Adopted: 25 March 2026

DOI: 10.2903/j.efsa.2026.10054

efsa JOURNAL

SCIENTIFIC REPORT

# The 2024 European Union report on pesticide residues in food

**European Food Safety Authority (EFSA) | Paula Medina Pastor | Luis Carrasco Cabrera | Giulio Di Piazza | Carmen González Ciria**

**Correspondence:** Ask a Question

The declarations of interest of all scientific experts active in EFSA's work are available at https://open.efsa.europa.eu/experts.

## Abstract

Under European Union legislation (Article 32, Regulation (EC) No 396/2005), the European Food Safety Authority publishes an annual report assessing pesticide residue levels in food. In 2024, 9842 samples were analysed as part of the EU-coordinated multiannual control programme subset, of which 1.2% were found to be non-compliant. National sampling procedures were used in 86,449 samples where the non-compliant rate was 1.8%. Increased import control programme accounted for 39,433 samples with a 3.6% non-compliant rate. Acute and chronic dietary exposure was estimated by providing the probabilities of exceeding the health-based guidance values (HBGV) for the pesticide residues in food. Overall, the estimated dietary risk was found to be low for most of the EU subpopulation groups and assessed substances. Recommendations are provided to risk managers to increase the effectiveness of European control systems and to ensure a high level of consumer protection throughout the EU.

**KEYWORDS**

acute, chronic, dietary exposure, European Union, food safety, imports, maximum residue levels, monitoring programme, pesticide residues, probability, risk assessment

# CONTENTS

## SUMMARY

The 2024 EU report on pesticide residues in food provides an overview of the official control activities on pesticide residues carried out in the EU Member States,[1] Iceland and Norway. The results derive from the EU-coordinated control (EU MACP), the national control (MANCP) and the temporary increased import control programmes.

The analysis of the data provided by all reporting countries is presented in a data visualisation format,[2] summarising the results and making it easy for stakeholders to understand the European situation related to the findings. The conclusions and recommendations derived from the findings within this report give risk managers a tool for designing future monitoring programmes and making informed decisions on which pesticides and food products should be targeted.

Additionally, the report includes acute and chronic probabilistic risk assessments for single substances of all the quantified pesticide residues in the 3 year cycle 2022–2024 from EU MACP and MANCP, covering objective and selective sampling. It provides the probabilities of exceedance of the health-based guidance values (HBGV) for the pesticides in food of the different subpopulations of European consumers.

EU-coordinated multiannual control programme (EU MACP)

The EU MACP uses a random sampling procedure, covering the most consumed food products by European citizens and being representative of the EU market. The control of these products is distributed across a 3 year cycle programme as indicated in the EU MACP Regulation (EU) 2023/731,[3] so that every 3 years the same products are analysed. A snapshot of the situation in 2024 of the pesticide residues present in those food products is provided and compared with 2021 and 2018.

In 2024, the 12 food products selected in the EU MACP were aubergines/eggplants, bananas, broccoli, cultivated fungi, grapefruits, melons, sweet peppers/bell peppers, table grapes, virgin olive oil, wheat grain, bovine fat and chicken eggs. A total of 9842 samples were analysed.[4] Overall, 9608 samples (97.6%) were found to be within the legal limits. MRLs[5] were numerically exceeded in 234 samples (2.4%), of which 113 samples (1.2%) were found to be non-compliant when considering measurement uncertainty (practically the same compliance rate (1.3%) as the same commodities sampled in 2021). On average, 46.6% of the samples analysed were domestic, 29.3% were from other reporting countries, 20.1% from third countries and 4.0% were of unknown origin. Similar rates were observed in 2021 where the same commodities were sampled.

National programmes (EU MACP + MANCP)

The 2024 programmes (both EU MACP and MANCP) amounted to a total of 86,449 samples analysed in over 1140 food products. Of the total number of samples analysed, 83,591 samples (96.7%) fell within the legal limits. Of those, 50,524 samples (58.4%) did not contain quantifiable residues (results below the limit of quantification (LOQ) for each pesticide analysed) while 33,067 samples (38.3%) contained quantified residues not exceeding the legal limits. In total, MRLs were exceeded in 2858 samples (3.3%), of which 1591 samples (1.8%) were non-compliant.

Temporary increased import control programme

An additional set of 39,433 samples was collected under Regulation (EU) No 2019/1793 on increased import control. These are suspect samples considered separately from the rest and are not included in the exposure assessments. Overall, 37,263 samples (94.5%) were found to be within the legal limits: of those, 15,099 samples (38.3%) had no quantifiable residues, and 22,164 samples (56.2%) had pesticide residues within the legally permitted levels. 2170 (5.5%) samples exceeded the MRL, of which 1403 (3.6%) were found non-compliant. Samples taken from imported products found to be non-compliant did not enter the EU market.

Dietary estimated exposure assessment

Acute and chronic exposure assessments in 30 EU subpopulation groups, including adults, children and toddlers, were performed using probabilistic modelling. The applied model aimed at quantifying the probability of true consumers being exposed to residues of individual substances at levels leading to an exceedance of the HBGV. The probabilistic calculations provide a realistic estimation of what consumers are exposed to, as they reflect real consumption events.

[1]In accordance with the Agreement on the withdrawal of the United Kingdom of Great Britain and Northern Ireland from the European Union and the European Atomic Energy Community, and in particular Article 5(4) of the Windsor Framework (see Joint Declaration No 1/2023 of the Union and the United Kingdom in the Joint Committee established by the Agreement on the withdrawal of the United Kingdom of Great Britain and Northern Ireland from the European Union and the European Atomic Energy Community of 24 March 2023, OJ L 102, 17.4.2023, p. 87) in conjunction with section 24 of Annex 2 to that Framework, for the purposes of this Regulation, references to Member States include the United Kingdom in respect of Northern Ireland.

[2]A dedicated website where EU MACP, MANCP and increased import control results are presented: https://multimedia.efsa.europa.eu/pesticides-report-2024/.

[3]Commission Implementing Regulation (EU) 2023/731 of 3 April 2023 concerning a coordinated multiannual control programme of the Union for 2024, 2025 and 2026 to ensure compliance with maximum residue levels of pesticides and to assess the consumer exposure to pesticide residues in and on food of plant and animal origin and repealing Implementing Regulation (EU) 2022/741. OJ L 95, 4.4.2023, pp. 28–40.

[4]These samples exclude those of baby food requested under the EU MACP.

[5]The 'maximum residue level' (MRL) is defined as the upper legal level of concentration for a pesticide residue in or on food or feed set in accordance with Regulation (EC) No. 396/2005, based on good agricultural practice and the lowest consumer exposure necessary to protect vulnerable consumers.

The probabilistic risk assessment was performed on the 367 substances with quantified results from EU MACP and MANCP, covering objective and selective sampling. For 33 of these substances, no HBGV was available, and for 64, no acute reference dose (ARfD) was deemed necessary (i.e. no acute adverse effect was observed in toxicological studies when these substances were assessed). For 215 active substances, the estimated probability of exceeding the ARfD was less than one individual consumer per day out of 1,000,000 based on the middle bound (median estimate value) of the confidence interval for the 40 commodities assessed. This indicates that, for most of the quantified substances, the probability of a consumer's intake posing an acute risk is very low. For 55 substances, the probability of exceeding the ARfD ranged from 0.001% to 0.6075%.

The probabilistic chronic risk assessment showed that, for 333 of 334 active substances assessed, the probability of exceeding the ADI was estimated to be less than 1 subject out of 1,000,000 based on the surveys used and their size. For one active substance only (pyrimethanil), a median estimate of the probability of exceeding the ADI was found ranging from 0.200% to 1.242% for seven EU population groups.

Overall, in the samples analysed in the framework of the 2022–2024 monitoring programmes, the estimated acute and chronic dietary exposure to individual substances for which HBGVs are available is below these values for most of the 30 EU subpopulation groups assessed. Thus, the estimated risk to EU consumers' health associated with individual pesticide substances is considered to be low. Previous assessments on cumulative exposure to pesticides affecting the nervous system, thyroid and craniofacial alterations concluded that the threshold for regulatory consideration established by risk managers was not exceeded.

In most of the cases where the estimated exposure for a specific pesticide/product combination was calculated to exceed the HBGV, EU legislation provides competent authorities with appropriate and proportionate corrective measures to address potential risks to consumers; these include withdrawing the product from the market, recalling it before even being placed on the market and monitoring the producers when non-compliant results are repeatedly found in checks.

# 1 | BACKGROUND

## 1.1 | Legal basis

The European Union (EU) has established a comprehensive legislative framework that defines rules for the approval of active substances under Regulation 1107/2009,[6] their use in plant protection products (PPP)[7] and their permissible residues[8] in food. These permissible residues in food are known as the 'maximum residue levels' (MRLs). The MRLs represent the upper legally tolerated concentration of a pesticide residue in or on food when a PPP is applied in accordance with its good agricultural practice (GAP). MRLs are authorised only after consumer health risks have been assessed.

The MRL can be numerically exceeded with no legal consequences. However, if MRLs are exceeded after having taken into account the measurement uncertainty of the analytical result, this constitutes an infringement of the legal MRL value, and the sample is considered non-compliant (European Commission, 2021). Non-compliant samples trigger legal actions and may be recalled from the market. However, these do not necessarily mean a risk to consumers. The non-compliant result is checked against the health-based guidance values (HBGVs) of the substance. These values are benchmarks used to assess the safety of pesticide residues in food. They represent the maximum amount of a substance that can be consumed during one single day (for acute values) or repeatedly over multiple days (for chronic values) without posing a significant risk to health. The HBGVs, therefore, depend on the duration of the consumption, considering toxicological data and accounting for uncertainties in these data. The HBGVs correspond to the lowest no observed adverse effect level (NOAEL) determined from a battery of toxicological studies done on animal tests divided by a safety factor (usually 100; sometimes 1000) which accounts for the possible differences in sensitivity between test in animals and humans and possible differences between humans. Therefore, the exceedance of a HBGV by an individual does not necessarily mean that an effect will take place in this individual.

The MRLs are established in Regulation (EC) No 396/2005.[9] EU-harmonised MRLs are set covering 378 food products/food groups. The substance(s) to which an MRL applies are included in the 'residue definition for enforcement' (i.e. 'RD' within this report). This differs from the 'residue definition for risk assessment', which may include additional metabolites with toxicological relevance. These risk assessment residue definitions are not used in the remit of this report due to the lack of a consolidated database compiling them or compiling the conversion factors used to convert residue concentration from an enforcement residue definition into a risk assessment one. Furthermore, a default MRL of 0.01 mg/kg is applicable to the pesticides which are not explicitly mentioned in the MRL legislation[10] or to those substances non-renewed, where the MRL can be set to the lowest quantifiable level which sometimes can be lower than 0.01 mg/kg (Annex V). Regulation (EC) No 396/2005[9] imposes the obligation on Member States to carry out controls to ensure that food placed on the market is compliant with the legal limits. There are different control programmes for which samples collected and analysed are reported to EFSA and presented in this report:

- EU-coordinated control programme: This programme covers the most consumed food products in Europe sampled in a randomised way, aiming at reflecting the real situation of the pesticide residues in the EU market in terms of frequency and levels. The listed food products are distributed across a 3-year cycle, so that every 3 years the same products are analysed. The EU-coordinated programme (EU MACP)[11] relevant for the calendar year 2024 was set up in Regulation (EU) 2023/731[3] hereafter referred to as '2024 EU MACP Regulation' or '2024 monitoring programme' applies. The minimum number of samples to be taken per commodity is set to 683. Annex II, distributes this minimum number of samples among EU MS[1] to be taken per food commodity in respect of their population size (EFSA, 2015a) to ensure compliance with maximum residue levels (MRLs) of pesticides and to assess the consumer exposure to pesticide residues. Annex A also provides the list of pesticides to be analysed in each EU MACP sample. In total, 200 pesticides were listed, of which 174 pesticides were to be analysed in only plant origin commodities, eight pesticides in only animal origin and 18 in both, plant and animal commodities. Appendix B – Annex II – Table 2.1 provides the pesticide/crop combinations to be analysed. A target number of required analysis can be calculated considering the minimum number of samples to be reported by each country and the number of pesticides to be analysed in each sample. This theoretical number is then compared against the total number of reported results.
- National control programmes: These programmes drawn by each Member States[1] shall be risk-based, aimed at assessing consumer exposure and compliance with MRL. The criteria defining the scope of the pesticide/product combinations to

[6]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.

[7]The term plant protection products (PPP) used throughout this report and its annexes, pertains to a product containing an active substance and other substances added and/or their products to ensure, among others, plant protection against harmful organisms, influence their life processes (e.g. growth regulators), destroy or prevent growth of undesired plants or parts of them in the fields, etc.

[8]The term pesticide residue is used throughout this report and its annexes to refer to measurable amounts of an active substance and/or related metabolites and/or degradation products that can be found on harvested crops or in foods of animal origin.

[9]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.

[10]https://food.ec.europa.eu/plants/pesticides/eu-pesticides-database_en.

[11]https://food.ec.europa.eu/plants/pesticides/maximum-residue-levels/enforcement/eu-multi-annual-control-programmes_en.

be selected are defined in Regulation (EU) No 2021/1355[12] (hereafter referred to as 'MANCP') such as the importance of domestic and imported products, the consumption of these products as a share of the national diet and the results of previous national control programmes.

- Temporary increase of official controls and emergency measures control programmes: in accordance with Regulation (EU) No 2019/1793[13] and its annual revisions[14,15,16] applicable to 2024, certain food products listed in its annexes are subject to a temporary increase of official controls or emergency measures. The analysis of these controls based on the data submitted is presented in Section 5. This year, samples falling under this programme are excluded from the MANCP set of samples. Increased import controls samples are carried out as a targeted sampling due to being suspect[17] from the likelihood of being non-compliant samples. Thus, they are not considered on the exposure/risk assessments (Section 6).

Food samples intended for infants and young children are also collected in the frame of the above-mentioned programmes. These samples have specific MRLs set in Article 4 of Regulation (EU) 2016/127,[18] Article 3 of Regulation (EU) 2016/128[19] and Article 7 of Directive 2006/125/EC[20] but taking into account the residue definitions as set out in Regulation (EC) No 396/2005.[9] In general, a default MRL of 0.01 mg/kg is applicable unless lower legal limits for the residue levels are defined in the above-mentioned legislations.

Regulation (EU) 2018/848[21] on organic production and labelling of organic products defines the restrictions in place for the use of plant protection products in this type of samples also collected under the above-mentioned programmes. Regulation (EU) No 2021/1165[22] provides authorisation of certain products and substances for use in organic production. However, the MRLs set in Regulation (EC) No 396/2005[9] apply equally to organic food and to conventional food.

Active substances for which legal limits are set under Regulation (EC) No 396/2005[9] may also be covered by Regulation (EU) No 37/2010 on pharmacologically active substances.[23] For these so-called dual use substances in respect to veterinary medicinal products (VMPR), Member States[1] perform official controls in accordance with Regulation (EU) 2022/1644[24] and Regulation (EU) 2022/1646.[25] Results of the official controls for these dual use substances are reported within this report if the MS Competent Authority flagged it as pesticide in the remit of the 2025 ChemMon data collection (EFSA, 2025f). Otherwise, results are reported in another EFSA output on VMPR residues (EFSA, 2026a).

Active substances falling under the Contaminant domains but also covered by Regulation (EC) No 396/2005[9] are also called dual substances. The same logic applies. If the Member States[1] flags it under the pesticide legal reference during the 2025 ChemMon data collection (EFSA, 2025f), results will be presented in this report. Otherwise, they will be captured in an EFSA opinion for that concrete given substance.

[12]Commission Implementing Regulation (EU) 2021/1355 of 12 August 2021 on multiannual national control programmes for pesticides residues to be established by Member States. OJ L 291, 13.8.2021, p. 120–121.

[13]Commission Implementing Regulation (EU) 2019/1793 of 22 October 2019 on the temporary increase of official controls and emergency measures governing the entry into the Union of certain goods from certain third countries implementing Regulations (EU) 2017/625 and (EC) No 178/2002 of the European Parliament and of the Council and repealing Commission Regulations (EC) No 669/2009, (EU) No 884/2014, (EU) 2015/175, (EU) 2017/186 and (EU) 2018/1660. OJ L 277, 29.10.2019, p. 89–129.

[14]Commission Implementing Regulation (EU) 2023/1110 of 6 June 2023 amending Implementing Regulation (EU) 2019/1793 on the temporary increase of official controls and emergency measures governing the entry into the Union of certain goods from certain third countries implementing Regulations (EU) 2017/625 and (EC) No 178/2002 of the European Parliament and of the Council. OJ L 147, 7.6.2023, p. 111–141.

[15]Commission Implementing Regulation (EU) 2024/286 of 16 January 2024 amending Implementing Regulation (EU) 2019/1793 on the temporary increase of official controls and emergency measures governing the entry into the Union of certain goods from certain third countries implementing Regulations (EU) 2017/625 and (EC) No 178/2002 of the European Parliament and of the Council. OJ L, 2024/286, 17.1.2024.

[16]Commission Implementing Regulation (EU) 2024/1662 of 11 June 2024 amending Implementing Regulation (EU) 2019/1793 on the temporary increase of official controls and emergency measures governing the entry into the Union of certain goods from certain third countries implementing Regulations (EU) 2017/625 and (EC) No 178/2002 of the European Parliament and of the Council. OJ L, 2024/1662, 12.6.2024.

[17]Suspect lots are defined in Directive 2002/63/EC on sampling methods, as one that for any reason is suspect to contain an excessive residue.

