Review of the existing maximum residue levels for carboxin according to Article 12 of Regulation (EC) No 396/2005

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Abstract

According to Article 12 of Regulation (EC) No 396/2005, EFSA has reviewed the maximum residue levels (MRLs) currently established at European level for the pesticide active substance carboxin. To assess the occurrence of carboxin residues in plants, processed commodities, rotational crops and livestock, EFSA considered the conclusions derived in the framework of Directive 91/414/EEC as well as the European authorisations reported by Member States (including the supporting residues data). Based on the assessment of the available data, MRL proposals were derived and a consumer risk assessment was carried out. Some information required by the regulatory framework was missing and a risk to consumers cannot be excluded for the existing EU MRLs. Hence, the consumer risk assessment is considered indicative only and all MRL proposals derived by EFSA still require further consideration by risk managers and measures for reduction of the consumer exposure should also be considered.

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Keywords: carboxin, MRL review, Regulation (EC) No 396/2005, consumer risk assessment, anilide, fungicide, aniline

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Summary

Carboxin was included in Annex I to Directive 91/414/EEC on 1 June 2011 by Commission Directive 2011/52/EC, and has been deemed to be approved under Regulation (EC) No 1107/2009, in accordance with Commission Implementing Regulation (EU) No 540/2011, as amended by Commission Implementing Regulation (EU) No 541/2011. As the active substance was approved after the entry into force of Regulation (EC) No 396/2005 on 2 September 2008, EFSA is required to provide a reasoned opinion on the review of the existing maximum residue levels (MRLs) for that active substance in compliance with Article 12(1) of the aforementioned regulation. To collect the relevant pesticide residues data, the European Food Safety Authority (EFSA) asked the United Kingdom, the designated rapporteur Member State (RMS), to complete the Pesticide Residues Overview File (PROFile) and to prepare a supporting evaluation report. The PROFile and evaluation report provided by the RMS were made available to the Member States. A request for additional information was addressed to the Member States in the framework of a completeness check period, which was initiated by EFSA on 31 October 2016 and finalised on 3 January 2017. After having considered all the information provided, EFSA prepared a completeness check report which was made available to Member States on 9 February 2017.

Based on the conclusions derived by EFSA in the framework of Directive 91/414/EEC and the additional information provided by the RMS and Member States, EFSA prepared in May 2017 a draft reasoned opinion, which was circulated to Member States for consultation via a written procedure. Comments received by 9 June 2017 were considered during the finalisation of this reasoned opinion. The following conclusions are derived.

The primary crop metabolism of carboxin was investigated in only one crop category (cereals). For cereals, the following residue definition for monitoring and risk assessment is proposed: carboxin plus its metabolites carboxin sulfoxide and oxycarboxin (carboxin sulfone), expressed as carboxin. In the absence of primary crop metabolism studies performed on other crop groups, it is proposed, on a tentative basis, to also apply this residue definition to pulses and oilseeds and root vegetables (the other crops under review). Based on the results of the metabolism studies in rotational crops, the same residue definition is applicable for rotational crops (leafy vegetables and root crops) and for cereals on a tentative basis. It was not possible to derive a residue definition for processed commodities.

An analytical method for the enforcement of the proposed residue definition at the combined limit of quantification (LOQ) of 0.03 mg/kg is available for high water, high acid and dry commodities. For high oil content commodities, a fully validated analytical method is missing and it is still required for the analysis of carboxin sulfoxide.

No hydrolysis studies are available. Moreover, according to the chemical structure of carboxin, the release of aniline may occur following processing. Given the toxicological concerns related to aniline, the formation and bioavailability of aniline in processed commodities must be investigated.

With the exception of rye, the available residue data is not considered sufficient to derive MRLs for processed commodities.

According to the results of the confined rotational crops studies, carboxin sulfone and carboxin sulfoxide are expected to occur in significant levels in feed items such as wheat hay and straw, and therefore, field rotational studies are necessary to elucidate this issue.

Studies investigating the magnitude of residues in processed commodities are not available. Therefore, it was not possible to assess the levels of aniline and/or metabolites in processed commodities.

Carboxin is authorised for use on cereals, pulses and oilseeds that might be fed to livestock. Therefore, further consideration of the residues in livestock is required. The maximum dietary burden was calculated accounting for the notified use on rye. For other feed items, it was not possible to derive proper upper values for exposure assessment which could underestimate the residue levels in livestock.

Due to the high level of uncertainties linked to the identified data gaps, it was not possible to conduct a risk assessment neither for the good agricultural practices (GAPs) reported in this MRL review nor for the existing EU MRLs. Therefore, EFSA assessed a scenario where all authorised uses would be withdrawn. Chronic consumer exposure, using the combined LOQ of 0.03 mg/kg for an indicative calculation, in the framework of this review was calculated using revision 2 of the EFSA Pesticide Residues Intake Model (PRIMo). The highest chronic exposure represented 76% of the acceptable daily intake (ADI) (Dutch child). Acute exposure calculations for the parent compound were not carried out because an acute reference dose (ARFD) was not deemed necessary for this active substance. Due to the lack of data, the potential exposure to aniline was not assessed; however the risk of exposure to aniline cannot be excluded.
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Background

Regulation (EC) No 396/2005\(^1\) (hereinafter referred to as ‘the Regulation’) establishes the rules governing the setting and the review of pesticide maximum residue levels (MRLs) at European level. Article 12(1) of that Regulation stipulates that the European Food Safety Authority (EFSA) shall provide within 12 months from the date of the inclusion or non-inclusion of an active substance in Annex I to Directive 91/414/EEC\(^2\) a reasoned opinion on the review of the existing MRLs for that active substance. In 2008, a decision on the non-inclusion of the active substance was taken by Commission Decision 2008/934/EC.\(^3\) The applicant submitted a new application requesting the accelerated procedure regarding the inclusion of the active substance in Annex I of Directive 91/414/EEC. Based on the EFSA conclusion which was issued on 11 October 2010 (EFSA, 2010a,b), the decision to approve the active substance carboxin in accordance with the provision of Regulation (EC) 1107/2009, repealing the provisions of Directive 91/414/EEC, was taken. As carboxin was included in Annex I to Council Directive 91/414/EEC on 1 June 2011 by means of Commission Implementing Directive 2011/52/EC,\(^4\) and has been deemed to be approved under Regulation (EC) No 1107/2009,\(^5\) in accordance with Commission Implementing Regulation (EU) No 540/2011,\(^6\) as amended by Commission Implementing Regulation (EU) No 541/2011,\(^7\) EFSA initiated the review of all existing MRLs for that active substance.

According to the legal provisions, EFSA shall base its reasoned opinion in particular on the relevant assessment report prepared under Directive 91/414/EEC. It should be noted, however, that, in the framework of Directive 91/414/EEC, only a few representative uses are evaluated, whereas MRLs set out in Regulation (EC) No 396/2005 should accommodate all uses authorised within the European Union (EU), and uses authorised in third countries that have a significant impact on international trade. The information included in the assessment report prepared under Directive 91/414/EEC is therefore insufficient for the assessment of all existing MRLs for a given active substance.

To gain an overview of the pesticide residues data that have been considered for the setting of the existing MRLs, EFSA developed the Pesticide Residues Overview File (PROFile). The PROFile is an inventory of all pesticide residues data relevant to the risk assessment and MRL setting for a given active substance. This includes data on:

- the nature and magnitude of residues in primary crops;
- the nature and magnitude of residues in processed commodities;
- the nature and magnitude of residues in rotational crops;
- the nature and magnitude of residues in livestock commodities;
- the analytical methods for enforcement of the proposed MRLs.

United Kingdom, the designated rapporteur Member State (RMS) in the framework of Directive 91/414/EEC, was asked to complete the PROFile for carboxin and to prepare a supporting evaluation report (United Kingdom, 2011). The PROFile and the supporting evaluation report were submitted to EFSA on 29 June 2011 and made available to the Member States. A request for additional information was addressed to the Member States in the framework of a completeness check period which was initiated by EFSA on 30 October 2016 and finalised on 3 January 2017. Additional evaluation reports were submitted by the Czech Republic, France, Hungary, Italy, Spain and the European Union Reference Laboratories for Pesticide Residues (EURLs) (EURLs, 2016; Spain, 2016; Czech Republic, 2017; France, 2017; Hungary, 2017; Italy, 2017) and, after having considered all the information

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\(^1\) Regulation (EC) No 396/2005 of the European Parliament and of the Council of 23 February 2005 on maximum residue levels of pesticides in or on food and feed of plant and animal origin and amending Council Directive 91/414/EEC. OJ L 70, 16.3.2005, p. 1–16.

\(^2\) Council Directive 91/414/EEC of 15 July 1991 concerning the placing of plant protection products on the market. OJ L 230, 19.8.1991, p. 1–32. Repealed by Regulation (EC) No 1107/2009.

\(^3\) Commission Decision 2008/934/EC of 5 December 2008 concerning the non-inclusion of certain active substances in Annex I to Council Directive 91/414/EEC and the withdrawal of authorisations for plant protection products containing these substances. OJ L 333, 11.12.2008, p. 11–14.

\(^4\) Commission Implementing Directive 2011/52/EC of 20 April 2011 amending Council Directive 91/414/EEC to include carboxin as active substance and amending Commission Decision 2008/934/EC. OJ L No 105, 21.4.2011, p. 19–23.

\(^5\) Regulation (EC) No 1107/2009 of the European Parliament and of the Council of 21 October 2009 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.

\(^6\) Commission Implementing Regulation (EU) No 540/2011 of 25 May 2011 implementing Regulation (EC) No 1107/2009 of the European Parliament and of the Council as regards the list of approved active substances. OJ L 153, 11.6.2011, p. 1–186.

\(^7\) Commission Implementing Regulation (EU) No 541/2011 of 1 June 2011 amending Implementing Regulation (EU) No 540/2011 implementing Regulation (EC) No 1107/2009 of the European Parliament and of the Council as regards the list of approved active substances. OJ L 153, 11.6.2011, p. 187–188.
provided by RMS and Member States, EFSA prepared a completeness check report which was made available to all Member States on 9 February 2017. Further clarifications were sought from Member States via a written procedure in February-March 2017.

Based on the conclusions derived by EFSA in the framework of Directive 91/414/EEC and the additional information provided by the Member States, EFSA prepared in May 2017 a draft reasoned opinion, which was submitted to Member States for commenting via a written procedure. All comments received by 9 June 2017 were considered by EFSA during the finalisation of the reasoned opinion.

The evaluation report submitted by the RMS (United Kingdom, 2011) and the evaluation reports submitted by Member States the Czech Republic, France, Hungary, Italy, Spain and the EURelS (EURelS, 2016; Spain, 2016; Czech Republic, 2017; France, 2017; Hungary, 2017; Italy, 2017) are considered as supporting documents to this reasoned opinion and, thus, are made publicly available.

