCS) ‡ | 202-361-1 |
| FAO Specification (including year of publication) ‡ | AGP: CP/310, FAO 1994:<br>960 g/kg |
| Minimum purity of the active substance as manufactured ‡ | min 960 g/kg<br><br>EU 2,4-D Task Force 2012:<br>Nufarm: min. 960 g/kg<br>Dow AgroSciences: min. 960 g/kg<br>Makhteshim-Agan Agro Poland S.A: min 970 g/kg |
| Identity of relevant impurities (of toxicological, ecotoxicological and/or environmental concern) in the active substance as manufactured | Dioxins and furans:<br>TCDD toxic equivalents (TEQ): max 10 ppb<br>(All the companies of the "EU 2,4D Task Force 2012" comply with the above limit) |
| Molecular formula ‡ | $C_8H_6Cl_2O_3$ |
| Molar mass ‡ | 221 g/mol |
| Structural formula ‡ |  |

**Physical and chemical properties (Annex IIA, point 2)**

| | |
|---|---|
| Melting point (state purity) ‡ | 138.68 °C with decomposition (99.5 %) |
| Boiling point (state purity) ‡ | No boiling point due to thermal decomposition |
| Temperature of decomposition (state purity) | Pure a.s. (99.5 %): 272.96 °C |
| Appearance (state purity) ‡ | Pure a.s. (99.8 %): White solid (fine crystalline powder) at 20 °C with no discernible odour |
| | Technical a.s. (97.8 %): White solid (fine crystalline powder) at 20 °C with fint phenolic odour |
| Vapour pressure (state temperature, state purity) ‡ | $9.9 \times 10^{-6}$ Pa at 20 °C<br>$2.3 \times 10^{-5}$ Pa at 25 °C<br>(99.8 % pure) |
| Henry's law constant ‡ | Calculated values at 20 °C:<br>$4.0 \times 10^{-6}$ $Pa.m^3.mol^{-1}$ |
| Solubility in water (state temperature, state purity and pH) ‡ | Pure a.s. (99.8 %): at 20 °C<br>Purified water: 0.547 g/L<br>pH 4 buffer solution: 3.39 g/L<br>pH 7 buffer solution: 24.3 g/L<br>pH 10 buffer solution: 26.5 g/L |
| Solubility in organic solvents ‡<br>(state temperature, state purity) | At 20 °C (97.8 % technical):<br>methanol: > 250 g/L<br>acetone: 212 g/L<br>xylene: 3 g/L<br>1,2-dichloroethane: 8 g/L<br>ethyl acetate: 93 g/L<br>heptane: 0.019 g/L |
| Surface tension ‡<br>(state concentration and temperature, state purity) | At 20 °C (99.8 %):<br>$\sigma$ = 70.5 mN / m 90% saturated solution at 20 °C |
| Partition co-efficient ‡<br>(state temperature, pH and purity) | 99.8 % at 25 °C:<br>pH 4: log $P_{ow}$: 1.54<br>pH 7: log $P_{ow}$: -0.82<br>pH 10: log $P_{ow}$: -1.07 |
| Dissociation constant (state purity) ‡ | $pK_a$ = 3.4 at 20 °C (99.8 %) |

| | |
|---|---|
| UV/VIS absorption (max.) incl. ε ‡ (state purity, pH) | UV/Vis –spectrum<br>UV Absorption Characteristics (99.8 % purity):<br>UV/Vis spectrum recorded between λ 200- 750 nm.<br>pH 1.6 :<br>λmax at 227nm, ε = 7347.4 L/mol.cm<br>λmax at 282nm, ε = 1448.9 L/mol.cm<br>pH neutral :<br>λmax at 228nm, ε = 8815.6 L/mol.cm<br>λmax at 283nm, ε = 1940.0 L/mol.cm<br>pH 11.3 :<br>λmax at 229nm, ε = 8984.5 L/mol.cm<br>λmax at 283nm, ε = 1977.5 L/mol.cm |
| Flammability ‡ (state purity) | Not highly flammable (97.8 %, technical)<br>2,4-D has no self-ignition temperature (97.3 % technical) |
| Explosive properties ‡ (state purity) | 2,4-D is not expected to have explosive properties (97.8 % technical) |
| Oxidising properties ‡ (state purity) | 2,4-D is not expected to have oxidizing properties (97.3 % technical) |

**Summary of representative uses evaluated (2,4-D)**

| Crop and/or situation (a) | Member State or Country | Product name | F G or I (b) | Pests or Group of pests controlled (c) | Preparation | | Application | | | | Application rate per treatment (for explanation see the text in front of this section) | | | PHI (days) (m) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Type (d-f) | Conc. of a.s. (i) | method kind (f-h) | growth stage & season (j) | number min-max (k) | Interval between applications | g a.s./hL min-max (l) | Water L/ha min-max | g a.s./ha min-max (l) | | |
| Winter wheat, winter barley, winter oats, winter rye & triticale | EU | 2,4-D DMA 600 SL | F | Dicotyledonous weeds | SL | 600 g a.s./L | Broad-cast | 21 to 32 (Feb to May) | 1 | - | 187.5 - 750 | 100-400 | Max 750 | N/A | |
| Spring wheat, spring barley, spring oats & spring rye | EU | 2,4-D DMA 600 SL | F | Dicotyledonous weeds | SL | 600 g a.s./L | Broad-cast | 11 to 32 (March to May) | 1 | - | 187.5 - 750 | 100-400 | Max 750 | N/A | |
| Maize | EU | 2,4-D DMA 600 SL | F | Dicotyledonous weeds | SL | 600 g a.s./L | Broad-cast | 11 to 16 (April to June) | 1 | - | 187.5 - 750 | 100-400 | Max 750 | N/A | |

(a) For crops, the EU and Codex classifications (both) should be taken into account; where relevant, the use situation should be described (e.g. fumigation of a structure)
(b) Outdoor or field use (F), greenhouse application (G) or indoor application (I)
(c) *e.g.* biting and sucking insects, soil born insects, foliar fungi, weeds
(d) *e.g.* wettable powder (WP), emulsifiable concentrate (EC), granule (GR)
(e) CropLife International Technical Monograph no 2, 6th Edition. Revised May 2008. Catalogue of pesticide
(f) All abbreviations used must be explained
(g) Method, e.g. high volume spraying, low volume spraying, spreading, dusting, drench
(h) Kind, *e.g.* overall, broadcast, aerial spraying, row, individual plant, between the plant- type of equipment used must be indicated
(i) g/kg or g/L. Normally the rate should be given for the active substance (according to ISO) and not for the variant in order to compare the rate for same active substances used in different variants (e.g. fluoroxypyr). **In certain cases, where only one variant is synthesised, it is more appropriate to give the rate for the variant (e.g. benthiavalicarb-isopropyl).**
(j) Growth stage at last treatment (BBCH Monograph, Growth Stages of Plants, 1997, Blackwell, ISBN 3-8263-3152-4), including where relevant, information on season at time of application
(k) Indicate the minimum and maximum number of applications possible under practical conditions of use
(l) The values should be given in g or kg whatever gives the more manageable number (e.g. 200 kg/ha instead of 200 000 g/ha or 12.5 g/ha instead of 0.0125 kg/ha
(m) PHI - minimum pre-harvest interval

**Methods of Analysis**

**Analytical methods for the active substance (Annex IIA, point 4.1)**

| | |
|---|---|
| Technical as (analytical technique) | *Nufarm:* Fully validated HPLC-UV<br>*Dow AgroSciences:* Fully validated HPLC-UV<br>*Makhteshim-Agan Agro Poland S.A:* Fully validated HPLC/UV |
| Impurities in technical as (analytical technique) | *Nufarm:*<br>-HPLC-UV: Fully validated<br>-HPLC-UV (DAD spectrum): Fully validated<br>-HRGC-HRMS (Dioxin and furans) : Fully validated<br><br>*Dow AgroSciences:*<br>-HPLC-UV: Fully validated<br>-HRGC-HRMS (dioxin/furans): Fully validated<br><br>*Makhteshim-Agan Agro Poland S.A:*<br>-HPLC-UV: Fully validated.<br>-HRGC-HRMS (dioxin/furans)<br><br>*FAO specifications:*<br>CIPAC method MT 69.1 (free phenols)<br>CIPAC method MT 30.1(Karl Fischer titration method for water)<br>CIPAC method MT 29 (sulphated ash)<br>CIPAC method MT 76 (triethanolamine insolubles) |
| Plant protection product (analytical technique) | *2,4- D DMA 600 SL (Nufarm's ppp)*<br>HPLC-UV: Fully validated<br>*LAF-74 (Dow Agrosciences's ppp)*<br>HPLC-UV: Fully validated<br>*Aminopielik Standard 600 SL (Makhteshim Agan's ppp)*<br>HPLC-UV: Fully validated |

**Analytical methods for residues (Annex IIA, point 4.2)**

**Residue definitions for monitoring purposes**

| | |
|---|---|
| Food of plant origin | sum of 2,4-D, its salts, esters and conjugates expressed as 2,4-D |
| Food of animal origin | sum of 2,4-D, its salts, esters and conjugates expressed as 2,4-D |
| Soil | 2,4-D |

| | | |
|---|---|---|
| Water | surface | 2,4-D |
| | drinking/ground | 2,4-D |
| Air | | 2,4-D |

**Monitoring/Enforcement methods**

| | |
|---|---|
| Food/feed of plant origin (analytical technique and LOQ for methods for monitoring purposes) | Substrates: corn forage, wheat forage, corn grain, wheat grain, wheat hay, wheat straw, orange, lemon, oilseed rape and soybean seed<br>Analysis: LC/MS/MS<br>Determined analyte: 2,4-D (sum of 2,4-D and its esters expressed as 2,4-D)<br>LOQ: 0.01 mg/kg<br>ILV submitted<br><br>Open for further data on extraction efficiency and hydrolysis step. |
| Food/feed of animal origin (analytical technique and LOQ for methods for monitoring purposes) | Substrates: Bovine muscle, Bovine kidney, Bovine milk, Poultry eggs, Bovine fat<br>Analysis: LC/MS/MS<br>Determined analyte: 2,4-D (sum of 2,4-D and its esters expressed as 2,4-D)<br>LOQ: 0.01 mg/kg<br>ILV submitted<br><br>Open for further data on extraction efficiency and hydrolysis step. |
| Soil (analytical technique and LOQ) | Substrates: Soil<br>Analysis: LC/MS/MS and GC-MS (for 2,4-DCA)<br>Determined analyte: 2,4-D (sum of 2,4-D and its esters expressed as 2,4-D)<br>2,4-DCP<br>4-CP<br>2,4-DCA<br>LOQ: 0.05 mg/kg<br><br>Method fully validated. |

| | |
|---|---|
| Water (analytical technique and LOQ) | Substrates: groundwater and surface water<br>Analysis: LC/MS/MS and GC-MS (for 2,4-DCA)<br>Determined analyte: 2,4-D (sum of 2,4-D and its esters expressed as 2,4-D)<br>2,4-DCP<br>4-CP<br>2,4-DCA<br>LOQ: 0.1 µg/L<br><br>ILV submitted<br><br>Method fully validated. |
| Air (analytical technique and LOQ) | Substrates: air<br>Analysis: LC/MS/MS<br>Determined analyte: 2,4-D<br>LOQ: 4.5 $\mu g/m^3$<br><br>Method fully validated. |
| Body fluids and tissues (analytical technique and LOQ) | Substrates: urine and blood<br>Analysis: LC/MS/MS<br>Determined analyte: 2,4-D<br>LOQ: 0.05 mg/L<br><br>Method fully validated but not required. |

**Classification and proposed labelling with regard to physical and chemical data (Annex IIA, point 10)**

| | RMS/peer review proposal |
|---|---|
| Active substance | None |

## Impact on Human and Animal Health

### Absorption, distribution, excretion and metabolism (toxicokinetics) (Annex IIA, point 5.1)

| | |
|---|---|
| Rate and extent of oral absorption ‡ | Rapid and almost complete (> 90 % within 48 h) |
| Distribution ‡ | Higher concentrations in kidney and liver; also detected in brain and cerebrospinal fluid (CSF) |
| Potential for accumulation ‡ | Low potential for accumulation |
| Rate and extent of excretion ‡ | Rat: Main route of excretion *via* urine (> 90 % within 48 h), up to 11 % excretion *via* faeces<br>Dog: species specific low capacity to excrete weak organic acids (such as 2,4-D) via urine |
| Metabolism in animals ‡ | > 97 % excreted unchanged, two minor metabolites (2,4-D conjugates) |
| Toxicologically relevant compounds ‡ (animals and plants) | 2,4-D |
| Toxicologically relevant compounds ‡ (environment) | 2,4-D |

### Acute toxicity (Annex IIA, point 5.2)

| | | |
|---|---|---|
| Rat $LD_{50}$ oral ‡ | > 300 & < 2000 mg/kg bw | H302 |
| Rat $LD_{50}$ dermal ‡ | > 2000 mg/kg bw | - |
| Rat $LC_{50}$ inhalation ‡ | > 1.79 mg/L air/4 h (whole body, highest attainable air concentration) | - |
| Skin irritation ‡ | Non irritant | - |
| Eye irritation ‡ | Severe irritant | H318 |
| Skin sensitisation ‡ | Non sensitiser (Buehler 3- and 9-inductions; LLNA) | - |

### Short-term toxicity (Annex IIA, point 5.3)

| | | |
|---|---|---|
| Target / critical effect ‡ | Kidneys /early chronic progressive nephropathy (rat, mouse & dog), increased BUN and creatinine (dog), decreased $T_3$ and $T_4$, increased TSH and increased thyroid weight (rat) | |
| Relevant oral NOAEL ‡ | 90-day rat & mouse: 15 mg/kg bw per day<br>90-day dog: 0.3 mg/kg bw per day (less relevant to human due to species-specific toxicokinetics) | |
| Relevant dermal NOAEL ‡ | 21-day, rabbit:<br>100 mg/kg bw per day for systemic effects (↑ kidney weight)<br>10 mg/kg bw per day for local effects (erythema and epidermal scaling) | EUH 066 |
| Relevant inhalation NOAEL ‡ | 28-day, rat:<br>0.3 mg/L air for systemic effects (↓ bw gain) | H335 |

| | | |
|---|---|---|
| | LOAEL 0.05 mg/L air for local effects (squamoid metaplasia of the larynx due to irritation properties) | |

**Genotoxicity ‡ (Annex IIA, point 5.4)**

| | | |
|---|---|---|
| | Unlikely to be genotoxic | |

**Long-term toxicity and carcinogenicity (Annex IIA, point 5.5)**

| | | |
|---|---|---|
| Target/critical effect ‡ | Rats: Kidney / brown tubular pigment and increased microcalculi, thyroid (increased weight, decreased $T_4$, thyroid masses/nodules), decreased cholesterol, platelet count and triglycerides, increased AST, ALT, AP)<br>Mice: Kidney / increased organ weight, histopathological changes | |
| Relevant NOAEL ‡ | 2-year rats & mice: 5 mg/kg bw per day | |
| Carcinogenicity ‡ | Unlikely to pose a risk to humans | |