[18]Commission Delegated Regulation (EU) 2016/127 of 25 September 2015 supplementing Regulation (EU) No 609/2013 of the European Parliament and of the Council as regards the specific compositional and information requirements for infant formula and follow-on formula and as regards requirements on information relating to infant and young child feeding. OJ L 25, 2.2.2016, p. 1–29.

[19]Commission Delegated Regulation (EU) 2016/128 of 25 September 2015 supplementing Regulation (EU) No 609/2013 of the European Parliament and of the Council as regards the specific compositional and information requirements for food for special medical purposes. OJ L 25, 2.2.2016, p. 30.

[20]Commission Directive 2006/125/EC of 5 December 2006 on processed cereal-based foods and baby foods for infants and young children. OJ L 339, 6.12.2006, p. 16–35.

[21]Regulation (EU) 2018/848 of the European Parliament and of the Council of 30 May 2018 on organic production and labelling of organic products and repealing Council Regulation (EC) No 834/2007. OJ L 150, 14.6.2018, p. 1–92.

[22]Commission Implementing Regulation (EU) 2021/1165 of 15 July 2021 authorising certain products and substances for use in organic production and establishing their lists. OJ L 253, 16.7.2021, p. 13–48.

[23]Commission Regulation (EU) No 37/2010 of 22 December 2009 on pharmacologically active substances and their classification regarding maximum residue limits in foodstuffs of animal origin. OJ L 015 20.1.2010, p. 1.

[24]Commission Delegated Regulation (EU) 2022/1644 of 7 July 2022 supplementing Regulation (EU) 2017/625 of the European Parliament and of the Council with specific requirements for the performance of official controls on the use of pharmacologically active substances authorised as veterinary medicinal products or as feed additives and of prohibited or unauthorised pharmacologically active substances and residues thereof. OJ L 248, 26.9.2022.

[25]Commission Implementing Regulation (EU) 2022/1646 of 23 September 2022 on uniform practical arrangements for the performance of official controls as regards the use of pharmacologically active substances authorised as veterinary medicinal products or as feed additives and of prohibited or unauthorised pharmacologically active substances and residues thereof, on specific content of multi-annual national control plans and specific arrangements for their preparation. OJ L 248, 26/09/2022, p. 32–45.

## 1.2 | Terms of Reference

In accordance with Article 32 of Regulation (EC) No 396/2005,[9] EFSA is responsible for preparing an Annual Report on pesticide residues. This annual report shall include at a minimum the following information:

- an analysis of the results of the controls on pesticide residues provided by EU Member States,[1]
- a statement of the possible reasons why the MRLs were exceeded, together with any appropriate observations regarding risk management options,
- an analysis of chronic and acute risks to the health of consumers from pesticide residues,
- an assessment of consumer exposure to pesticide residues based on the information provided by Member States[1] and any other relevant information available, including reports submitted in accordance with Regulation (EU) 2022/1644[24] and Regulation (EU) 2022/1646.[25]
- In addition, the report may include a recommendation on the pesticides, products or combinations of them that should be included in future monitoring programmes.

# 2 | INTRODUCTION

This report provides a detailed insight into the control activities at European level and the results from the official control activities performed by the EU Member States,[1] including Iceland and Norway as members of the European Free Trade Association (EFTA) and of the European Economic Area (EEA).[26] This report is intended to provide information to the different stakeholders with an interest and responsibilities in the food chain, particularly food supply chain operators. Its aim is to present a comprehensive overview of residue findings in food placed on the EU market, including possible non-compliances with legal limits, and to assess the potential exposure of consumers to pesticide residues and possible health risks. Furthermore, it gives recommendations on various possible risk management options where appropriate. The report's findings are systematically used by the European Commission and the Member States[1] to establish priorities for controls of food on the market, including the most relevant substance/commodity combinations to be included in the EU MACP regulation or in the national control programmes of Member States.[1] Decisions on the increased import control regulation are not taken on the outcome of this report but on the yearly working groups meetings.[27]

The report aims to address questions such as:

- How frequently were pesticide residues quantified in food?
- Which food products frequently contained pesticide residues?
- Compared with previous years, are there any notable changes?
- In which products were breaches of the legal limits identified by the Member States?[1] and what could be the reasons for these breaches?
- Were actions taken by the national competent authorities sufficient to ensure that pesticide residues in food non-compliant with European food standards were not placed on the EU market?
- Do the residues in food pose a risk to consumer health?

EFSA developed a data visualisation tool to help end-users gain insights from the vast amount of data underpinning this report. The 2024 control programme results are presented in Appendix B – Annex A.[2] An overall summary evaluation can still be found in Sections 3–5 of this report, but figures, maps and tables are in Annex A.

The results of the dietary exposure assessments to individual pesticides are described in Section 6.

Appendix B – Annex II to Annex VIII with complementary data to this report are published in the Open Science platform Zenodo.[28] Information on the content of these annexes can be checked in Appendix B.

The raw data provided by reporting countries[29] and anonymised by EFSA can also be downloaded from Zenodo[30] by typing: 'Member-State-Name results from the monitoring of pesticide residues in food'. A subset of these raw data, aggregated and used to prepare this report, is published under Annex VIII along with an explanatory document aiming at helping the user understanding the data filters applied.

In addition, EFSA compiled a technical report (EFSA, 2026c) containing the descriptive information on the pesticide monitoring activity by year and submitted by the reporting countries. Here, further details at national level are provided. The names and websites of the reporting data national competent authorities can be seen in Appendix A.

[26]Iceland and Norway are considered as second countries in respect to EU MSs* considered first. The rest of the countries are referred in this report as third countries.

[27]https://food.ec.europa.eu/horizontal-topics/official-controls-and-enforcement/expert-groups-and-working-groups_en#working-group-on-temporary-measures-for-the-import-of-food-and-feed-of-non-animal-origin-regulation-eu-20191793.

[28]https://doi.org/10.5281/zenodo.18327006.

[29]Within this report, the term 'reporting countries' refers to EU MS[1], Norway and Iceland.

[30]https://zenodo.org/.

# 3 | EU-MULTIANNUAL COORDINATED CONTROL PROGRAMME (EU MACP)

The food products included in the 2024 EU MACP were aubergines/eggplants, bananas, broccoli, cultivated fungi, grapefruits, melons, sweet peppers/bell peppers, table grapes, virgin olive oil, wheat grain, bovine fat and chicken eggs. The Regulation[3] allowed to sample wheat flour in case not enough samples of wheat cereals were retrieved. In the case of bovine fat, it also allowed to sample meat.

A total of 9842 samples were reported. In 4241 of those samples (43.1%), no quantifiable residues were reported (residues were below the limit of quantification (LOQ)). The number of samples with pesticide residues within legally permitted levels (at or above the LOQ but below or at the MRL) was 5367 (54.5%). MRLs were numerically exceeded in 234 samples (2.4%), of which 113 samples (1.2%) were found to be non-compliant when considering measurement uncertainty[31] (the same compliance rate as in 2021, where the same commodities were covered by the EU MACP).

The overall MRL exceedance rate increased from 1.4% in 2018 (EFSA, 2020c) to 2.1% in 2021 (EFSA, 2023d) and 2.4% in 2024. Among individual food commodities, MRL exceedance rate rose the most in sweet peppers/bell peppers (from 2.4% in 2018 to 3.4% in 2021 to 4.7% in 2024) followed by table grapes (from 2.6% in 2018 to 2.1% in 2021 to 4.3% in 2024), broccoli (from 2.0% in 2018 to 1.7% in 2021 to 2.2% in 2024), virgin olive oil (from 0.6% in 2018 to 0.3% in 2021 to 2.5% in 2024), aubergines/eggplants (from 1.6% in 2018 to 2.1% in 2021 to 2.2% in 2024) and chicken eggs (from 0.1% in 2018 to 0% in 2021 to 1.4% in 2024). In cultivated fungi, the MRL exceedance rate increased from 2018 (1.2%) to 2021 (2.2%) and remained unchanged in 2024 (2.2%). The exceedance rate in grapefruit was still high in 2024 (3.7%) but much lower than in 2021 (9.9%).[32] The MRL exceedance rates in bovine fat in 2024 was the highest (0.2%) compared to the previous two cycles (0.1% in 2018 and 0.05% in 2021). An increased in melon's exceedance rate to 1.8% was also observed in 2024 compared to 1.3% in 2021, but not reaching the level of 2018 (2.2%). In bananas and in wheat, the exceedance rates were lower in 2024 (1.6% and 0.5%, respectively) than in 2021 (2.3% and 1.5%) and in 2018 (1.7% and 0.6%).

The pesticides contributing the most to MRL exceedances were ethephon (RD) (0.7%), followed by flonicamid (RD) (0.5%) and nicotine (RD) (0.4%). The ones contributing the most to non-compliances were ethephon (RD) (0.6%), flonicamid (RD) (0.3%) and glufosinate (RD) (0.2%).

The minimum number of 683 samples set in the EU MACP Regulation to be taken for each commodity was reached in all cases except for wheat cereals (658 samples, of which 196 samples were of wholemeal flour) and virgin olive oil (487 samples). Not all countries fulfilled the legal requirement of sampling each type of products as well as taking the minimum number of samples from each one.[2] Thus, EFSA recommends EU MSs to make sure enough resources are placed to fulfil the legal requirements.

The countries taking the highest number of samples with respect to the total amount of samples under the EU MACP were Germany (18.7%), France (12.1%) and Spain (8.6%). However, the Regulation sets a minimum number based on the population size of each country. Therefore, those EU MS[1] sampling the most in respect to their legal requirement were Romania (3 times more), Denmark, Belgium, Croatia and Latvia (2 times more, respectively). Instead, those sampling the least in respect to the minimum number given in the Regulation were Italy[33] (0.3) and Sweden (0.4).

Reporting countries do not take the same rate of domestic, EU or third country samples. However, the sampling strategy is aimed to reflect the national market share. Thus, countries sampling more than 80% of domestic samples were Lithuania (100%), Spain (88.8%) and Italy (81.5%). Countries that sampled more than 30% from third countries were The Netherlands (40.2%), Denmark (36.9%), Ireland (33.1%) and Northern Ireland (31.6%). Countries with a percentage of samples with origin unknown higher than 10% were The Netherlands (13.8%) and Germany (12.1%). In the last years, the total percentage of samples with unknown origin has been raising. Reporting countries are aware of its importance, and they work to decrease this percentage.

Of the total 9842 samples taken under the EU MACP, 7467 (75.9%) were reported as produced in one of the reporting countries. Of these EU samples, 3759 samples (50.3%) did not show quantifiable results (i.e. below the LOQ for each pesticide result analysed), while 3574 samples (47.9%) contained residues at or above the LOQ but below or equal to the MRL. One hundred and thirty-four samples (1.8%) numerically exceeded the MRL, and of these, 58 samples (0.8%) were not compliant with the MRL (after due consideration of the measurement uncertainty). In 1978, samples (20.1%) produced in a third country, 339 samples (17.1%) were reported as without quantifiable residues, while in 1545 samples (78.1%) contained quantifiable residues within the legal limits. The MRL exceedance rate (4.8%) and non-compliance rate (2.6%) were three times higher than in food products grown in one of the reporting countries. The remaining 397 samples (4%) were reported as origin unknown. Of these, three samples (0.8%) led to non-compliances.

Bananas was the commodity with the highest rate of imported samples (78%) compared to the percentage of samples with EU origin (14%), followed by grapefruit (50.7% of imported samples vs. 45% of samples with origin in the EU) and table grapes (43.2% of imported samples vs. 54.9% grown in the EU). For the rest of the commodities, EU origin rates were all above 70%. The commodity with the highest rate of unknown country of origin was virgin olive oil (12.5%) followed by

[31]The differences between MRL exceedances and non-compliant results are that in the first, the comparison is only numerical -used in the remit of this report-, while in the latter, legal actions may be triggered (European Commission, 2021).

[32]In 2021, the exceedance rate of 9.9% was due to high findings in grapefruits coming from Türkiye (EFSA, 2023d). This combination of commodity and country of origin remains since then under Regulation (EU) 2019/1793 on increased import control (see Section 5).

[33]Italy informed EFSA of a problem during the data collection. Thus, this report does not reflect the entire sampling programme. For a full overall picture of the Italian situation in 2024, EFSA recommends consulting the National Summary Report (EFSA, 2026c).

wheat (9.9%), both bulked commodities where the country of origin is difficult to report if the lots are mixed or there are many intermediate steps in the marketing process before being packed. EFSA recommends competent authorities (CA) and food business operators (FBO) to guarantee the traceability of the extra virgin and virgin olive oils by providing the place of origin as stated in Article 8 of Regulation (EU) 2022/2104[34] and Regulation (EU) 1308/2013.[35] Moreover, EFSA recommends MS to report the country of production when the country of origin is not available.

Of 113 non-compliant samples reported under the EU MACP, 126 corresponded to non-compliant results. In 50.8%, the origin of the sample was one of the reporting countries whereas, in 46.8%, the place of origin was outside the European market; the remaining 2.4% were reported to be of unknown origin. A reason for non-compliant results could come from the good agricultural practice (GAP) not being respected (e.g. excessive rate, non-authorised GAP) (see Section 4.4). Since no consolidated database on authorised uses is available at EU level, EFSA presumes that an authorisation exists when the MRL is not set at the LOQ in the EU MRL database.[10] For authorised uses, the non-compliant rate resulted in 13.5% of samples originated in the EU, compared to 11.1% in a third country. For non-authorised uses leading to non-compliant, 37.3% were attributed to samples from the EU, while 35.7% came from third countries. The figures are very similar independently of the country of origin (i.e. grown in the EU or outside). The number of non-compliant results despite the origin is higher for non-authorised uses than for those authorised.

Information on non-compliant results is provided in Appendix B – Annex A – chapter 1.[2] Those pesticide/crop combinations where more than one non-compliant result was reported are summarised as follows:

- In samples with EU origin, the pesticide/crop combinations with authorised uses leading to non-compliance were copper in chicken eggs (2 results) and cypermethrin and formetanate in table grapes (2 results each). The pesticide/crop combinations with non-authorised uses were flonicamid in broccoli (5 results), cyromazine in cultivated fungi (2 results), thiamethoxam in cultivated fungi – Oyster mushrooms variety (2 results), ethephon in sweet/bell peppers (9 results) and iprovalicarb in sweet/bell peppers (2 results).
- Among samples reported to come from outside the EU internal market, the pesticide/crop combinations with authorised uses leading to non-compliant results were glufosinate in grapefruits from South Africa (5 results). The pesticide/crop combinations not authorised in the EU leading to non-compliance were in clofentezine, formetanate and tebufenpyrad in sweet/bell peppers (2 results, respectively) and thiabendazole in melons (2 results); all samples from Morocco.

EFSA recommends reporting countries to keep analysing these combinations in their scope of analysis of their analytical methods.

Samples from organic production systems were to be taken under the EU MACP in proportion to the market share of each commodity within each reporting country with a minimum of one sample per listed commodity. In total, 1003 organic samples[36] were analysed. Of the 30 reporting countries, 23 provided organic samples. EFSA recommends MS to fulfil the requirement on sampling by taking at least one sample per listed commodity if organic farms for the relevant products are available at country level.

In addition, 10 samples of 'processed cereal-based foods for infants and young children' were to be sampled by each reporting country. The total number of samples reported under this food category amounted to 374 samples.[37] EFSA recommends MS to fulfil the requirement on sampling per given type of commodities. A comprehensive analysis of these results is reported in Section 4.3.3 where the data for all these types of samples are pooled together. This category of samples has not been included in Appendix B – Annex A – chapter 1.[2]

On average, 128 different pesticide residues out of the 200 of the EU MACP were analysed per sample per reporting countries. Analysing all 200 pesticides of the targeted scope was fulfilled by three EU MS only.

For 86 pesticides, the minimum number of samples (683) was not reached signalling an insufficient analytical scope by reporting countries: glyphosate (RD), copper (RD), clopyralid (RD), pencycuron (RD), glufosinate (RD), 2-phenylphenol (RD), spirotetramat (RD), mepiquat chloride (RD), fosetyl (RD),[38] sulfoxaflor (RD), folpet (RD), captan (RD), flupyradifurone (RD), fipronil (RD), flonicamid (RD), cyantraniliprole (RD), ametoctradin (RD), spinetoram (RD), abamectin (RD), fenpyrazamine (RD), chlorothalonil (RD), cyflufenamid (RD), formetanate (hydrochloride) (RD), dicofol (RD), triflumizole (RD), pyridalyl (RD), carbendazim (RD), biphenyl (RD), oxydemeton-methyl (RD), flubendiamide (RD), carbofuran (RD), clofentezine (RD), 2,4-D (RD), imazalil (RD), dieldrin (RD), haloxyfop (RD), metaflumizone (RD), prochloraz (RD), chlormequat-chloride (RD), phosmet (RD), dodine (RD), dithiocarbamates (RD), fenpropidin (RD), famoxadone (RD), teflubenzuron (RD), fenvalerate (RD),

[34]Commission Delegated Regulation (EU) 2022/2104 of 29 July 2022 supplementing Regulation (EU) No 1308/2013 of the European Parliament and of the Council as regards marketing standards for olive oil and repealing Commission Regulation (EEC) No 2568/91 and Commission Implementing Regulation (EU) No 29/2012. OJ L 284, 4.11.2022, pp. 1–22.

[35]Regulation (EU) No 1308/2013 of the European Parliament and of the Council of 17 December 2013 establishing a common organisation of the markets in agricultural products and repealing Council Regulations (EEC) No 922/72, (EEC) No 234/79, (EC) No 1037/2001 and (EC) No 1234/2007. OJ L 347, 20.12.2013, pp. 671–854.