In addition, key supporting documents to this reasoned opinion are the completeness check report (EFSA, 2017a) and the Member States consultation report (EFSA, 2017b). These reports are developed to address all issues raised in the course of the review, from the initial completeness check to the reasoned opinion. Also, the chronic exposure calculations for all crops reported in the framework of this review performed using the EFSA Pesticide Residues Intake Model (PRIMo) and the PROFile are key supporting documents and made publicly available as background documents to this reasoned opinion. Furthermore, a screenshot of the Report sheet of the PRIMo is presented in Appendix C.

Terms of Reference

According to Article 12 of Regulation (EC) No 396/2005, EFSA shall provide a reasoned opinion on:

- the inclusion of the active substance in Annex IV to the Regulation, when appropriate;
- the necessity of setting new MRLs for the active substance or deleting/modifying existing MRLs set out in Annex II or III of the Regulation;
- the inclusion of the recommended MRLs in Annex II or III to the Regulation;
- the setting of specific processing factors as referred to in Article 20(2) of the Regulation.

The active substance and its use pattern

Carboxin is the ISO common name for 5,6-dihydro-2-methyl-1,4-oxathiine-3-carboxanilide (IUPAC). Carboxin belongs to the group of anilide compounds which are used as fungicides. An anilide obtained by formal condensation of the amino group of aniline with the carboxy group of 2-methyl-5,6-dihydro-1,4-oxathiine-3-carboxylic acid.

The chemical structure of the active substance and its main metabolites are reported in Appendix F.

Carboxin was evaluated in the framework of Directive 91/414/EEC with the United Kingdom designated as RMS. The representative uses supported for the peer review process comprised seed treatment to control soil and seed borne diseases in cereals (wheat, barley, oats, rye and triticale).

Following the peer review, which was carried out by EFSA, a decision on inclusion of the active substance in Annex I to Directive 91/414/EEC was published by means of Commission Implementing Directive 2011/52/EC, which entered into force on 1 June 2011. According to Regulation (EU) No 540/2011, carboxin is deemed to have been approved under Regulation (EC) No 1107/2009. This approval is restricted to uses as fungicide only.

The EU MRLs for carboxin are established in Annex IIIA of Regulation (EC) No 396/2005 and CXLs for active substance are not available. There are no MRL changes occurred since the entry into force of the Regulation mentioned above.

For the purpose of this MRL review, the critical uses of carboxin currently authorised within the EU, have been collected by the RMS and reported in the PROFile. The additional Good Agricultural Practices (GAPs) reported by Member States during the completeness check were also considered. The details of the authorised GAP(s) for carboxin are given in Appendix A. The RMS did not report any use authorised in third countries that might have a significant impact on international trade.

Assessment

EFSA has based its assessment on the PROFile submitted by the RMS, the evaluation report accompanying the PROFile (United Kingdom, 2011), the draft assessment report (DAR) and its addenda prepared under Council Directive 91/414/EEC (United Kingdom, 2006, 2009, 2010, 2015), the conclusion on the peer review of the pesticide risk assessment of the active substance carboxin (EFSA,
2010a,b), the technical report on carboxin confirmatory data (EFSA, 2016) as well as the evaluation reports submitted during the completeness check (EURs, 2016; Spain, 2016; Czech Republic, 2017; France, 2017; Hungary, 2017; Italy, 2017). The assessment is performed in accordance with the legal provisions of the uniform principles for evaluation and authorisation of plant protection products as set out in Commission Regulation (EU) No 546/2011 and the currently applicable guidance documents relevant for the consumer risk assessment of pesticide residues (European Commission, 1997a-g, 2000, 2010a,b, 2016 and OECD, 2011, 2013).

More detailed information on the available data and on the conclusions derived by EFSA can be retrieved from the list of end points reported in Appendix B.

1. Residues in plants

1.1. Nature of residues and methods of analysis in plants

1.1.1. Nature of residues in primary crops

The metabolism of carboxin, labelled on the aniline ring, was investigated in a seed treatment conducted with wheat at an application rate of 60 g a.s./100 kg seed (United Kingdom, 2006). The total residues at harvest in grain and straw were 0.04 mg eq/kg and 1.9 mg eq/kg, respectively. Carboxin was extensively degraded and two major components were identified as carboxin sulfoxide and carboxin sulfone (oxyacarboxin) (see Appendix F), accounting for 9% of total radioactivity in the grain and 53% of the total radioactivity in straw (no parent carboxin was detected in the grain or straw). The amounts of carboxin sulfoxide and carboxin sulfone were 0.7 mg eq/kg and 0.3 mg eq/kg in straw, respectively, and below 0.01 mg eq/kg in grain. The metabolism study was under dosed when compared to the GAPs on cereals reported for this MRL review, with the exception of GAPs on rye and rice. However, the study was considered sufficient to depict the metabolic pathway in cereals. Metabolism studies on pulses/oilseeds and tubers/roots are not available. Therefore, GAPs belonging to those crop categories are not supported by a primary crop metabolism study. As a consequence, a data gap is identified regarding the nature of residues in primary crops.

1.1.2. Nature of residues in rotational crops

According to the soil degradation studies evaluated in the framework of the peer review the field DT$_{90}$ was greater than 100 days, indicating that carboxin is persistent in the soil (EFSA, 2010a,b). However, no rotational crop studies were available for the peer review and therefore a data gap was identified (EFSA, 2010a,b).

To address this issue, a rotational crop study with carboxin labelled on the oxathiine and phenyl ring conducted at an application rate of 0.125–0.133 kg a.s./ha (equivalent to 60 g carboxin/100 kg seed) or 1.25–1.31 kg a.s./ha and after plant-back intervals of 30, 120 and 365 days after treatment (DAT) was reported as confirmatory data (United Kingdom, 2015). The total radioactive residues (TRR) were above 0.01 mg/kg in all sampling intervals at the application rate of 0.125–0.130 kg a.s./ha with the exception of wheat grain (> 120 DAT), immature lettuce foliage (> 120 DAT, for oxathiine label only) and mature lettuce foliage (> 120 DAT), immature carrot root (> 30 DAT) and mature carrot root (> 120 DAT). The levels of carboxin were below the LOQ in all crops at all sampling intervals. Residues of carboxin sulfone and carboxin sulfoxide were below the LOQ in wheat grain 30 DAT and below 0.01 mg/kg at 120 and 365 DAT. However, in wheat hay and wheat straw, carboxin sulfone and carboxin sulfoxide were observed at levels higher than 0.01 mg/kg in all sampling periods. Metabolites P/V-55 and P/V-54 were also observed at levels above 0.01 mg/kg in wheat hay and wheat straw. As a consequence, in the technical report on carboxin confirmatory data (EFSA, 2016) it was recommended that these compounds (P/V-55 and P/V-54) would be looked for in field rotational studies. In lettuce, carrot foliage (for the phenyl label) and carrot root, carboxin sulfone and carboxin sulfoxide were observed at levels below 0.01 mg/kg in all sampling intervals.

The total radioactive residues (TRR) were above 0.01 mg/kg in all sampling intervals at the highest application rate with the exception of carrot roots (> 120 DAT). The metabolism in rotational crops followed a similar pathway to the metabolism observed in primary crops for cereals.

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8 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, 11.06.2011, p. 127–175.
1.1.3. Nature of residues in processed commodities

Studies investigating the effect of processing on the nature of residues of carboxin are not available. However, according to the chemical structure of carboxin, the release of aniline during hydrolysis may occur. Therefore, studies investigating the nature of residues in processed commodities are needed. Given the toxicological concerns related to aniline, the formation and bioavailability of aniline in processed commodities must be investigated.

1.1.4. Methods of analysis in plants

In the framework of the peer review, a multiresidue analytical method using high performance liquid chromatography with tandem mass spectrometry (HPLC-MS/MS) was validated for the determination of carboxin in dry commodities, with a LOQ of 0.01 mg/kg for each individual component: carboxin, carboxin sulfone and carboxin sulfoxide (EFSA, 2010a,b). A combined LOQ of 0.03 mg/kg can be achieved for the sum of these individual components. Furthermore, the EURL reported data for Quick, Easy, Cheap, Effective, Rugged, and Safe (QuEChERS) methods also using HPLC-MS/MS for the determination of carboxin in dry commodities, high water commodities, high oil and acidic commodities with an LOQ of 0.01 mg/kg and for carboxin sulfone in dry commodities, high oil and acidic commodities with an LOQ of 0.01 mg/kg and for high water commodities with an LOQ of 0.005 mg/kg (EURL, 2016). In addition, the EURL reported data for QuEChERS methods also using HPLC-MS/MS for the determination of carboxin sulfoxide with an LOQ of 0.01 mg/kg in high water, high acidic and dry commodities (EFSA, 2017b). Therefore, the EURLs confirmed that the QuEChERS/HPLC-MS/MS is validated for carboxin and carboxin sulfone in all matrices and for carboxin-sulfoxide in high water, high acid and dry commodities (2017b). For high oil content commodities, a fully validated analytical method is missing and it is still required for the analysis of carboxin sulfoxide.

1.1.5. Stability of residues in plants

The storage stability of carboxin, carboxin sulfone and carboxin sulfoxide was demonstrated for a period of 18 months at −18°C in high water and dry commodities and for 24 months at −18°C in wheat straw (United Kingdom, 2006). There are no studies on the storage stability in high oil content commodities, and therefore, a data gap is identified.

1.1.6. Proposed residue definitions

The metabolism study performed with wheat supports the residue definition for enforcement and risk assessment for cereals proposed in the framework of the peer review: carboxin plus its metabolites carboxin sulfoxide and oxycarboxin (carboxin sulfone), expressed as carboxin (EFSA, 2010a,b). The rotational crop study showed that the metabolic pathway in leafy vegetables and root crops was similar to the metabolism depicted for cereals (primary crops); however for cereals grown in rotation, additional field studies looking for metabolites P/V-54 and P/V-55 are still needed to conclude on the residue definition for cereals grown in rotation (EFSA, 2016).

In the absence of primary crop metabolism studies performed on other crop groups, it is proposed, on a tentative basis, to also apply this residue definition to pulses and oilseeds and root vegetables (the other crops also under review).

For processed commodities, a residue definition could not be derived.

An analytical method for the enforcement of the proposed residue definition at the combined LOQ of 0.03 mg/kg is available for high water content, high acid content and dry commodities. For high oil content commodities, a fully validated analytical method is missing and it is still required for the analysis of carboxin sulfoxide.

1.2. Magnitude of residues in plants

1.2.1. Magnitude of residues in primary crops

To assess the magnitude of carboxin residues resulting from the reported GAPs, EFSA considered all residue trials reported by the RMS in its evaluation report (United Kingdom, 2011), including residue trials evaluated in the framework of the peer review (EFSA, 2010a,b) and additional data submitted during the completeness check (Spain, 2016; Czech Republic, 2017; France, 2017; Hungary, 2017; Italy, 2017). Storage conditions for the residue trials considered in this framework were not reported.
For cereals, considering that storage stability in high water content and dry content commodities was demonstrated for 18 months decline of residues during storage of the trial samples is not expected. For high oil content crops, considering that storage stability has not been demonstrated, degradation of the residues cannot be excluded. Therefore, storage stability studies on high oil content commodities and information on storage conditions of the samples are still required to confirm the validity of the residue trials reported for linseeds and oilseed rape.