**Reproductive toxicity (Annex IIA, point 5.6)**

**Reproduction toxicity**

| | | |
|---|---|---|
| Reproduction target / critical effect ‡ | Parental toxicity: decreased body weight during lactation and kidney effects (decreased organ weight and histopathological changes)<br>Reproductive toxicity:<br>Reduced fertility indices and offspring survival, and increased gestational length at higher dose levels [limited multigeneration study]<br>No reproductive effect [F1-extended one generation study]<br>Offspring toxicity:<br>Increased incidence of skeletal and visceral variations, reduced body weight, clinical signs and increased mortality were noted in the presence of high parental toxicity [limited multigeneration study]<br>Reduced pup growth during lactation and kidney effects (increased weight and histopathological changes) [F1-extended one generation study] | |
| Relevant parental NOAEL ‡ | 16.6 mg/kg bw per day | |
| Relevant reproductive NOAEL ‡ | 40.2 mg/kg bw per day (the highest dose tested) | |
| Relevant offspring NOAEL ‡ | 16.6 mg/kg bw per day | |

**Developmental toxicity**

| | | |
|---|---|---|
| Developmental target / critical effect ‡ | Rat: fetotoxicity (increased incidence of skeletal variations) at maternally toxic doses (reduced body weight gain)<br>Rabbit: no developmental effects (maternal toxicity: reduced body weight) | |
| Relevant maternal NOAEL ‡ | Rat: 25 mg/kg bw per day<br>Rabbit: 30 mg/kg bw per day | |
| Relevant developmental NOAEL ‡ | Rat: 25 mg/kg bw per day<br>Rabbit: 90 mg/kg bw per day (the highest dose tested) | |

**Neurotoxicity (Annex IIA, point 5.7)**

| | | |
|---|---|---|
| Acute neurotoxicity ‡ | Limited study indicative of NOAEL 75 mg/kg bw based on clinical signs (abnormal gait, altered coordination and motor activity) | |
| Repeated neurotoxicity ‡ | Limited study indicative of a NOAEL of 5 mg/kg bw per day based on moderate to severe bilateral retina degeneration, increased urination and uncertain histopathological finding in neural tissues | |
| Delayed neurotoxicity ‡ | No data – not required | |

**Other toxicological studies (Annex IIA, point 5.8)**

| | |
|---|---|
| Mechanism studies ‡ | 2,4-D induces peroxisomal proliferation, ↑ catalase and carnitine acetyltransferase activity, and ↓ cholesterol and serum triglyceride concentration through β-oxidation of fatty acids in peroxisomes. |
| Studies performed on metabolites or impurities ‡ | 2,4-DCP: some positive genotoxicity results *in vitro*, equivocal results on carcinogenicity in male mice.<br>Based on the available equivocal data no firm conclusion could be drawn on the genotoxic or carcinogenic potential of 2,4-DCP.<br>Developmental toxicity in rat:<br>Embryotoxicity (reduced intrauterine survival, foetal weight, ossification of strenebrae and vertebral arches) at maternal toxic doses (mortality, reduced body weight gain)<br>Maternal NOAEL: 200 mg/kg bw per day<br>Developmental NOAEL: 375 mg/kg bw per day |

**Medical data ‡ (Annex IIA, point 5.9)**

| | |
|---|---|
| | No conclusive association can be established between exposure to phenoxy-herbicides (including 2,4-D acid) and human carcinogenicity.<br>No conclusive evidence in the open literature that 2,4-D may exhibit toxicological properties other than those concluded already based on the toxicity studies conducted with the technical active substance. |

| **Summary (Annex IIA, point 5.10)** | Value | Study | Safety factor |
|---|---|---|---|
| ADI ‡ | 0.05 mg/kg bw per day | 2-year studies (mouse and rat) | 100 |
| AOEL ‡ | 0.15 mg/kg bw per day | 90-day studies (mouse and rat) | 100* |
| ARfD ‡ | 0.75 mg/kg bw | Acute neurotoxicity, rat | 100 |

*no correction regarding oral absorption needed

**Dermal absorption ‡ (Annex IIIA, point 7.3)**

| | |
|---|---|
| Formulation (600 g 2,4-D DMA/L SL formulation) | Undiluted product: 0.1 %<br>Dilution (1.5 g/L): 4 %<br>Based on *in vitro* (split-thickness skin membranes) human data |

**Exposure scenarios (Annex IIIA, point 7.2)**

| | |
|---|---|
| Operator | Crops: spring and winter cereal crops and maize<br>Tractor-mounted/trailed boom sprayer: hydraulic nozzles; 1.25 L product/ha (750 g a.s./ha); 100 L/ha<br>No PPE — % of AOEL<br>UK POEM: 144 %<br>German model: 12 %<br>PPE (Gloves M/L & application)<br>UK POEM: 27 %<br>German model: 9 % |
| Workers | 3 % of AOEL (crop inspection; no PPE) |
| Bystanders/residents | % of AOEL<br>bystander, adult: 0.1 - 0.6 %<br>bystander, children: 0.08 %<br>resident, adult: 0.2 %<br>resident, children: 0.4 % |

**Classification and proposed labelling with regard to toxicological data (Annex IIA, point 10)**

| | |
|---|---|
| Substance classified (name) | 2,4-D |
| Harmonised classification according to Regulation (EC) No 1272/2008 (CLP Regulation)[10] | GHS05 Danger<br>GHS07 Warning<br>Acute Tox. 4, H302 'Harmful if swallowed'<br>Skin Sens. 1, H317 'May cause an allergic skin reaction'<br>Eye Dam. 1, H318 'Causes serious eye damage'<br>STOT SE 3, H335 'May cause respiratory irritation' |
| RMS/peer review proposal[11] | GHS05 Danger<br>GHS07 Warning<br>Acute Tox. 4; H302 'Harmful if swallowed'<br>Eye Dam. 1; H318 'Causes serious eye damage'<br>STOT SE 3; H335 'May cause respiratory irritation'<br>EUH066 'Repeated exposure may cause skin dryness or cracking' |

[10] Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006. OJ L 353, 31.12.2008, 1-1355.

[11] It should be noted that classification and labelling is formally proposed and decided in accordance with Regulation (EC) No 1272/2008. Proposals for classification made in the context of the evaluation procedure under Regulation (EC) No 1107/2009 are not formal proposals.

## Residues

**Metabolism in plants (Annex IIA, point 6.1 and 6.7, Annex IIIA, point 8.1 and 8.6)**

| | |
|---|---|
| Plant groups covered | Cereals (wheat) foliar treatment<br>Root/tuber crops (potato) foliar treatment<br>Fruit crops (apple) soil treatment<br>Additional studies by stem injection (soya bean, maize) and cell cultures (soya bean): informative only |
| Rotational crops | Not required ($DT_{90}$ < 100 days) |
| Metabolism in rotational crops similar to metabolism in primary crops? | Not applicable |
| Processed commodities | Not required (residues of 2,4-D < 0.1 mg/kg) |
| Residue pattern in processed commodities similar to residue pattern in raw commodities? | Not applicable |
| Plant residue definition for monitoring | Sum of 2,4-D, its salts, esters and conjugates, expressed as 2,4-D |
| Plant residue definition for risk assessment | Sum of 2,4-D, its salts, esters and conjugates, expressed as 2,4-D |
| Conversion factor (monitoring to risk assessment) | Not applicable |

**Metabolism in livestock (Annex IIA, point 6.2 and 6.7, Annex IIIA, point 8.1 and 8.6)**

| | |
|---|---|
| Animals covered | Lactating goat, laying hen |
| Time needed to reach a plateau concentration in milk and eggs | Milk-plateau was reached within 28 days |
| Animal residue definition for monitoring | Sum of 2,4-D, its salts, esters and conjugates, expressed as 2,4-D |
| Animal residue definition for risk assessment | Sum of 2,4-D, its salts, esters and conjugates, expressed as 2,4-D |
| Conversion factor (monitoring to risk assessment) | Not applicable |
| Metabolism in rat and ruminant similar (yes/no) | Yes |
| Fat soluble residue: (yes/no) | No |

**Residues in succeeding crops (Annex IIA, point 6.6, Annex IIIA, point 8.5)**

| | |
|---|---|
| | Not required (2,4-D declines rapidly in soil) |

**Stability of residues (Annex IIA, point 6 introduction, Annex IIIA, point 8 Introduction)**

| | |
|---|---|
| | 2,4-D residues stable at least 12 months (-23 °C to -27 °C) in :<br>- high water content (sugar cane, grass, wheat and maize forage),<br>- high starch content (wheat, rice, maize and sorghum grain),<br>- high oil content (soya bean)<br>- and dry matrices (cereal straw, hay)<br><br>2,4-D residues stable at least 18 months under frozen conditions (-18 °C) in:<br>- high water content (cereal greens)<br>- high starch content (cereal grain)<br>- and dry matrices (cereal straw)<br><br>2,4-D residues are stable in milk and beef tissues for at least 4 months when stored deep frozen. |

**Residues from livestock feeding studies (Annex IIA, point 6.4, Annex IIIA, point 8.3)**

| | **Ruminant** | **Poultry**[1] | **Pig**[1] |
|---|---|---|---|
| | Conditions of requirement of feeding studies | | |
| Expected intakes by livestock ≥ 0.1 mg/kg diet (dry weight basis) (yes/no) | Yes<br>3.8 mg/kg DM[2] | No<br>0.07 mg/kg DM[2] | Yes<br>0.66 mg/kg DM[2] |
| Potential for accumulation (yes/no): | No | No | No |
| Metabolism studies indicate potential level of residues ≥ 0.01 mg/kg in edible tissues (yes/no) | Yes | No | No |
| | Feeding studies: Lactating cow, 4 feeding levels, 28 days<br>Residue levels in matrices: Mean (max) mg/kg in the lowest feeding level (1446 mg/kg feed or 53 mg/kg bw) equivalent to a 325/380N rate for beef/dairy cattle | | |
| Muscle | 0.21 (0.24) | - | |
| Liver | 0.12 (0.20) | - | |
| Kidney | 3.8 (6.5) | - | |
| Fat | 0.42 (0.51) | - | |
| Milk | 0.04 (0.07) | | |
| Eggs | | - | |

[1]: According to the calculated dietary burden, a poultry feeding study was not required.
[2]: Equivalent to 0.138, 0.163, 0.004 and 0.026 mg/kg bw for dairy cattle, beef cattle, chicken and pig, respectively.

**Summary of residues data according to the representative uses on raw agricultural commodities and feedingstuffs (Annex IIA, point 6.3, Annex IIIA, point 8.2)**

| Crop | Northern, Southern Region, field or glasshouse | Trials results relevant to the representative uses (a) | Recommendation/comments | MRL estimated from trials according to representative use | HR (c) | STMR (b) |
|---|---|---|---|---|---|---|
| **Barley, Oats and Wheat** (grain) | NEU | Barley: <0.02, 4x <0.05<br><0.01, 2x<0.05 (overdosed trials)<br>Oats: <0.05<br>Wheat: 5x <0.02, <0.04, 2x < 0.05<br><0.01, 2x <0.05(overdosed trials) | Overdosed trials (1000 to 1303 g/ha) were considered for MRL setting as all values < LOQ. MRL, HR and STMR are derived from the merged data sets (15 trials). | 0.05* | 0.05 | 0.05 |
| | SEU | Barley: 2x < 0.05 (overdosed trials)<br>Wheat: 4 × < 0.05 (overdosed trials) | | | | |
| **Barley, Oats and Wheat** (straw) | NEU | Barley: < 0.02, 3x < 0.05, 0.19<br>2x < 0.05, < 0.10 (overdosed trials)<br>Oats: < 0.05<br>Wheat: 2x < 0.02, < 0.05, 0.025, 0.08, 0.28, 0.65, 1.4<br>< 0.05, < 0.10, 0.06 (overdosed trials) | As a worst case, residues in straw from overdosed trials were taken into account to derive STMR and HR for animal burden calculations. | - | 1.4 | 0.05 |
| | SEU | Barley: < 0.05, 0.08 (overdosed trials)<br>Wheat: < 0.05, 0.06, 2x 0.08 (overdosed trials) | | | | |
| **Maize** (grain) | NEU | 4x< 0.02<br>2x< 0.05 (overdosed trials) | Overdosed trials (1141 to 1210 g /ha) were considered for MRL setting as all values in grain were < LOQ. MRL, HR and STMR are derived from the merged data sets (8 trials). | 0.05* | 0.05 | 0.035 |
| | SEU | 2x< 0.05 (overdosed trials) | | | | |
| **Maize** (forage) | NEU | <0.01, 3x< 0.02, 0.01, 0.15<br>0.06 (overdosed trial) | As a worst case, residues in whole plant from overdosed trials were taken into account to derive STMR and HR for animal burden calculation. Residues in whole plant at stage BBCH 73 to 85 (silage stage) were considered. HR and STMR are derived from the merged data sets (10 trials). | - | 0.76 | 0.02 |
| | SEU | 2<0.01,<br>0.76 (overdosed trial) | | | | |

(a) Numbers of trials in which particular residue levels were reported *e.g.* 3 x <0.01, 1 x 0.01, 6 x 0.02, 1 x 0.04, 1 x 0.08, 2 x 0.1, 2 x 0.15, 1 x 0.17
(b) Supervised Trials Median Residue *i.e.* the median residue level estimated on the basis of supervised trials relating to the representative use
(c) Highest residue
* the MRL is proposed at the LOQ

**Consumer risk assessment (Annex IIA, point 6.9, Annex IIIA, point 8.8)**

| | |
|---|---|
| ADI | 0.05 mg/kg bw per day |
| TMDI (% ADI) according to EFSA PRIMo | Highest TMDI: < 2 % (DK, Child) |
| TMDI (% ADI) according to (national diet) | - |
| IEDI (WHO European Diet) (% ADI) | - |
| NEDI (specify diet) (% ADI) | - |
| Factors included in IEDI and NEDI | - |
| ARfD | 0.75 mg/kg bw |
| IESTI (% ARfD) according to EFSA PRIMo | Highest IESTI: < 1% ARfD (milk, UK infant) |
| NESTI (% ARfD) according to (national diet) | - |
| Factors included in IESTI and NESTI | MRLs |

**Processing factors (Annex IIA, point 6.5, Annex IIIA, point 8.4)**

| Crop/processed product | Number of studies | Processing factors | | Amount Transferred (%) |
|---|---|---|---|---|
| | | Transfer factor | Yield factor | |
| Not submitted and not requested | | | | |
| | | | | |

**Proposed MRLs (Annex IIA, point 6.7, Annex IIIA, point 8.6)**

| Commodity | Proposed EU MRL (mg/kg) | Justification for proposal |
|---|---|---|
| Barley | 0.05* | Based on NEU and SEU trials |
| Wheat | 0.05* | Based on NEU and SEU trials |
| Oats | 0.05* | Extrapolate from wheat and barley |
| Rye | 0.05* | Extrapolate from wheat and barley |
| Triticale | 0.05* | Extrapolate from wheat and barley |
| Maize | 0.05* | Based on NEU and SEU trials |

When the MRL is proposed at the LOQ, this should be annotated by an asterisk after the figure.