[36]These organic samples were pooled with the ones in the MANCP chapter to have a better representativeness of this type of production in the market. These represent 878 samples grown under organic farming plus 125 samples grown too as organic but also flagged as foods for infants and young children.

[37]The minimum number of 10 samples of processed cereal-based baby food category mentioned in the EU MACP was not reached by Denmark (6 samples), Slovenia (7 samples), France (8 samples) and Latvia (8 samples). The following countries did not report processed cereal-based foods for infants and young children needed to be sampled under the 2024 EU MACP: Bulgaria, Estonia, Hungary, Iceland, Lithuania and the United Kingdom in respect of Northern Ireland. Belgium and Greece managed to take enough number of samples but miscoded them when reporting to EFSA. Further information on food for infants and young children samples reported by MSs can be consulted in the National Summary Report (EFSA, 2026c).

[38]Findings on fosetyl (RD) refer to residues of two approved fungicides: disodium phosphonate and phosphonic acid.

proquinazid (RD), etoxazole (RD), hexachlorobenzene (RD), fenbutatin oxide (RD), cypermethrin (RD), malathion (RD), methoxychlor (RD), parathion (RD), chlorpyrifos-methyl (RD), chlordane (RD), fluazifop (RD), lindane (RD), ethephon (RD), DDT (RD), endosulfan (RD), alpha-hexachlorocyclohexane (RD), beta-hexachlorocyclohexane (RD), emamectin (RD), tetraconazole (RD), fluxapyroxad (RD), parathion-methyl (RD), dithianon (RD), bifenthrin (RD), cyazofamid (RD), heptachlor (RD), fenthion (RD), ethylene oxide (RD), fenamiphos (RD), spinosad (RD), lufenuron (RD), hexythiazox (RD), triadimenol (RD), methiocarb (RD), nicotine (RD), cyromazine (RD), fenpyroximate (RD), flufenoxuron (RD), tau-fluvalinate (RD), bromide ion (RD), cymoxanil (RD). Most of these substances require a single residue method (SRM) to be quantified, but not only. This year the number of substances not fulfilling the minimum number of results was close to threefold more than last year (EFSA, 2025g). EFSA recommends reporting countries to take the necessary measures to make sure the full list of pesticides in the EU MACP is covered and seek reasons why this year the coverage was so weak.

Of the 9842 samples, 5601 had quantified results (56.9%), 15% more than in 2021 (41.9%). Of those, more than one pesticide was quantified in 3432 samples (34.9%) versus 27% in 2021. The food products with more than 50% of the samples with multiple residues were table grapes (78%), grapefruits (73.5%) and bananas (66.1%). The highest number of multiple residues was found in a sweet/bell pepper sample, grown in Türkiye, where 17 different pesticides were quantified, all above the MRL values but compliant.

Detailed analyses are presented in Appendix B – Annex A – chapter 1.[2]

## 4 | NATIONAL MONITORING PROGRAMMES (EU MACP AND MANCP)

The MANCPs are risk-based sampling programmes. The focus is placed on products likely to contain pesticide residues or for which MRL infringements were identified in previous monitoring programmes. These programmes are not designed to provide statistically representative results for residues expected in food placed on the European market. Risk managers consider these findings useful to take decisions on designing the risk-based national monitoring programmes in future years. The findings are also a valuable source of information for food business operators and can be used to enhance the efficiency of self-control systems.

The reporting countries define the priorities for their national control programmes in accordance with Regulation (EU) No 2021/1355[12] and Article 110 to Regulation (EU) 2017/625[39] considering several factors such as the importance of food products in trade or in the national diets, the historically high residue prevalence or non-compliance rates, the use pattern of pesticides and the national laboratory capacities. The results of national control programmes cannot be used to compare countries directly as there are specific needs in each country and their dietary habits and access to local products may differ among them. The number of samples and/or the number of pesticides analysed by any reporting country is determined by the capacities of their national control laboratories and available budget resources. Therefore, some countries combine the same sample to enforce the EU MACP and the MANCP programmes. Thus, the EU MACP samples are pooled in this section together with the MANCP.

The data are displayed into three different sections: geospatial visualisation based on overall number of samples by reporting countries and country of origin, findings at residue level and analysis at food product level. Article 32 of Regulation (EC) 396/2005[9] requests to provide in this report reasons for MRL exceedances placed in Section 4.4. More information on the national control programmes can be found in a separate EFSA technical report that summarises the national results (EFSA, 2026c). The data analysis of this section is also presented in Appendix B – Annex A – chapter 2.[2]

### 4.1 | Geospatial findings

Under the MANCP in 2024, the EU Member States,[1] Iceland and Norway, analysed a total of 86,449 samples for pesticide residues on/in food products, a decrease of 17% compared to last year's (104,400 samples were taken in 2023 under the MANCP programme). On the contrary, the number of samples under the increased import control programme rose in 2024 compared to 2023 by 39% (39,433 samples – separately analysed in Section 5 – compared to 28,393 taken in 2023). A shift towards more import controls is noticed. When both programmes are combined, the overall number of samples still shows a slight decrease of around 5% compared to 2023.

Of the total 86,449 samples analysed, 50.8% were domestic samples, 15.8% were from a different reporting country, while 21.0% had been imported to the EU from a third country. The remaining 12.4% were reported as being of unknown origin, a high rate compared to last year (4%). The Netherlands, Belgium, Germany and Luxembourg reported a rate of

[39]Regulation (EU) 2017/625 of the European Parliament and of the Council of 15 March 2017 on official controls and other official activities performed to ensure the application of food and feed law, rules on animal health and welfare, plant health and plant protection products, amending Regulations (EC) No 999/2001, (EC) No 396/2005, (EC) No 1069/2009, (EC) No 1107/2009, (EU) No 1151/2012, (EU) No 652/2014, (EU) 2016/429 and (EU) 2016/2031 of the European Parliament and of the Council, Council Regulations (EC) No 1/2005 and (EC) No 1099/2009 and Council Directives 98/58/EC, 1999/74/EC, 2007/43/EC, 2008/119/EC and 2008/120/EC, and repealing Regulations (EC) No 854/2004 and (EC) No 882/2004 of the European Parliament and of the Council, Council Directives 89/608/EEC, 89/662/EEC, 90/425/EEC, 91/496/EEC, 96/23/EC, 96/93/EC and 97/78/EC and Council Decision 92/438/EEC (Official Controls Regulation). OJ L 95, 7.4.2017, pp. 1–142.

samples of unknown origin,[2] higher than 10%. Regulation (EU) No 1169/2011,[40] Regulation (EU) No 1308/2013[41] and Regulation (EU) 2023/2429[42] set the obligation of reporting the country of origin of the food placed on the market. Possible reasons for the country of origin not to be reported can be due to the multiple transactions undergone between economic operators, including processing steps (e.g. peeling, cutting, washing). As a result, the packaging of the processed food does not indicate the country of origin of the raw material. Reporting countries are aware of its importance, and they work to improve its reportability. Nonetheless, since the rate of unknown samples remains high, EFSA still recommends reporting countries to make all efforts possible to report the country of origin.

Of the 86,449 samples reported, in 66.6% (57,574 samples), the origin was one of the countries of the EU market. Of these, 59.7% (34,347 samples) were found not to contain any residue above the LOQ, while 38.2% (22,018 samples) contained residues at or above the LOQ but below or equal to the MRL. A 2.1% (1209 samples) exceeded the MRL, and of these, 1.0% (594 samples) were non-compliant with the MRL.

Of the 86,449 samples reported, in 21% (18,184 samples), the origin was a third country. Of these, 42.1% (7653 samples) were found not to contain any residue above the LOQ, while 49.6% (9013 samples) contained residues at or above the LOQ but below or equal to the MRL. An 8.3% (1518 samples) exceeded the MRL, and of these, 5.2% (943 samples) were non-compliant with the MRL. The highest non-compliant rate was on samples with origin Türkiye (14.8%), on pomegranates, lemons and tomatoes.

The remaining 10,691 samples were reported as unknown country of origin. Of these 79.7% (8524 samples) were found not to contain any residue above the LOQ, while 19.0% (2036 samples) contained residues at or above the LOQ but below or equal to the MRL. A 1.2% (131 samples) exceeded the MRL, and of these, 0.5% (54 samples) were non-compliant with the MRL.

Additionally, 11 countries reported 1442 feed samples. Most of the samples were cereal grains (177 feed wheat grain samples, 105 feed barley grain samples and 95 feed maize grain samples). Despite no MRLs are established for these feed products under Regulation (EC) No 396/2005, quantification rates[43] were observed for fosetyl[44,45] (26%) mainly in feed green forage (e.g. grass, herbs, legume plants), glyphosate[45] (25.9%) and diquat[45] (19.5%), both substances in feed soya beans, and chlormequat chloride[45] (19.3%) mainly in feed wheat grain.

Additionally, 21 countries reported 1063 fish samples. There has been an increase in the number of countries reporting fish samples. The highest number of samples was reported on 'trouts' (193 samples) followed by 'shrimps or prawns' (164 samples). Despite no MRLs above the LOQ are established in/on fish under Regulation (EC) No 396/2005,[9] quantifiable residue levels in fish were observed for copper (87.5%), chlorate (55%) mostly in pangas catfishes from Vietnam and DDT (RD) (13.9%) mostly in trouts from Germany and from Türkiye. A short summary of the pesticides found in fish has been included in Appendix B – Annex A – chapter 2.[2]

## 4.2 | Results by pesticide residues

Of the total of 86,449 samples, 50,524 samples (58.4%) did not contain quantifiable residues (results below the LOQ for each pesticide analysed) while 33,067 (38.3%) of the samples contained quantified residues not exceeding the legal limits. Thus, in total, 96.7% of the samples fell within the legal limits (83,591 samples). This tendency seems to be constant for the last years (96.3% in 2023 and 2022, 96.1% in 2021; 94.9% in 2020) even if the increased import control samples were not accounted in this section. The MRL exceedance rate was 3.3% (2858 samples) and the non-compliance rate of 1.8% (1591 samples).[31] Comparing the non-compliance rate with the last years (taking samples from the increased import control programmes out), 2024 is slightly higher than in 2023, but lower than the other previous years (1.5% in 2023, 2.1% in 2022 and 2.4% in 2021).

More than 19.5 million analytical determinations (individual residue results) were submitted to EFSA (see Appendix B – Annex II – Table 2.3). The number of determinations for which residue levels were quantified at or above the LOQ amounted to 98,070 (i.e. 0.5% of the total determinations) in relation to the overall number of 86,449 samples.

Analytical scopes (i.e. the total number of pesticides analysed in at least one sample) higher than 600 pesticides at country level were reported by Malta (738), followed by Germany (719) Luxembourg (692), Austria (626) and Spain (622). On average, 261 different pesticide residues were analysed per sample.

[40]Regulation (EU) No 1169/2011 of the European Parliament and of the Council of 25 October 2011 on the provision of food information to consumers, amending Regulations (EC) No 1924/2006 and (EC) No 1925/2006 of the European Parliament and of the Council, and repealing Commission Directive 87/250/EEC, Council Directive 90/496/EEC, Commission Directive 1999/10/EC, Directive 2000/13/EC of the European Parliament and of the Council, Commission Directives 2002/67/EC and 2008/5/EC and Commission Regulation (EC) No 608/2004. OJ L 304, 22.11.2011, pp. 18–63.

[41]Regulation (EU) No 1308/2013 of the European Parliament and of the Council of 17 December 2013 establishing a common organisation of the markets in agricultural products and repealing Council Regulations (EEC) No 922/72, (EEC) No 234/79, (EC) No 1037/2001 and (EC) No 1234/2007. OJ L 347, 20.12.2013, pp. 671–854.

[42]Commission Delegated Regulation (EU) 2023/2429 of 17 August 2023 supplementing Regulation (EU) No 1308/2013 of the European Parliament and of the Council as regards marketing standards for the fruit and vegetables sector, certain processed fruit and vegetable products and the bananas sector and repealing Commission Regulation (EC) No 1666/1999 and Commission Implementing Regulations (EU) No 543/2011 and (EU) No 1333/2011. OJ L, 2023/2429, 3.11.2023.

[43]Samples containing quantified residues (i.e. above the LOQ) of one or several pesticides but in concentrations below or at the MRL.

[44]Findings of fosetyl should be understood as possible uses of the approved fungicides: disodium phosphonate and phosphonic acid, the latter resulting from the use of potassium and disodium phosphonates which can be used as foliar feed fertiliser (EFSA, 2018c).

[45]Authorised use in food for that particular pesticide/crop combination.

The pesticides with a quantification rate (i.e. percentage of samples with a residue level above the limit of quantification) higher than 10% and analysed in more than 300 samples reported were copper (RD) (64.7%), bromide ion (RD) (16.5%), trichlamide (14.1%) and fosetyl (RD)[46] (13.0%).

- Copper (RD) was analysed in 9055 samples (0.1% of the total number of samples) and quantified in 5854. The MRL was exceeded in 0.3% of the samples, and 0.09% were reported to be non-compliant. Twenty-two reporting countries provided results on copper. Findings tend to be linked to different sources rather than uniquely use as a pesticide. These different sources can be as a naturally occurring substance in food and in drinking water. It can be a nutrient added in the diet as food additive. Copper can be added in feed given to livestock and can also have as source its use as a fertiliser. Given its inclusion under the 2024 EU MACP Regulation and the future 3-year data collection[47] to review the existing MRLs for copper, EFSA recommends increasing efforts to ensure adequate coverage of this pesticide within the analytical scope. Moreover, based on EFSA recent statement (EFSA, 2025b), it was acknowledged the lack of monitoring data in 37 commodities.[48] Thus, EFSA recommends EU MS generating data on those.
- Bromide ion (RD) was analysed in 7171 samples and quantified in 1180. The MRL was exceeded in 0.15% of the samples, and 0.1% were reported to be non-compliant. Twenty-four of all reporting countries recorded results. Bromide ion is a naturally occurring substance unlikely to occur from a pesticide use as methyl bromide was banned worldwide since some years ago. Revision of current MRLs is under negotiation with risk managers after EFSA Scientific Committee reviewed the HBGV (EFSA, 2025a).
- Trichlamide[49] was analysed in 759 samples. A quantification rate of 14.1% was reported. This substance was only analysed by three reporting countries. Most of the quantifications were in oranges (in the varieties chironjas and blood oranges) coming from Egypt. The concentration ranged from 0.01 to 0.13 mg/kg. None of the samples were considered non-compliant. This substance is listed in the List for Chemicals of Emerging Concern.[50] Thus, EFSA recommends reporting countries be vigilant to this substance and include it in their analytical scope.
- Fosetyl (RD) was analysed in 11,155 samples and quantified in 1454. The MRL was exceeded in 0.13% of the samples and 0.08% were reported to be non-compliant. Of all reporting countries, 24 reported results. It is an approved substance. Its findings may include residues of two approved fungicides: disodium and potassium phosphonates. All three substances degrade into phosphonic acid, which can also be used as foliar fertiliser. Following EFSA's review on fosetyl, potassium phosphonates and disodium phosphonates (EFSA, 2021), a new residue definition for enforcement was adopted to 'phosphonic acid and its salts expressed as phosphonic acid' applicable from 29/04/2025 under Regulation (EU) 2024/2619.[51]

The pesticides with an MRL exceedance rate of 0.5% or higher, and for which a minimum number of 400 samples were reported were ethylene oxide (RD), chlorate (RD) and chlorpyrifos (RD).

- Ethylene oxide (RD) was analysed in 1396 samples, resulting in 0.9% of MRL exceedances and 0.4% of non-compliances, mostly in paprika powder. It is a non-approved substance in the EU known in the past to have caused many RASFF notifications. The quantification rate has gradually decreased along the years. However, EFSA recommends MSs keep monitoring this substance in processed products.
- Chlorate (RD) was analysed in 7719 samples, resulting in 0.8% of MRL exceedances and 0.3% of non-compliances. This substance is not used as a pesticide but rather occurs as a degradation product under sanitisation processes. It is reported in many different commodities. EFSA received a mandate[52] to update the tentative MRLs set in Regulation (EU) 2020/749.[53]
- Chlorpyrifos (RD) was analysed in 65,207 samples, resulting in 0.5% of MRL exceedances and 0.3% of non-compliances. This substance is not approved in the EU since April 2020. Still, it has been reported in 90 different commodities, the most often being kales, wheat, table grapes, bananas, oranges, olives for oil production, sweet/bell peppers and sunflower seeds. Poland, Ukraine, India and Egypt are the countries of origin with the highest findings. This substance has proven genotoxic effect (EFSA, 2019b). EFSA recommends reporting countries to keep monitoring these combinations in their

[46]Findings may include residues of two approved fungicides: disodium phosphonate and phosphonic acid, the latter resulting from the use of potassium and disodium phosphonates (which can also be used as foliar feed fertiliser). A residue definition for enforcement common to all was derived 'fosetyl-Al (sum of fosetyl, phosphonic acid and their salts, expressed as fosetyl)' (EFSA, 2018c).

[47]Commission Regulation (EU) 2026/840 of 15 April 2026 amending Annexes II and III to Regulation (EC) No 396/2005 of the European Parliament and of the Council as regards maximum residue levels for copper compounds in or on certain products. OJ L, 2026/840, 16.4.2026.