The number of residue trials and extrapolations were evaluated in accordance with the European guidelines on comparability, extrapolation, group tolerances and data requirements for setting MRLs (European Commission, 2016).

The samples from cereals, with the exception of rye grain and straw, were analysed for parent compound only. It was not clear if samples from oilseeds residue trials were analysed for all relevant components (carboxin, carboxin sulfone and carboxin sulfoxide); therefore, EFSA assumed that the residue levels referred to the parent compound only. As a consequence, and apart from rye, data from residue trials could not be used to propose MRLs; therefore, additional residue trials analysing all the components in the residue definition are required for all commodities other than rye.

1.2.2. Magnitude of residues in rotational crops

In its assessment of the confirmatory data, the RMS (United Kingdom) concluded that issue of residues in rotational crops was not fully addressed and therefore rotational crop field trials were required (United Kingdom, 2015). In the technical report on the outcome of the consultation with Member States following evaluation of the confirmatory data, EFSA also considered that the issue of residues in rotational crops was not fully addressed by the available data and that it was necessary to conduct rotational crop field studies since in certain feed items residues of carboxin sulfone and carboxin sulfoxide, metabolites included in the residue definition, were above 0.01 mg/kg (EFSA, 2016). Field studies investigating the magnitude of residues on rotational crops were not available for this review, and therefore, a data gap remains regarding the issue of residues in rotational crops.

1.2.3. Magnitude of residues in processed commodities

Studies investigating the magnitude of residues in processed commodities are not available.

1.2.4. Proposed MRLs

Consequently, the available data is considered sufficient to derive MRLs proposal as well as risk assessment values for rye. However, due to the major data gap identified in the previous sections (residue trials were not analysed for all relevant component in the residue definition), the available data is not considered sufficient to derive MRLs proposal as well as risk assessment values for all other commodities considered in this review.

2. Residues in livestock

Carboxin is authorised for use on cereals, pulses and oilseeds that might be fed to livestock. Therefore, further consideration of the residues in livestock is required. Livestock dietary burdens were therefore calculated for different groups of livestock according to OECD guidance (OECD, 2013), which has now also been agreed upon at European level. The input values for the notified use on rye are summarised in Appendix D. Since calculated dietary burdens for all groups of livestock were found to be below the trigger value of 0.1 mg/kg dry matter (DM), further investigation of residues as well as the setting of MRLs in commodities of animal origin is unnecessary for the notified use on rye. For the other feed items, there were no proper input values for exposure assessment, the animal intake of carboxin residues via these commodities has therefore not been assessed and may have been underestimated.

3. Consumer risk assessment

The available residues dataset is incomplete for all crops apart from the GAP on rye, which is supported by residue data analysed for all components included in the residue definition. In addition, it was not clear if the residues from trials available on oilseeds were analysed for all components included in the residue definition. Moreover, due to the lack of standard hydrolysis studies it was not possible to assess the potential release of aniline following processing. Therefore, due to the high level
of uncertainties linked to the identified data gaps, a risk for consumers due to the potential exposure to aniline cannot be excluded. It was not possible to conduct a risk assessment neither for the GAPs reported in this MRL review nor for the existing EU MRLs.

Therefore, EFSA assessed a scenario where all authorised uses would be withdrawn. It should be noted that in this scenario the potential exposure to aniline was not assessed. Chronic exposure calculations were done using the specific combined LOQ of 0.03 mg/kg for all commodities (assuming that this LOQ would be achievable for enforcement in all matrices but noting that this LOQ is not fully validated for high oil content commodities for the analysis of carboxin sulfoxide and animal commodities). Chronic exposure calculations for all crops reported in the framework of this review were performed using revision 2 of the EFSA PRIMo (EFSA, 2007). All input values included in the exposure calculations are summarised in Appendix D. Acute exposure calculations were not carried out because an acute reference dose (ARfD) was not deemed necessary for this active substance.

The exposures calculated were compared with the toxicological reference value for carboxin, derived by EFSA (2010a,b) under Directive 91/414/EEC. The highest chronic exposure was calculated for Dutch children, representing 76% of the acceptable daily intake (ADI).

Conclusions

The primary crop metabolism of carboxin was investigated in only one crop category (cereals). For cereals the following residue definition for monitoring and risk assessment is proposed: carboxin plus its metabolites carboxin sulfoxide and oxycarboxin (carboxin sulfone), expressed as carboxin. In the absence of primary crop metabolism studies performed on other crop groups, it is proposed, on a tentative basis, to also apply this residue definition to pulses and oilseeds and root vegetables (the other crops under review). Based on the results of the metabolism studies in rotational crops, the same residue definition is applicable for rotational crops (leafy vegetables and root crops) and for cereals on a tentative basis. It was not possible to derive a residue definition for processed commodities.

An analytical method for the enforcement of the proposed residue definition at the combined LOQ of 0.03 mg/kg is available for high water, high acid and dry commodities. For high oil content commodities, a fully validated analytical method is missing and it is still required for the analysis of carboxin sulfoxide.

No hydrolysis studies are available. Moreover, according to the chemical structure of carboxin, the release of aniline may occur following processing. Given the toxicological concerns related to aniline, the formation and bioavailability of aniline in processed commodities must be investigated.

With the exception of rye, the available residue data is not considered sufficient to derive MRLs proposal as well as risk assessment values for all other commodities considered in this review.

According to the results of the confined rotational crops studies, carboxin sulfone and carboxin sulfoxide are expected to occur in significant levels in feed items such as wheat hay and straw and therefore field rotational studies are necessary to elucidate this issue.

Studies investigating the magnitude of residues in processed commodities are not available. Therefore, it was not possible to assess the levels of aniline and/or metabolites in processed commodities.

Carboxin is authorised for use on cereals, pulses and oilseeds that might be fed to livestock. Therefore further consideration of the residues in livestock is required. The maximum dietary burden was calculated accounting for the notified use on rye. For other feed items, it was not possible to derive proper input values for exposure assessment which could underestimate the residue levels in livestock.

Due to the high level of uncertainties linked to the identified data gaps, it was not possible to conduct a risk assessment neither for the GAPs reported in this MRL review nor for the existing EU MRLs. Therefore, EFSA assessed a scenario where all authorised uses would be withdrawn. Chronic consumer exposure, using the combined LOQ of 0.03 mg/kg for an indicative calculation, in the framework of this review was calculated using revision 2 of the EFSA PRIMo. The highest chronic exposure represented 76% of the ADI (Dutch child). Acute exposure calculations for the parent compound were not carried out because an ARfD was not deemed necessary for this active substance. Due to the lack of data, the potential exposure to aniline was not assessed; however the risk of exposure to aniline cannot be excluded.
**Recommendations**

MRL recommendations were derived in compliance with the decision tree reported in Appendix E of the reasoned opinion (see Table 1). No MRL values could be recommended for inclusion in Annex II and further consideration by risk managers are still required (see Table 1 footnotes for details). In particular, the following data is needed to support the existing uses:

- additional supervised residue trials with samples analysed according to the proposed residue definition for the uses on potatoes, garlic, sweet corn, beans (with pods), peas (with pods), peas (without pods), peas (dry), lupins/lupini beans (dry), linseeds, sunflower seeds, rapeseeds/canola seeds, soybeans, cotton seeds, barley grains, maize/corn grains, common millet/proso millet grains, oat grains, rice grains, sorghum grains, wheat grains and sugar beet roots;
- a representative study investigating primary crop metabolism in pulses and oilseeds;
- a representative study investigating primary crop metabolism in root and tuber vegetables;
- a representative hydrolysis study investigating the potential release of aniline;
- storage stability study covering the high oil content commodities and information on the storage conditions of the samples of the residue trials on oilseed crops;
- a fully validated analytical method for enforcement in high oil content commodities for the analysis of carboxin sulfoxide;
- a representative rotational crop field study.

Depending on the outcome of the above reported studies, the following additional studies may still be required:

- a representative study investigating the nature of residues in livestock;
- a representative study investigating the magnitude of residues in livestock.

Considering the relevant data gaps identified during the assessment and that a risk to consumers cannot be excluded for the existing uses, Member States are in any case recommended to withdraw the relevant authorisations at national level. This recommendation to withdraw the authorisations at national level is valid even for rye where residues analysed according to the residue definition for risk assessment are below the proposed default combined LOQ of 0.03 mg/kg. However, an MRL at the combined LOQ of 0.03 mg/kg may not be sufficient to control if the restriction is respected, i.e. confirm if the GAP was withdrawn.

**Table 1: Summary table**

| Code number(a) | Commodity                      | Existing EU MRL (mg/kg) | Outcome of the review |
|----------------|--------------------------------|-------------------------|-----------------------|
| 211000         | Potatoes                       | 0.05*                   | Further consideration needed(b) |
| 220010         | Garlic                         | 0.1                     | Further consideration needed(b) |
| 234000         | Sweet corn                     | 0.1                     | Further consideration needed(b) |
| 260010         | Beans (with pods)              | 0.2                     | Further consideration needed(b) |
| 260030         | Peas (with pods)               | 0.2                     | Further consideration needed(b) |
| 260040         | Peas (without pods)            | 0.2                     | Further consideration needed(b) |
| 300030         | Peas (dry)                     | 0.2                     | Further consideration needed(b) |
| 300040         | Lupins/lupini beans (dry)      | 0.05*                   | Further consideration needed(b) |
| 401010         | Linseeds                       | 0.2                     | Further consideration needed(b) |
| 401050         | Sunflower seeds                | 0.2                     | Further consideration needed(b) |
| 401060         | Rapeseeds/canola seeds         | 0.1                     | Further consideration needed(b) |
| 401070         | Soyabees                       | 0.2                     | Further consideration needed(b) |
| 401090         | Cotton seeds                   | 0.2                     | Further consideration needed(b) |
| 500010         | Barley grains                  | 0.01*                   | Further consideration needed(b) |
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| Code number(a) | Commodity               | Existing EU MRL (mg/kg) | Outcome of the review | Comment                                           |
|----------------|-------------------------|-------------------------|-----------------------|--------------------------------------------------|
| 500030         | Maize/corn grains       | 0.01*                   | –                     | Further consideration needed(b)                  |
| 500040         | Common millet/proso millet grains | 0.01*       | –                     | Further consideration needed(b)                  |
| 500050         | Oat grains              | 0.01*                   | –                     | Further consideration needed(b)                  |
| 500060         | Rice grains             | 0.01*                   | –                     | Further consideration needed(b)                  |
| 500070         | Rye grains              | 0.01*                   | –                     | Further consideration needed(b)                  |
| 500080         | Sorghum grains          | 0.01*                   | –                     | Further consideration needed(b)                  |
| 500090         | Wheat grains            | 0.01*                   | –                     | Further consideration needed(b)                  |
| 900010         | Sugar beet roots        | 0.2                     | –                     | Further consideration needed(b)                  |
| –              | Other commodities of plant and/or animal origin | See Reg. (EC) No 839/2008 | – | Further consideration needed(d) |

MRL: maximum residue level; CXL: codex maximum residue limit.