## Environmental fate and behaviour

**Route of degradation (aerobic) in soil (Annex IIA, point 7.1.1.1.1)**

| | |
|---|---|
| Mineralization after 100 days ‡ | *28-49* % after *26* d, $^{14}$C-label (n[12]= *4*) |
| Non-extractable residues after 100 days ‡ | *33-58* % after *26* d, $^{14}$C-label (n= 4) |
| Metabolites requiring further consideration ‡ - name and/or code, % of applied (range and maximum) | 2,4-DCP – *8.7* % at *10* d (n= *4*)<br>2,4-DCA – 15 % at *17* d (n= 4) |

**Route of degradation in soil - Supplemental studies (Annex IIA, point 7.1.1.1.2)**

Anaerobic degradation ‡

| | |
|---|---|
| Mineralization after 100 days | *9-14* % after 125 d, $^{14}$C-label (n= *4*) |
| Non-extractable residues after 100 days | 10-40 % after 125 d, $^{14}$C-X-label (n= *4*) |
| Metabolites that may require further consideration for risk assessment - name and/or code, % of applied (range and maximum) | 2,4-DCP – *38* % at 28 d (n= *4*)<br>2,4-DCA – 9 % at 10 d (n= 4)<br>4-CP – 33 % at 59 d (n= 4) |

Soil photolysis ‡

| | |
|---|---|
| Metabolites that may require further consideration for risk assessment - name and/or code, % of applied (range and maximum) | None. |

**Rate of degradation in soil (Annex IIA, point 7.1.1.2, Annex IIIA, point 9.1.1)**

Laboratory studies ‡

| **2,4-D** | Aerobic conditions | | | | | |
|---|---|---|---|---|---|---|
| Soil type | pH | t. °C / % MWHC | $DT_{50}$ /$DT_{90}$ (d) | $DT_{50}$ (d) 20 °C pF2/10kPa | St. ($r^2$) $X^2$ | Method of calculation |
| Silt Loam (Mississippi) | 7.4 | 25 °C / [a] | 58.9/195.6 | 94.6 d [b] | 7.4 | SFO |
| Clay loam (Fayette) | 6.2 | 20 °C / 50 % MWHC | 7.5 / 24.8 | 5.3 | 6.3 | SFO |
| Clay loam (RefSol 03-G) | 6.2 | 20 °C / 50 % MWHC | 1.6 / 5.4 | 1.2 | 6.3 | SFO |
| Sandy loam (Site E1) | 6.7 | 20 °C / 50 % MWHC | 2.2 / 7.4 | 1.6 | 4.5 | SFO |

[12] n corresponds to the number of soils.

| | | | | | | |
|---|---|---|---|---|---|---|
| Sandy loam (Site I2) | 7.8 | 20 °C / 50 % MWHC | 2.0/6.5 | 1.8 | 7.8 | SFO |
| Geometric mean/median | | | 2.66 | 4.4 | | |

a) Moisture content not reported in the study summary in the RAR
b) normalized only for temperature.

| **2,4-DCP** | Aerobic conditions | | | | | | |
|---|---|---|---|---|---|---|---|
| Soil type | pH | t. °C / % MWHC | $DT_{50}$/ $DT_{90}$ (d) | f. f. $k_{dp}/k_f$ | $DT_{50}$ (d) 20 °C pF2/10kPa | St. ($r^2$) $X^2$ | Method of calculation |
| Clay loam (Fayette) | 6.2 | 20 °C / 50 % MWHC | - | | - | | |
| Clay loam (RefSol 03-G) | 6.2 | 20 °C / 50 % MWHC | 15.5 | 1 | 11.1 | 6.3 | HS |
| Sandy loam (Site E1) | 6.7 | 20 °C / 50 % MWHC | 6.2 | 1 | 4.4 | 9.2 | SFO |
| Sandy loam (Site I2) | 7.8 | 20 °C / 50 % MWHC | 7.7 | 1 | 6.9 | 12.8 | FOMC |
| Geometric mean/median | | | 9.0 | | 7.0[a] | | |

a) According to FOCUS (2006) the $DT_{50}$ was back-calculated from $DT_{90}$/3.32 of the FOMC kinetic model and should be used for modelling.

| **2,4-DCA** | Aerobic conditions | | | | | | |
|---|---|---|---|---|---|---|---|
| Soil type | pH | t. °C / % MWHC | $DT_{50}$/ $DT_{90}$ (d) | f. f. $k_{dp}/k_f$ | $DT_{50}$ (d) 20 °C pF2/10kPa | St. ($r^2$) $X^2$ | Method of calculation |
| Clay loam (Fayette) | 6.2 | 20 °C / 50 % MWHC | - | | - | | |
| Clay loam (RefSol 03-G) | 6.2 | 20 °C / 50 % MWHC | 16.3 | | 11.7 | 3.7 | SFO |
| Sandy loam (Site E1) | 6.7 | 20 °C / 50 % MWHC | 13.7 | | 9.8 | 6.3 | SFO |
| Sandy loam (Site I2) | 7.8 | 20 °C / 50 % MWHC | 10.9 | | 9.8 | 8.5 | SFO |
| Geometric mean/median | | | 13.4 | | 10.4 | | |

| | |
|---|---|
| pH dependence ‡<br>(yes / no) (if yes type of dependence) | No |
| Soil accumulation and plateau concentration ‡ | No data. Not required. |

Field studies ‡

| | |
|---|---|
| | No reliable data available. Data gap identified. |

Laboratory studies ‡

| 2,4-D | Anaerobic conditions | | | | | |
|---|---|---|---|---|---|---|
| Soil type | pH ($H_2O$) | t. °C / % MWHC | $DT_{50}$ / $DT_{90}$ (d) | $DT_{50}$ (d) 20 °C pF2/10kPa | St. ($r^2$) | Method of calculation |
| Clay loam (RefeSol 03-G) | 6.9 | 20 ± 2 °C / pF2 | 32 / 107 | 32 / 107 | 0.9861 (5.1 % err.) | SFO |
| Loam (Kenslow) | 5.8 | 20 ± 2 °C / pF2 | 23 / 77 | 23 / 77 | 0.9778 (5.3 % err.) | SFO |
| Silt loam (Chelmorton) | 6.8 | 20 ± 2 °C / pF2 | 38 / 127 | 38 / 127 | 0.9824 (3.9 % err.) | SFO |
| Sandy loam (Longwoods) | 8.1 | 20 ± 2 °C / pF2 | 22 / 74 | 22 / 74 | 0.9031 (27.7 % err.) | SFO |
| Geometric mean/median | | | - | - | | |

**Soil adsorption/desorption (Annex IIA, point 7.1.2)**

| **2,4-D** | | | | | | | |
|---|---|---|---|---|---|---|---|
| Soil Type | OC % | Soil pH ($CaCl_2$) | Kd (mL/g) | Koc (mL/g) | Kf (mL/g) | Kfoc (mL/g) | 1/n |
| Clay loam (M800) | 1.3 | 7.1 | 0.89 | 68 | 0.55 | 42 | 0.83 |
| Loamy sand (M801) | 1.1 | 5.2 | 0.72 | 65 | 0.45 | 41 | 0.83 |
| Loam (M802) | 2.5 | 5.0 | 0.69 | 28 | 0.42 | 17 | 0.82 |
| Silt loam (M803) | 3.6 | 5.9 | 1.22 | 34 | 0.83 | 23 | 0.87 |
| Sandy loam (M804) | 1.4 | 7.5 | 0.32 | 23 | 0.19 | 14 | 0.81 |
| Silt loam (M816) | 0.9 | 5.9 | 0.37 | 41 | 0.21 | 23 | 0.78 |
| Clay loam (M822) | 4.4 | 7.2 | 0.68 | 16 | 0.51 | 12 | 0.90 |
| Arithmetic mean | | | | | 0.45 | 24 | 0.83 |
| pH dependence, Yes or No | | | No | | | | |

| **2,4-DCP** | | | | | | | |
|---|---|---|---|---|---|---|---|
| Soil Type | OC % | Soil pH ($CaCl_2$) | Kd (mL/g) | Koc (mL/g) | Kf (mL/g) | Kfoc (mL/g) | 1/n |
| Clay loam (M800) | 1.3 | 7.1 | 18 | 1395 | 10 | 765 | 0.85 |
| Loamy sand (M801) | 1.1 | 5.2 | 9 | 799 | 4 | 405 | 0.80 |
| Loam (M802) | 2.5 | 5.0 | 21 | 823 | 16 | 655 | 0.94 |
| Silt loam (M803) | 3.6 | 5.9 | 33 | 906 | 25 | 690 | 0.94 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sandy loam (M804) | 1.4 | 7.5 | 5 | 351 | 3 | 244 | 0.88 |
| Silt loam (M816) | 0.9 | 5.9 | 9 | 1043 | 5 | 574 | 0.83 |
| Clay loam (M822) | 4.4 | 7.2 | 14 | 318 | 11 | 250 | 0.93 |
| Arithmetic mean | | | | | 11 | 512 | 0.88 |
| pH dependence (yes or no) | | | No | | | | |

| **2,4-DCA** | | | | | | | |
|---|---|---|---|---|---|---|---|
| Soil Type | OC % | Soil pH ($CaCl_2$) | Kd (mL/g) | Koc (mL/g) | Kf (mL/g) | Kfoc (mL/g) | 1/n |
| Clay loam (M800) | 1.3 | 7.1 | 32 | 2465 | 18 | 1386 | 0.85 |
| Loamy sand (M801) | 1.1 | 5.2 | 23 | 2122 | 18 | 1630 | 0.93 |
| Loam (M802) | 2.5 | 5.0 | 28 | 1104 | 21 | 841 | 0.93 |
| Silt loam (M803) | 3.6 | 5.9 | 37 | 1017 | 27 | 746 | 0.93 |
| Sandy loam (M804) | 1.4 | 7.5 | 14 | 1004 | 12 | 836 | 0.95 |
| Silt loam (M816) | 0.9 | 5.9 | 13 | 1496 | 10 | 1137 | 0.92 |
| Clay loam (M822) | 4.4 | 7.2 | 47 | 1077 | 27 | 622 | 0.92 |
| Arithmetic mean | | | | | 19 | 1028 | 0.92 |
| pH dependence (yes or no) | | | No | | | | |

**Mobility in soil (Annex IIA, point 7.1.3, Annex IIIA, point 9.1.2)**

| | |
|---|---|
| Column leaching ‡ | - |
| | - |
| Aged residues leaching ‡ | Aged for (d): 28 and 30 d (2 studies)<br>Study no 1: 96.73 % of AR in soil profile was found in the top soil layer (0-4.5 cm). Concentration of 2,4-D in the pooled leachate was 0.1 µg/L (equivalent to 0.27 % AR and 1.53 % of radioactivity submitted to leachate)<br>Study no 2: Concentration of 2,4-D in the pooled leachate was 0.035 µg/L (equivalent to 0.35 % AR and 2.15 % of radioactivity submitted to leachate) |
| | - |

| | |
|---|---|
| Lysimeter/ field leaching studies ‡ | Location: Borstel / Neustadf a.R./FRG (lower Saxony) (Study submitted in the dossier of 1991)<br>Study type (e.g. lysimeter, field): lysimeter<br>Soil properties: texture, pH =5.7, OC=1.5, MWHC =20-34<br>Dates of application : 15$^{th}$ June<br>Crop : /Interception estimated: Winter rye was sown on November |

| | |
|---|---|
| | Number of applications: 1 application<br>Duration: 2 growing seasons<br>Application rate: 750 g/ha/year<br>2,4-D and its known metabolites were not detected in any of the leachates in both lysimeters. Up to three unknown fractions at low concentrations were detected. Unidentified metabolite M1 exceeded 0.1 µg/L in the leachate. |

**PEC (soil) (Annex IIIA, point 9.1.3)**

| | |
|---|---|
| **Parent**<br>Method of calculation | $DT_{50}$ (d): 7.5 days<br>Kinetics: SFO<br>Field or Lab: lab value |
| Application data | Crop: spring cereals, maize, winter cereals<br>Depth of soil layer: 5cm<br>Soil bulk density: 1.5 g/cm$^3$<br>% plant interception: 25 % (spring cereals, maize), 50 % winter cereals<br>Number of applications: 1<br>Interval (d): -<br>Application rate(s): 750 g a.s./ha |

**Spring cereals, maize**

| **PEC$_{(s)}$** (mg/kg) | Single application Actual | Single application Time weighted average | Multiple application Actual | Multiple application Time weighted average |
|---|---|---|---|---|
| Initial | 0.750 | | - | |

**Winter cereals**

| **PEC$_{(s)}$** (mg/kg) | | Single application Actual | Single application Time weighted average | Multiple application Actual | Multiple application Time weighted average |
|---|---|---|---|---|---|
| Initial | | 0.500 | | - | |
| Short term | 24h | 0.456 | 0.478 | - | - |
| | 2d | 0.416 | 0.457 | - | - |
| | 4d | 0.345 | 0.418 | - | - |
| Long term | 7d | 0.262 | 0.368 | - | - |
| | 14d | 0.137 | 0.280 | | |
| | 21d | 0.072 | 0.221 | | |
| | 28d | 0.038 | 0.179 | | |
| | 50d | 0.005 | 0.107 | | |
| | 100d | <0.001 | 0.054 | | |

| PEC(s) (mg/kg) | Single application Actual | Single application Time weighted average | Multiple application Actual | Multiple application Time weighted average |
|---|---|---|---|---|

| | | |
|---|---|---|
| Plateau concentration | < 0.001 | 0.054 |

| | |
|---|---|
| **2,4-DCP**<br>Method of calculation | Molecular weight relative to the parent: 0.74<br>$DT_{50}$ (d): 14 days<br>Kinetics: SFO<br>Field or Lab: lab value |
| Application data | Application rate assumed: 77.7 g a.s./ha (assumed 2,4-DCP is formed at a maximum of 8.7 % of the applied dose) |