[48]The 37 individual commodities for which not enough occurrence data were available were chestnuts, coconuts, quinces, medlars, dewberries, cranberries, dates, kumquats, carambolas, litchis/lychees, passion fruits/maracujas, prickly pears/cactus fruits, cherimoyas, guavas, cassava roots/manioc, turnips, okra (lady's fingers), cresses, and other sprouts and shoots, baby leaf crops (including brassica species), watercress, sage, rosemary, thyme, laurel/bay leaf, tarragon, globe artichokes, lupins (dry), safflower seeds, valerian root, ginseng root, fenugreek, nutmeg, allspice, juniper berry, sugar cane, sheep fat and horse milk.

[49]Substance manufactured aiming at preventing infection of crops with soil pathogens through contact effect.

[50]https://zenodo.org/records/7305138.

[51]Commission Regulation (EU) 2024/2619 of 8 October 2024 amending Annexes II and III to Regulation (EC) No 396/2005 of the European Parliament and of the Council as regards maximum residue levels for fosetyl, potassium phosphonates and disodium phosphonate in or on certain products. OJ L, 2024/2619, 9.10.2024.

[52]https://open.efsa.europa.eu/questions/EFSA-Q-2025-00706?search=chlorate.

[53]Commission Regulation (EU) 2020/749 of 4 June 2020 amending Annex III to Regulation (EC) No 396/2005 of the European Parliament and of the Council as regards maximum residue levels for chlorate in or on certain products. OJ L 178, 8.6.2020, pp. 7–20.

scope of analysis and withdraw the respective lots from the market when quantified.[54]

The OECD defines PFAS as fluorinated substances containing at least one fully fluorinated methyl or methylene carbon atom. According to this classification, certain pesticides could be considered a PFAS pesticide. Trifluoroacetic acid (TFA) is a potential degradation product from per- and polyfluorinated active substances (PFAS). TFA is not included in any residue definition for enforcement of any PFAS pesticide listed under Regulation (EC) 396/2005. EFSA and ECHA have been recently mandated[55] among other points, to characterise the possible formation of TFA from PFAS active substances used in plant protection products (PPPs) and biocidal products (BPs). Only one result has been reported to EFSA in 2024. To increase the monitoring of this substance, Commission has requested the EURL on pesticide residues (FV and SRM) to organise a European Proficiency Test (EUPT) to assess the capabilities of the EU official laboratories.[56] Thus, EFSA recommends reporting countries adding TFA in their analytical scope of analysis and report findings to EFSA, in accordance with the working document on 'inclusion of pesticides in the MANCP analytical scope'.[57] Details on the samples exceeding the MRL can be consulted in Appendix B – Annex II – Table 2.2.

### 4.2.1 | Multiple pesticide residues

Multiple residues in one single sample may result from the application of different types of pesticides (e.g. application of herbicides, fungicides or insecticides against different pests or diseases), from the use of different active substances aiming at avoiding the development of resistant pests or diseases, from the uptake of residues from soil from treatments used in previous seasons and/or from the spray/dust drift from adjacent treated fields. In addition to multiple residues resulting from the agricultural practice, multiple residues may also occur as a result of mixing or blending products with different treatment histories at different stages in the supply chain, including contamination during food processing. According to the present EU legislation, the presence of multiple residues within a sample complies with the legislation, as long as each individual residue level does not exceed the respective individual MRL.

Of the 86,449 samples analysed, 41.6% (35,925) of samples contained one or several pesticides in quantifiable concentrations. Multiple residues were reported in 25.5% (22,051) of samples. Up to 36 different pesticides were reported in an individual sample of dried fruit from Vietnam. The sample was deemed non-compliant, taken under a border control post.

Of the 22,051 samples with multiple residues, 20,757 samples (94.1%) were of unprocessed products. The highest number of samples with multiple residues was found for oranges (1287 samples), table grapes (1150 samples), strawberries (1095 samples) and apples (1032 samples). The remaining 1294 samples (5.9%) were of processed products. The highest number of samples with multiple residues was reported in dried vine fruits (e.g. raisins) (160 samples), in wine (160 samples), in paprika powder (109 samples) and wheat flour (84 samples).

### 4.2.2 | Results on glyphosate

Given the general interest on glyphosate, EFSA has a dedicated webpage.[58] Thus, it is considered appropriate presenting in this dedicated section of the report all data received on the parent and on any metabolite/degradation products listed on EFSA MRL review (EFSA, 2019d).

Glyphosate is approved for use until 15 December 2033.[59] EFSA is working on an updated MRL review.[60] Under this review, authorised uses on glyphosate-tolerant genetically modified organism (GMO) crops were notified[61] for sweet corn, cotton seeds, maize, sugar beet, rapeseeds and soya beans.

In 2024, glyphosate was reported by 28 countries analysing 14,607 samples of different products, of which 436 were samples of feed and 28 of fish. Regarding the remaining 14,143 food samples (including 10 taken under the increased import control programme), no residues of glyphosate were quantified in 13,889 samples (98.2%). In 228 samples (1.6%), it was quantified at levels above the LOQ but below the MRL, and in 26 samples (0.2%), the residue levels exceeded the MRL. Of these, after due consideration of the measurement uncertainty, 16 samples (0.1%) were non-compliant, mainly on buckwheat and other pseudo-cereals. Glyphosate residues were analysed in 429 samples of food for infants and young children where all samples were below the LOQ.

[54] https://food.ec.europa.eu/document/download/cf2f5103-20e7-4fea-92d5-82ade0606de1_en?filename=pesticides_mrl_enforcement_guidelines_genotoxic-carcinogens-incidents.pdf.

[55] https://open.efsa.europa.eu/question/EFSA-Q-2025-00693.

[56] https://www.eurl-pesticides.eu/docs/public/tmplt_article.asp?LabID=500&CntID=1317&Theme_ID=1&Pdf=False&Lang=EN.

[57] SANCO/12745/2013, Rev.17(3), 24–25 November 2025 https://food.ec.europa.eu/document/download/cd4670e3-a7fe-4620-97f4-e5675370022c_en?filename=pesticides_mrl_guidelines_wrkdoc_12745.pdf.

[58] https://www.efsa.europa.eu/en/topics/topic/glyphosate.

[59] Commission Implementing Regulation (EU) 2023/2660 of 28 November 2023 renewing the approval of the active substance glyphosate in accordance with Regulation (EC) No 1107/2009 of the European Parliament and of the Council and amending Commission Implementing Regulation (EU) No 540/2011. OJ L, 2023/2660, 29.11.2023.

[60] https://open.efsa.europa.eu/questions/EFSA-Q-2024-00177?search=glyphosate.

[61] https://ec.europa.eu/food/food-feed-portal/screen/gmo/search.

Glyphosate metabolites[62] were analysed in different food samples: AMPA (7329 samples), AMPA-N-acetyl (1869 samples) and N-acetyl glyphosate (4522 samples). AMPA and AMPA-N-acetyl were quantified in cultivated fungi (40 samples equivalent to 0.6% and 4 samples equivalent to 0.2%, respectively). No quantified sample was reported for N-acetyl glyphosate. AMPA-N-acetyl is a relevant metabolite resulting from the use of glyphosate on tolerant genetically modified (GMO) crops, while AMPA could result from the use on both conventional and GMO crops. A Northern European use on conventional cultivated fungi, not supported by data, was notified under the ongoing MRL review. Potential uptake from the soil or cross-contamination from the substrate (conventional cereals or GMO straw) could result in the observed presence of glyphosate metabolites in cultivated fungi. Thus, EFSA recommends MSs to investigate with FBO what type of straws (from conventional or GMO crops) are being used as substrate to cultivate fungi and to implement proper risk mitigation measures to avoid future cross-contamination.

Trimethyl-sulfonium cation was analysed in 4177 samples reported by 10 MS. It was quantified in 25 samples (0.6%), of which two were above the MRL. Commodities with quantified residues were mainly citrus fruits and cultivated fungi. Glyphosate-trimesium is currently not authorised for use. However, trimethyl-sulfonium cation can be naturally formed during the drying process of some commodities, like tea, dry herbs and spices.

A total of 573 samples of crops or parts of crops exclusively used for animal feed production[63] were analysed, where no MRLs are set. Glyphosate was quantified in 113 samples (25.9%) and trimethyl-sulfonium cation in 11 samples (5%). Glyphosate-related substances were quantified as follows: AMPA in 28 samples (16.8%) and AMPA-N-acetyl was quantified in 23 samples (46.9%); no quantifications were reported in N-acetyl glyphosate. Reflecting the new restrictions of approval, a slight decrease in the reported quantification rates was observed in 2024 compared with 2023 (with quantification rates of 27% for glyphosate, 20% for AMPA and 54% for AMPA-N-acetyl).

## 4.3 | Results by food products

### 4.3.1 | Results by processed versus unprocessed food products

The compliance of processed food samples is checked against the maximum residue levels in the respective raw agricultural commodity after applying a processing factor derived for the given processed technique as per Article 20[64] of Regulation (EC) No 396/2005. The latest compendium of processing factors was published in May 2025 (Kittelmann et al., 2025; Zincke et al., 2025).

Overall, 1140 different food products were analysed.

Of 86,449 total samples, 7641 samples (9%) were processed food (excluding 1546 samples of foods for infants and young children (Section 4.3.3)). In 255 samples of processed food (3.3%), the MRL was exceeded, of which 121 samples (1.6%) were non-compliant taking into account the measurement uncertainty. The latter rate was the lowest of the last 3 years (3.1% in 2023 and 2.3% in 2022).

The processed food products with a non-compliance rate higher than 10% and for which more than 10 samples were reported were grape leaves and similar species, mainly pickled/marinated vegetables (40.0%), dried parsley (21.1%) and blended honey (11.1%).

On the contrary, 77,262 samples (91%) were reported as unprocessed food products.[65] Of these, 2574 samples (3.3%) had residues exceeding the MRL, of which 1456 samples (1.9%) were non-compliant after taking into account measurement uncertainty. Similar non-compliant rates were found in the last years (2.0% in 2023 and 2022).

Those unprocessed food products for which more than 100 samples were reported and the non-compliance rate was higher than 10% were granate apples/pomegranates (29.2%), passion fruits/maracujas (16.6%) and kales (15.1%). Other food products appearing in the visualisation[2] do not reach the 100 samples reported.

### 4.3.2 | Results on organic products

No specific MRLs are established for organic products. The MRLs set in Regulation (EC) No 396/2005[9] apply equally to organic food and to conventional food. However, Regulation (EU) No 2021/1165[22] authorises certain plant protection products containing specific approved active substances for use in organic production.

Of the 86,449 samples, a total of 5939[66] (6.9%) were labelled as organic. Of those, 878 samples were reported under the EU MACP. The proportion of organic samples increases slightly compared to previous years (5.3% in 2023 and 6.1% in 2022).

[62]These three metabolites are currently not included in the residue definition for enforcement under Regulation (EC) 396/2005.

[63]Other pesticides are analysed in feed. However, they are not presented in this report as they are not part of Regulation (EC) 396/2005. Glyphosate and derived metabolites reported in feed are presented in this report to allow readers having a complete overview of the monitoring data EFSA receives.

[64]Information note on Article 20 of Regulation (EC) No 396/2005 as regards processing factors and composite food and feed. SANTE/10704/2021.

[65]In the framework of this report, unprocessed food products are considered those to which a MRL is directly applicable and are listed in Annex A to Regulation (EC) No 396/2005, i.e. products such as fermented tea, dried spices, dried herbal infusions, etc.

[66]No samples of food for infants and young children are included in this section.

Overall, 4774 samples (80.4%) flagged as organic did not contain quantifiable residues (80% in 2023, 79% in 2022) and 1114 samples (18.8%) contained quantifiable residues below or at the MRL level (19% in 2023, 18.6% in 2022). Samples reported as having residue levels above the MRL were 51 (0.9%) (0.9% in 2023, 2.4% in 2022), of which 21 samples (0.4%) were non-compliant (0.4% in 2023, 1.4% in 2022).

The quantification and MRL exceedance rates were lower in organic food compared to conventionally produced food (i.e. non-organic) for all food product categories, except for animal products. This is due to copper, a substance authorised in organic farming and having other uses such as feed supplement and fertiliser, and for which the findings are high. MRLs have recently been reviewed in PLAN/2025/350.[67]

The pesticides with highest quantification rate[43] in organic products found in more than 10 samples were copper (RD) (46.3%) found in 148 of wheat samples, 82 samples of dried and fresh lentils, 72 samples of chicken eggs, 60 samples of bananas, 47 samples of oat grain, 29 apple samples, 23 sweet/bell pepper samples, 21 cultivated fungi samples, 19 cocoa bean samples, 18 broccoli samples, 14 aubergines/eggplants samples and 13 grapefruit samples and spinosad (RD) (5.1%) found in 14 samples of Roman rocket/rucola and 11 samples of bananas. The pesticides exceeding the MRL the most often were chlorate (RD) (0.1%) and chlorpyrifos (RD) (0.1%).

Most of the quantified substances present in samples flagged as organic were either authorised for use (e.g. copper, spinosad), naturally occurring substances (e.g. bromide ion with 3.2% quantification rate), degradation products of a sanitisation process (e.g. chlorate) or environmental contaminants (e.g. mercury with 0.4% quantification rate).

The occurrence of other pesticides not authorised in organic farming (e.g. acetamiprid (2.0%), boscalid (2.0%), fludioxonil (1.4%)) can – as for conventional products – be the result of spray drift, environmental contaminations or contaminations during handling, packaging, storage or processing of organic products. This occurrence could also be linked to the incorrect labelling of conventionally produced food as organic food. EFSA recently has published a report (EFSA, 2025d) providing possible reasons for unintentional presence of pesticides in organic farming.

Despite different circumstances that may lead to different findings, EFSA recommends reporting countries to always try elucidating the possible reasons for occasional findings of quantifiable residues of not-authorised substances in products labelled as organic.

### 4.3.3 | Results on food for infants and young children

Reporting countries analysed 1546 samples of foods for infants and young children as defined in Regulation (EU) No 2016/127,[18] Regulation (EU) 2016/128[19] and Directive 2006/125/EC,[20] herein referred to as food for infants and young children.

Of the 1546 samples reported, 454 samples (29.4%) were flagged as organic samples and 374 samples (24.2%) as EU MACP. By type of food, 547 samples were processed cereal-based foods for infants and young children, 412 of food for infants and young children, 276 samples other than processed cereal-based foods, 172 samples of follow-on formulae and 139 samples of infant formulae.

The MRLs in food for infants and young children are established at the default MRL of 0.01 mg/kg, except for a given number of substances to which a much lower level applies[20] (EFSA, 2018b). Other substances authorised as microelement in infant formula and follow-on formula have specific values too (EFSA, 2014).

In 1290 samples (83.4%), no residues were quantified (a rate lower than in 2023 – 91.3% – but similar to 2022 – 80.8%). Quantified samples with residues at or above the LOQ but below the MRL were found in 227 samples (14.7%). In 29 samples (1.9%), the MRL was exceeded of which, 14 samples (0.9%) were considered as non-compliant when taking the measurement uncertainty into account. Although the quantification rate of 14.7% was nearly three times higher than in 2023 (5.5%), this was driven by copper findings. Copper in food for infants and young children is permitted as a supplement,[19] whose levels set in regulation could exceed the default 0.01 mg/kg MRL.

In this type of food, 897 different pesticides were analysed. The pesticides most frequently found to exceed the MRL were copper (RD) (5%), fosetyl (RD) (2.2%) and chlorate (RD) (1.2% of samples). While copper may occur naturally or added as a supplement, fosetyl evidences the use of fertilisers on the crop intended for infants and young children's food and chlorate findings are likely occurring after sanitisation practice in the food chain.

### 4.3.4 | Results on animal products

A total of 19,995 samples of animal products were reported. The results showed that 18,614 samples were free of quantifiable residues (93.1%). This is the highest rate of the last 3 years (90.0% in 2023 and 92.4% in 2022). While, in 1279 samples (6.4%), quantifiable pesticides at or below the MRL were reported, MRL exceedances were identified in 102 samples (0.5%), a lower rate than in previous years (0.8% in 2023; 1.0% in 2022), of which 48 (0.2%) were deemed non-compliant when measurement uncertainty was taken into account. This non-compliance rate was three times lower than in previous 2 years (0.6%, both in 2023 and 2022).

[67] https://ec.europa.eu/food/plant/pesticides/eu-pesticides-database/start/screen/mrls/details?lg_code=EN&pest_res_id_list=262&product_id_list=.

From all the animal products, 88 different pesticides were quantified. The one with a quantification rate higher than 10% was copper (RD) (55%). Copper was quantified in 819 samples, mostly in chicken and bird eggs and in bovine muscle. Copper compound is a naturally occurring substance but can also be used as a feed additive.

The highest MRL exceedance rates were shown in bromide ion (5.2%) in bovine fat, followed by chlorate (RD) (1.9%) in poultry and bovine muscles and copper (RD) (1.0%) in chicken eggs. The presence of these substances is explained either because is a naturally occurrence substance (i.e. bromide ion), either present in feed given to livestock (i.e. copper) or as a residue form after applying sanitising practices to the food (i.e. chlorate).