*: Indicates that the MRL is set/proposed at the level of quantification.

(a): Commodity code number, as listed in Annex I of Regulation (EC) No 396/2005.

(b): GAP evaluated at EU level is not supported by data and a risk to consumers cannot be excluded for the existing EU MRL; no CXL is available. Either a specific LOQ or the default MRL of 0.01 mg/kg may be considered (combination B-I in Appendix E).

(c): GAP evaluated at EU level is not fully supported by data and a risk to consumers cannot be excluded; no CXL is available. Either a specific LOQ or the default MRL of 0.01 mg/kg may be considered (combination D-I in Appendix E).

(d): There are no relevant authorisations or import tolerances reported at EU level; no CXL is available. Either a specific LOQ or the default MRL of 0.01 mg/kg may be considered (combination A-I in Appendix E).
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Abbreviations

- a.i.: active ingredient
- a.s.: active substance
- ADI: acceptable daily intake
- AR: applied radioactivity
- ARfd: acute reference dose
- BBCH: growth stages of mono- and dicotyledonous plants
- Bw: body weight
- CXL: codex maximum residue limit
- DAR: draft assessment report
- DAT: days after treatment
- DB: dietary burden
- DT90: period required for 90% dissipation (define method of estimation)
- DM: dry matter
- dw: dry weight
- eq: residue expressed as a.s. equivalent
### Glossary

- **EURLs**: European Union Reference Laboratories for Pesticide Residues (former CRLs)
- **HPLC-MS/MS**: high performance liquid chromatography with tandem mass spectrometry
- **HR**: highest residue
- **IEDI**: international estimated daily intake
- **IESTI**: international estimated short-term intake
- **ILV**: independent laboratory validation
- **ISO**: International Organisation for Standardization
- **IUPAC**: International Union of Pure and Applied Chemistry
- **LC**: liquid chromatography
- **LOQ**: limit of quantification
- **MRL**: maximum residue level
- **MS/MS**: tandem mass spectrometry detector
- **MW**: molecular weight
- **NEU**: northern European Union
- **OECD**: Organisation for Economic Co-operation and Development
- **PBI**: plant-back interval
- **PHI**: preharvest interval
- **PRIMO**: (EFSA) Pesticide Residues Intake Model
- **PROFile**: (EFSA) Pesticide Residues Overview File
- **QuEChERS**: Quick, Easy, Cheap, Effective, Rugged, and Safe (analytical method)
- **RA**: risk assessment
- **RD**: residue definition
- **RMS**: rapporteur Member State
- **SANCO**: Directorate-General for Health and Consumers
- **SEU**: southern European Union
- **STMR**: supervised trials median residue
- **TRR**: total radioactive residue
- **WHO**: World Health Organization
### Appendix A – Summary of authorised uses considered for the review of MRLs

#### Critical outdoor GAPs for Northern Europe

| Crop | Common name | Scientific name | Region | Outdoor/Indoor | Member state or country | Pest controlled | Formulation | Method | PHI or waiting period (days) | Comments |
|------|-------------|-----------------|--------|----------------|-------------------------|----------------|-------------|--------|-----------------------------|----------|
| Potatoes | Solanum tuberosum subsp. tuberosum | NEU Outdoor HU | Fungal diseases | FS 200.0 g/L | Seed treatment – general (see also comment field) | 0 0 1 | 60 g a.i./100 kg |
| Sweet corn | Zea mays convar. Saccharata | NEU Outdoor HU | Fungal diseases | FS 200.0 g/L | Seed treatment – general (see also comment field) | 0 0 1 | 50 g a.i./100 kg |
| Peas (with pods) | Pisum sativum | NEU Outdoor HU | Fungal diseases | FS 200.0 g/L | Seed treatment – general (see also comment field) | 0 0 1 | 50 g a.i./100 kg |
| Peas (without pods) | Pisum sativum | NEU Outdoor HU | Fungal diseases | FS 200.0 g/L | Seed treatment – general (see also comment field) | 0 0 1 | 50 g a.i./100 kg |
| Peas (dry) | Pisum sativum | NEU Outdoor FR | Fungi | FS 200.0 g/L | Seed treatment – general (see also comment field) | 0 0 1 | 50 g a.i./100 kg |
## Critical outdoor GAPs for Northern Europe

| Crop | Common name | Scientific name | Region | Outdoor/Indoor | Member state or country | Pest controlled | Formulation | Application | PHI or waiting period (days) | Comments |
|------|-------------|-----------------|--------|----------------|-------------------------|----------------|-------------|-------------|-----------------------------|----------|
| Lupins (dry) | Lupinus albus subsp. albus; Lupinus angustifolius; Lupinus luteus; Lupinus mutabilis | NEU Outdoor FR | Fungal diseases | FS | Seed treatment – general (see also comment field) | 0 | 0 | 1 | 50 | g a.i./100 kg |
| Linseeds | Linum usitatissimum | NEU Outdoor CZ | Fungal diseases | FS | Seed treatment – general (see also comment field) | 0 | 0 | 1 | 56 | g a.i./100 kg |
| Sunflower seeds | Helianthus annuus | NEU Outdoor HU | Fungal diseases | LS | Seed treatment – general (see also comment field) | 0 | 0 | 1 | 40 | g a.i./100 kg |
| Rapeseeds | Brassica napus subsp. napus | NEU Outdoor CZ | Fungal diseases | LS | Seed treatment – general (see also comment field) | 0 | 0 | 1 | 80 | g a.i./100 kg |
| Crop      | Common name       | Scientific name | Region | Outdoor/Indoor | Member state or country | Pest controlled                                                                 | Formulation Type | Content | Conc. | Unit | Method                                             | Growth stage | Application | Interval (days) | Rate | PHI or waiting period (days) | Comments |
|-----------|-------------------|-----------------|--------|----------------|------------------------|-------------------------------------------------------------------------------|------------------|---------|-------|------|----------------------------------------------------|-------------|-------------|------------------|------|--------------------------|----------|
| Soyabeans | Glycine max       | NEU             | Outdoor | SI, HU         | SI, HU                 | Phytophthora sp., Ustilago sp., Fusarium sp., Penicillium sp., Aspergillus sp., Helminthosporium sp. | FS               | 200.0   | g/L   | Seed treatment – general (see also comment field) | 0            | 0           | 1                | 50   | g a.i./100 kg             |          |
| Barley    | Hordeum vulgare   | NEU             | Outdoor | DE             | DE                     | Drechslera graminea, Ustilago nuda                                            | FS               | 225.0   | g/L   | Seed treatment – general (see also comment field) | 0            | 0           | 1                | 90   | g a.i./100 kg             |          |
| Maize     | Zea mays          | NEU             | Outdoor | FR             | FR                     | Fungal diseases                                                               | FS               |         |       | Seed treatment – general (see also comment field) | 0            | 0           | 1                | 100  | g a.i./100 kg             |          |
| Oat       | Avena sativa      | NEU             | Outdoor | EE             | EE                     | Leaf stripe, loose and stinking smut and foot rot diseases                    | FS               | 750.0   | g/kg  | Seed treatment – general (see also comment field) | 0            | 0           | 1                | 150  | g a.i./100 kg             |          |
| Rice      | Oryza sativa      | NEU             | Outdoor | HU             | HU                     | Fungal diseases                                                               | FS               | 200.0   | g/L   | Seed treatment – general (see also comment field) | 0            | 0           | 1                | 40   | g a.i./100 kg             |          |
| Crop                          | Scientific name                  | Region | Outdoor/Indoor | Member state or country | Pest controlled                  | Formulation | Type | Content | Method                              | Growth stage From BBCH | Application Number Interval (days) | Rate | PHI or waiting period (days) | Comments |
|------------------------------|----------------------------------|--------|----------------|-------------------------|----------------------------------|--------------|------|---------|----------|---------------------------------|------------------------|---------------------------------|-------|-----------------------------|----------|
| Rye                          | Secale cereale                   | NEU    | Outdoor        | CZ                      | Fungal diseases                  | LS           | 200.0 | g/L     | Seed treatment – general         | 0                     | 0                              | 1     | 60                         | g a.i./100 kg |
| Sorghum                      | Sorghum bicolor                  | NEU    | Outdoor        | HU                      | Fungal diseases                  | FS           | 200.0 | g/L     | Seed treatment – general         | 0                     | 0                              | 1     | 60                         | g a.i./100 kg |
| Wheat                        | Triticum aestivum                | NEU    | Outdoor        | EE                      | Leaf stripe, loose and stinking smut and foot rot diseases | FS           | 750.0 | g/kg    | Seed treatment – general         | 0                     | 0                              | 1     | 150                        | g a.i./100 kg |
| Sugar beets                  | Beta vulgaris subsp. vulgaris var. altissima | NEU    | Outdoor        | SI                      | Phytium sp, Fusarium sp., Phoma sp. | FS           | 200.0 | g/L     | Seed treatment – general         | 0                     | 0                              | 1     | 100                        | g a.i./100 kg |
| Garlic                       | Allium sativum                   | SEU    | Outdoor        | ES                      | Fusarium spp.                    | FS           | 200.0 | g/L     | Seed treatment – general         | 0                     | 0                              | 1     | 140                        | g a.i./100 kg |
## Critical outdoor GAPs for Northern Europe

| Crop | Scientific name | Region | Outdoor/Indoor | Member state or country | Pest controlled | Formulation | Application | PHI or waiting period (days) |
|------|----------------|--------|---------------|-------------------------|----------------|-------------|-------------|-----------------------------|
| Sweet corn | *Zea mays* convar. *Saccharata* | SEU | Outdoor | ES | *Ustilago maydis* | FS | 200.0 g/L | Seed treatment – general (see also comment field) | 0 0 1 90 g a.i./100 kg |
| Beans (with pods) | *Phaseolus vulgaris* | SEU | Outdoor | IT | Fungal diseases | FS | 200.0 g/L | Seed treatment – general (see also comment field) | 0 0 1 60 g a.i./100 kg |
| Soyabeans | *Glycine max* | SEU | Outdoor | IT | Fungal diseases | FS | 200.0 g/L | Seed treatment – general (see also comment field) | 0 0 1 60 g a.i./100 kg |
| Cotton seeds | *Gossypium barbadense*; *Gossypium herbaceum* | SEU | Outdoor | ES | *Sclerotinia spp.* | FS | 200.0 g/L | Seed treatment – general (see also comment field) | 0 0 1 90 g a.i./100 kg |
| Barley | *Hordeum vulgare* | SEU | Outdoor | IT | Fungal diseases | FS | 200.0 g/L | Seed treatment – general (see also comment field) | 0 0 1 100 g a.i./100 kg |
### Critical outdoor GAPs for Northern Europe