**Spring cereals and maize**

| **PEC(s)** (mg/kg) | | Single application Actual | Single application Time weighted average | Multiple application Actual | Multiple application Time weighted average |
|---|---|---|---|---|---|
| Initial | | 0.048 | | - | |
| Short term | 24h | 0.046 | 0.047 | - | - |
| | 2d | 0.044 | 0.046 | - | - |
| | 4d | 0.039 | 0.044 | - | - |
| Long term | 7d | 0.034 | 0.041 | - | - |
| | 14d | 0.024 | 0.035 | | |
| | 21d | 0.017 | 0.030 | | |
| | 28d | 0.012 | 0.026 | - | - |
| | 50d | 0.004 | 0.018 | - | - |
| | 100d | <0.001 | 0.010 | - | - |

| | |
|---|---|
| Plateau concentration | - |

**Winter cereals**

| **PEC$_{(s)}$** (mg/kg) | | Single application Actual | Single application Time weighted average | Multiple application Actual | Multiple application Time weighted average |
|---|---|---|---|---|---|
| Initial | | 0.032 | | - | |
| Short term | 24h | 0.031 | 0.031 | - | - |
| | 2d | 0.029 | 0.031 | - | - |
| | 4d | 0.026 | 0.029 | - | - |
| Long term | 7d | 0.023 | 0.027 | - | - |
| | 14d | 0.016 | 0.023 | | |
| | 21d | 0.011 | 0.020 | | |
| | 28d | 0.008 | 0.017 | - | - |
| | 50d | 0.003 | 0.012 | - | - |
| | 100d | <0.001 | 0.006 | - | - |

| | |
|---|---|
| **2,4-DCA**<br>Method of calculation | Molecular weight relative to the parent: 0.80<br>$DT_{50}$ (d): 15.4 days<br>Kinetics: SFO<br>Field or Lab: lab value |
| Application data | Application rate assumed: 92.4 g a.s./ha (assumed 2,4-DCA is formed at a maximum of 15 % of the applied dose) |

**Spring cereals and maize**

| **PEC$_{(s)}$** (mg/kg) | | Single application Actual | Single application Time weighted average | Multiple application Actual | Multiple application Time weighted average |
|---|---|---|---|---|---|
| Initial | | 0.090 | - | - | |
| Short term | 24h | 0.086 | 0.088 | - | - |
| | 2d | 0.082 | 0.086 | - | - |
| | 4d | 0.075 | 0.082 | - | - |
| Long term | 7d | 0.066 | 0.077 | - | - |
| | 14d | 0.048 | 0.067 | | |
| | 21d | 0.035 | 0.058 | | |
| | 28d | 0.026 | 0.051 | - | - |
| | 50d | 0.009 | 0.036 | - | - |
| | 100d | 0.001 | 0.020 | - | - |

| | |
|---|---|
| Plateau concentration | - |

**Winter cereals**

| **$PEC_{(s)}$** (mg/kg) | | Single application Actual | Single application Time weighted average | Multiple application Actual | Multiple application Time weighted average |
|---|---|---|---|---|---|
| Initial | | 0.060 | | - | |
| Short term | 24h | 0.057 | 0.059 | - | - |
| | 2d | 0.055 | 0.057 | - | - |
| | 4d | 0.050 | 0.055 | - | - |
| Long term | 7d | 0.044 | 0.052 | - | - |
| | 14d | 0.032 | 0.045 | | |
| | 21d | 0.023 | 0.039 | | |
| | 28d | 0.017 | 0.034 | - | - |
| | 50d | 0.006 | 0.024 | - | - |
| | 100d | 0.001 | 0.013 | - | - |

| | |
|---|---|
| Plateau concentration | - |

**Route and rate of degradation in water (Annex IIA, point 7.2.1)**

| | |
|---|---|
| Hydrolytic degradation of the active substance and metabolites > 10 % ‡ | pH 4: no hydrolysis of 2,4-D<br>no metabolites detected |
| | pH 7: no hydrolysis of 2,4-D<br>no metabolites detected |
| | pH 9: no hydrolysis of 2,4-D<br>no metabolites detected |
| Photolytic degradation of active substance and metabolites above 10 % ‡ | Natural light, 40°N; $DT_{50}$ 90 days<br>pH buffer 7, $DT_{50}$ 38 days<br>Major metabolite: 1,2,4-benzenetriol. Max 31.7 % AR |
| Quantum yield of direct phototransformation in water at Σ > 290 nm | $6.1 \cdot 10^{-3}$ mol · Einstein $^{-1}$ |
| Readily biodegradable ‡ (yes/no) | 2,4-D considered to be readily biodegradable. |

**Degradation in water / sediment**

| **Parent** | Distribution (e.g. max in water 100 % after 0 d. Max. sed 24.7 % after 7 d) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Water/sediment system | pH water phase | pH sed | t. $^{0}$C | $DT_{50}$ $DT_{90}$ whole system | St. ($r^2$) $X^2$ | $DT_{50}$-$DT_{90}$ water | St. ($r^2$) $X^2$ | $DT_{50}$-$DT_{90}$ sed | St. ($r^2$) $X^2$ | Method of calculation |
| Pond system (loamy sand) | 6.5 | 6.4 | 20 | 18/60 | 2.6 | 12.6/ 41.9 | 4.0 | 9.8/32.6 | 8.6 | SFO |
| Pond system (silt loam) | 8.3 | 7.8 | 20 | 6.4/21.1 | 8.8 | 4.7/1 5.7 | 9.9 | - | - | SFO |
| Pond system (silty clay loam) | 6.9 | 7.8 | 25 | (29/96.3) $DT_{50\ Norm\ 20\ C}$ = 52 d | - | - | - | - | | SFO |
| Geometric mean/median | | | | 18.16 | | 7.7 | | 9.8 | | |

| **2,4-DCP** | Distribution (e.g. max in water 2.6 % after 26 d. Max. sed 31.8 % after 13 d) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Water/sediment system | pH water phase | pH sed | t. $^{0}$C | $DT_{50}$-$DT_{90}$ whole system | St. ($r^2$) $X^2$ | $DT_{50}$-$DT_{90}$ water | St. ($r^2$) $X^2$ | $DT_{50}$-$DT_{90}$ sed | St. ($r^2$) $X^2$ | Method of calculation |
| Pond system (loamy sand) | 6.5 | 6.4 | 20 | 1000 [a b] | | - | - | 197.2/654.7 | 5.8 | SFO |
| Pond system (silt loam) | 8.3 | 7.8 | 20 | 10.8 [c] | | - | - | 11/36.6 | | FOMC |
| Geometric mean/median | | | | 103.9 | | - | | 46.6 | | |

[a] No acceptable fit could be derived.
[b] Default value
[c] According to FOCUS (2006) the $DT_{50}$ was back-calculated from $DT_{90}$/3.32 of the FOMC kinetic model and should be used for modelling.

| Mineralization and non extractable residues | | | | | |
|---|---|---|---|---|---|
| Water / sediment system | pH water phase | pH sed | Mineralization x % after n d. (end of the study). | Non-extractable residues in sed. max x % after n d | Non-extractable residues in sed. max x % after n d (end of the study) |
| Pond system (loamy sand) | 6.5 | 6.4 | 57.3 % after 105 days | 26.2 % after 105 days | 26.2 % after 105 days |
| Pond system (silt loam) | 8.3 | 7.8 | 60.8 % after 105 days | 27.9 % after 70 days | 17 % after 105 days |
| Pond system (silty clay loam) | 6.9 | 7.8 | 63.9 % after 46 days | 15.6 % after 46 days | 15.6 % after 46 days |

**PEC (surface water) and PEC sediment (Annex IIIA, point 9.2.3)**

| | |
|---|---|
| **Parent**<br>Parameters used in FOCUSsw step 1 and 2 | Version control no. of FOCUS calculator: FOCUS STEPS 1-2 (version 2.1), FOCUS SWASH (version 3.1)<br>Molecular weight (g/mol): 221<br>Water solubility (mg/L): 24300 at 25 °C<br>$Kf_{OC}$ (L/kg): 58.6<br>$DT_{50}$ soil (d): 2.1 days (Lab)[a]<br>$DT_{50}$ water/sediment system (d): 9.4 days[b]<br>$DT_{50}$ water (d): 9.4 days[b]<br>$DT_{50}$ sediment (d): 9.4 days<br>Crop interception (%): 50 % for winter cereals, 25 % for spring cereals / maize |
| Parameters used in FOCUSsw step 3 (if performed) | Version control no.'s of FOCUS software:<br>Vapour pressure: 9.9 x$10^{-5}$ at 25 °C[c]<br>Kfoc (L/kg): 58.6[d]<br>$DT_{50}$ sediment (d): 1000 days (worst case for STEP 3 calculations)<br>1/n: 0.87[d] |
| Application rate | Crop: Winter cereals, Spring cereals / maize<br>Crop interception: 50 % for winter cereals, 25 % for spring cereals / maize / CAM 2 with standard application depth of 4 cm at Step 3<br>Number of applications: 1<br>Interval (d): -<br>Application rate(s): 1 x 750 g a.s./ha |

a) Soil $DT_{50}$ = 4.4 d should be used in future calculations as end point resulting of the renewal peer review.
b) Whole water sediment $DT_{50}$ = 18.16 should be used in future calculations as end point resulting of the renewal peer review.
c) Actual value measured for 2,4-D is 9.9 $10^{-6}$ Pa at 20° C (to be used in future calculations).
d) Values derived from old and new dossier data.

| FOCUS STEP 1 Scenario | Day after overall maximum | $PEC_{SW}$ (µg/L) | | $PEC_{SED}$ (µg/kg) | |
|---|---|---|---|---|---|
| | | Actual | TWA | Actual | TWA |
| Spring / winter cereals / maize | 0 | 238.780 | -- | 135.883 | -- |
| | 1 | 221.342 | 230.061 | 129.706 | 132.795 |
| | 2 | 205.607 | 221.719 | 120.486 | 128.917 |
| | 4 | 177.415 | 206.442 | 103.965 | 120.470 |
| | 7 | 142.205 | 186.179 | 83.332 | 108.812 |
| | 14 | 84.868 | 148.630 | 49.733 | 86.953 |
| | 21 | 50.649 | 121.185 | 29.681 | 70.918 |
| | 28 | 30.228 | 100.779 | 17.713 | 58.985 |
| | 42 | 10.766 | 73.470 | 6.309 | 43.005 |

| FOCUS STEP 2 Scenario | Day after overall maximum | $PEC_{SW}$ (µg/L) | $PEC_{SED}$ (µg/kg) |
|---|---|---|---|
| | | Actual | Actual |
| Northern EU Winter cereals March-May-June-September | 0 h | 11.074 | 5.964 |

| FOCUS STEP 2 Scenario | Day after overall maximum | $PEC_{SW}$ (µg/L) | $PEC_{SED}$ (µg/kg) |
|---|---|---|---|
| | | Actual | Actual |
| Southern EU Winter cereals March May | 0 h | 17.267 | 9.335 |

| FOCUS STEP 2 Scenario | Day after overall maximum | $PEC_{SW}$ (µg/L) | $PEC_{SED}$ (µg/kg) |
|---|---|---|---|
| | | Actual | Actual |
| Northern EU Spring cereals March-May-June-September | 0 h | 14.170 | 7.649 |

| FOCUS STEP 2 Scenario | Day after overall maximum | $PEC_{SW}$ (µg/L) | $PEC_{SED}$ (µg/kg) |
|---|---|---|---|
| | | Actual | Actual |
| Southern EU Spring cereals and Maize March-May | 0 h | 23.459 | 12.794 |

FOCUS STEP 3 / Winter cereals

| Scenario | Water body | Main entry route | $PEC_{sw}$ (µg/L) | $PEC_{sed}$ (µg/kg) |
|---|---|---|---|---|
| D1 | ditch | Drift | 4.911 | 3.803 |
| D1 | stream | Drift | 4.208 | 0.973 |
| D2 | ditch | Drainage | 15.586 | 5.709 |
| D2 | stream | Drainage | 10.027 | 2.806 |
| D3 | ditch | Drift | 4.753 | 0.872 |
| D4 | pond | Drift | 0.164 | 0.161 |
| D4 | stream | Drift | 3.879 | 0.186 |
| D5 | pond | Drift | 0.164 | 0.164 |
| D5 | stream | Drift | 3.826 | 0.095 |
| D6 | ditch | Drift | 4.847 | 0.858 |
| R1 | pond | Runoff | 0.189 | 0.251 |
| R1 | stream | Runoff | 10.142 | 1.257 |
| R3 | stream | Runoff | 10.281 | 1.527 |
| R4 | stream | Drift | 3.131 | 0.261 |

FOCUS STEP 3 / Spring cereals

| Scenario | Water body | Main entry route | $PEC_{sw}$ (µg/L) | $PEC_{sed}$ (µg/kg) |
|---|---|---|---|---|
| D1 | ditch | Drift | 4.797 | 1.318 |
| D1 | stream | Drift | 3.775 | 0.192 |
| D3 | ditch | Drift | 4.752 | 0.865 |
| D4 | pond | Drift | 0.164 | 0.155 |
| D4 | stream | Drift | 3.836 | 0.168 |
| D5 | pond | Drift | 0.164 | 0.163 |
| D5 | stream | Drift | 3.722 | 0.083 |
| R4 | stream | Drift | 3.128 | 0.255 |