In honey, 1540 samples were collected. In 1287 samples (83.6%), no quantifiable[43] levels of residues were reported (residues were below the LOQ), a lower percentage than last year (88.2%). The number of samples with quantifiable pesticide residues within the legally permitted levels (at or above the LOQ but below or at the MRL) was 220 (14.3%). MRLs were exceeded in 33 samples (2.1 vs. 1.7% in 2023), of which 12 samples (0.8% vs. 1.2% in 2023) were found to be non-compliant taking the measurement uncertainty into account. In total, 31 different pesticides were reported. The most frequent quantified pesticides were acetamiprid (RD) (108 samples), amitraz (RD) (39 samples), copper (RD) (37 samples), coumaphos (RD) (22 samples), thiacloprid (RD) (20 samples), glyphosate (RD) (15 samples) and azoxystrobin (RD) (10 samples). The highest non-compliance rate was on acetamiprid (1.1%). In 50 samples (3.3%), the country of origin was unknown. EFSA recommends reporting countries, keep tracking the country of origin of this product placed on the market to comply with Directive 2002/110/EC.[68]

Despite no MRLs are applicable to fish under Regulation (EC) No 396/2005,[9] 1063 fish samples were reported, where 531 pesticides were covered by the laboratories' analytical scopes from 21 different countries. In total, 14 different pesticides were quantified. The highest frequency was for copper (RD) (87.5%), followed by chlorate (55%), most in pangas catfishes from Vietnam, and DDT (RD) (13.9%), mostly in trouts from Germany and Türkiye. These findings cannot be directly linked to recent pesticide uses.

## 4.4 | Reasons for MRL exceedances/non-compliances

The legal limits (MRLs) are established based on supervised residue trials that reflect the residue levels expected under field conditions, or animal feeding studies for animal products based on appropriate dietary requirements of different food producing animals. The MRL value is estimated using statistical methods and it is usually established to cover at least the upper confidence interval of the 95th percentile of the expected residue distribution (OECD, 2014). Therefore, even if good agricultural practices (GAP) are fully respected, a low percentage of MRL exceedances are expected. A sample is non-compliant when at least one pesticide is quantified at a level that after considering the measurement uncertainty, the result is above the MRL value (European Commission, 2021). When a non-compliant sample is identified, an action at Member State level in line with Article 50 of Regulation (EC) No 178/2002[69] is required. Generally, Member States reply with appropriate measures to non-compliances in accordance with the Alert and Cooperation Network (ACN) standard operating procedures[70,71] (e.g. administrative fines, RASFF notifications[72] and follow-up actions, etc.).

In 2024, of 86,449 samples reported, 2858 (3.3%) samples contained pesticide residues exceeding their respective MRLs, slightly lower than in 2023 (3.8%). When considering measurement uncertainty, 1591 samples resulted into non-compliance (1.8%), very similar to 2023 (2.0%).

Several possible reasons for MRL exceedances are summarised below:

- In samples coming from third countries:
  - The use of pesticides which are not approved in EU and for which no import tolerance[73] is granted (either because not requested or because the request was unsuccessful) (e.g. imidacloprid: in basil from Thailand, in cherimoya from Brazil, in litchis/lychees and green tea from Vietnam, pomegranate from Peru and Egypt, potato from Egypt and rice from Pakistan; chlorpyrifos in green tea from China and Sri Lanka; tricyclazole: in rice from India and Türkiye and cumin seed from India; thiamethoxam: in cumin seed from India; chlorpyrifos: in cumin seeds from China and Syria; propargite in aubergines from Thailand).
  - GAP of a third country not respected: application rate, preharvest interval, application method and number of applications non-respected (e.g. tebuconazole in litchis from Thailand).

[68]Council Directive 2001/110/EC of 20 December 2001 relating to honey. OJ L 10, 12.1.2002, pp. 47–52.

[69]Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety. OJ L 31, 1.2.2002, p. 1–24.

[70]https://food.ec.europa.eu/food-safety/acn_en#the-acn-in-practice.

[71]https://food.ec.europa.eu/system/files/2023-02/acn_working-instructions_2-2_pest-residues.pdf.

[72]https://webgate.ec.europa.eu/rasff-window/screen/search.

[73]As set in Regulation (EC) No 396/2005, an import tolerance is a MRL set for imported products to meet the needs of international trade different than the one in place in the EU, for which prevails no risk to EU consumers. The ones granted from 2009 to 2024 can be found: https://food.ec.europa.eu/document/download/32890e29-6ce2-44dc-a33a-a12fbf4c2585_en?filename=pesticides_mrl_guidelines_overview-it-table.pdf.

- In samples originating from the internal EU market (reporting countries):
  - Use of approved pesticides in a crop for which no GAP is authorised (e.g. phosmet, formetanate (hydrochloride) and triflumuron in peaches, ethephon in sweet/bell peppers and in bananas).
  - GAP of the pesticides product not respected regarding the application rates, preharvest intervals, number or method of applications (e.g. aclonifen in celeries and fluazifop in thyme).
  - Cross contamination: spray drift from an adjacent treated field or other accidental contamination (e.g. spiroxamine in cherries (sweet), methoxyfenozide in peaches, prosulfocarb in kales).
  - Use of non-EU approved pesticides (e.g. chlorpyrifos-methyl in mandarins, spiroxamine, dimethoate and omethoate in cherries (sweet) and phosmet in pears) that have not been subject to emergency authorisations[74] granted during 2024.
  - Natural presence of the substance in the crop (e.g. copper compounds in wild terrestrial vertebrate animals, dithiocarbamates in turnips).
  - Biocides' uses resulting in residues of substances covered by the pesticide MRL regulation (e.g. sanitisation practices resulting in chlorate residues in different food commodities).
  - Contamination from previous use of a pesticide: uptake of residues from the soil (e.g. chloridazon in parsley, mepiquat chloride in sweet potatoes).
  - Environmental contamination of persistent organic pollutants (POP) included in the Stockholm Convention of prohibited substances (UNEP, 2001). These substances are no longer used as pesticides but are very persistent in the environment and found to contaminate and concentrate in the food chain (e.g. aldrin and dieldrin in courgettes and cucumbers, DDT in bovine fat and cow's milk).

More details on the pesticide/crop combinations exceeding the legal limits are compiled in Appendix B – Annex III – Table 2.2 and in the National Summary Report (EFSA, 2026c).

## 5 | RESULTS ON TEMPORARY INCREASE OF IMPORT CONTROLS

In Regulation (EU) 2019/1793[13] on temporary increase of import controls, certain food products are subject to an increased frequency of official controls for pesticide residues at border control posts (BCPs)[75] or at control points (CPs)[75] at their entry into the EU territory.

These controls are reported through the Integrated Management System for Official Controls (IMSOC),[76] under the TRACES platform[77] (Article 133 of Regulation (EU) 2017/625). Some of these controls may have entered the RASFF[78] notification system of the European Commission. More information on the 2024 notifications issued can be found in the 2024 RASFF report (EC, 2025).

The data transmitted to TRACES are data at a very aggregated level and uses a different terminology from the one used when data are provided to EFSA. Until the two systems are aligned with each other, the European Commission requested EU Member States[79] to submit the results of those controls also to EFSA, i.e. to submit data both to TRACES and to EFSA. So far, EFSA does not receive the full set of data that are sent to TRACES. Thus, the data presented in this section are a subset of the overall data the EC collects.[80] Therefore, this section may not give the overall picture of the situation under this Regulation.

The controls on consignments are done based on specific information provided under Annex A to Regulation (EU) 2019/1793, which includes the hazard (e.g. pesticide residues, not approved food additives, mycotoxins, pentachlorophenol, dioxins and microbiological contamination), the food and/or feed product and the given third country where they come from. It also includes the frequency of checks. During 2024, there were three annual revisions.[14,15,16] Depending on the real-time findings, the different entries and their frequencies were updated. Composite food products[81] and feed were included in this section. These food products are outside the scope of Regulation (EC) 396/2005.

The total number of samples reported to EFSA under this Regulation was 39,433 samples. In 15,099 of those samples (38.3%), no quantifiable residues were reported (residues were below the LOQ). The number of samples with pesticide residues within legally permitted levels (at or above the LOQ but below or at the MRL) was 22,164 (56.2%). MRLs were

[74] An emergency authorisation in accordance with Article 53 of Regulation (EC) 1107/2009.

[75] As referred to in Article 53(1)(a) of Regulation (EU) 2017/625 of the European Parliament and of the Council of 15 March 2017 on official controls and other official activities performed to ensure the application of food and feed law, rules on animal health and welfare, plant health and plant protection products, amending Regulations (EC) No 999/2001, (EC) No 396/2005, (EC) No 1069. OJ L 95, 7.4.2017, pp. 1–142.

[76] Commission Implementing Regulation (EU) 2019/1715 of 30 September 2019 laying down rules for the functioning of the information management system for official controls and its system components (the IMSOC Regulation) OJ L 261, 14.10.2019, p. 37–96.

[77] https://webgate.ec.europa.eu/IMSOC/tracesnt-help/Content/en/index.html.

[78] https://webgate.ec.europa.eu/rasff-window/screen/search.

[79] Agenda point A.17 of the 18–19 September 2023 SCoPAFF meeting: https://food.ec.europa.eu/system/files/2023-10/sc_phyto_20230918_ppr_sum.pdf.

[80] Through IMSOC system, the real number of samples of import control are collected. More information on this can be requested through sante-import-controls@ec.europa.eu.

[81] Composite food products are food made of more than one product, either plant based or/and animal commodities. The MRL that applies needs to be recalculated on a case by case depending on the ingredients and proportion contained in the food. The type of products the regulation listed as composite were tea, whether or not flavoured; mucilage's and thickeners, whether or not modified, derived from locust beans or locust beans seeds; xanthan gum; guar gum; mixtures of food additives containing locust bean gum or guar gum; mixtures of nuts or dried fruits containing pistachios; oilcake and other solid residues, whether or not ground or in the form of pellets, resulting from the extraction of groundnut oil; groundnut flours, meals and paste; peanut butter; sauces and preparations thereof; food supplements containing botanicals; instant noodles containing spices/seasonings or sauces; calcium carbonate.

numerically exceeded in 2170 samples (5.5%), of which 1403 samples (3.6%) were found to be non-compliant when considering the measurement uncertainty. The sample with the highest number of non-compliant results was a sample of cumin seed from India with 19 non-compliant results. The non-compliant consignments presented in this section were not introduced in the EU market. The pesticides leading to the highest non-compliance rates were acetamiprid, sulfoxaflor, spirotetramat, bifenazate and pyrimethanil. Of the total, 663 samples were of composite food products and feed.

A description of the required controls regarding type of food products and countries of origin relevant for the calendar year 2024 can be found in Appendix B – Annex II – Table 2.4 and in Table 2.5, detailed information on the samples exceeding the MRLs.

# 6 | PROBABILISTIC DIETARY EXPOSURE RESULTS AND ANALYSIS OF THE HEALTH RISKS

Regulation (EC) No 396/2005,[9] Article 32, requests EFSA to conduct an analysis on the health risks to European consumers and publish this within its annual report on pesticide residues. This analysis is based on the results from the official controls provided by reporting countries, which are combined with data on food consumption to obtain estimates of exposure to those pesticide residues.

Based on the scientific and technical knowledge available, EFSA has decided to base the estimation of the exposure assessment on a probabilistic correlation between the residue level in the analysed food and the amount eaten of the most consumed food commodities by real consumers. This probabilistic methodology provides an estimation of the actual exposure based on real consumption events in the selected population, expressed as a distribution across individuals. This methodology aligns as much as possible with the one used in cumulative risk assessments (EFSA, 2020a; EFSA, 2020b; EFSA, 2022), in accordance with the agreed roadmap between EFSA and SANTE[82] and the Technical Annex on retrospective CRA,[83] with the main difference that in this report the assessment is done to single substances.

## 6.1 | Data

### 6.1.1 | Primary input data

#### 6.1.1.1 | *Raw primary commodities*

The 35 raw primary commodities (RPCs) of plant origin that were once considered in the EU MACP were selected to carry out the probabilistic risk assessment to pesticide residues. In addition, courgettes were also included because according to EFSA's design assessment of the pesticide monitoring programme (EFSA, 2015a), courgettes are consumed in higher amounts than other commodities previously included in the EU MACP (e.g. spinach and broccoli). Foods specifically intended for infants and young children were also integrated in the exposure assessment.

The full list of the included food commodities is provided in Table 1.

**TABLE 1** RPC list.

| Number of commodities | prodCode[a] | prodName[b] |
|---|---|---|
| 1 | P0110010A | Grapefruits |
| 2 | P0110020A | Oranges |
| 3 | P0110050A | Mandarins |
| 4 | P0130010A | Apples |
| 5 | P0130020A | Pears |
| 6 | P0140030A | Peaches |
| 7 | P0151010A | Table grapes |
| 8 | P0151020A | Wine grapes |
| 9 | P0152000A | Strawberries |
| 10 | P0162010A | Kiwi fruits |
| 11 | P0163020A | Bananas |
| 12 | P0211000A | Potatoes |
| 13 | P0213020A | Carrots |
| 14 | P0220020A | Onions |

[82] https://food.ec.europa.eu/system/files/2021-03/pesticides_mrl_cum-risk-ass_action-plan.pdf.
[83] https://food.ec.europa.eu/plants/pesticides/maximum-residue-levels/cumulative-risk-assessment/technical-annex_en.

**TABLE 1** (Continued)

| Number of commodities | prodCode[a] | prodName[b] |
|---|---|---|
| 15 | P0231010A | Tomatoes |
| 16 | P0231020A | Peppers |
| 17 | P0231030A | Aubergines (egg plants) |
| 18 | P0232010A | Cucumbers |
| 19 | P0232030A | Courgettes |
| 20 | P0233010A | Melons |
| 21 | P0241010A | Broccoli |
| 22 | P0241020A | Cauliflower |
| 23 | P0242020A | Head cabbage |
| 24 | P0251020A | Lettuce |
| 25 | P0252010A | Spinach |
| 26 | P0260010A | Beans (with pods) |
| 27 | P0260040A | Peas (without pods) |
| 28 | P0270060A | Leek |
| 29 | P0280010A | Cultivated fungi |
| 30 | P0300010A | Beans (dry) |
| 31 | P0402010A | Olives for oil production |
| 32 | P0500010A | Barley |
| 33 | P0500050A | Oats |
| 34 | P0500060A | Rice |
| 35 | P0500070A | Rye |
| 36 | P0500090A | Wheat |
| 37 | PX100001A | Foods for infants and young children other than processed cereal-based foods |
| 38 | PX100003A | Processed cereal-based foods for infants and young children |
| 39 | PX100004A | Infant formulae |
| 40 | PX100005A | Follow-on formulae |

[a]Code of the raw primary commodity as defined by EFSA's harmonised terminology for scientific research (MATRIX catalogue; EFSA, 2025e).
[b]Name of the raw primary commodity as defined by EFSA's harmonised terminology for scientific research (MATRIX catalogue; EFSA, 2025e).

#### 6.1.1.2 | *Active substances*

The active substances under analysis are those having been quantified at least once in the last 3-year cycle, i.e. monitoring data from sampling years 2024, 2023 and 2022, both from EU coordinated and national programmes. The list of active substances is presented in Appendix B – Annex III – Table 3.1. The total number of active substances amounted to 367 (8 less respect to last year cycle).

#### 6.1.1.3 | *Residue definitions*

While the probabilistic risk assessment is executed at the level of the active substances, the occurrence data reported to EFSA refer to the enforcement residue definition. As the residue definitions defined in Regulation (EC) No 396/2005[9] may change over time, single active substances may be associated with multiple residue definitions throughout the reference period 2022–2024. Therefore, all the residue definitions that were applicable to the selected food commodities during the reference period were collected. The residue definitions retained are presented in Appendix B – Annex III – Table 3.1.

Depending on the metabolism of the active substance and the availability of analytical methods, the residue definitions for enforcement may be equal to the active substance (most typical case), may include additional metabolites, even incorporate multiple active substances or only contain a metabolite without the parent active substance.

A residue definition including additional metabolites specific to the parent active substance is defined as a *complex residue definition*; the measurement is assigned to the active substance assuming that the metabolite(s) have the same toxicological properties as the parent compound.

A residue definition including or applying to multiple active substances having different toxicological properties is defined as an *unspecific residue definition*.

In these cases, molecular weight conversion factors are applied to convert the occurrence data as expressed in the residue definition into the active substances.

In the case of an unspecific residue definitions, there are further distinctions on how the occurrence data are converted into one or more active substances. This depends on whether one active substance converts into another. If it does, the residue definition is known to be as *non-exclusive residue definition* (e.g. gamma- and lambda- cyhalothrin or metalaxyl and metalaxyl-M). So, the occurrence data reflecting the enforcement residue definition will be mapped to each active substance. As the proportions of conversion of one active substance into another is not known to EFSA, a default proportion of 0.5 is assumed for all different conversions. If the active substance does not convert into another, then it is known as *exclusive residue definition* (e.g. MCPA). In this case, the occurrence data are mapped completely to the active substance (i.e. in a proportion equal to 1).

In cases where the residue definition contains active substances not approved for more than 10 years, and there is confidence that they have been phased out globally; they are not considered when mapping occurrence data to active substances (e.g. fenvalerate).

#### 6.1.1.4 | *Occurrence data*

The occurrence data collected under Article 31 of Regulation (EC) No 396/2005[9] are the most appropriate data available to EFSA for performing the probabilistic risk assessments. These data are obtained from the official control activities carried out in the EU Member States,[1] Iceland and Norway and are reported to EFSA using the Standard Sample Description ver2 (SSD2) (EFSA, 2013). The occurrence data are collected at the level of residue definition (Section 6.1.1.3). The collected data, after having been validated by EFSA, are integrated in the EFSA's Scientific Data Warehouse (sDWH). All occurrence data referring to the relevant food commodities (Section 6.1.1.1) and residue definitions (Section 6.1.1.3) were extracted from the sDWH. Only measurements validated under 2022, 2023 and 2024 sampling year were selected.