| Crop                  | Scientific name | Region | Outdoor/Indoor | Member state or country | Pest controlled | Formulation | Application | PHI or waiting period (days) | Comments                      |
|-----------------------|-----------------|--------|----------------|--------------------------|-----------------|-------------|-------------|-----------------------------|-------------------------------|
| Maize                 | Zea mays        | SEU    | Outdoor        | FR                       | Fungal diseases | FS          | Seed treatment                  | 0 0 1 100 g a.i./100 kg       |                               |
| Common millet         | Panicum miliaceum | SEU    | Outdoor      | ES                       | Fungal diseases | FS          | Seed treatment                  | 0 0 1 90 g a.i./100 kg        |                               |
| Oat                   | Avena sativa    | SEU    | Outdoor       | ES                       | Fungal diseases | FS          | Seed treatment                  | 0 0 1 90 g a.i./100 kg        |                               |
| Rice                  | Oryza sativa    | SEU    | Outdoor       | IT                       | Fungal diseases | FS          | Seed treatment                  | 0 0 1 100 g a.i./100 kg       |                               |
| Rye                   | Secale cereale  | SEU    | Outdoor       | ES                       | Covered smut    | FS          | Seed treatment                  | 0 0 1 90 g a.i./100 kg        |                               |
### Critical outdoor GAPs for Northern Europe

| Common name | Scientific name | Region | Outdoor/Indoor | Pest controlled | Formulation | Application | PHI or waiting period (days) | Comments |
|-------------|-----------------|--------|----------------|-----------------|-------------|-------------|----------------------------|----------|
| Sorghum     | *Sorghum bicolor* | SEU    | Outdoor        | ES              | FS          | Seed treatment general (see also comment field) | 90 | g a.i./100 kg |
| Wheat       | *Triticum aestivum* | SEU    | Outdoor        | IT              | Fungal diseases | Seed treatment general (see also comment field) | 100 | g a.i./100 kg |
| Sugar beets | *Beta vulgaris subsp. vulgaris var. altissima* | SEU    | Outdoor        | IT              | Seed/soil borne fungi | Seed treatment general (see also comment field) | 120 | g a.i./100 kg |

MRL: maximum residue level; GAP: Good Agricultural Practice; NEU: northern European Union; SEU: southern European Union; BBCH: growth stages of mono- and dicotyledonous plants; a.i.: active ingredient; PHI: preharvest interval.
Appendix B – List of end points

B.1. Residues in plants

B.1.1. Nature of residues and methods of analysis in plants

B.1.1.1. Metabolism studies, methods of analysis and residue definitions in plants

| Primary crops (available studies) | Crop groups | Crop(s) | Application(s) | Sampling |
|-----------------------------------|-------------|---------|----------------|----------|
| Cereals/grass crops              | Wheat       | 60 g a.s./100 kg seed | 47, 167   |
| Pulses and oilseeds              |             | –       | –              | –        |
| Root/tuber crops                 |             | –       | –              | –        |

Source: United Kingdom, 2006
Sampling was done 47 days (foliage) and 167 days (chaff, straw and grain) after planting of the treated seed.

| Rotational crops (available studies) | Crop groups | Crop(s) | Application(s) | PBI (DAT) |
|--------------------------------------|-------------|---------|----------------|-----------|
| Root/tuber crops                     | Carrot      | Bare soil, 0.13 kg a.s./ha (equivalent to 60 g carboxin/100 kg seed) or 1.3 kg a.s./ha (equivalent to 600 g carboxin/100 kg seed) | 30, 120, 365 |
| Leafy crops                          | Lettuce     | Bare soil, 0.13 kg a.s./ha (equivalent to 60 g carboxin/100 kg seed) or 1.3 kg a.s./ha (equivalent to 600 g carboxin/100 kg seed) | 30, 120, 365 |
| Cereal (small grain)                 | Wheat       | Bare soil, 0.13 kg a.s./ha (equivalent to 60 g carboxin/100 kg seed) or 1.3 kg a.s./ha (equivalent to 600 g carboxin/100 kg seed) | 30, 120, 365 |

Source: United Kingdom, 2015

| Processed commodities (hydrolysis study) | Conditions | Investigated? |
|------------------------------------------|------------|---------------|
|                                          | Pasteurisation (20 min, 90°C, pH 4) | No             |
|                                          | Baking, brewing and boiling (60 min, 100°C, pH 5) | No             |
|                                          | Sterilisation (20 min, 120°C, pH 6) | No             |

According to the chemical structure of carboxin, the release of aniline during hydrolysis may occur. Given the toxicological concerns related to aniline, the formation and bioavailability of aniline in processed commodities must be investigated.
Can a general residue definition be proposed for primary crops? | No
---|---
Rotational crop and primary crop metabolism similar? | Yes (tentative for cereals)
Residue pattern in processed commodities similar to residue pattern in raw commodities? | Inconclusive
Plant residue definition for monitoring (RD-Mo) | Carboxin plus its metabolites carboxin sulfoxide and oxycarboxin (carboxin sulfone), expressed as carboxin (valid for cereals but tentative for pulses and oilseeds and root/tubers)
Plant residue definition for risk assessment (RD-RA) | Carboxin plus its metabolites carboxin sulfoxide and oxycarboxin (carboxin sulfone), expressed as carboxin (valid for cereals but tentative for pulses and oilseeds and root/tubers)
Conversion factor (monitoring to risk assessment) | Not relevant
Methods of analysis for monitoring of residues (analytical technique, crop groups, LOQs) | HPLC–MS/MS (United Kingdom, 2006; EURL, 2016; EFSA, 2017b):
• Individual LOQ: carboxin (0.01 mg/kg); carboxin sulfoxide (0.01 mg/kg); carboxin sulfone (oxycarboxin) (0.01 mg/kg);
• Combined LOQ: 0.03 mg/kg validated in high water, high acid content and dry commodities
• ILV available for dry commodities

B.1.1.2. Stability of residues in plants

| Plant products (available studies) | Category | Commodity | T (°C) | Stability (Months/years) |
|---|---|---|---|---|
| High water content | Wheat forage | –18 | 18 months |
| Dry | Wheat grain | –18 | 18 months |
| Other | Wheat straw | –18 | 24 months |

Source: United Kingdom, 2010
Stability demonstrated for carboxin, carboxin sulfone and carboxin sulfoxide.
### B.1.2. Magnitude of residues in plants

#### B.1.2.1. Summary of residues data from the supervised residue trials

| Crop                          | Region/ indoor(a) | Residue levels observed in the supervised residue trials relevant to the supported GAPs (mg/kg) | Recommendations/comments (OECD calculations) | MRL proposals (mg/kg) | HR (mg/kg)(b) | STMR (mg/kg)(c) |
|-------------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------|-----------------------------------------------|-----------------------|---------------|-----------------|
| Sweet corn                    | NEU               | No data available                                                                                                 |                                               |                       |               |                 |
|                               | SEU               | No data available                                                                                                 |                                               |                       |               |                 |
| Barley grains                 | NEU               | $2 \times < 0.025; 7 \times < 0.005$ Trials on barley performed with 100–125 g a.s./100 kg seed (1.1–1.4N) analysed for parent compound only (United Kingdom, 2011). Storage period and analytical method unknown. Extrapolation to rye is proposed $\text{MRL}_{\text{OECD}} = 0.05$ |                                               |                       |               |                 |
|                               | SEU               | No data available                                                                                                 |                                               |                       |               |                 |
| Rye grains                    | NEU               | $11 \times < 0.03$ Extrapolated from trials on wheat grain performed at 60 g a.s./100 kg seed (EFSA, 2010a,b) compliant with the residue definition for risk assessment using a validated method of analysis $\text{MRL}_{\text{OECD}} = 0.03$ |                                               | $0.03^*$              | $< 0.03$      | $< 0.03$        |
|                               | SEU               | No data available                                                                                                 |                                               |                       |               |                 |
| Maize/corn grains             | NEU               | $2 \times < 0.025$ Trials performed with 450 g a.s./100 kg seed (4.5N) and 2,600 g a.s./100 kg seed (26N) conducted outside the EU (United Kingdom, 2011) analysed for parent compound only. Storage period and analytical method unknown. Extrapolation to sorghum is proposed |                                               |                       |               |                 |
| Sorghum grains                | SEU               | No data available                                                                                                 |                                               |                       |               |                 |
| Common millet/proso millet grains | SEU        | No data available                                                                                                 |                                               |                       |               |                 |
| Oat grains/Wheat grains       | NEU               | $5 \times < 0.05$ Trials on barley performed with 120–125 g a.s./100 kg (0.8N) seed analysed for parent compound only (United Kingdom, 2011). Storage period and analytical method unknown. Extrapolation to oat grain and wheat grain is proposed $\text{MRL}_{\text{OECD}} = 0.05$ |                                               |                       |               |                 |
|                               | SEU               | No data available                                                                                                 |                                               |                       |               |                 |
| Crop                | Region/indoor(a) | Residue levels observed in the supervised residue trials relevant to the supported GAPs (mg/kg) | Recommendations/comments (OECD calculations) | MRL proposals (mg/kg) | HR (mg/kg)(b) | STMR (mg/kg)(c) |
|---------------------|------------------|-------------------------------------------------------------------------------------------------|-----------------------------------------------|----------------------|----------------|-----------------|
| Rice grains         | NEU              | No data available                                                                              |                                               |                      |                |                 |
|                     | SEU              | $2 \times < 0.025$                                                                              | Trials performed with 2,600 g a.s./100 kg seed (26N) conducted outside the EU analysed for parent compound only (United Kingdom, 2011). Storage period, analytes and analytical method unknown |                      |                |                 |
| Barley straw        | NEU              | $4 \times < 0.10; 0.11; < 0.12; 0.13$                                                           | Trials on barley performed with 120–125 g a.s./100 kg (1.1–1.4N) analysed for parent compound only (United Kingdom, 2011). Storage period and analytical method unknown. Extrapolation to rye straw is proposed MRL_{OECD} = 0.17 |                      |                |                 |
|                     | SEU              | No data available                                                                              |                                               |                      |                |                 |
| Rye straw           | NEU              | $11 \times < 0.03$                                                                             | Extrapolated from trials on wheat straw performed at 60 g a.s./100 kg seed (EFSA, 2010a,b) compliant with the residue definition for risk assessment using a validated method of analysis MRL_{OECD} = 0.03 | $0.03^*$             | $< 0.03$       | $< 0.03$        |
|                     | SEU              | No data available                                                                              |                                               |                      |                |                 |
| Common millet straw | SEU              | No data available                                                                              |                                               |                      |                |                 |
| Maize/corn stover   | NEU              | No data available                                                                              |                                               |                      |                |                 |
|                     | SEU              | No data available                                                                              |                                               |                      |                |                 |
| Oat straw           | NEU              | $2 \times < 0.10; 0.11; < 0.12; 0.13$                                                           | Trials on barley performed with 120–125 g a.s./100 kg seed (0.8N) analysed for parent compound only are considered on a tentative basis. Storage period and analytical method unknown. Extrapolation to oat straw and wheat straw is proposed MRL_{OECD} = 0.20 |                      |                |                 |
| Wheat straw         | SEU              | No data available                                                                              |                                               |                      |                |                 |
| Rice straw          | NEU              | No data available                                                                              |                                               |                      |                |                 |
| Sorghum stover      | NEU              | No data available                                                                              |                                               |                      |                |                 |
|                     | SEU              | No data available                                                                              |                                               |                      |                |                 |
| Potatoes            | NEU              | No data available                                                                              |                                               |                      |                |                 |
| Garlic              | SEU              | No data available                                                                              |                                               |                      |                |                 |
### Crop Residue Levels