FOCUS STEP 3 / Maize

| Scenario | Water body | Main entry route | $PEC_{sw}$ (µg/L) | $PEC_{sed}$ (µg/kg) |
|---|---|---|---|---|
| D3 | ditch | Drift | 3.926 | 0.738 |
| D4 | pond | Drift | 0.159 | 0.131 |
| D4 | stream | Drift | 3.391 | 0.178 |
| D5 | pond | Drift | 0.159 | 0.125 |
| D5 | stream | Drift | 3.363 | 0.090 |
| D6 | ditch | Drift | 3.910 | 0.589 |
| R1 | pond | Runoff | 0.225 | 0.244 |
| R1 | stream | Runoff | 7.205 | 0.847 |
| R2 | stream | Runoff | 5.442 | 1.071 |
| R3 | stream | Runoff | 14.440 | 2.258 |
| R4 | stream | Runoff | 18.295 | 3.551 |

| | |
|---|---|
| **Metabolite 2,4-DCP**<br>Parameters used in FOCUSsw step 1 and 2 | Molecular weight:163<br>Water solubility (mg/L):4870 (20 ºC)<br>Soil or water metabolite: Soil and Water metabolite<br>Kfoc (L/kg): 512<br>$DT_{50}$ soil (d): 7 days (Lab)<br>$DT_{50}$ water/sediment system (d): 103.9 days<br>$DT_{50}$ water (d): 103.9 days<br>$DT_{50}$ sediment (d): 103.9 days<br>Crop interception (%): 50 % for winter cereals, 25 % for spring cereals / maize<br>Maximum occurrence observed in soil: 8.7 %<br>Water / Sediment study: 32.1 % (calculated in the kinetic evaluation water/sediment study) |
| Application rate | Crop: Winter cereals, Spring cereals / maize<br>Number of applications: 1<br>Interval (d): -<br>Application rate(s): 1 x 750 g a.s./ha<br>Depth of water body: 30 cm |
| Main routes of entry | Drift, run-off, drainage |

| FOCUS STEP 1 Scenario | Day after overall maximum | $PEC_{SW}$ (µg/L) | | $PEC_{SED}$ (µg/kg) | |
|---|---|---|---|---|---|
| | | Actual | TWA | Actual | TWA |
| Spring / winter cereals / maize | 0 | 11.167 | -- | 48.812 | -- |
| | 1 | 10.434 | 10.800 | 53.423 | 51.118 |
| | 2 | 10.365 | 10.600 | 53.068 | 52.182 |
| | 4 | 10.228 | 10.448 | 52.365 | 52.449 |
| | 7 | 10.025 | 10.310 | 51.327 | 52.190 |
| | 14 | 9.567 | 10.052 | 48.985 | 51.168 |
| | 21 | 9.131 | 9.817 | 46.750 | 50.065 |
| | 28 | 8.714 | 9.593 | 44.617 | 48.968 |
| | 42 | 7.937 | 9.169 | 40.639 | 46.844 |
| | 50 | 7.525 | 8.938 | 38.527 | 45.681 |
| | 100 | 5.391 | 7.668 | 27.599 | 39.220 |

| FOCUS STEP 2 Scenario | Day after overall maximum | $PEC_{SW}$ (µg/L) | $PEC_{SED}$ (µg/kg) |
|---|---|---|---|
| | | Actual | Actual |
| Northern EU Winter cereals March-May-June-September | 0 h | 1.734 | 8.09 |

| FOCUS STEP 2 Scenario | Day after overall maximum | $PEC_{SW}$ (µg/L) | $PEC_{SED}$ (µg/kg) |
|---|---|---|---|
| | | Actual | Actual |
| Southern EU Winter cereals March May | 0 h | 2.376 | 11.332 |

| FOCUS STEP 2 Scenario | Day after overall maximum | $PEC_{SW}$ (µg/L) | $PEC_{SED}$ (µg/kg) |
|---|---|---|---|
| | | Actual | Actual |
| Northern EU Spring cereals March-May-June-September | 0 h | 2.055 | 9.700 |

| FOCUS STEP 2 Scenario | Day after overall maximum | $PEC_{SW}$ (µg/L) | $PEC_{SED}$ (µg/kg) |
|---|---|---|---|
| | | Actual | Actual |
| Southern EU Spring cereals and Maize March-May | 0 h | 3.018 | 14.595 |

| | |
|---|---|
| **Metabolite 2,4-DCA**<br>Parameters used in FOCUSsw step 1 and 2 | Molecular weight:177<br>Water solubility (mg/L): 96.3 (20 °C)<br>Soil or water metabolite: Soil and Water metabolite<br>Kfoc (L/kg): 1028<br>$DT_{50}$ soil (d): 10.4 days (Lab)<br>$DT_{50}$ water/sediment system (d): 1000 days<br>$DT_{50}$ water (d): 1000 days<br>$DT_{50}$ sediment (d): 1000 days<br>Crop interception (%): 50 % for winter cereals, 25 % for spring cereals / maize<br>Maximum occurrence in soil 15 %<br>Water / Sediment study: 5.3 % (calculated in the kinetic evaluation water/sediment study) |
| Application rate | Crop: Winter cereals, Spring cereals / maize<br>Number of applications: 1<br>Interval (d): -<br>Application rate(s): 1 x 750 g a.s./ha<br>Depth of water body: 30 cm |
| Main routes of entry | Drift, run-off, drainage |

| FOCUS STEP 1 Scenario | Day after overall maximum | $PEC_{SW}$ (µg/L) | | $PEC_{SED}$ (µg/kg) | |
|---|---|---|---|---|---|
| | | Actual | TWA | Actual | TWA |
| Spring cereals / maize | 0 | 12.962 | -- | 130.237 | -- |
| | 1 | 12.784 | 12.873 | 131.416 | 130.826 |
| | 2 | 12.775 | 12.826 | 131.325 | 131.098 |
| | 4 | 12.757 | 12.796 | 131.143 | 131.166 |
| | 7 | 12.731 | 12.774 | 130.870 | 131.098 |
| | 14 | 12.669 | 12.737 | 130.237 | 130.825 |
| | 21 | 12.608 | 12.704 | 129.606 | 130.524 |
| | 28 | 12.547 | 12.672 | 128.979 | 130.216 |
| | 42 | 12.425 | 12.610 | 127.734 | 129.596 |
| | 50 | 12.357 | 12.575 | 127.027 | 129.241 |
| | 100 | 11.936 | 12.360 | 122.700 | 127.046 |

| FOCUS STEP 2 Scenario | Day after overall maximum | $PEC_{SW}$ (µg/L) | $PEC_{SED}$ (µg/kg) |
|---|---|---|---|
| | | Actual | Actual |
| Northern EU Winter cereals March-May-June-September | 0 h | 1.123 | 11.234 |

| FOCUS STEP 2 Scenario | Day after overall maximum | $PEC_{SW}$ (µg/L) | $PEC_{SED}$ (µg/kg) |
|---|---|---|---|
| | | Actual | Actual |
| Southern EU Winter cereals March May | 0 h | 2.094 | 21.203 |

| FOCUS STEP 2 Scenario | Day after overall maximum | $PEC_{SW}$ (µg/L) | $PEC_{SED}$ (µg/kg) |
|---|---|---|---|
| | | Actual | Actual |
| Northern EU Spring cereals March-May-June-September | 0 h | 1.608 | 16.219 |

| FOCUS STEP 2 Scenario | Day after overall maximum | $PEC_{SW}$ (µg/L) | $PEC_{SED}$ (µg/kg) |
|---|---|---|---|
| | | Actual | Actual |
| Southern EU Spring cereals and Maize March-May | 0 h | 3.064 | 31.172 |

**PEC (ground water) (Annex IIIA, point 9.2.1)**

| | |
|---|---|
| Method of calculation and type of study (*e.g.* modelling, field leaching, lysimeter ) | For FOCUS gw modelling, values used –<br>Modelling using FOCUS model(s), with appropriate FOCUSgw scenarios, according to FOCUS guidance.<br>Model(s) used: PEARL 4.4.4<br>Scenarios (list of names): Châteaudun, Hamburg, Jokioinen, Kremsmünster, Okehampton, Piacenza, Porto, Sevilla, Thiva<br>Crop: Winter cereals, Spring cereals, Maize<br>Geometric mean or median parent $DT_{50lab}$ 2.1 d [a)] (normalisation to pF2, 20 °C with Q10 of 2.58).<br>$K_{OC}$: parent, arithmetic mean 24, $^{1}/_{n}$= 0.83.<br>Metabolites: 2,4-DCP and 2,4-DCA<br>$DT_{50}$ (2,4-DCP) = 7.0 days<br>$DT_{50}$ (2,4-DCA) = 10.4 days<br>Koc (2,4-DCP) = 512, 1/n = 0.88<br>Koc (2,4-DCA) = 1028, 1/n = 0.92<br>Dates of application :<br>**Winter cereals**:<br>Châteaudun 10-Mar, Hamburg 1-Apr,<br>Jokioinen 18-May, Kremsmünster 1-Apr,<br>Okehampton 1-Apr, Piacenza 10-Mar,<br>Porto10-Mar, Sevilla 10-Mar<br>Thiva 10-Mar<br>**Spring cereals**:<br>Châteaudun 12-Mar, Hamburg 3-Apr,<br>Jokioinen 20-May, Kremsmünster 3-Apr,<br>Okehampton 3-Apr, Porto 12-Mar<br>**Maize**<br>Châteaudun 3-May, Hamburg 7-May,<br>Jokioinen 7-May, Okehampton 27-May,<br>Piacenza 17-May, Porto 3-Mar,<br>Sevilla 9-Mar, Thiva 22-Apr<br>Crop: Interception estimated: 50 % for winter cereals, 25 % for spring cereals and maize<br>Number of applications: 1 application/year |
| Application rate | Application rate: 750 g a.s./ha<br>No. of applications: 1 |

a) Soil $DT_{50}$ = 4.4 d should be used in future calculations as end point resulting of the renewal peer review.

**PEC(gw) - FOCUS modelling results (80th percentile annual average concentration at 1m)**

| | Scenario | Parent (µg/L) | Metabolite (µg/L) | |
|---|---|---|---|---|
| | | | 2,4-DCP | 2,4-DCA |
| PEARL 4.4.4 /winter cereals | Chateaudun | <0.001 | <0.001 | <0.001 |
| | Hamburg | <0.001 | <0.001 | <0.001 |
| | Jokioinen | <0.001 | <0.001 | <0.001 |
| | Kremsmunster | <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 |

| | Scenario | Parent (µg/L) | Metabolite (µg/L) | |
|---|---|---|---|---|
| | | | 2,4-DCP | 2,4-DCA |
| PEARL 4.4.4 /Spring cereals | Chateaudun | <0.001 | <0.001 | <0.001 |
| | Hamburg | <0.001 | <0.001 | <0.001 |
| | Jokioinen | <0.001 | <0.001 | <0.001 |
| | Kremsmunster | <0.001 | <0.001 | <0.001 |
| | Okehampton | <0.001 | <0.001 | <0.001 |
| | Porto | <0.001 | <0.001 | <0.001 |
| | | | | |
| | | | | |
| | | | | |

| | Scenario | Parent (µg/L) | Metabolite (µg/L) | |
|---|---|---|---|---|
| | | | 2,4-DCP | 2,4-DCA |
| PEARL 4.4.4 /Maize | Chateaudun | <0.001 | <0.001 | <0.001 |
| | Hamburg | <0.001 | <0.001 | <0.001 |
| | Kremsmunster | <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 |
| | | | | |

**Fate and behaviour in air (Annex IIA, point 7.2.2, Annex III, point 9.3)**

| | |
|---|---|
| Direct photolysis in air ‡ | Not studied - no data requested<br>- |
| Quantum yield of direct phototransformation | active substance: x, Met I: x |
| Photochemical oxidative degradation in air ‡ | $DT_{50}$ of 1.6 days (assuming $1.5x10^6$ OH radicals $cm^3$ ) |
| Volatilisation ‡ | from plant surfaces (BBA guideline): no data |
| | from soil surfaces (BBA guideline): negligible after 15 days |
| Metabolites | None |

**PEC (air)**

| | |
|---|---|
| Method of calculation | Not calculated. |

**$PEC_{(a)}$**

| | |
|---|---|
| Maximum concentration | Not calculated because of low volatility. |

**Residues requiring further assessment**

| | |
|---|---|
| Environmental occurring residues requiring further assessment by other disciplines (e.g. toxicology and ecotoxicology) and or requiring consideration for groundwater exposure. | **Soil**: 2,4-D; 2,4-DCA; (4-CP only for situations where anaerobic conditions may be expected).<br>**Surface water and sediment**: 2,4-D; 2,4-DCP; 2,4-DCA; 1,2,4-benzenetriol; (4-CP from soil; only for situations where anaerobic conditions may be expected).<br>**Ground water**: 2,4-D; 2,4-DCP; 2,4-DCA; (4-CP only |

| | |
|---|---|
| | for situations where anaerobic conditions may be expected).<br>**Air**: 2,4-D |

**Monitoring data, if available (Annex IIA, point 7.4)**

| | |
|---|---|
| Soil (indicate location and type of study) | None available |
| Surface water (indicate location and type of study) | Europe (review of the occurrence of herbicide compounds (2,4-D included) in surface water from 1990 to 2002 across several European countries).<br>Analysed samples: ≥ 44110<br>Samples ≥ 0.1µg/L: 39 (≤ 0.09 %) |
| Ground water (indicate location and type of study) | Europe (review of the occurrence of herbicide compounds (2,4-D included) in ground water from 1990 to 2002 across several European countries).<br>Analysed samples: ≥ 71048<br>Samples ≥ 0.1µg/L: ≥ 528 (0.74 %) |
| Air (indicate location and type of study) | None available |

**Points pertinent to the classification and proposed labelling with regard to fate and behaviour data**

| |
|---|
| - |

## Ecotoxicology

**Effects on terrestrial vertebrates (Annex IIA, point 8.1, Annex IIIA, points 10.1 and 10.3)**

| Species | Test substance | Time scale | End point (mg/kg bw per day) | End point (mg/kg feed) |
|---|---|---|---|---|
| Birds ‡ | | | | |
| Canary *(Serinus canaria)* | a.s. | Acute | 633 | |
| Japanese quail *(Coturnix coturnix japonica)* | a.s. | Acute | 617.3 | |
| Bobwhite quail *(Colinus virginianus)* | a.s. | Acute | 500 | |
| Northern Bobwhite | a.s. | Short-term (5 days) | - | > 5620 |
| Mallard duck | a.s. | Short-term (5 days) | - | > 5620 |
| Bobwhite quail *(Colinus virginianus)* | a.s. | Long-term | 100[1] | > 1000 |
| Bobwhite quail *(Colinus virginianus)* | a.s. | Long-term | > 101[2] | 1000[3] |
| *Japanese quail (Coturnix coturnix japonica)* | a.s. | Long-term | 100[2] | 1000 |
| Mammals ‡ | | | | |
| Rat | a.s | Acute | 699 | |
| Rat | a.s | Acute | 486 | |
| Rat | a.s | Acute | > 500 | |
| Rat | a.s. | Long-term | 20.6 | |

[1] Estimated based on NOEC (ppm diet) x 0.1 in accordance with EFSA, 2009
[2] Estimated based on study results
[3] Maximum dose tested

**Geometric mean values calculated from the above mentioned acute values used in birds and mammals acute risk assessment**

| Species | Test substance | $LD_{50}$ (mg a.s./kg bw) |
|---|---|---|
| Canary *(Serinus canaria)* | a.s. | 633 mg |
| Japanese quail *(Coturnix coturnix japonica)* | a.s. | 617.3 |
| Bobwhite quail *(Colinus virginianus)* | a.s. | 500 |
| Geometric mean to be used in risk assessment | | 580.3 |
| Rat | a.s. | 699 |

| | | |
|---|---|---|
| Rat | a.s. | 486 |
| Rat | a.s. | >500 |
| Geometric mean to be used in risk assessment | | >554 |

**Toxicity/exposure ratios for terrestrial vertebrates (Annex IIIA, points 10.1 and 10.3)**

Cereals at 1 x 750 g a.s./ha
(Winter cereals, BBCH 21-32 Feb – May), (Spring cereals, BBCH 11-31, March-June)

| Indicator species/Category[2] | Time scale | ETE | TER[1] | Annex VI Trigger[3] |
|---|---|---|---|---|
| Screening Step (Birds) | | | | |
| Small omnivorous bird | Acute | 119.1 | 4.9 | 10 |
| Small omnivorous bird | Long-term | 25.76 | 2.3 | 5 |
| Tier 1 (Birds) | | | | |
| Large herbivorous bird | Acute | 22.9 | 25 | 10 |
| Small omnivorous bird | Acute | 18.0 | 32 | 10 |
| Large herbivorous bird | Long-term* | 6.44 | 9.0 | 5 |
| Small omnivorous bird | Long-term* | 4.33 | 13.4 | 5 |
| Tier 1 (Mammals) | | | | |
| Small insectivorous mammals (BBCH ≥ 20) | Acute | 4.05 | 136.8 | 10 |
| Small insectivorous mammals (BBCH 10-19) | Acute | 5.7 | 97 | 10 |
| Large herbivorous mammals | Acute | 31.57 | 18 | 10 |
| Small omnivorous mammal | Acute | 12.9 | 43 | 10 |
| Small insectivorous mammals (BBCH ≥ 20) | Long-term | 0.76 | 27.1 | 5 |
| Small insectivorous mammals (BBCH 10-19) | Long-term | 1.66 | 12.4 | 5 |
| Large herbivorous mammals | Long-term | 8.86 | **2.3** | 5 |
| Small omnivorous mammal | Long-term | 3.12 | 6.6 | 5 |

[1] in higher tier refinement provide brief details of any refinements used (e.g., residues, PT, PD or AV)
[2] for cereals indicate if it is early or late crop stage
[3] If the Annex VI Trigger value has been adjusted during the risk assessment of the active substance (e.g. many single species data), it should appear in this column.
* The risk assessment has been conducted with the lowest endpoint (58 mg/kg bw based on $LD_{50}$/10) in accordance with the current EFSA Guidance (2009).