The following additional criteria were applied to the extracted data:

- Only samples resulting from the EU-coordinated control programme (EU MACP), national control programmes (MANCP)[84] or a combination of those were selected (i.e. SSD2 programme type codes K005A, K009A and K018A). Samples associated with the increased control programmes (i.e. K019A) or any other type of programme were excluded as they were not considered to be representative of the market.
- Only samples obtained through objective or selective sampling[84] were retained (SSD2 sampling strategy codes ST10A and ST20A, respectively). Samples obtained through suspect sampling (ST30A), or any other type of sampling were not considered to be representative of the market and therefore excluded.

Occurrence data are systematically extracted for the assessment when related to one of the 36 RPCs mentioned above (i.e. raw primary commodity). In addition, when a minimum number of 10 determinations are available for a processed food (raw primary commodity derivative (RPCD)) of one of these 36 RPCs for at least 95% of all the substances analysed in the respective RPC, the occurrence data for this RPCD are also extracted in view of the assessment. The detailed list of the processed and unprocessed products retained for the assessment is reported in Table 2. In the case of juices, only orange juice (FoodEx2 terms: 'A03AM' or/and 'A0DZB#F28.A07LN') is taken.

**TABLE 2** List of product treatments retained for the assessment.

| Prodcode[a] | PRODNAME[b] | PRODTREAT[c] | PRODTREAT_DESC[d] |
|---|---|---|---|
| P0110010A | Grapefruits | F28.A0C0S | PROCESS=Unprocessed |
| P0110020A | Oranges | F28.A07LN | PROCESS=Juicing |
| P0110020A | Oranges | F28.A0C0S | PROCESS=Unprocessed |
| P0110050A | Mandarins | F28.A0C0S | PROCESS=Unprocessed |
| P0130010A | Apples | F28.A0C0S | PROCESS=Unprocessed |
| P0130020A | Pears | F28.A0C0S | PROCESS=Unprocessed |
| P0140030A | Peaches | F28.A0C0S | PROCESS=Unprocessed |
| P0151010A | Table grapes | F28.A07KG | PROCESS=Drying (dehydration) |
| P0151010A | Table grapes | F28.A0C0S | PROCESS=Unprocessed |
| P0151020A | Wine grapes | F28.A0C00$F10.A0F2R | PROCESS=Winemaking,QUAL=White |
| P0151020A | Wine grapes | F28.A0C00$F10.A0F2S | PROCESS=Winemaking,QUAL=Red |
| P0151020A | Wine grapes | F28.A0C0S | PROCESS=Unprocessed |
| P0152000A | Strawberries | F28.A0C0S | PROCESS=Unprocessed |
| P0162010A | Kiwi fruits (green, red, yellow) | F28.A0C0S | PROCESS=Unprocessed |
| P0163020A | Bananas | F28.A0C0S | PROCESS=Unprocessed |

[84]Sensitive analysis conducted under the cumulative risk assessment (EFSA, 2020a), has evidenced that selecting programme type 'Official (National) programme' (K005A) or sample strategy 'Selective sampling' (ST20A), does not have significant differences from selection only programme type 'Official (EU) programme' (K009A) or sample strategy 'objective sampling' (ST10A). Thus, samples were able to be pooled under the exposure assessment without specific likelihood of biasing the analysis.

**TABLE 2** (Continued)

| Prodcode[a] | PRODNAME[b] | PRODTREAT[c] | PRODTREAT_DESC[d] |
|---|---|---|---|
| P0211000A | Potatoes | F28.A0C0S | PROCESS=Unprocessed |
| P0213020A | Carrots | F28.A0C0S | PROCESS=Unprocessed |
| P0220020A | Onions | F28.A0C0S | PROCESS=Unprocessed |
| P0231010A | Tomatoes | F28.A0C0S | PROCESS=Unprocessed |
| P0231020A | Sweet peppers/bell peppers | F28.A07KG$F28.A07LA | PROCESS=Drying (dehydration),PROCESS=Grinding/milling/crushing |
| P0231020A | Sweet peppers/bell peppers | F28.A0C0S | PROCESS=Unprocessed |
| P0231030A | Aubergines/eggplants | F28.A0C0S | PROCESS=Unprocessed |
| P0232010A | Cucumbers | F28.A0C0S | PROCESS=Unprocessed |
| P0232030A | Courgettes | F28.A0C0S | PROCESS=Unprocessed |
| P0233010A | Melons | F28.A0C0S | PROCESS=Unprocessed |
| P0241010A | Broccoli | F28.A0C0S | PROCESS=Unprocessed |
| P0241020A | Cauliflowers | F28.A0C0S | PROCESS=Unprocessed |
| P0242020A | Head cabbages | F28.A0C0S | PROCESS=Unprocessed |
| P0251020A | Lettuces | F28.A0C0S | PROCESS=Unprocessed |
| P0252010A | Spinaches | F28.A07KQ | PROCESS=Freezing |
| P0252010A | Spinaches | F28.A0C0S | PROCESS=Unprocessed |
| P0260010A | Beans (with pods) | F28.A0C0S | PROCESS=Unprocessed |
| P0260040A | Peas (without pods) | F28.A0C0S | PROCESS=Unprocessed |
| P0270060A | Leeks | F28.A0C0S | PROCESS=Unprocessed |
| P0280010A | Cultivated fungi | F28.A0C0S | PROCESS=Unprocessed |
| P0300010A | Beans (dry) | F28.A0C0S | PROCESS=Unprocessed |
| P0401070A | Soya beans | F28.A0C0S | PROCESS=Unprocessed |
| P0402010A | Olives for oil production | F28.A0C02$F02.A068M | PROCESS=Oil production, PART=Vegetable fats and oils (as part-nature) |
| P0402010A | Olives for oil production | F28.A0C0S | PROCESS=Unprocessed |
| P0500010A | Barley | F28.A0C0S | PROCESS=Unprocessed |
| P0500050A | Oat | F28.A07LH | PROCESS=Flattening/rolling |
| P0500050A | Oat | F28.A0C0S | PROCESS=Unprocessed |
| P0500060A | Rice | F28.A0BZV | PROCESS=Polishing |
| P0500060A | Rice | F28.A0C0S | PROCESS=Unprocessed |
| P0500070A | Rye | F28.A0C03$F02.A067Z$F10.A06HR | PROCESS=Grain milling, PART=Flour/meal or finely ground powder (as part-nature), QUAL=Integral/not refined |
| P0500070A | Rye | F28.A0C0S | PROCESS=Unprocessed |
| P0500090A | Wheat | F28.A0C03$F02.A067Z$F10.A06HR | PROCESS=Grain milling, PART=Flour/meal or finely ground powder (as part-nature), QUAL=Integral/not refined |
| P0500090A | Wheat | F28.A0C03$F02.A067Z$F10.A07XK | PROCESS=Grain milling, PART=Flour/meal or finely ground powder (as part-nature), QUAL=White/refined |
| P0500090A | Wheat | F28.A0C0S | PROCESS=Unprocessed |
| PX100001A | Foods for infants and young children other than processed cereal-based foods | F28.A0C0R | PROCESS=Processed |
| PX100003A | Processed cereal-based foods for infants and young children | F28.A0C0R | PROCESS=Processed |
| PX100004A | Infant formulae | F28.A0C0R$F03.A06JD | PROCESS=Processed, STATE=Powder |
| PX100005A | Follow-on formulae | F28.A0C0R$F03.A06JD | PROCESS=Processed, STATE=Powder |

[a]Code of the raw primary commodity as defined by EFSA's harmonised terminology for scientific research (MATRIX catalogue; EFSA, 2025e).

[b]Name of the raw primary commodity as defined by EFSA's harmonised terminology for scientific research (MATRIX catalogue; EFSA, 2025e).

[c]Codes of FoodEx2 facet describing the processing technique, including additional descriptors such as qualitative information, part consumed or the nature of the food (MTX catalogue; EFSA, 2015b).

[d]Names of FoodEx2 facet describing the processing technique, including additional descriptors such as qualitative information, part consumed or the nature of the food (MTX catalogue; EFSA, 2015b).

- Only measurements reported as a numerical (i.e. quantifiable) value or as a non-quantified value were considered useful for the assessment (SSD2 resType codes VAL and LOQ). Other result types were not considered valid and therefore excluded.
- Under the acute assessment, the input value of the occurrence data is the value reported for each result. Whereas under the chronic assessment, the input value is the average occurrence value.
- Only measurements reported for the enforcement residue definitions in place at the time of sampling were used (SSD2 paramType codes P004A and P005A). Measurements referring to parts of the residue definition (i.e. P002A) were excluded from the assessment.
- When an LOQ value for a complex residue definition could not be reported by the reporting countries, the SANCO/12574/2014[85] document was applied and the summed LOQ recalculated.
- When the LOQ value for a measurement was found to be more than 100 times higher than the median LOQ of all measurements referring to the same combination of commodity and residue definition, the measurement was excluded from the assessment.
- Measurements below the LOQ (i.e. left-censored data) were imputed with ½ LOQ for a number of samples equal to the number of samples with a quantified result (i.e. above the LOQ) for the same substance/commodity combination, provided that the use of the substance was authorised for that commodity (see Section 6.1.2.2) within the last day of the last year of the reference period (i.e. 31/12/2024). This corresponds to the assumption that the use frequency of a product is two times the observed frequency of quantifiable samples, and that residues are equal to ½ LOQ when they are not quantifiable. For the non-authorised uses, results below the LOQ were imputed with a zero (i.e. assuming a no-residue situation).
- When several measurements with different residue definitions were reported for a same sample of food for infants and young children (i.e. different commodities can coexist in a same food i.e. fruits and animal origin commodities, each with a different residue definition), only the measurement referring to the most relevant enforcement residue definition was retained for the assessment.

#### 6.1.1.5 | *Consumption data*

The EFSA Comprehensive European Food Consumption Database (Comprehensive Database) provides a compilation of existing national information on food consumption at the individual level. Details on how the Comprehensive Database is used are published in the Guidance of EFSA (EFSA, 2011a).

In order to cover as many populations as possible without compromising the reliability of intake estimates at high percentiles of the distribution, only the dietary surveys with more than 300 survey consumers were retained, covering 17 different countries.

- Toddlers[86]: Bulgaria, Denmark, Finland, Germany, Netherlands.
- Other children[87]: Belgium, Bulgaria, Czechia, Finland, France, Germany, Greece, Netherlands, Spain, Sweden.
- Adults[88]: Austria, Belgium, Czechia, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Netherlands, Romania, Spain, Sweden.

The full dataset is not reported in this report. However, the description of the variables is provided in Table 3.

**TABLE 3** Description of the variable contained in the food consumption database used.

| Name | Label | Description |
|---|---|---|
| Country | Country | Country where the dietary survey took place as defined by EFSA's harmonised terminology for scientific research (COUNTRY catalogue; EFSA, 2025e). |
| Survey | Survey | Acronym of the dietary survey |
| PopClass | Population class | Participant's population class, based on age, as defined by EFSA's harmonised terminology for scientific research (AGECLS catalogue; EFSA, 2025e). |
| ORSUBID | Consumer ID | A pseudonymised consumer ID number generated by EFSA upon receipt of the data |
| Weight | Body weight | Bodyweight of the consumer (in kg) |
| ndays | Number of survey days | Number of days on which the participant's consumption was surveyed |
| day | Survey day | Ordinal number of the day on which the participant's consumption was surveyed |
| prodCode | RPC code | Code of the raw primary commodity as defined by EFSA's harmonised terminology for scientific research (MATRIX catalogue; EFSA, 2025e). |

[85]Working document on the summing up of LOQs in case of complex residue definitions. SANCO/12574/2014 rev.5.1, 1 December 2015 (European Commission, 2018).
[86]The population class 'toddlers' refers to participants from ≥ 12 months to < 36 months old.
[87]The population class 'other children' refers to participants from ≥ 36 months to < 10 years old.
[88]The population class 'adults' refers to participants from ≥ 18 years to < 65 years old.

**TABLE 3** (Continued)

| Name | Label | Description |
|---|---|---|
| prodName | RPC name | Name of the raw primary commodity as defined by EFSA's harmonised terminology for scientific research (MATRIX catalogue; EFSA, 2025e). |
| FoodEx2_Facets | Processing code | FoodEx2 facet code describing the processing technique, including additional descriptors such as qualitative information, part consumed or the nature of the food (EFSA, 2015b). |
| RPCD_amount | RPCD amount | Amount of raw primary commodity derivative (in grams) |
| RPC_amount | RPC amount | Amount of raw primary commodity (in grams) |

#### 6.1.1.6 | *Yield factors*

Data reported in the Comprehensive Database may either refer to raw primary commodities (RPCs), RPC derivatives (i.e. single-component foods altered by processing) or composite foods (i.e. multicomponent).

Consumption data for an RPC derivative or composite food, however, can only be used in exposure assessments if either occurrence data were extracted for this RPC derivative (see Table 2) or composite food or a processing factor applicable to the respective substance/RPC/processing type is available (see Appendix B – Annex III – Table 3.3).

When such information is not available, it is assumed in the exposure assessment that a substance in the RPC entirely migrates to the RPCD without any loss or degradation. This assumption requires the conversion of the consumed amount of RPC derivative or composite food into the respective amount of RPC.

Therefore, EFSA transformed the Comprehensive Database into a new RPC Consumption Database by means of the RPC model (EFSA, 2019a). This model converts the consumption data for composite foods RPC derivatives into their equivalent quantities of RPCs using the reverse yield factors (i.e. 1 divided by the yield factor), except foods for infants and young children.[89] The RPC model was applied to the Comprehensive Database as of 31 March 2018, when it contained results from different dietary surveys carried out in 23 different Member States covering 94,523 individuals.

A yield factor is the ratio of the amount of food (RPCD) that results from an industrial process or household handling of the food to the amount of starting material (RPC) that was used. The consolidated list of reverse yield factors currently used by EFSA can be found in Annex A.5 of the RPC Model (EFSA, 2019a).

Based on the Compendium of Representative Processing Techniques (Scholz et al., 2025), the concentrated orange juice and the normal orange juice were established to be equivalent, where the water extracted at one point in the process of the concentrated juice was later added back again. Thus, EFSA did not consider the reverse yield factor in this type of juice, as it only led to an unrealistic consumed amount. The reverse yield factor for normal juice was used. As an example, the value of 2.22 converted the juice into raw mandarins (i.e. 1 kg of mandarin juice – normal and concentrated – was converted into 2.22 kg of mandarins). This was applied in analogy to all concentrated juices.

### 6.1.2 | Secondary input data

#### 6.1.2.1 | *Maximum residue level*

Certain assumptions on the authorised uses require information on the MRLs. MRLs may have been modified throughout the reference period (i.e. years 2022–2024). In order to obtain a single list of MRLs, EFSA decided to use the MRLs as applicable on 31 December 2024 (i.e. the end of the current reference period). Hence, it was assumed that those MRLs were applicable during the entire reference period, regardless of whether the MRL may have changed during that period.

MRLs for the relevant food commodities (Section 6.1.1.1) and enforcement residue definitions (Section 6.1.1.3) were extracted from the EU Pesticides Database[10] and organised in a data format that could be used directly for exposure assessment.

#### 6.1.2.2 | *Authorised uses*

In some cases, the imputations and simulations performed on the occurrence data rely on assumptions regarding the authorisations for use of plant protection products containing the active substance(s) (Section 6.1.1.4). While the approval status of an active substance under Regulation (EC) No 1107/2009 is regulated at EU level, the authorisations on plant protection products (i.e. formulated products containing the active substances) are delivered at national level within the EU Member States. A centralised database compiling these national authorisations is not yet available at EU level.

National authorisations can be reported to EFSA under Regulation (EC) No 396/2005, either for an MRL application under Article 10 or for an MRL review under Article 12. There is, however, no legal obligation to systematically report all national

[89]Consumption data for foods for infants and young children were not converted to their equivalent amounts of RPC because, in this case, chemical occurrence data are collected for the processed food commodity.

authorisations in real time to EFSA. Therefore, a comprehensive overview of all pesticides authorisations within the EU is not available to EFSA. However, a tentative list of authorised uses was elaborated according to the following principles:

- When the MRL for a given combination of an active substance and RPC was not set at the LOQ (Section 6.1.2.1), the active substance was assumed to be authorised for use on that specific commodity. This assumption also accounted for uses authorised outside the EU (i.e. import tolerance) for which treated products may be placed on the EU market. Furthermore, this assumption also concerns non-approved substances in the EU, including persistent organic pollutants, for which temporary MRLs on certain crops are set above the LOQ due to their long degradation period, and thus, considered authorised.
- When MRLs that are not set at the LOQ, referred to *unspecific residue definitions* (i.e. including or applying to multiple active substances, see Section 6.1.1.3), only the substances approved under Regulation (EC) No 1107/2009 were assumed to be authorised for use on the respective crops. If none of the active substances were approved, it was assumed that any active substance may be authorised for use outside the EU.
- When MRLs that are not set at the LOQ refer to a residue definition involving two different active substance, one of which is not renewed under Regulation (EC) No 1107/2009 (e.g. fenvalerate). The MRL only represents the use of the approved substance (e.g. esfenvalerate).
- For all combinations of active substance and commodities with the MRL set at LOQ, EFSA screened the relevant reasoned opinions issued under Article 12 and the subsequent reasoned opinions issued under Article 10 and any Article 43 of Regulation (EC) No 396/2005.[9] Any authorised use reported in those reasoned opinions was recorded. Otherwise, it was assumed that the use was not authorised. The combinations that have been considered authorised are listed in the Appendix B – Annex III – Table 3.4.
- For the group of dithiocarbamates, still under discussion by risk managers, the latest MRL review (EFSA, 2023c) provides the most recent update of the different European uses, import tolerances or CODEX MRLs authorised for each precursor included in the unspecific residue definition. For mancozeb, maneb, metiram and ziram, common authorised uses were considered. Whereas for propineb and thiram, no authorisation was considered in place for any relevant commodity.
- For the group of cypermethrins, still under discussion by risk managers, the MRL review assessment (EFSA, 2023a) provided the uses for alpha-cypermethrin, zeta-cypermethrin and cypermethrin (sum of isomers), including import tolerances and uses implemented at CODEX level. The authorisations considered were those for cypermethrin (sum of isomers).
- For the group of cyhalothrins, lambda- and gamma- were considered approved in accordance with the MRL reviews (EFSA, 2015d and EFSA, 2024d, respectively), despite the expiration of approval for gamma-cyhalothrin on 31 March 2025 – after the reference period considered in this report. Lambda- authorised uses were considered for both substances.