| Crop                           | Region/indoor(a) | Residue levels observed in the supervised residue trials relevant to the supported GAPs (mg/kg) | Recommendations/comments (OECD calculations)                                                                 | MRL proposals (mg/kg) | HR (mg/kg)(b) | STMR (mg/kg)(c) |
|--------------------------------|------------------|-----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|----------------------|--------------|-----------------|
| Beans (with pods)              | SEU              | No data available                                                                             |                                                                                                                 |                      |              |                 |
| Peas (with pods)               | NEU              | No data available                                                                             |                                                                                                                 |                      |              |                 |
| Peas (without pods)            | NEU              | No data available                                                                             |                                                                                                                 |                      |              |                 |
| Peas (dry)                     | NEU              | No data available                                                                             |                                                                                                                 |                      |              |                 |
| Lupins/lupini beans (dry)      | NEU              | No data available                                                                             |                                                                                                                 |                      |              |                 |
| LinseedsSunflower seedsRapeseeds/canola seedsSoyabeans | NEU | 9 × < 0.05                                                                                   | Combined data set of 2 trials performed on linseed at 80 g a.s./100 kg seed (1.4N) and 7 trials performed on oilseed rape at 99 g a.s./100 kg seed (1.8N) analysed for carboxin equivalents (United Kingdom, 2011). It was not clear if samples from oilseeds residue trials were analysed for all relevant components (carboxin, carboxin sulfone and carboxin sulfoxide); therefore, EFSA assumed that the residue levels referred to the parent compound only. Extrapolation to sunflower seeds, rapeseeds and soyabeans is proposed MRL_{OECD} = 0.05 |                      |              |                 |
| Soyabeans                      | SEU              | No data available                                                                             |                                                                                                                 |                      |              |                 |
| Cotton seeds                   | SEU              | No data available                                                                             |                                                                                                                 |                      |              |                 |
| Sugar beet roots               | NEU              | No data available                                                                             |                                                                                                                 |                      |              |                 |
| Sugar beet tops                | NEU, SEU         | No data available                                                                             |                                                                                                                 |                      |              |                 |

**GAP:** Good Agricultural Practice; **OECD:** Organisation for Economic Co-operation and Development; **MRL:** maximum residue level.

*: Indicates that the MRL is proposed at the limit of quantification.

(a): NEU: Outdoor trials conducted in northern Europe, SEU: Outdoor trials conducted in southern Europe, Indoor: indoor EU trials or Country code: if non-EU trials.

(b): Highest residue.

(c): Supervised trials median residue.
B.1.2.2. Residues in succeeding crops

| Study Type                      | Residence Description                                                                 |
|---------------------------------|----------------------------------------------------------------------------------------|
| Confined rotational crop study  | Residues of carboxin sulfone and carboxin sulfoxide observed at amounts higher than 0.1 mg/kg in wheat grain and straw |
| Field rotational crop study     | No studies available but required                                                       |

B.2. Residues in livestock

| Relevant groups | Dietary burden expressed in mg/kg bw for day | Most critical diet(a) | Most critical commodity(a) | Trigger exceeded (Y/N) |
|-----------------|---------------------------------------------|-----------------------|----------------------------|------------------------|
| Cattle (all diets) | 0.0008 (Med.) - 0.0008 (Max.) | Cattle (dairy) | Rye, straw | No |
| Cattle (dairy only) | 0.0008 (Med.) - 0.0008 (Max.) | Cattle (dairy) | Rye, straw | No |
| Sheep (all diets) | 0.0012 (Med.) - 0.0012 (Max.) | Sheep (lamb) | Rye, straw | No |
| Sheep (ewe only) | – | Sheep (ram/ewe) | – | No |
| Swine (all diets) | 0.0007 (Med.) - 0.0007 (Max.) | Swine (finishing) | Rye, grain | No |
| Poultry (all diets) | 0.0017 (Med.) - 0.0017 (Max.) | Poultry (broiler) | Rye, grain | No |
| Poultry (layer only) | 0.0008 (Med.) - 0.0008 (Max.) | Poultry (layer) | Rye, grain | No |

bw: body weight; DM: dry matter.  
(a): Calculated for the maximum dietary burden from the notified use on rye.

B.2.1. Nature of residues and methods of analysis in livestock

B.2.1.1. Metabolism studies, methods of analysis and residue definitions in livestock

| Livestock (available studies) | Animal     | Dose (mg/kg bw per day) | Duration (days) | N rate/comment |
|--------------------------------|------------|-------------------------|-----------------|----------------|
| Laying hen                     | –          | –                       | –               | –              |
| Lactating goat/cow             | –          | –                       | –               | –              |
| Pig                            | –          | –                       | –               | –              |
| No studies available.          |            |                         |                 |                |

Time needed to reach a plateau concentration in milk and eggs (days) Not available
Metabolism in rat and ruminant similar (Yes/No) Not available
Animal residue definition for monitoring (RD-Mo) Not available
Animal residue definition for risk assessment (RD-RA) Not available
Conversion factor (monitoring to risk assessment) Not available
Fat soluble residues (Yes/No) No
Methods of analysis for monitoring of residues (analytical technique, crop groups, LOQs) (EFSA, 2017b):
- LOQ of 0.01 mg/kg is achievable for the metabolite carboxin sulfoxide in milk
B.2.1.2. Stability of residues in livestock

| Animal products (available studies) | Animal | Commodity | T (°C) | Stability (Months/years) |
|------------------------------------|--------|-----------|--------|--------------------------|
| -                                  | Muscle | –         | –      | –                        |
| -                                  | Liver  | –         | –      | –                        |
| -                                  | Kidney | –         | –      | –                        |
| -                                  | Milk   | –         | –      | –                        |
| -                                  | Egg    | –         | –      | –                        |

No studies available

B.2.2. Magnitude of residues in livestock

B.2.2.1. Summary of the residue data from livestock feeding studies

| Animal commodity | Residues at the closest feeding level (mg/kg) | Estimated value at 1N MRL proposal (mg/kg) | MRL proposal (mg/kg) |
|------------------|---------------------------------------------|-------------------------------------------|---------------------|
|                  | Mean                                         | Highest STMR (mg/kg)                      | HR (mg/kg)          |
| Cattle (all diets) | No MRL proposal is possible                    |                                           |                     |
| Cattle (dairy only) | No MRL proposal is possible                    |                                           |                     |
| Sheep (all diets)  | No MRL proposal is possible                    |                                           |                     |
| Sheep (dairy only) | No MRL proposal is possible                    |                                           |                     |
| Swine             | No MRL proposal is possible                    |                                           |                     |
| Poultry (all diets) | No MRL proposal is possible                    |                                           |                     |
| Poultry (layer only) | No MRL proposal is possible                    |                                           |                     |

B.3. Consumer risk assessment

| ADI                                      | 0.008 mg/kg bw per day (EFSA, 2010a,b) |
|------------------------------------------|---------------------------------------|
| Highest IEDI, according to EFSA PRIMo   | 76% ADI (Dutch, child)                 |

Assumptions made for the calculations

For all commodities, EFSA considered the LOQ of 0.03 mg/kg for an indicative calculation. It is highlighted that the potential exposure to aniline was not assessed. The contributions of commodities where no GAP was reported in the framework of this review were not included in the calculation.

ARfD

Not necessary (EFSA, 2010a,b)

Highest IESTI, according to EFSA PRIMo

Assumptions made for the calculations

ADI: acceptable daily intake; bw: body weight; IEDI: international estimated daily intake; PRIMo: (EFSA) Pesticide Residues Intake Model; WHO: World Health Organization; ARfD: acute reference dose; IESTI: international estimated short-term intake.
### Proposed MRLs

| Code number\(^{(a)}\) | Commodity | Existing EU MRL (mg/kg) | Outcome of the review |
|-----------------------|-----------|------------------------|-----------------------|
| **Enforcement residue definition (existing):** carboxin |
| 211000 Potatoes | 0.05* | – | Further consideration needed\(^{(b)}\) |
| 220010 Garlic | 0.1 | – | Further consideration needed\(^{(b)}\) |
| 234000 Sweet corn | 0.1 | – | Further consideration needed\(^{(b)}\) |
| 260010 Beans (with pods) | 0.2 | – | Further consideration needed\(^{(b)}\) |
| 260030 Peas (with pods) | 0.2 | – | Further consideration needed\(^{(b)}\) |
| 260040 Peas (without pods) | 0.2 | – | Further consideration needed\(^{(b)}\) |
| 300030 Peas (dry) | 0.2 | – | Further consideration needed\(^{(b)}\) |
| 300040 Lupins/lupini beans (dry) | 0.05* | – | Further consideration needed\(^{(b)}\) |
| 401010 Linseeds | 0.2 | – | Further consideration needed\(^{(b)}\) |
| 401050 Sunflower seeds | 0.2 | – | Further consideration needed\(^{(b)}\) |
| 401060 Rapeseeds/canola seeds | 0.1 | – | Further consideration needed\(^{(b)}\) |
| 401070 Soyabeans | 0.2 | – | Further consideration needed\(^{(b)}\) |
| 401090 Cotton seeds | 0.2 | – | Further consideration needed\(^{(b)}\) |
| 500010 Barley grains | 0.01* | – | Further consideration needed\(^{(b)}\) |
| 500030 Maize/corn grains | 0.01* | – | Further consideration needed\(^{(b)}\) |
| 500040 Common millet/proso millet grains | 0.01* | – | Further consideration needed\(^{(b)}\) |
| 500050 Oat grains | 0.01* | – | Further consideration needed\(^{(b)}\) |
| 500060 Rice grains | 0.01* | – | Further consideration needed\(^{(b)}\) |
| 500070 Rye grains | 0.01* | – | Further consideration needed\(^{(b)}\) |
| 500080 Sorghum grains | 0.01* | – | Further consideration needed\(^{(b)}\) |
| 500090 Wheat grains | 0.01* | – | Further consideration needed\(^{(b)}\) |
| 900010 Sugar beet roots | 0.2 | – | Further consideration needed\(^{(b)}\) |
| – Other commodities of plant and/or animal origin | See Reg. (EC) No 839/2008 | – | Further consideration needed\(^{(d)}\) |