Maize at 1 x 750 g a.s./ha

| Indicator species/Category[2] | Time scale | ETE | TER[1] | Annex VI Trigger[3] |
|---|---|---|---|---|
| Screening Step (Birds) | | | | |
| Small omnivorous bird | Acute | 119.1 | 4.9 | 10 |
| Small omnivorous bird | Long-term | 25.76 | 2.3 | 5 |

| Indicator species/Category[2] | Time scale | ETE | TER[1] | Annex VI Trigger[3] |
|---|---|---|---|---|
| Tier 1 (Birds) | | | | |
| Medium granivorous bird | Acute | 5.0 | 117 | 10 |
| Small insectivorous/worm feeding species | Acute | 7.9 | 74 | 10 |
| Small omnivorous bird | Acute | 18.0 | 32 | 10 |
| Medium herbivorous/granivorous bird | Acute | 41.7 | 14 | 10 |
| Small insectivorous | Acute | 20.1 | 29 | 10 |
| Medium granivorous bird | Long-term* | 1.19 | 48.7 | 5 |
| Small insectivorous/worm feeding species | Long-term* | 2.27 | 25.6 | 5 |
| Small omnivorous bird | Long-term* | 4.33 | 13.4 | 5 |
| Medium herbivorous/granivorous bird | Long-term* | 9.02 | 6.4 | 5 |
| Small insectivorous bird | Long-term* | 4.49 | 12.9 | 5 |
| Tier 1 (Mammals) | | | | |
| Small insectivorous mammal | Acute | 5.7 | 97 | 10 |
| Small herbivorous mammal | Acute | 102.3 | **5.4** | 10 |
| Small omnivorous mammal | Acute | 12.9 | 43 | 10 |
| Small insectivorous mammal | Long-term | 1.67 | 12.3 | 5 |
| Small herbivorous mammal | Long-term | 28.7 | **0.7** | 5 |
| Small omnivorous mammal | Long-term | 3.12 | 6.6 | 5 |
| | | | | |
| | | | | |
| Higher tier refinement (Mammals – long-term)<br>(Refinement of $DT_{50}$ value with the use of measured residues in cereals and maize) | | | | |
| Large herbivorous mammals (cereals) | Long-term | 2.64 | 7.8 | 5 |
| Small herbivorous mammal (maize) | Long-term | 5.73 | **3.6** | 5 |

[1] in higher tier refinement provide brief details of any refinements used (e.g., residues, PT, PD or AV)
[2] for cereals indicate if it is early or late crop stage
[3] If the Annex VI Trigger value has been adjusted during the risk assessment of the active substance (e.g. many single species data), it should appear in this column.
* The risk assessment has been conducted with the lowest endpoint (58 mg/kg bw based on $LD_{50}$/10) in accordance with the current EFSA Guidance (2009).

**Risk to earthworm-eating birds and mammals**

| Group | Metabolite | Daily Dose (mg/kg bw per day) | Endpoint[1] (mg/kg bw per day) | TER | Trigger |
|---|---|---|---|---|---|
| Birds | 2,4-DCP | 0.071 | 5.8 | 82 | 5 |
| Birds | 2,4-DCA | 0.130 | 5.8 | 45 | 5 |
| Mammals | 2,4-DCP | 0.087 | 2.09 | 24 | 5 |
| Mammals | 2,4-DCA | 0.159 | 2.09 | 13 | 5 |

[1] For the screening assessment it was assumed that the lowest long-term endpoint is 10 times lower than for 2,4-D.

**Risk to fish-eating birds and mammals**

| Group | Metabolite | Daily Dose (mg/kg bw per day) | Endpoint[1] (mg/kg bw per day) | TER | Trigger |
|---|---|---|---|---|---|
| Birds | 2,4-DCP | 0.086 | 5.8 | 67 | 5 |
| Birds | 2,4-DCA | 0.012 | 5.8 | 483 | 5 |
| Mammals | 2,4-DCP | 0.077 | 2.09 | 27 | 5 |
| Mammals | 2,4-DCA | 0.010 | 2.09 | 209 | 5 |

[1] For the screening assessment it was assumed that the lowest long-term endpoint is 10 times lower than for 2,4-D.

**Toxicity data for aquatic species (most sensitive species of each group) (Annex IIA, point 8.2, Annex IIIA, point 10.2)**

| Group | Test substance | Time-scale (Test type) | End point | Toxicity[1] (mg/L) |
|---|---|---|---|---|
| Laboratory tests ‡ | | | | |
| Fish | | | | |
| *Primephales promelas* | a.s. | 96 hr (flow-through) | Mortality, $LC_{50}$ | 100 (nom) |
| *Primephales promelas* | a.s. | 32 d ELS (flow-through) | Growth NOEC | 63.4 (mm) |
| *Cyprinus carpio* | 2,4-D-DMA 600 SL | 96 hr (static) | Mortality, $LC_{50}$ | > 100 mg prod./L (nom)<br>> 59.9 mg a.s. /L (mm) |
| *Oncorthynchus mykiss* | 2,4-DCA | 96 hr | Mortality, $LC_{50}$ | > 1.4 (mm) |
| Aquatic invertebrates | | | | |
| *Daphnia magna* | a.s. | 48 h (static) | Mortality, $EC_{50}$ | 134.2 (nom) |
| *Daphnia magna* | a.s. | 21 d (semi-static) | Reproduction, NOEC | 46.2 mg DMA salt/L (nom)<br>**38.4** mg a.s./L |
| *Daphnia magna* | a.s. | 21 d (flow-through) | Reproduction, NOEC | 79 (mm) |
| *Daphnia magna* | 2,4-D-DMA 600 SL | 48 h (static) | Mortality, $EC_{50}$ | > 100 mg prod./L (nom)<br>> 50.6 mg a.s. /L (mm) |
| *Daphnia magna* | 2,4-DCP | 48 h (static) | Mortality, $EC_{50}$ | 2.8 (nom) |
| *Daphnia magna* | 2,4-DCA | 48 h (static) | Mortality, $EC_{50}$ | 6.4 (mm) |
| Algae | | | | |
| *Pseudokirchneriella subcapitata* | a.s. | 72 h (static) | Yield: $E_yC_{50}$<br>Growth rate: $E_rC_{50}$ | >78 (mm)<br>>78 (mm) |
| *Navicula pelliculosa* | a.s. | 72 h | Yield: $E_yC_{50}$<br>Growth rate: $E_rC_{50}$ | > 100 (nom)<br>> 100 (nom |
| *Desmodesmus subspicatus* | a.s. | 72 h | Yield: $E_yC_{50}$<br>Growth rate: $E_rC_{50}$ | >582.2 (mm)<br>>582.2 (mm) |
| *Skeletonema costatum** | a.s. | 120 h (static) | Yield: $E_yC_{50}$<br>Growth rate: $E_rC_{50}$ | **0.68** (nom)<br>4.58 (nom) |

| Group | Test substance | Time-scale (Test type) | End point | Toxicity[1] (mg/L) |
|---|---|---|---|---|
| *Pseudokirchneriella subcapitata* | 2,4-D-DMA 600 SL | 72 h (static) | Yield: $E_yC_{50}$<br>Growth rate: $E_rC_{50}$ | > 186.65 mg prod. /L (115.35 mg a.s./L)<br>> 320 mg prod./L (197.8 mg a.s./L) |
| *Pseudokirchneriella subcapitata* | 2,4-DCP | 72 h (static) | Yield: $E_yC_{50}$<br>Growth rate: $E_rC_{50}$ | 1.13 (mm)<br>3.44 (mm) |
| *Pseudokirchneriella subcapitata* | 2,4-DCA | 72 h (static) | Yield: $E_yC_{50}$<br>Growth rate: $E_rC_{50}$ | 2.2 (mm)<br>4.3 (mm) |
| Higher plant | | | | |
| *Lemna minor* | a.s. | 7 d (static) | Fronds, $E_yC_{50}$<br>Fronds, $E_rC_{50}$<br>Dry weight, $E_yC_{50}$<br>Dry weight, $E_rC_{50}$ | 10.66 (nom)<br>17.51 (nom)<br>18.50 (nom)<br>> 100 |
| *Myriophyllum spicatum* | a.s. | 14 d | Total root length, $EC_{50}$<br>Total root length, NOEC | 0.011 mg a.s./L (nom) #<br>0.0047 mg a.s./L# |
| *Lemna minor* | 2,4-D-DMA 720 SL | 7 d | Fronds, $EyC_{50}$<br>Growth rate, $ErC_{50}$ | 4.6 mg prod./L (2.7 mg a.s./L) (nom)<br>24.6 mg prod./L (14.4 mg a.s./L) (nom) |
| *Lemna gibba* | 2,4-DCP | 10 d | Fronds, $EC_{50}$ | 1.5 (mm) |
| *Lemna gibba* | 2,4-DCA | 7 d | Fronds, $EC_{50}$ | 2.1 (mm) |
| *Myriophyllum aquaticum* | 2,4-DCP | 10 d (static) | Fresh weight, $EC_{50}$ | 12.4 (mm) |
| *Myriophyllum aquaticum* | 2,4-DCA | 10 d (static) | Shoot length, $EC_{50}$ | 1.16 (mm) |
| Microcosm or mesocosm tests | | | | |
| Not submitted | | | | |

[1] Endpoint based on nominal ($_{nom}$) or mean measured concentrations ($_{mm}$).
* marine species
# endpoint agreed at the Pesticides Peer Review Meeting 111 (04 – 07 February 2013) and it is the geometric mean value for root length from the available 6 ring test studies with *Myriophyllum*.

**Toxicity/exposure ratios for the most sensitive aquatic organisms (Annex IIIA, point 10.2)**

**FOCUS Step1**

Cereals at 1 x 750 g a.s./ha
Maize at 1 x 750 g a.s./ha

| Test substance | Organism | Toxicity end point (mg/L) | Time scale | $PEC_i$ | $PEC_{twa}$ | TER | Annex VI Trigger |
|---|---|---|---|---|---|---|---|
| a.s. | Fish *(Primephales promelas)* | 100 | Acute | 0.239 | n.r. | 418 | 100 |
| a.s. | Fish *(Primephales promelas)* | 63.4 | Chronic | 0.239 | n.r. | 265 | 10 |
| a.s. | Aquatic invertebrates (*Daphnia magna*) | 134.2 | Acute | 0.239 | n.r. | 561 | 100 |
| a.s. | Aquatic invertebrates (*Daphnia magna*) | 38.4 | Chronic | 0.239 | n.r. | 160.7 | 10 |
| a.s. | Algae *Pseudokirchneriella subcapitata* | 78 | Chronic | 0.239 | n.r. | 326 | 10 |
| a.s. | Algae *Skeletonema costatum* | 0.68 | Chronic | 0.239 | n.r. | **2.8** | 10 |
| a.s. | Higher plants *Lemna minor* | 10.66 | Chronic | 0.239 | n.r. | 44.6 | 10 |
| a.s. | Higher plants *Myriophyllum spicatum* | 0.011[#] | Chronic | 0.239 | n.r. | **0.05** | 10 |
| a.s. | Sediment-dwelling organisms | n.r. | Chronic | n.r. | n.r. | n.r. | 10 |
| 2,4-DCP | Fish *Pimephales promelas* | 10* | Acute | 0.0112 | n.r. | 893 | 100 |
| 2,4-DCP | Aquatic invertebrates (*Daphnia magna*) | 2.8 | Acute | 0.0112 | n.r. | 250 | 100 |
| 2,4-DCP | Algae *Pseudokirchneriella subcapitata* | 1.13 | Chronic | 0.0112 | n.r. | 101 | 10 |
| 2,4-DCP | Higher plants *Lemna gibba* | 1.5 | Chronic | 0.0112 | n.r. | 134 | 10 |
| 2,4-DCP | Higher plants *Myriophyllum aquaticum* | 12.4 | Chronic | 0.0112 | n.r. | 1107 | 10 |

| Test substance | Organism | Toxicity end point (mg/L) | Time scale | $PEC_i$ | $PEC_{twa}$ | TER | Annex VI Trigger |
|---|---|---|---|---|---|---|---|
| 2,4-DCA | Fish *Oncorthynchus mykiss* | > 1.49 | Acute | 0.0130 | n.r. | > 115 | 100 |
| 2,4–DCA | Aquatic invertebrates (*Daphnia magna*) | 6.4 | Acute | 0.0130 | n.r. | 492 | 100 |
| 2,4–DCA | Algae *Pseudokirchneriella subcapitata* | 2.2 | Chronic | 0.0130 | n.r. | 169 | 10 |
| 2,4-DCA | Higher plants *Lemna gibba* | 2.1 | Chronic | 0.0130 | n.r. | 161 | 10 |
| 2,4-DCA | Higher plants *Myriophyllum aquaticum* | 1.16 | Chronic | 0.0130 | n.r. | 89 | 10 |
| 2,4-D-DMA | Fish (*Cyprinus carpio*) | > 59.9 mg a.s. /L | Acute | 0.239 | n.r. | > 251 | 100 |
| 2,4-D-DMA | Aquatic invertebrates (*Daphnia magna*) | > 50.6 mg a.s. /L | Acute | 0.239 | n.r. | >212 | 100 |
| 2,4-D-DMA | Algae *Pseudokirchneriella subcapitata* | 115.35 mg a.s./L | Chronic | 0.239 | n.r. | 483 | 10 |
| 2,4-D DMA 720 g/L | Higher plants *Lemna minor* | 2.7 mg a.s./L | Chronic | 0.239 | n.r. | 11.3 | 10 |

n.r. not required
# based on total root length
* The endpoint used for risk assessment for the metabolite 2,4-DCP is the $EC_{50}$ of parent molecule / 10, according to SANCO Guidance Document on Aquatic Ecotoxicology p.49 (European Commission, 2002b)