#### 6.1.2.3 | *Processing factors*

Occurrence data for pesticide residues are collected at the level of the RPC (Section 6.1.1.1) and in some cases at the level of RPC derivatives (Section 6.1.1.4). Food consumption data may be collected at the level of RPC, RPC derivative or composite food. For the purpose of this assessment, consumption data for composite foods and RPC derivatives were converted into their equivalent quantities of RPCs (Section 6.1.1.5) except if the occurrence data were already reported as RPC derivative (e.g. fruit juices, olive oil) or if a processing factor (PF) is available for the respective RPC/active substance/processing type.

The effect of processing on residue levels is usually addressed by means of processing factors. A processing factor accounts for the change in residue concentrations and is specific to each RPC, processing type and active substance. Processing factors are quantified by dividing the residue concentration in the processed commodity by the residue concentration in the raw commodity.

The European database on processing factors is the most recent and the most comprehensive compilation of processing factors currently available at EU level (Zincke et al., 2025). Processing factors for the active substances and RPCs under assessment were extracted from this database[90] according to the following criteria:

- For each active substance, RPC and processing technique, only the median processing factor was extracted.
- Only the processing factors indicated as reliable or indicative were extracted. Processing factors indicated as unreliable were excluded from the assessment.

Processing techniques reported in the processing factor database were then compared to the processing techniques reported in the RPC consumption data set. The processing techniques from both databases were matched according to the following principles:

- When a generic processing technique was reported in the RPC consumption database (e.g. juice) while more specific processing techniques were reported in the processing factor database (e.g. pasteurised juice and unpasteurised juice), the specific processing technique with the highest processing factor was selected.

[90] https://doi.org/10.5281/zenodo.1488652.

- When a specific processing technique was reported in the RPC consumption database (e.g. mashed potato) while a more generic processing technique was reported in the processing factor database (e.g. boiled potato), the generic processing factor was applied to the specific processing techniques.
- Processing factors were extrapolated between raw primary commodities with similar properties (i.e. oranges and mandarins, apples and pears, table and wine grapes, wheat and rye grain).
- Processing factors for peeling were applied to the corresponding fruit with inedible peel, even when the processing technique was not specified in the RPC consumption database (i.e. grapefruits, oranges, mandarins, bananas and melons).
- When more than one processing factor was reported for the same RPC and processing technique, which differs for the type of application (e.g. preharvest treatment/post-harvest treatment), the highest processing factor was selected.

The list of PFs used in this assessment is available in the Appendix B – Annex III – Table 3.4.

#### 6.1.2.4 | *Variability factors*

The occurrence data used for the assessment are related to the average concentrations in composite laboratory samples (Section 6.1.1.4). Consumers, on the other hand, are exposed to individual units of the commodity. Acute exposure assessments for pesticide residues should account for the variability of residues among the single commodity units of the composite laboratory samples.[91] To account for this variability, several parameters are required for each food commodity.

- Unit weight: Estimated weight for a single commodity unit.
- Units per sample: Estimated number of units within a composite laboratory sample.
- Variability factor (VF): Expected variability among the single unit concentrations, which is defined as the ratio between the 97.5th percentile and mean of the distribution of unit concentrations.

Unit weights for each commodity were retrieved from the Pesticide Residues Intake Model rev. 3.0 (EFSA, 2018a). Residue concentrations may vary among the individual units, referred to as unit-to-unit variability. For RPCs that have a unit weight lower than 25 g and for processed foods that were subject to blending or bulking, the unit-to-unit variability is not considered relevant since the residue concentration in the composite laboratory sample is expected to reflect the residue concentration in the portion that would be consumed (FAO, 2003).

The number of units per sample was obtained from Commission Directive 2002/63/EEC,[92] establishing community methods of sampling for the official control of pesticide residues in and on products of plant and animal origin. This directive defines a minimum weight and a minimum number of units for composite laboratory samples of each food category. Hence, the minimum number of units (as defined by Directive 2002/63/EEC) was used, unless the minimum sample weight divided by the corresponding unit weight was higher. In that case, the latter calculated value (rounded up to the next integer) was retained. The VFs were also retrieved from the Pesticide Residues Intake Model (PRIMo) rev. 3.0 (EFSA, 2018a).

While a fixed VF is usually applied for acute deterministic calculations, for probabilistic exposure assessment, the use of a distribution of unit concentrations is considered more adequate than using a fixed VF. Therefore, unit-to-unit variability is modelled using a beta distribution, which can be bounded between 0 and an upper limit. If the average concentration in a composite sample is normalised to 1, the concentration in a single unit can never be higher than the number of units within the composite sample (assuming all other units have a concentration of zero). Hence, for each RPC with a unit weight exceeding 25 g, the beta distribution was parameterised with the following restrictions.

- Lower bound = 0.
- Mean = 1.
- 97.5th percentile = VF.
- Upper bound = number of units per sample.

Stochastic VFs can then be drawn from the beta distribution and multiplied with the composite sample concentration to obtain a plausible estimate of the unit concentration. When the portion consumed by an individual is smaller than a single unit, the stochastic VF is directly applicable to the consumed portion. When the consumed portion is composed of multiple units, however, multiple stochastic VFs will be drawn from the same beta distribution to estimate concentration in the whole portion consumed. Therefore, the concentration in the whole portion is estimated by multiplying the sample concentration with a weighted VF, which is calculated as follows:

$$WVF = SVF_n \qquad \text{if } n = 1$$

[91]Commission Directive 2002/63/EC of 11 July 2002 establishing Community methods of sampling for the official control of pesticide residues in and on products of plant and animal origin and repealing Directive 79/700/EEC. OJ L 187, 16.7.2002, pp. 30–43.

[92]Commission Directive 2002/63/EC of 11 July 2002 establishing Community methods of sampling for the official control of pesticide residues in and on products of plant and animal origin and repealing Directive 79/700/EEC. OJ L 187, 16.7.2002, p. 30–43.

$$WVF = \frac{\left(\sum_{i=1}^{n-1} SVF_i\right) + SVF_n \cdot (n_0 - n + 1)}{n_0} \quad \text{if} \quad n > 1$$

where WVF is the weighted VF;
$SVF_i$ is the stochastic VF drawn for unit *i*;
$n_0$ is the estimated number of units within the consumed portion (unrounded), assuming the unit weights retrieved from PRIMo rev. 3.0 (EFSA, 2018a);
$n$ is the number of stochastic VFs to be drawn (i.e. ceiling of $n_0$).

In Table 4, the stochastic VF parameters are shown for each RPC selected for the probabilistic risk assessment. If the commodity is not listed, it means that the unit-to-unit variability is not relevant.

**TABLE 4** Variability factor parameters.

| prodCode[a] | prodName[b] | Cat_2002_63_EC[c] | Samp weight[d] | minUnits[e] | UnitWeight[f] | NrUnits[g] | VF[h] | $\alpha$[i] | $\beta$[j] |
|---|---|---|---|---|---|---|---|---|---|
| P0110010A | Grapefruits | Large, 250 g or more | 2000 | 5 | 270.5 | 8 | 5 | 0.341154 | 2.388078 |
| P0110020A | Oranges | Medium, 25 to 250 g | 1000 | 10 | 160 | 10 | 7 | 0.158731 | 1.428581 |
| P0110050A | Mandarins | Medium, 25 to 250 g | 1000 | 10 | 100 | 10 | 7 | 0.158731 | 1.428581 |
| P0130010A | Apples | Medium, 25 to 250 g | 1000 | 10 | 112 | 10 | 7 | 0.158731 | 1.428581 |
| P0130020A | Pears | Medium, 25 to 250g | 1000 | 10 | 206.5 | 10 | 7 | 0.158731 | 1.428581 |
| P0140030A | Peaches | Medium, 25 to 250 g | 1000 | 10 | 127.6 | 10 | 7 | 0.158404 | 1.425633 |
| P0151010A | Table grapes | Large, 250 g or more | 2000 | 5 | 581.55 | 6 | 5 | 0.248312 | 1.241558 |
| P0162010A | Kiwi fruits | Medium, 25 to 250 g | 1000 | 10 | 83 | 13 | 7 | 0.184385 | 2.212620 |
| P0163020A | Bananas | Medium, 25 to 250 g | 1000 | 10 | 100 | 10 | 7 | 0.158731 | 1.428581 |
| P0211000A | Potatoes | Medium, 25 to 250 g | 1000 | 10 | 216 | 10 | 7 | 0.158731 | 1.428581 |
| P0213020A | Carrots | Medium, 25 to 250 g | 1000 | 10 | 80 | 13 | 7 | 0.184385 | 2.212620 |
| P0220020A | Onions | Medium, 25 to 250 g | 1000 | 10 | 105.8 | 10 | 7 | 0.158731 | 1.428581 |
| P0231010A | Tomatoes | Medium, 25 to 250 g | 1000 | 10 | 142.5 | 10 | 7 | 0.158731 | 1.428581 |
| P0231020A | Peppers | Medium, 25 to 250 g | 1000 | 10 | 154.9 | 10 | 7 | 0.158731 | 1.428581 |
| P0231030A | Aubergines (egg plants) | Large, 250 g or more | 2000 | 5 | 271 | 8 | 5 | 0.341154 | 2.388078 |
| P0232010A | Cucumbers | Large, 250 g or more | 2000 | 5 | 411.4 | 6 | 5 | 0.248312 | 1.241558 |
| P0232030A | Courgettes | Medium, 25 to 250 g | 1000 | 10 | 114 | 10 | 7 | 0.158731 | 1.428581 |
| P0233010A | Melons | Large, 250 g or more | 2000 | 5 | 540 | 6 | 5 | 0.248312 | 1.241558 |
| P0241010A | Broccoli | Medium, 25 to 250 g | 1000 | 10 | 186 | 10 | 7 | 0.158731 | 1.428581 |
| P0241020A | Cauliflower | Large, 250 g or more | 2000 | 5 | 689.9 | 6 | 5 | 0.248312 | 1.241558 |
| P0242020A | Head cabbage | Large, 250 g or more | 2000 | 5 | 1281.9 | 6 | 5 | 0.248312 | 1.241558 |

**TABLE 4** (Continued)

| prodCode[a] | prodName[b] | Cat_2002_63_EC[c] | Samp weight[d] | minUnits[e] | UnitWeight[f] | NrUnits[g] | VF[h] | $\alpha$[i] | $\beta$[j] |
|---|---|---|---|---|---|---|---|---|---|
| P0251020A | Lettuce | Large, 250 g or more | 2000 | 5 | 534.7 | 6 | 5 | 0.248312 | 1.241558 |
| P0270060A | Leek | Medium, 25 to 250 g | 1000 | 10 | 168.8 | 10 | 7 | 0.158731 | 1.428581 |
| P0280010A | Cultivated fungi | Medium, 25 to 250 g | 1000 | 10 | 25 | 40 | 7 | 0.227164 | 8.859387 |

[a]Code of the RPC as defined by EFSA's harmonised terminology for scientific research (MATRIX catalogue; EFSA, 2025e).
[b]Name of the RPC as defined by EFSA's harmonised terminology for scientific research (MATRIX catalogue; EFSA, 2025e).
[c]Commodity classification defined by Table 4 of the Annex to Commission Directive 2002/63/EC.
[d]Minimum size of each laboratory sample (expressed in g) defined by Table 4 of the Annex to Commission Directive 2002/63/EC.
[e]Minimum size of each laboratory sample (expressed in number of units) defined by Table 4 of the Annex to Commission Directive 2002/63/EC.
[f]Estimated weight (expressed in g) for a single commodity unit as reported in the Pesticide Residues Intake Model (rev. 3) (EFSA, 2018a).
[g]Estimated number of units required to obtain the minimum size of a composite laboratory sample, both in terms of weight and number of units.
[h]Default VF as reported in the Pesticide Residues Intake Model (rev. 3) (EFSA, 2018a). This factor represents the variability among the single unit concentrations, which is defined as the ratio between the 97.5th percentile and mean of the distribution of unit concentrations.
[i]Computed $\alpha$ parameter of the beta distribution.
[j]Computed $\beta$ parameter of the beta distribution.

Variability among the single commodity units of the composite laboratory samples is not relevant when the food consumed is subject to processing techniques that involve bulking and blending. Processing types are looked in the acute assessment.

Therefore, all processing techniques reported in the RPC consumption data (Section 6.1.1.5) were extracted and the processes that normally involve blending or bulking identified. Typically, these are processing techniques performed at industrial level (e.g. milling, oil production, etc.). Household processes, however, were assumed not to involve any bulking or blending (e.g. boiling, stewing, etc.). Although juicing may also be carried out at household level, it is assumed that most fruit juices are produced at industrial level.

#### 6.1.2.5 | *Health-based guidance values*

The health-based guidance values (HBGVs) used were the acute reference dose (ARfD, expressed in mg of residue/kg bw) for acute (short-term) assessments and the acceptable daily intake (ADI, expressed in mg of residue/kg bw per day) for chronic (long-term) assessments.

Both acute and chronic assessments have been categorised into primary or tentative scenarios or no assessment situation depending on the type and availability of HBGVs.

- If the value was established by EFSA under Regulation (EC) No 1107/2009 or Regulation (EC) No 396/2005, the outcome was considered '*primary*' and presented in Annex IV for acute assessments or Annex VI for chronic assessments.
- If the active substance was never reviewed by EFSA, but the value was derived by other bodies (e.g. EPA, JMPR), even if it was a tolerable daily intake (TDI) (expressed in mg of residue/kg bw per day), the assessment was considered '*tentative*'.
- If the active substance was once reviewed by EFSA, but in a later assessment, there were uncertainties on key endpoints, typically cut-off criteria (CMR) (i.e. carcinogenic, mutagenic and/or toxic for reproduction); the outcome was considered '*tentative*'.

It can be consulted in Annex V for acute and Annex VII for chronic. The aim of including these substances is to provide risk managers a view on possible situations if the sample remains in the market or the sample is not taken by the inspector. EFSA acknowledges the level of uncertainty the assessment on these substances may lead to, but a dietary '*tentative*' risk assessment was decided to be conducted as samples with quantified residues were found on the market. Some of these substances were dimethoate,[93] chlorpyrifos[94] and chlorpyrifos-methyl.[95] Omethoate, a metabolite of dimethoate, having been proven to be in vivo mutagenic (EFSA, 2018d), its only presence should be sufficient to withdraw a sample from the market.[96,97]

[93]During dimethoate peer review, concerns on genotoxicity could not be ruled out (EFSA, 2018d).
[94]During chlorpyrifos peer review follow-up statement, concerns on genotoxicity potential could not be ruled out and uncertainties in the developmental neurotoxicity potential were identified (EFSA, 2019b).
[95]During chlorpyrifos-methyl peer review follow-up statement, concerns on genotoxicity potential could not be ruled out and uncertainties in the developmental neurotoxicity potential were identified (EFSA, 2019c).
[96]Omethoate was quantified over the 3-year period in 49 samples covering 17 different commodities of the 40 under this assessment.
[97]https://food.ec.europa.eu/system/files/2023-02/acn_working-instructions_2-2_pest-residues.pdf.

In case the ARfD was not available, if the ADI was used as a conservative surrogate for ARfD, these cases were under the '*tentative*' assessment.

- In case it was agreed that an ARfD/ADI was not needed, no acute/chronic risk assessment was performed.
  In case no HBGV was available at the time of the assessment, no risk assessment was possible. This was the case for 33 substances. These were alachlor, ametryn, azinphos-ethyl, bromide ion, bromacil, captafol, cartap, difluoroacetic acid (DFA), dinoseb, EPN, etaconazole, copper, ethylene oxide, fenobucarb, fluacrypyrim, isocarbophos, formothion, halofenozide, isoprocarb, mepronil, metominostrobin, pebulate, piperalin, pirimiphos-ethyl, promecarb, prothiocarb, pyracarbolid, pyrifenox, thionazin, transfluthrin, thiophanate-ethyl, trimethyl-sulfonium cation and uniconazole.
- The HBGV of bromide ion and copper (both, previously counted) have recently been reviewed under EFSA Scientific Committee assessments (EFSA, 2025a, 2025b, respectively). Both substances occur naturally and have uses beyond plant protection products. Therefore, their findings in the monitoring programmes cannot be linked uniquely to a pesticide use. The dietary exposure assessments conducted by the Scientific Committee on copper considered occurrence data from different domains (pesticides, contaminants, feed additives, etc.) and accounted for far more commodities than the 40 retained in this report. The Scientific Committee used deterministic models and set different protection goals (95% on copper compared to 99.9% set by risk managers for pesticides in the frame of CRA). EFSA has decided not to include exposure estimates to copper in this report and refer the reader to the conclusions drawn by the Scientific Committee and the methodology to be used by applicants and Member States to perform consumer risk assessment to PPP containing copper (EFSA, 2026b). In the case of bromide ion, EFSA Scientific Committee review the HBGVs, but due to a lack of sufficient monitoring data, the methodology to conduct a dietary exposure assessment was not assessed (EFSA, 2025a–g). EFSA has meanwhile been mandated to perform a consumer risk assessment of dietary exposure to bromide ion and to review the existing maximum residue limits (MRLs).[98]

The list of HBGVs under each category is available in Appendix B – Annex III – Table 3.2.