\(^{(a)}\): Commodity code number, as listed in Annex I of Regulation (EC) No 396/2005.
\(^{(b)}\): GAP evaluated at EU level is not supported by data and a risk to consumers cannot be excluded for the existing EU MRL; no CXL is available. Either a specific LOQ or the default MRL of 0.01 mg/kg may be considered (combination B-I in Appendix E).
\(^{(c)}\): GAP evaluated at EU level is not fully supported by data and a risk to consumers cannot be excluded; no CXL is available. Either a specific LOQ or the default MRL of 0.01 mg/kg may be considered (combination D-I in Appendix E).
\(^{(d)}\): There are no relevant authorisations or import tolerances reported at EU level; no CXL is available. Either a specific LOQ or the default MRL of 0.01 mg/kg may be considered (combination A-I in Appendix E).
Appendix C – Pesticide Residue Intake Model (PRIMo)

### Carboxin

| Toxicological end points | Code no.  | LOQ (mg/kg) | ADI (mg/kg bw per day) | ARfD (mg/kg bw) | Source of ADI | Year of evaluation | Source of ARfD | Year of evaluation |
|-------------------------|-----------|-------------|------------------------|----------------|---------------|-------------------|----------------|-------------------|
| ADI                     | 0.008     |             |                        |                | EFSA          | 2010              |               |                   |
| ARfD                    | n.n.      |             |                        |                |               |                   |               |                   |
| Source of ADI           |           |             |                        |                |               |                   |               |                   |
| Year of evaluation      |           |             |                        |                |               |                   |               |                   |

| No of diets exceeding ADI: | --- |
|---------------------------|-----|

| Commodity/group of commodities | pTMRLs at LOQ (in % of ADI) |
|-------------------------------|-----------------------------|
| Milk and milk products: Cattle | 76.0 NL child 12.3 11.0 11.0 |
| VEGETABLES                    | 67.0 FR toddler 16.2 14.9 6.5 |
| SUGAR PLANTS                  | 63.7 DE child 8.8 8.6 5.4 |
| CEREALS                       | 60.0 FR infant 9.7 9.2 9.2 |
| PRODUCTS OF ANIMAL ORIGIN     | 59.3 UK Infant 3.8 3.4 3.4 |
| FRUIT (FRESH OR FROZEN)       | 56.5 UK Toddler 8.8 8.6 8.6 |
| CEREALS                       | 52.8 WHO Cluster diet B 8.6 8.6 8.6 |
| VEGETABLES                    | 42.7 BE adult 4.0 3.4 2.5 |
| CEREALS                       | 42.0 SE general population 9th percentile 8.6 8.6 8.6 |
| VEGETABLES                    | 40.4 DK child 8.2 8.2 8.2 |
| VEGETABLES                    | 40.4 ES child 6.6 6.6 6.6 |
| FRUIT (FRESH OR FROZEN)       | 34.2 WHO cluster diet E 3.4 3.4 3.4 |
| SUGAR PLANTS                  | 32.3 WHO regional European diet 3.5 3.5 3.5 |
| VEGETABLES                    | 31.4 WHO cluster diet D 3.4 3.4 3.4 |
| VEGETABLES                    | 29.4 WHO Cluster diet F 2.7 2.7 2.7 |
| FRUIT (FRESH OR FROZEN)       | 26.0 NL general 3.1 3.1 3.1 |
| PRODUCTS OF ANIMAL ORIGIN     | 23.3 ES adult 3.0 3.0 3.0 |
| PRODUCTS OF ANIMAL ORIGIN     | 22.4 FR all population 2.3 2.3 2.3 |
| VEGETABLES                    | 21.3 PT General population 2.4 2.4 2.4 |
| VEGETABLES                    | 19.6 LT adult 2.2 2.2 2.2 |
| VEGETABLES                    | 17.9 UK education 1.4 1.4 1.4 |
| VEGETABLES                    | 17.5 DK adult 2.8 2.8 2.8 |
| VEGETABLES                    | 17.1 UK adult 1.7 1.7 1.7 |
| VEGETABLES                    | 13.8 FT adult 2.6 2.6 2.6 |
| VEGETABLES                    | 12.9 FT adult 1.6 1.6 1.6 |
| VEGETABLES                    | 11.9 FT general population 2.3 2.3 2.3 |

### Chronic risk assessment – refined calculations

| MS Diet | TMDI (range) in % of ADI | Commodity/group of commodities | TMDI values in % of ADI | Commodity/group of commodities | TMDI values in % of ADI | Commodity/group of commodities | TMDI values in % of ADI | Commodity/group of commodities |
|---------|--------------------------|--------------------------------|------------------------|--------------------------------|------------------------|--------------------------------|------------------------|--------------------------------|
| NL child| 76.0                     | PRODUCTS OF ANIMAL ORIGIN      | 11.0                   | Milk and cream                  | 11.0                   | Milk and milk products: Cattle | 14.5                   | Milk and cream                  |
| FR toddler| 67.0                    | PRODUCTS OF ANIMAL ORIGIN      | 14.3                   | Milk and cream                  | 6.5                    | VEGETABLES                       | 5.4                    | Milk and cream                  |
| DE child| 63.7                     | PRODUCTS OF ANIMAL ORIGIN      | 14.5                   | Milk and cream                  | 3.7                    | VEGETABLES                       | 3.7                    | Milk and cream                  |
| FR infant| 60.0                     | PRODUCTS OF ANIMAL ORIGIN      | 14.7                   | Milk and cream                  | 3.7                    | VEGETABLES                       | 3.7                    | Milk and cream                  |
| UK toddler| 56.5                    | VEGETABLES                     | 2.7                    | Milk and cream                  | 4.7                    | Milk and milk products: Cattle | 4.7                    | Milk and milk products: Cattle |
| WHO Cluster diet B| 52.8 | PRODUCTS OF ANIMAL ORIGIN | 2.7                    | Milk and cream                  | 4.7                    | Milk and milk products: Cattle | 4.7                    | Milk and milk products: Cattle |
| BE adult| 42.7                     | FRUIT (FRESH OR FROZEN)        | 2.5                    | PRODUCTS OF ANIMAL ORIGIN       | 2.3                    | CEREALS                          | 2.3                    | CEREALS                          |
| SE general population 9th percentile | 42.0 | PRODUCTS OF ANIMAL ORIGIN | 3.5                    | VEGETABLES                       | 3.5                    | VEGETABLES                       | 3.5                    | VEGETABLES                       |
| DK child| 40.4                     | PRODUCTS OF ANIMAL ORIGIN      | 3.2                    | CEREALS                         | 2.6                    | VEGETABLES                       | 2.6                    | VEGETABLES                       |
| ES child| 40.4                     | VEGETABLES                     | 3.2                    | CEREALS                         | 2.6                    | VEGETABLES                       | 2.6                    | VEGETABLES                       |
| WHO cluster diet E| 34.2 | VEGETABLES                    | 3.2                    | CEREALS                         | 2.6                    | VEGETABLES                       | 2.6                    | VEGETABLES                       |
| WHO regional European diet | 32.3 | PRODUCTS OF ANIMAL ORIGIN | 1.9                    | Milk and cream                  | 1.9                    | Milk and milk products: Cattle | 1.9                    | Milk and milk products: Cattle |
| WHO cluster diet D| 31.4 | VEGETABLES                    | 1.7                    | PRODUCTS OF ANIMAL ORIGIN       | 1.7                    | VEGETABLES                       | 1.7                    | VEGETABLES                       |
| WHO Cluster diet F| 29.4 | PRODUCTS OF ANIMAL ORIGIN | 1.6                    | Barley & small grain | 2.0                    | VEGETABLES                       | 2.0                    | VEGETABLES                       |
| NL general| 26.0                   | VEGETABLES                     | 1.9                    | VEGETABLES                       | 1.5                    | CEREALS                          | 1.5                    | CEREALS                          |
| ES adult| 23.3                     | PRODUCTS OF ANIMAL ORIGIN      | 1.4                    | VEGETABLES                       | 1.4                    | VEGETABLES                       | 1.4                    | VEGETABLES                       |
| FR all population| 22.4                  | FRUIT (FRESH OR FROZEN)        | 1.3                    | VEGETABLES                       | 1.3                    | VEGETABLES                       | 1.3                    | VEGETABLES                       |
| PT General population| 21.3                  | FRUIT (FRESH OR FROZEN)        | 1.3                    | VEGETABLES                       | 1.3                    | VEGETABLES                       | 1.3                    | VEGETABLES                       |
| LT adult| 19.6                     | PRODUCTS OF ANIMAL ORIGIN      | 1.3                    | VEGETABLES                       | 1.3                    | VEGETABLES                       | 1.3                    | VEGETABLES                       |

### Conclusion:

The estimated Theoretical Maximum Daily Intakes (TMDI), based on pTMRLs were below the ADI. A long-term intake of residues of carboxin is unlikely to present a public health concern.
Acute risk assessment/children – refined calculations

| No of commodities for which ARfD/ADI is exceeded (IESTI 1): | No of commodities for which ARfD/ADI is exceeded (IESTI 2): | No of commodities for which ARfD/ADI is exceeded (IESTI 1): | No of commodities for which ARfD/ADI is exceeded (IESTI 2): |
|-----------------------------------------------------------|-----------------------------------------------------------|-----------------------------------------------------------|-----------------------------------------------------------|
| IESTI 1 | *) | **) | IESTI 2 | *) | **) | IESTI 1 | *) | **) | IESTI 2 | *) | **) |
| Highest % of ARfD/ADI Commodity | pTMRL/Threshold MRL (mg/kg) | Highest % of ARfD/ADI Commodity | pTMRL/Threshold MRL (mg/kg) | Highest % of ARfD/ADI Commodity | pTMRL/Threshold MRL (mg/kg) | Highest % of ARfD/ADI Commodity | pTMRL/Threshold MRL (mg/kg) |

\[ \text{No of critical MRLs (IESTI 1):} \]

\[ \text{No of critical MRLs (IESTI 2):} \]

Processed commodities Unprocessed commodities

\[ \text{No of commodities for which ARfD/ADI is exceeded (IESTI 1):} \]

\[ \text{No of commodities for which ARfD/ADI is exceeded (IESTI 2):} \]

Highest % of ARfD/ADI Processed commodities | pTMRL/Threshold MRL (mg/kg) | Highest % of ARfD/ADI Processed commodities | pTMRL/Threshold MRL (mg/kg) | Highest % of ARfD/ADI Processed commodities | pTMRL/Threshold MRL (mg/kg) |

\[ \text{No of commodities for which ARfD/ADI is exceeded (IESTI 1):} \]

\[ \text{No of commodities for which ARfD/ADI is exceeded (IESTI 2):} \]

Highest % of ARfD/ADI Processed commodities | pTMRL/Threshold MRL (mg/kg) | Highest % of ARfD/ADI Processed commodities | pTMRL/Threshold MRL (mg/kg) | Highest % of ARfD/ADI Processed commodities | pTMRL/Threshold MRL (mg/kg) |

\[ \text{The results of the IESTI calculations are reported for at least 5 commodities. If the ARfD is exceeded for more than 5 commodities, all IESTI values > 90% of ARfD are reported.} \]

\[ **) pTMRL: provisional temporary MRL. ***) pTMRL: provisional temporary MRL for unprocessed commodity. \]

Conclusion:

As no ARD was considered necessary, it is concluded that the short-term intake of carboxin residues is unlikely to present a public health concern.
## Appendix D – Input values for the exposure calculations

### D.1. Livestock dietary burden calculations

| Feed commodity | Median dietary burden | Maximum dietary burden |
|----------------|-----------------------|------------------------|
|                | Input value (mg/kg)   | Comment                | Input value (mg/kg) | Comment |
| **Risk assessment residue definition** – carboxin plus its metabolites carboxin sulfoxide and oxycarboxin (carboxin sulfone), expressed as carboxin | | | | |
| Rye, grain     | 0.03                  | STMR<sup>(a)</sup>     | 0.03                | STMR<sup>(a)</sup> |
| Rye, straw     | 0.03                  | STMR                   | 0.03                | HR       |

STMR: supervised trials median residue; HR: highest residue.