**FOCUS Step 2**

Spring cereals/Maize at 1 x 750 g a.s./ha (worst case)

| Test substance | N/S[1] | Organism | Toxicity end point (mg/L) | Time scale | PEC (mg/L) | TER | Annex VI Trigger |
|---|---|---|---|---|---|---|---|
| a.s. | S | Algae *Skeletonema costatum* | 0.68 | Chronic | 0.0234 | 29 | 10 |
| a.s. | N | Algae *Skeletonema costatum* | 0.68 | Chronic | 0.0142 | 48 | 10 |
| a.s. | S | Higher plants *Myriophyllum aquaticum* | 0.011 | Chronic | 0.0234 | **0.47** | 10 |
| a.s. | N | Higher plants | 0.011 | Chronic | 0.0142 | **0.78** | 10 |

| Test substance | N/S[1] | Organism | Toxicity end point (mg/L) | Time scale | PEC (mg/L) | TER | Annex VI Trigger |
|---|---|---|---|---|---|---|---|
| | | *Myriophyllum spicatum* | | | | | |

[1] Northern or Southern Europe

**FOCUS Step 3**

FOCUS STEP 3 / Winter cereals

| Scenario | Water body | $EC_{50}$ *Myriophyllum spicatum* (µg a.s./L) | $PEC_{sw}$ (µg/L) | TER | Trigger |
|---|---|---|---|---|---|
| D1 | ditch | 11 | 4.911 | **2.2** | 10 |
| D1 | stream | 11 | 4.208 | **2.6** | 10 |
| D2 | ditch | 11 | 15.586 | **0.7** | 10 |
| D2 | stream | 11 | 10.027 | **1.1** | 10 |
| D3 | ditch | 11 | 4.753 | **2.3** | 10 |
| D4 | pond | 11 | 0.164 | 67.1 | 10 |
| D4 | stream | 11 | 3.879 | **2.8** | 10 |
| D5 | pond | 11 | 0.164 | 67.1 | 10 |
| D5 | stream | 11 | 3.826 | **2.9** | 10 |
| D6 | ditch | 11 | 4.847 | **2.3** | 10 |
| R1 | pond | 11 | 0.189 | 58.2 | 10 |
| R1 | stream | 11 | 10.142 | **1.1** | 10 |
| R3 | stream | 11 | 10.281 | **1.1** | 10 |
| R4 | stream | 11 | 3.131 | **3.5** | 10 |

TER values presented in **bold** are less than the Trigger

FOCUS STEP 3 / Spring cereals

| Scenario | Water body | $EC_{50}$ *Myriophyllum spicatum* (µg a.s./L) | $PEC_{sw}$ (µg/L) | TER | Trigger |
|---|---|---|---|---|---|
| D1 | ditch | 11 | 4.797 | **2.3** | 10 |
| D1 | stream | 11 | 3.775 | **2.9** | 10 |
| D3 | ditch | 11 | 4.752 | **2.3** | 10 |
| D4 | pond | 11 | 0.164 | 67.1 | 10 |
| D4 | stream | 11 | 3.836 | **2.9** | 10 |
| D5 | pond | 11 | 0.164 | 67.1 | 10 |
| D5 | stream | 11 | 3.722 | **3.0** | 10 |
| R4 | stream | 11 | 3.128 | **3.5** | 10 |

TER values presented in **bold** are less than the Trigger

FOCUS STEP 3 / Maize

| Scenario | Water body | $EC_{50}$ *Myriophyllum spicatum* (µg a.s./L) | $PEC_{sw}$ (µg/L) | TER | Trigger |
|---|---|---|---|---|---|
| D3 | ditch | 11 | 3.926 | **2.8** | 10 |
| D4 | pond | 11 | 0.159 | 69.2 | 10 |

| Scenario | Water body | $EC_{50}$ *Myriophyllum spicatum* (µg a.s./L) | $PEC_{sw}$ (µg/L) | TER | Trigger |
|---|---|---|---|---|---|
| D4 | stream | 11 | 3.391 | **3.2** | 10 |
| D5 | pond | 11 | 0.159 | 69.2 | 10 |
| D5 | stream | 11 | 3.363 | **3.3** | 10 |
| D6 | ditch | 11 | 3.910 | **2.8** | 10 |
| R1 | pond | 11 | 0.225 | 48.9 | 10 |
| R1 | stream | 11 | 7.205 | **1.5** | 10 |
| R2 | stream | 11 | 5.442 | **2.0** | 10 |
| R3 | stream | 11 | 14.440 | **0.8** | 10 |
| R4 | stream | 11 | 18.295 | **0.6** | 10 |

TER values presented in **bold** are less than the Trigger

| **Bioconcentration** | | | |
|---|---|---|---|
| | 2,4-D | 2,4-DCA | 2,4-DCP |
| $logP_{O/W}$ | 1.54 | 3.36 | 3.06 |
| Bioconcentration factor (BCF)[1]‡ | - | 31[2] | 340 |
| Annex VI Trigger for the bioconcentration factor | | | |
| Clearance time (days) ($CT_{50}$) | | 7.03 | |
| ($CT_{90}$) | | 23.3 | |
| Level and nature of residues (%) in organisms after the 14 day depuration phase | | | |

[1] only required if log $P_{O/W}$ >3.
[2] lipid normalized BCF value

**Effects on honey bees (Annex IIA, point 8.3.1, Annex IIIA, point 10.4)**

| Test substance | Acute oral toxicity ($LD_{50}$ µg/bee) | Acute contact toxicity ($LD_{50}$ µg/bee) |
|---|---|---|
| a.s. ‡ | 94 | >100 |
| Aminopielik Standard 600 SL | > 100 µg prod. /bee | > 200 µg prod./bee |
| Field or semi-field tests | | |

**Hazard quotients for honey bees (Annex IIIA, point 10.4)**

Cereals 1 x 750 g a.s / ha
Maize 1 x 750 g a.s./ha

| Test substance | Route | Hazard quotient | Annex VI Trigger |
|---|---|---|---|
| a.s. | Contact | < 7.50 | 50 |
| a.s. | Oral | 7.98 | 50 |
| Aminopielik Standard 600 SL | Contact | < 7.54 | 50 |
| Aminopielik Standard 600 SL | Oral | < 15.08 | 50 |

**Effects on other arthropod species (Annex IIA, point 8.3.2, Annex IIIA, point 10.5)**

Laboratory tests with standard sensitive species

| Species | Test Substance | End point | Effect ($LR_{50}$ g a.s./ha[1]) |
|---|---|---|---|
| *Typhlodromus pyri* ‡ | Glass plates | Mortality | > 3000 |
| *Aphidius rhopalosiphi* ‡ | Glass cover slides | Mortality | > 3000 |

[1] for preparations indicate whether end point is expressed in units of a.s. or preparation

Winter/Spring cereals and Maize 1 x 750 g a.s./ha

| Test substance | Species | Effect ($LR_{50}$ g a.s./ha) | HQ in-field | HQ off-field[1] | Trigger |
|---|---|---|---|---|---|
| 2,4-D DMA 600SL | *Typhlodromus pyri* | > 3000 | < 0.25 | < 0.01 | |
| 2,4-D DMA 600SL | *Aphidius rhopalosiphi* | > 3000 | < 0.25 | < 0.01 | |

[1] indicate distance assumed to calculate the drift rate

Further laboratory and extended laboratory studies ‡

| Species | Life stage | Test substance, substrate and duration | Dose (g a.s./ha)[1] | End point | % effect[2] | Trigger value |
|---|---|---|---|---|---|---|
| *Aleochara bilineata* | adult | Herbizid Marks,<br>Arenas containing sand (glass beakers)<br>4 weeks + 5 weeks | 1000 | Mortality<br>Beneficial capacity | 0<br>1.3 | 50 % |
| *Poecillus cupreus* | adult | Herbizid Marks,<br>Arenas containing sand (plastic trays)<br>14 days | 1000 | Mortality<br>Feeding reduction | 0<br>29.6 | 50 % |
| *Pardosa spp.* | adult | Herbizid Marks,<br>Arenas containing sand (plastic containers)<br>14 days | 1000 | Mortality<br>Food consumption | 5<br>0 | 50 % |

[1] for preparations indicate whether dose is expressed in units of a.s. or preparation
[2] positive percentages relate to adverse effects

**Effects on earthworms, other soil macro-organisms and soil micro-organisms (Annex IIA points 8.4 and 8.5. Annex IIIA, points, 10.6 and 10.7)**

| Test organism | Test substance | Time scale | End point[1] |
|---|---|---|---|
| Earthworms | | | |
| *Eisenia foetida* | a.s. ‡ | Acute 14 days | $LC_{50}$ 350 mg a.s./kg dw soil (mg a.s./ha) |

| Test organism | Test substance | Time scale | End point[1] |
|---|---|---|---|
| *Eisenia foetida* | a.s. ‡ | Chronic 8 weeks | NOEC= 62.5 mg a.s./kg dw soil (mg a.s./ha) |
| *Eisenia foetida* | Aminopielik Standard 600 SL | Acute 14 days | $LC_{50}$ > 618 mg a.s./kg soil |
| *Eisenia foetida* | 2,4-DCA | Acute 14 days | $LC_{50}$ > 101.8 mg/kg soil<br>$LC_{50corr}$ > 50.9 mg/kg soil |
| *Eisenia foetida* | 2,4-DCA | Chronic 8 weeks | NOEC 10 mg/kg soil<br>$NOEC_{corr}$ 5 mg/kg soil |
| *Eisenia foetida* | 2,4-DCP | Chronic 8 weeks | NOEC 10 mg/kg soil<br>$NOEC_{corr}$ 5 mg/kg soil |
| Other soil macroorganisms | | | |
| Soil mite | a.s. ‡ | n.r. | n.r. |
| Soil mite<br>*Hypoaspis aculeifer* | 2,4–DCA | Chronic | NOEC 10 mg a.s./kg dw soil (mg a.s./ha) |
| Soil mite<br>*Hypoaspis aculeifer* | 2,4-DCP | Chronic | NOEC 5 mg a.s./kg dw soil (mg a.s./ha) |
| Collembola | | | |
| Collembola | a.s. ‡ | n.r | n.r |
| Collembola<br>*Folsomia candida* | 2,4-DCA | Chronic | NOEC 10 mg a.s./kg dw soil (mg a.s/ha) |
| Collembola<br>*Folsomia candida* | 2,4-DCP | Chronic | NOEC 1.25 mg a.s./kg dw soil (mg a.s/ha) |
| Soil microorganisms | | | |
| Nitrogen mineralisation | a.s. ‡ | | No effect at 3 mg a.s./kg soil |
| | LAF-74 | 56 days | No effect at 29.9 mg a.s./kg soil[2] |
| | 2,4-DCA | 28 days | No effect at 5 mg a.s./kg soil |
| | 2,4-DCP | 42 days | No effect at 5 mg a.s./kg soil |
| Carbon mineralisation | a.s. ‡ | | No effect at 3 mg a.s./kg soil |
| | LAF-74 | 28 days | No effect at 29.9 mg a.s./kg soil |
| | 2,4-DCA | 28 days | No effect at 5 mg a.s./kg soil |
| | 2,4-DCP | 28 days | No effect at 5 mg a.s./kg soil |

[1] Endpoint has been corrected due to log Pow >2.0 (e.g. $LC_{50corr}$)
[2] endpoints based on nitrate formation rates
n.r. not required

**Toxicity/exposure ratios for soil organisms**

Spring cereals, winter cereals and maize, single application of 0.75 kg a.s./ha

| Test organism | Test substance | Time scale | Soil PEC | TER | Trigger |
|---|---|---|---|---|---|
| Earthworms | | | | | |
| *Eisenia foetida* | a.s. ‡ | Acute | 0.750 | 467 | 10 |

| Test organism | Test substance | Time scale | Soil PEC | TER | Trigger |
|---|---|---|---|---|---|
| *Eisenia foetida* | a.s. ‡ | Chronic | 0.750 | 83 | 5 |
| *Eisenia foetida* | Aminopielik Standard 600 SL | Acute | 0.750 | > 824 | 10 |
| *Eisenia foetida* | 2,4-DCA | Acute | 0.090 | 565 | 10 |
| *Eisenia foetida* | 2,4-DCA | Chronic | 0.090 | 55.5 | 5 |
| *Eisenia foetida* | 2,4-DCP | Chronic | 0.048 | 104 | 5 |
| Other soil macroorganism | | | | | |
| Soil mite *Hypoaspis aculeifer* | 2,4-DCA | Chronic | 0.090 | ≥ 111 | 5 |
| Soil mite *Hypoaspis aculeifer* | 2,4-DCP | Chronic | 0.048 | 104 | 5 |
| Collembola *Folsomia candida* | 2,4-DCA | Chronic | 0.090 | 111 | 5 |
| Collembola *Folsomia candida* | 2,4-DCP | Chronic | 0.048 | 26 | 5 |

**Effects on non-target plants (Annex IIA, point 8.6, Annex IIIA, point 10.8)**

Preliminary screening data

| |
|---|
| Not required for herbicides as $ER_{50}$ tests should be provided. |

**Deterministic assessment of risk to non-target terrestrial plants**

Laboratory dose response tests

| Most sensitive species | Test substance | $ER_{50}$ (g/ha) vegetative vigour | $ER_{50}$ (g/ha) emergence |
|---|---|---|---|
| Lettuce *Lactuca sativa* | LAF-74 | 19 g a.s./ha | 27 g a.s./ha |

Spring cereals, winter cereals and maize, 1 x 0.75 kg a.s./ha

| Buffer distance (meters) | Application rate (g a.s./ha) | Drift value (%)[1] | Drift reduction (%) | $PER_{drift}$ (g a.s./ha) | $ER_{50}$ (g a.s./ha) | TER | Trigger |
|---|---|---|---|---|---|---|---|
| 1 | 750 | 2.77 | 0 | 20.775 | 19.2 | **0.9** | 5 |
| | | | 50 | 10.388 | | **1.8** | 5 |
| | | | 75 | 5.194 | | **3.7** | 5 |
| | | | 90 | 2.078 | | 9.2 | 5 |
| 5 | 750 | 0.57 | 0 | 4,275 | 19.2 | **4.5** | 5 |
| | | | 50 | 2.138 | | 9.0 | 5 |
| | | | 75 | 1.069 | | 18.0 | 5 |
| 10 | 750 | 0.29 | 0 | 2.175 | 19.2 | 8.8 | 5 |

[1] Drift values according to ESCORT 2

**Probabilistic assessment of risk to non-target terrestrial plants**

Laboratory dose response tests

| Most sensitive species | Test substance | $HR_5$ |
|---|---|---|
| SSD | LAF-74 | 23.8 g a.s./ha |

HR = Hazard Rate

| Buffer distance (meters) | Application rate (g a.s./ha) | Drift value (%) | $PER_{drift}$ (g a.s./ha) | $HR_5$ (g a.s./ha) | TER | Trigger |
|---|---|---|---|---|---|---|
| 1 | 750 | 2.77 | 20.775 | 23.8 | 1.1 | 1 |
| 5 | 750 | 0.57 | 4,275 | 23.8 | 5.6 | 1 |
| 10 | 750 | 0.29 | 2.175 | 23.8 | 10.9 | 1 |

HR = Hazard Rate

**Effects on biological methods for sewage treatment (Annex IIA 8.7)**

| Test type/organism | end point |
|---|---|
| Activated sludge | NOEC |
| *Pseudomonas sp* | > 1000 mg/L |

**Ecotoxicologically relevant compounds** (consider parent and all relevant metabolites requiring further assessment from the fate section)

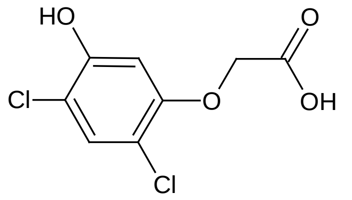
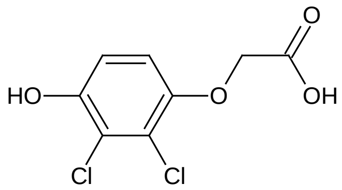
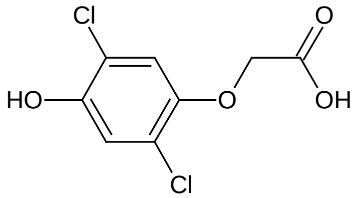
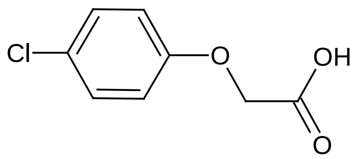
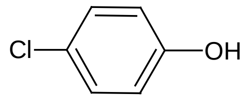
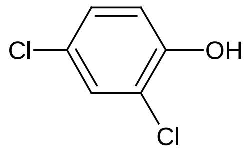
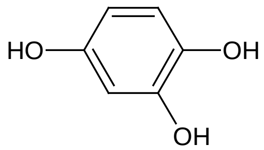
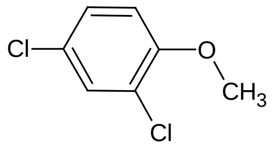
| Compartment | |
|---|---|
| soil | 2,4-D; 4-CP (from soil, anaerobic conditions) |
| surface water | 2,4-D; 1,2,4-benzenetriol (photolysis metabolite); 4-CP (from soil, anaerobic conditions) |
| sediment | 2,4-D |
| groundwater | 2,4-D; 4-CP (from soil, anaerobic conditions) |

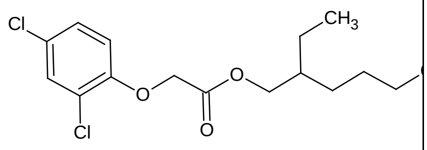
**Classification and proposed labelling with regard to ecotoxicological data (Annex IIA, point 10 and Annex IIIA, point 12.3)**

| | |
|---|---|
| | RMS proposal* |
| Active substance | 2,4-D |
| | Regulation (EC) No 1272/2008, amended by Commission Regulation 286/2011<br>Category: Aquatic Acute 1, H400; Aquatic Chronic 1, H410: Very Toxic to aquatic life with long lasting effects<br>M-factor: 10 (acute); 1 (chronic) (for rapidly degradable substances)<br>Pictogram Code: GHS09<br>Signal word: Warning<br>The classification is based on the 14-d $EC_{50}$ of 0.011 mg a.s./L and 14-d NOEC of 0.0047 mg a.s./L (Total root length) for *Myriophyllum spicatum* |

* It should be noted that classification is formally proposed and decided in accordance with Regulation (EC) No 1272/2008. Proposals for classification made in the context of the evaluation procedure under Regulation (EC) No 1107/2009 are not formal proposals.

## APPENDIX B – USED COMPOUND CODE(S)

| Code/Trivial name* | Chemical name/SMILES notation** | Structural formula** |
|---|---|---|
| **5-OH-2,4-D** | (2,4-dichloro-5-hydroxyphenoxy)acetic acid<br>Clc1cc(Cl)c(O)cc1OCC(=O)O |  |
| **4-OH-2,3-D** | (2,3-dichloro-4-hydroxyphenoxy)acetic acid<br>Oc1ccc(OCC(=O)O)c(Cl)c1Cl |  |
| **4-OH-2,5-D** | (2,5-dichloro-4-hydroxyphenoxy)acetic acid<br>Clc1cc(O)c(Cl)cc1OCC(=O)O |  |
| **4-chlorophenoxyacetic acid** | (4-chlorophenoxy)acetic acid<br>Clc1ccc(OCC(=O)O)cc1 |  |
| **4-CP** | 4-chlorophenol<br>Oc1ccc(Cl)cc1 |  |
| **2,4-DCP** | 2,4-dichlorophenol<br>Clc1cc(Cl)c(O)cc1 |  |
| **1,2,4-benzenetriol** | benzene-1,2,4-triol<br>Oc1cc(O)c(O)cc1 |  |
| **2,4-DCA** | **2**,4-dichloro-1-methoxybenzene<br>COc1ccc(Cl)cc1Cl |  |

| Code/Trivial name* | Chemical name/SMILES notation** | Structural formula** |
|---|---|---|
| **2,4-D 2-EHE** | 2-ethylhexyl (2,4-dichlorophenoxy)acetate<br><br>Clc1cc(Cl)ccc1OCC(=O)OCC(CC)CCCC |  |

* The metabolite name in bold is the name used in the conclusion.
** ACD/ChemSketch, Advanced Chemistry Development, Inc., ACD/Labs Release: 12.00 Product version: 12.00 (Build 29305, 25 Nov 2008)

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## ABBREVIATIONS

| | |
|---|---|
| 1/n | slope of Freundlich isotherm |
| λ | wavelength |
| ε | decadic molar extinction coefficient |
| °C | degree Celsius (centigrade) |
| µg | microgram |
| µm | micrometer (micron) |
| a.s. | active substance |
| AChE | acetylcholinesterase |
| ADE | actual dermal exposure |
| ADI | acceptable daily intake |
| a.e. | acid equivalent |
| AF | assessment factor |
| ALT | alanine aminotransferase (SGPT) |
| AOEL | acceptable operator exposure level |
| AP | alkaline phosphatase |
| AR | applied radioactivity |
| ARfD | acute reference dose |
| AST | aspartate aminotransferase (SGOT) |
| AV | avoidance factor |
| BBCH | Biologische Bundesanstalt, Bundessortenamt und CHemische Industrie |
| BCF | bioconcentration factor |
| BUN | blood urea nitrogen |
| bw | body weight |
| CAS | Chemical Abstracts Service |
| CFU | colony forming units |
| ChE | cholinesterase |
| CI | confidence interval |
| CIPAC | Collaborative International Pesticides Analytical Council Limited |
| CL | confidence limits |
| cm | centimetre |
| CPN | chronic progressive nephropathy |
| CSF | cerebrospinal fluid |
| d | day |
| DAA | days after application |
| DAD | diode array detector |
| DAR | draft assessment report |
| DAT | days after treatment |
| DDD | daily dietary dose |
| DM | dry matter |
| $DT_{50}$ | period required for 50 percent disappearance (define method of estimation) |
| $DT_{90}$ | period required for 90 percent disappearance (define method of estimation) |
| dw | dry weight |
| $EbC_{50}$ | effective concentration (biomass) |
| $EC_{50}$ | effective concentration |
| ECHA | European Chemicals Agency |
| EEC | European Economic Community |
| EINECS | European Inventory of Existing Commercial Chemical Substances |
| ELINCS | European List of New Chemical Substances |
| EMDI | estimated maximum daily intake |
| $ER_{50}$ | emergence rate/effective rate, median |
| $ErC_{50}$ | effective concentration (growth rate) |
| ETE | estimated theoretical exposure |
| EU | European Union |

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|---|---|
| EUROPOEM | European Predictive Operator Exposure Model |
| f(twa) | time weighted average factor |
| FAO | Food and Agriculture Organization of the United Nations |
| FID | flame ionisation detector |
| FIR | Food intake rate |
| FOB | functional observation battery |
| FOCUS | Forum for the Co-ordination of Pesticide Fate Models and their Use |
| FOMC | first-order multi-compartment model |
| g | gram |
| GAP | good agricultural practice |
| GC | gas chromatography |
| GC-MS | gas chromatography-mass spectrometry |
| GCPF | Global Crop Protection Federation (formerly known as GIFAP) |
| GGT | gamma glutamyl transferase |
| GLP | good laboratory practice |
| GM | geometric mean |
| GS | growth stage |
| GSH | glutathione |
| h | hour(s) |
| ha | hectare |
| Hb | haemoglobin |
| Hct | haematocrit |
| hL | hectolitre |
| HPA | hypothalamic-pituitary-adrenal |
| HPLC | high pressure liquid chromatography or high performance liquid chromatography |
| HPLC-MS | high pressure liquid chromatography – mass spectrometry |
| HPLC-UV | high performance liquid chromatography with ultra violet detector |
| HR | hazard rate |
| HRGC | high resolution gas chromatography |
| HRMS | high resolution mass spectrometry |
| HQ | hazard quotient |
| IEDI | international estimated daily intake |
| IESTI | international estimated short-term intake |
| ILV | independent laboratory validation |
| ISO | International Organization for Standardization |
| IUPAC | International Union of Pure and Applied Chemistry |
| JMPR | Joint Meeting on the FAO Panel of Experts on Pesticide Residues in Food and the Environment and the WHO Expert Group on Pesticide Residues (Joint Meeting on Pesticide Residues) |
| $K_{doc}$ | organic carbon linear adsorption coefficient |
| kg | kilogram |
| $K_{Foc}$ | Freundlich organic carbon adsorption coefficient |
| L | litre |
| LC | liquid chromatography |
| $LC_{50}$ | lethal concentration, median |
| LC-MS | liquid chromatography-mass spectrometry |
| LC-MS-MS | liquid chromatography with tandem mass spectrometry |
| $LD_{50}$ | lethal dose, median; dosis letalis media |
| LDH | lactate dehydrogenase |
| LLNA | local lymph node assay |
| LOAEL | lowest observable adverse effect level |
| LOD | limit of detection |
| LOQ | limit of quantification (determination) |
| m | metre |

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|---|---|
| M/L | mixing and loading |
| MAF | multiple application factor |
| MCH | mean corpuscular haemoglobin |
| MCHC | mean corpuscular haemoglobin concentration |
| MCV | mean corpuscular volume |
| mg | milligram |
| mL | millilitre |
| M/L | mixing and loading |
| mm | millimetre (also used for mean measured concentrations) |
| mN | milli-newton |
| MRL | maximum residue limit or level |
| MS | mass spectrometry |
| MSDS | material safety data sheet |
| MTD | maximum tolerated dose |
| MWHC | maximum water holding capacity |
| NESTI | national estimated short-term intake |
| ng | nanogram |
| NOAEC | no observed adverse effect concentration |
| NOAEL | no observed adverse effect level |
| NOEC | no observed effect concentration |
| NOEL | no observed effect level |
| NPD | nitrogen phosphorous detector |
| OECD | Organisation for Economic Co-operation and Development |
| OM | organic matter content |
| Pa | pascal |
| PD | proportion of different food types |
| PEC | predicted environmental concentration |
| $PEC_{air}$ | predicted environmental concentration in air |
| $PEC_{gw}$ | predicted environmental concentration in ground water |
| $PEC_{sed}$ | predicted environmental concentration in sediment |
| $PEC_{soil}$ | predicted environmental concentration in soil |
| $PEC_{sw}$ | predicted environmental concentration in surface water |
| pH | pH-value |
| PHED | pesticide handler's exposure data |
| PHI | pre-harvest interval |
| PIE | potential inhalation exposure |
| $pK_a$ | negative logarithm (to the base 10) of the dissociation constant |
| $P_{ow}$ | partition coefficient between *n*-octanol and water |
| ppb | parts per billion ($10^{-9}$) |
| PPE | personal protective equipment |
| ppm | parts per million ($10^{-6}$) |
| PPP | plant protection product |
| PRIMo | Pesticide Residues Intake Model (EFSA) |
| PT | proportion of diet obtained in the treated area |
| PTT | partial thromboplastin time |
| QSAR | quantitative structure-activity relationship |
| $r^2$ | coefficient of determination |
| REACH | Registration, Evaluation, Authorisation of Chemicals Regulation |
| RPE | respiratory protective equipment |
| RUD | residue per unit dose |
| SC | suspension concentrate |
| SD | standard deviation |
| SFO | single first-order |
| SL | soluble concentrate |
| SMILES | simplified molecular-input line-entry system |

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|---|---|
| SSD | species sensitivity distribution |
| STMR | supervised trials median residue |
| $t_{1/2}$ | half-life (define method of estimation) |
| $T_3$ | triiodothyronine |
| $T_4$ | thyroxine |
| TCDD | 2,3,7,8-tetrachlorodibenzo-*p*-dioxin |
| TEQ | toxic equivalents |
| TER | toxicity exposure ratio |
| $TER_A$ | toxicity exposure ratio for acute exposure |
| $TER_{LT}$ | toxicity exposure ratio following chronic exposure |
| $TER_{ST}$ | toxicity exposure ratio following repeated exposure |
| TK | technical concentrate |
| TLV | threshold limit value |
| TMDI | theoretical maximum daily intake |
| TRR | total radioactive residue |
| TSH | thyroid stimulating hormone (thyrotropin) |
| TWA | time weighted average |
| UF | uncertainty factor |
| UDS | unscheduled DNA synthesis |
| UV | ultraviolet |
| W/S | water/sediment |
| w/v | weight per volume |
| w/w | weight per weight |
| WBC | white blood cell |
| WHO | World Health Organization |
| wk | week |
| yr | year |