<sup>(a)</sup>: For cereal bran no default processing factor was applied because carboxin is applied early in the growing season and residues are expected to be below the LOQ. Concentration of residues in these commodities is therefore not expected.

### D.2. Consumer risk assessment

| Commodity                  | Chronic risk assessment |
|----------------------------|-------------------------|
|                            | Input value (mg/kg)     | Comment   |
| **Risk assessment residue definition**: carboxin plus its metabolites carboxin sulfoxide and oxycarboxin (carboxin sulfone), expressed as carboxin | | |
| Potatoes                   | 0.03*                   | LOQ<sup>(a)</sup> |
| Garlic                     | 0.03*                   | LOQ<sup>(a)</sup> |
| Sweet corn                 | 0.03*                   | LOQ<sup>(a)</sup> |
| Beans (with pods)          | 0.03*                   | LOQ<sup>(a)</sup> |
| Peas (with pods)           | 0.03*                   | LOQ<sup>(a)</sup> |
| Peas (without pods)        | 0.03*                   | LOQ<sup>(a)</sup> |
| Peas (dry)                 | 0.03*                   | LOQ<sup>(a)</sup> |
| Lupins/lupini beans (dry)  | 0.03*                   | LOQ<sup>(a)</sup> |
| Linseeds                   | 0.03*                   | LOQ<sup>(a)</sup> |
| Sunflower seeds            | 0.03*                   | LOQ<sup>(a)</sup> |
| Rapeseeds/canola seeds     | 0.03*                   | LOQ<sup>(a)</sup> |
| Soyabeans                  | 0.03*                   | LOQ<sup>(a)</sup> |
| Cotton seeds               | 0.03*                   | LOQ<sup>(a)</sup> |
| Barley grains              | 0.03*                   | LOQ<sup>(a)</sup> |
| Maize/corn grains          | 0.03*                   | LOQ<sup>(a)</sup> |
| Common millet/proso millet grains | 0.03*   | LOQ<sup>(a)</sup> |
| Oat grains                 | 0.03*                   | LOQ<sup>(a)</sup> |
| Rice grains                | 0.03*                   | LOQ<sup>(a)</sup> |
| Rye grains                 | 0.03*                   | LOQ<sup>(a)</sup> |
| Sorghum grains             | 0.03*                   | LOQ<sup>(a)</sup> |
| Wheat grains               | 0.03*                   | LOQ<sup>(a)</sup> |
| Sugar beet roots           | 0.03*                   | LOQ<sup>(a)</sup> |
| Swine muscle               | 0.03*                   | LOQ<sup>(a)</sup> |
| Swine fat tissue           | 0.03*                   | LOQ<sup>(a)</sup> |
| Swine liver                | 0.03*                   | LOQ<sup>(a)</sup> |
| Swine kidney               | 0.03*                   | LOQ<sup>(a)</sup> |
| Bovine muscle              | 0.03*                   | LOQ<sup>(a)</sup> |
| Bovine fat tissue          | 0.03*                   | LOQ<sup>(a)</sup> |
| Bovine liver               | 0.03*                   | LOQ<sup>(a)</sup> |
| Bovine kidney              | 0.03*                   | LOQ<sup>(a)</sup> |
| Sheep muscle               | 0.03*                   | LOQ<sup>(a)</sup> |
| Commodity              | Chronic risk assessment |
|------------------------|-------------------------|
|                        | Input value (mg/kg)     | Comment            |
| Sheep fat tissue       | 0.03*                   | LOQ\(^{(a)}\)      |
| Sheep liver            | 0.03*                   | LOQ\(^{(a)}\)      |
| Sheep kidney           | 0.03*                   | LOQ\(^{(a)}\)      |
| Goat muscle            | 0.03*                   | LOQ\(^{(a)}\)      |
| Goat fat tissue        | 0.03*                   | LOQ\(^{(a)}\)      |
| Goat liver             | 0.03*                   | LOQ\(^{(a)}\)      |
| Goat kidney            | 0.03*                   | LOQ\(^{(a)}\)      |
| Equine muscle          | 0.03*                   | LOQ\(^{(a)}\)      |
| Equine fat tissue      | 0.03*                   | LOQ\(^{(a)}\)      |
| Equine liver           | 0.03*                   | LOQ\(^{(a)}\)      |
| Equine kidney          | 0.03*                   | LOQ\(^{(a)}\)      |
| Poultry muscle         | 0.03*                   | LOQ\(^{(a)}\)      |
| Poultry fat tissue     | 0.03*                   | LOQ\(^{(a)}\)      |
| Poultry liver          | 0.03*                   | LOQ\(^{(a)}\)      |
| Cattle milk            | 0.03*                   | LOQ\(^{(a)}\)      |
| Sheep milk             | 0.03*                   | LOQ\(^{(a)}\)      |
| Goat milk              | 0.03*                   | LOQ\(^{(a)}\)      |
| Horse milk             | 0.03*                   | LOQ\(^{(a)}\)      |
| Birds eggs             | 0.03*                   | LOQ\(^{(a)}\)      |

*: Indicates that the input value is proposed at the limit of quantification.
(a): Since the existing MRLs are not fully supported by data and there is a high level of uncertainties it was not possible to conduct a risk assessment with the current MRLs. Chronic consumer exposure, with the combined LOQ of 0.03 mg/kg as input value was used for an indicative calculation.
Appendix E – Decision tree for deriving MRL recommendations

Evaluation of the GAPs and available residues data at EU level

- GAP of DB > 0.1 mg/kg DM in EU?
  - No
    - MRL derived in Section 3?
      - No
        - Specific LOQ or default MRL?
          - No
            - Not considered for the RA.
          - Yes
            - Risk identified?
              - No
                - Median/highest values are included in the RA.
              - Yes
                - Fall-back MRL available?
                  - No
                    - Risk identified?
                      - No
                        - Median/highest values are included in the RA.
                      - Yes
                        - Tentative median/highest values are included in the RA.
                  - Yes
                    - Fall-back MRL available?
                      - No
                        - Risk identified?
                          - No
                            - Median/highest values are included in the RA.
                          - Yes
                            - Tentative median/highest values are included in the RA.
                    - Yes
                      - Median/highest values are included in the RA.

Consumer risk assessment for GAPs evaluated at EU level – EU scenarios

- Not considered for the RA.
- Current EU MRL is included in the RA.
- Tentative median/highest values are included in the RA.
- Median/highest values are included in the RA.

- Risk identified?
  - Yes
    - Fall-back MRL available?
      - Yes
        - Risk identified?
          - Yes
            - Median/highest values are included in the RA.
          - No
            - Tentative median/highest values are included in the RA.
      - No
        - Risk identified?
          - No
            - Median/highest values are included in the RA.
          - Yes
            - Tentative median/highest values are included in the RA.

Recommendations resulting from EU authorisations and import tolerances

- (A) Specific LOQ or default MRL?
- (B) Specific LOQ or default MRL?
- (C) Maintain current EU MRL?
- (D) Specific LOQ or default MRL?
- (E) Establish tentative EU MRL?
- (F) Specific LOQ or default MRL?
- (G) MRL is recommended.

Comparison with CXLs
Review of the existing MRLs for carboxin

Comparison of the EU recommendation with the existing CXL

- CXL available?
  - Yes
    - RD comparable?
      - Yes
        - CXL higher?
          - Yes
            - Maintain EU recommendation; higher CXL is not safe for consumer.
          - No
            - CXL is included in the RA.
              - Risk identified?
                - Yes
                  - Input values for the RA remain unchanged.
                - No
                  - Input values for the RA remain unchanged.

- No
  - RD comparable?
    - Yes
      - CXL higher?
        - Yes
          - Input values for the RA remain unchanged.
        - No
          - Input values for the RA remain unchanged.
    - No
      - CXL higher?
        - Yes
          - Input values for the RA remain unchanged.
        - No
          - Input values for the RA remain unchanged.

Consumer risk assessment with consideration of the existing CXL

- CXL supported by data?
  - Yes
    - CXL is included in the RA.
      - Risk identified?
        - Yes
          - Input values for the RA remain unchanged.
        - No
          - CXL is included in the RA.
            - Risk identified?
              - Yes
                - Input values for the RA remain unchanged.
              - No
                - CXL is included in the RA.

- No
  - CXL supported by data?
    - Yes
      - CXL is included in the RA.
        - Risk identified?
          - Yes
            - Input values for the RA remain unchanged.
          - No
            - CXL is included in the RA.
              - Risk identified?
                - Yes
                  - Input values for the RA remain unchanged.
                - No
                  - Input values for the RA remain unchanged.

Recommendations with consideration of the existing CXL

- (I) Maintain EU recommendation indicating that no CXL is available.
- (II) Maintain EU recommendation indicating CXL is not compatible.
- (III) Maintain EU recommendation indicating that CXL is covered.
- (IV) Maintain current CXL or EU recommendation; higher CXL is not safe for consumer.
- (V) Maintain EU recommendation; higher CXL is not safe for consumer.
- (VI) Maintain EU recommendation; higher CXL is not safe for consumer.
- (VII) CXL is recommended; EU recommendation is covered as well.
## Appendix F – Used compound codes

| Code/trivial name | Chemical name/SMILES notation | Structural formula |
|-------------------|-------------------------------|--------------------|
| Carboxin          | 5,6-dihydro-2-methyl-N-phenyl-1,4-oxathiin-3-carboxamide | ![Structural formula for Carboxin](image) |
| Carboxin sulfoxide| 2-methyl-N-phenyl-5,6-dihydro-1,4-oxathiine-3-carboxamide 4-oxide | ![Structural formula for Carboxin sulfoxide](image) |
| Carboxin sulfone (oxycarboxin)| 5,6-dihydro-2-methyl-1,4-oxathiine-3-carboxanilide 4,4-dioxide | ![Structural formula for Carboxin sulfone](image) |
| P/V-54            | 2-methyl-5,6-dihydro-1,4-oxathiine-3-carboxamide 4-oxide CC=1OCCS(O)=C1(C(N)=O) | ![Structural formula for P/V-54](image) |
| P/V-55            | 2-methyl-5,6-dihydro-1,4-oxathiine-3-carboxamide 4,4-dioxide CC=1OCCS(=O)=C1(C(N)=O) | ![Structural formula for P/V-55](image) |

SMILES: simplified molecular-input line-entry system.