## 6.2 | Methodology

The methodology used is presented in Figure 1. This figure presents the general process used in probabilistic dietary exposure assessment to single substances, for both the acute and chronic exposure scenarios.

[98] https://open.efsa.europa.eu/questions/EFSA-Q-2026-00132?search=bromide.

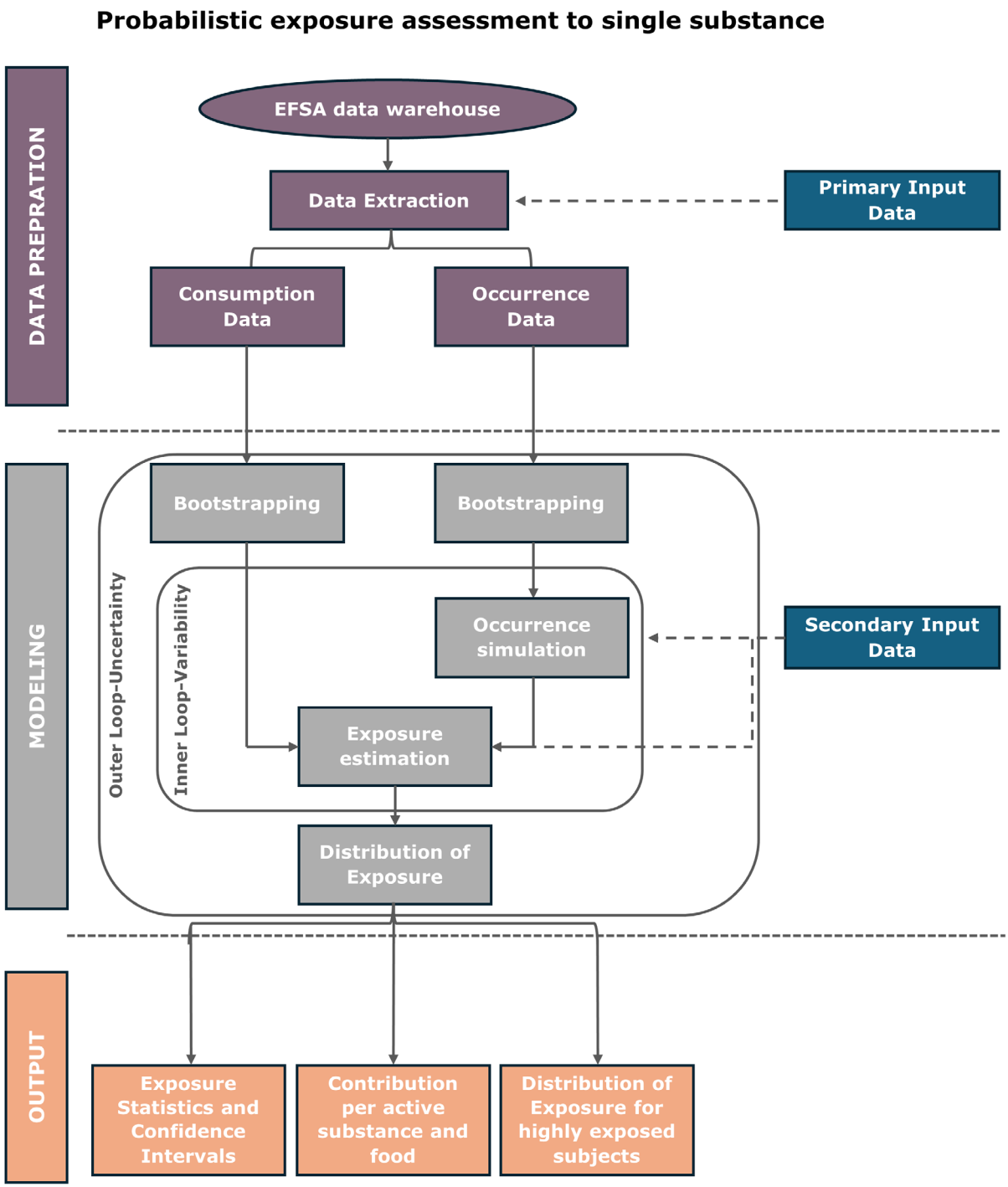


**FIGURE 1** General process implemented for the probabilistic estimation of exposure to single substances.

The primary input data require the occurrence and food consumption data. These data are extracted from the EFSA Data Warehouse for the relevant food commodities, active substances, associated residue definitions and dietary surveys. See Section 6.1.1 for a full description of the data used.

Within the inner loop execution, occurrence data are subject to several simulations and imputations. These adjustments are intended to account for uncertainties and missing information in the occurrence data set (e.g. unspecific measurements, measurements below the analytical limit of quantification (LOQ), etc.).

The exposure modelling also accounts for the effect of processing, either by using available occurrence data in the processed food or by incorporating a specific processing factor to account for the magnitude of transfer to the RPCD and the chemical alteration of the substance.

In the absence of occurrence date in the processed food, when such PFs are available, occurrence data in the RPC are combined with the consumed amount of processed food (i.e. RPC derivative) and the PF.

In contrast, when PFs are not available, occurrence in the RPC is combined with the amount of RPC corresponding to the consumed amount of processed food (as established by the RPC model), assuming that all residues present in the RPC will reach the consumer what generally tends to overestimate the actual exposure. Furthermore, as the consumed amounts are expressed in g and occurrence data are expressed in mg/kg, a correction factor of 1000 needs to be considered.

Acute and chronic calculations present differences in the inner loop execution:

**Methodology for the acute exposure assessment**

The acute probabilistic exposure to pesticide residues was assessed in accordance with the guidance on probabilistic modelling of dietary exposure to pesticide residues for the annual review of monitoring data (EFSA, 2012a). Acute exposure estimates were obtained using a two-dimensional method where variability of exposure within the population is modelled by means of an inner loop execution. The consumption data and occurrence data (as adjusted by the relevant imputations according to the assumptions regarding left-censored data, complex and unspecific residue definitions, etc.) are then used to estimate acute dietary exposures using an empirical Monte Carlo simulation (i.e. samples are selected at random 100,000 times' iterations), by assigning to each food consumption event of an individual, a random sample from the occurrence data[99] for the same food category consumed. This results in a distribution that represents the variability of acute exposures within the population. The different simulations performed during the inner loop execution require the use of additional data, referred to as secondary input data (processing factors (PFs), variability factors, processing types, MRL and authorisation status).

The acute dietary exposure accounts for the unit-to-unit variability for all food commodities which may contain non-uniform residue distributions (see Table 4). As described above, the unit-to-unit variability is modelled using a beta-distribution.

All acute exposure estimates (e.g. percentiles of the distribution) are expressed as percentage of ARfD. Hence, a calculated value greater than 100% suggests that the estimated exposure exceeds the ARfD for that active substance. This also allows to calculate within each subpopulation the percentage of individual consumer day that have an exposure exceeding the ARfD.

A further assessment was to calculate the risk to consumers for those substances exceeding the percentage of ARfD in samples with the highest concentration. EFSA considers it unnecessary to present such an assessment in this report as the exceedances led by few high concentration samples, leading to concern, have already been identified and addressed in the result section.

**Methodology for the chronic exposure assessment**

Chronic estimates were also obtained using a two-dimensional method where variability of exposure within the population is modelled by means of an inner loop execution. However, whereas acute exposure (within the inner loop execution) is modelled through a Monte Carlo simulation, the chronic exposure is modelled through the observed individual means (OIM) approach (EFSA, 2012b). This method uses the mean consumption over the survey days of each individual to estimate the individuals' long-term consumption for each food commodity. Individuals who participated for only 1 day of the dietary survey were excluded because at least two survey days per individual are normally required to assess repeated exposure (EFSA, 2011a). Using the individuals' body weight and the mean occurrence values calculated for each food commodity, the individuals' chronic exposures resulting from each food commodity are calculated and added to obtain the individuals' total chronic exposure.

Chronic risks depend on the average chronic exposure and not on single exposure events, as this is the case for acute effects. Hence, chronic exposure assessments rely on the assumption that all commodities contain an average residue concentration, calculated from the available monitoring data. Exposure estimates (e.g. percentiles of the distribution) are then expressed as a percentage of ADI. Thus, a calculated exposure greater than 100% suggests that the estimated exposure exceeds the ADI for that active substance, and a health risk cannot be excluded. This also allows to calculate within each subpopulation the percentage of consumers that have an exposure exceeding the ADI.

To quantify the confidence around the acute and chronic exposure distributions, the model uses an outer loop execution where the inner loop execution is repeated several times. Prior to each execution, the original consumption and occurrence data sets are modified by means of bootstrapping, a random resampling technique for quantifying uncertainty. By repeating the inner loop execution multiple times (i.e. 100), the model produces multiple distributions of exposure. The differences between those distributions reflects the impact of the sampling variability, i.e. the uncertainty depending on the sample size. During the output preparation, summary statistics are generated for the multiple distributions, resulting in multiple estimates for each percentile of exposure. The *outer loop execution* allows to estimate the 95% confidence intervals around the calculated percentage of individual days exceeding the ARfD (acute exposure assessments) or the individuals exceeding the ADI (chronic exposure assessments). For these percentages, the lower bound (LB, i.e. 2.5th percentile), middle bound[100] (MB, i.e. 50th percentile) and upper bound (UB, i.e. 97.5th percentile) are estimated.

To identify risk drivers, details on the highly exposed consumers are extracted (i.e. consumers with exposure close to the 99th percentile) and average contributions per food commodity are calculated.

[99]Under the acute assessment, the input value of the occurrence is the value reported for each result.

[100]The term 'middle bound' in this report is equivalent to the 'median estimate' term used in CRA.

The overall risk assessment formula is expressed as the hazard quotient (HQ) in percentage.

**For the acute assessment:**

$$HQ_{ids} = \sum_{c \in \text{Commodities}} \sum_{p \in \text{Processes}_c} \begin{cases} \dfrac{RPCD_{idcp} \cdot X_{idcps}}{BW_i \cdot ARfD_s \cdot 10^3}; & \text{if Case 1} \\ \dfrac{RPC_{idcp} \cdot X_{idcps} \cdot WVF_{idcps}}{BW_i \cdot ARfD_s \cdot 10^3}; & \text{if Case 2} \\ \dfrac{RPCD_{idcp} \cdot PF_{cps} \cdot X_{idcps} \cdot WVF_{idcps}}{BW_i \cdot ARfD_s \cdot 10^3}; & \text{if Case 3} \end{cases}$$

*Case 1*: Occurrence data on the commodity *c* with the processing type *p* is available for the assessment.
*Case 2*: Occurrence data on the commodity *c* with the processing type *p* is not available for the assessment and a $PF_{cps}$ is not available.
*Case 3*: occurrence data on the commodity *c* with the processing type *p* is not available for the assessment and a $PF_{cps}$ is available.

Where

- $HQ_{ids}$ is the hazard quotient of individual *i* on day *d* for the substance *s*;
- Commodities is the set of raw primary commodities as listed in Table 1 (Section 6.1.1.1);
- $Processes_c$ is the set of processes related to the commodities *c* for which specific consumption data are retained; the subset of processes for which occurrence data are also retained for the assessment is listed in Table 2 (Section 6.1.1.4);
- $RPC_{idcp}$ is the amount of commodity *c* with processing type *p* consumed by individual *i* on day *d*, expressed in g of RPC (i.e. yield factor applied; Section 6.1.1.6);
- $RPCD_{idcp}$ is the amount of commodity *c* with processing type *p* consumed by individual *i* on day *d*, expressed in g of RPC derivative;
- BW is the body weight of individual *i*, expressed in kg;
- $WVF_{idcps}$ is the weighted VF that was randomly assigned to individual *i* on day *d* for substance *s* in commodity *c* with processing type *p*;
- $PF_{cps}$ is the processing factor for substance *s* in commodity *c* with processing type *p*;
- $ARfD_s$ is the acute reference dose for substance *s*, expressed in mg/kg body weight;
- $X_{idcps}$ is the imputed concentration of the substance *s* in a sample that was randomly assigned to individual *i* on day *d* for commodity *c* with processing type *p*, expressed in mg/kg, calculating $X_{idcps}$ depending on the type of case:

$$X_{idcps} = \begin{cases} VAL_{zs} \cdot MWF_s; & \text{if Case A} \\ \frac{1}{2}\left(VAL_{zs}\right) \cdot MWF_s; & \text{if Case B} \\ \frac{1}{2} LOQ_{zs} \cdot MWF_s; & \text{if Case C; for a random sample } z \in Samples_{cps} \\ \frac{1}{2}\left(\frac{1}{2} LOQ_{zs}\right) \cdot MWF_s; & \text{if Case D} \\ 0; & \text{if Case E} \end{cases}$$

*Case A:* if the result for *z* is quantified, and the assignment of the residue definition to the active substance is *exclusive* (Section 6.1.1.3).
*Case B:* if the result for *z* is quantified, and the assignment of the residue definition to the active substance is *not exclusive* (Section 6.1.1.3).
*Case C:* if the result for *z* is not quantified, the use of the substance is authorised on the crop and the sample is within the randomly selected samples for which ½ LOQ is imputed (Section 6.1.1.3), and the assignment of the residue definition to the active substance is *exclusive* (Section 6.1.1.3).
*Case D:* if the result for *z* is not quantified, the use of the substance is authorised on the crop and the sample is within the randomly selected samples for which a positive concentration is imputed (Section 6.1.1.3), and the assignment of the residue definition to the active substance is *not exclusive* (Section 6.1.1.3).
*Case E:* if the result for *z* is not quantified, the use of the substance is not authorised on the crop or the sample is not within the randomly selected samples for which ½ LOQ is imputed (Section 6.1.1.3).

Where

- $Sample_{cps}$ is the set of samples of commodities *c* with processing type *p* analysed for the substance *s*;

- $VAL_{zs}$ is the quantified concentration in the sample *z* for the substance *s*
- $LOQ_{zs}$ is the analytical limits of quantification in the sample *z* for the substance *s*;
- $MWF_s$ is the molecular weight factor from the residue definition analysed to the substance *s*.

If the hazard quotient of individual *i* on day *d* for the substance *s* is above 1, the HBGV (ARfD) is exceeded.

**For the chronic assessment:**

$$HQ_{is} = \sum_{c \in \text{Commodities}} \sum_{p \in \text{Processes}_c} \begin{cases} \dfrac{RPCD_{icp} \cdot X_{cps}}{BW_i \cdot ADI_s \cdot 10^3}; & \text{if Case 1} \\ \dfrac{RPC_{icp} \cdot X_{icps}}{BW_i \cdot ADI_s \cdot 10^3}; & \text{if Case 2} \\ \dfrac{RPCD_{icp} \cdot PF_{cps} \cdot X_{icps}}{BW_i \cdot ADI_s \cdot 10^3}; & \text{if Case 3} \end{cases}$$

Case 1: Occurrence data on the commodity *c* with the processing type *p* are available for the assessment;
Case 2: Occurrence data on the commodity c with the processing type *p* are not available for the assessment and a $PF_{cps}$ is not available;
Case 3: Occurrence data on the commodity *c* with the processing type *p* are not available for the assessment and a $PF_{cps}$ is available.

Where

- $HQ_{is}$ is the hazard quotient of individual *i* for the substance *s*;
- Commodities is the set of raw primary commodities as listed in Table 1 (Section 6.1.1.1);
- $Processes_c$ is the set of processes related to the commodities *c* for which specific consumption data is retained; the subset of processes for which occurrence data are also retained for the assessment is listed in Table 2 (Section 6.1.1.4);
- $RPC_{icp}$ is the average amount of commodity *c* with processing type *p* consumed by individual *i*, expressed in g of RPC (i.e. yield factor applied; Section 6.1.1.6); $RPC_{icp} = \sum_{d=1}^{n_{day}} RPC_{idcp}/n_{day_i}$
- $RPCD_{icp}$ is the average amount of commodity *c* with processing type *p* consumed by individual *i*, expressed in g of RPC derivative; $RPCD_{icp} = \sum_{d=1}^{n_{day}} RPCD_{idcp}/n_{day_i}$
- $n_{day_i}$ is the total number of days the individual *i* participated to the consumption survey;
- BW is the body weight of individual *i*, expressed in kg;
- $PF_{cps}$ is the processing factor for substance *s* in commodity *c* with processing type *p*;
- $ADI_s$ is acceptable daily intake for substance *s*, expressed in mg/kg body weight day;
- $X_{cps}$ is the imputed average concentration of the substance *s* for commodity *c* with processing type *p*, expressed in mg/kg, calculating $X_{cps}$ depending on the type of case:

$$X_{cps} = \sum_{z \in \text{Samples}_{cps}} \begin{cases} VAL_{zs} \cdot MWF_s; & \text{if Case A} \\ \frac{1}{2}\left(VAL_{zs}\right) \cdot MWF_s; & \text{if Case B} \\ \frac{1}{2} LOQ_{zs} \cdot MWF_s; & \text{if Case C} \\ \frac{1}{2}\left(\frac{1}{2} LOQ_{zs}\right) \cdot MWF_s; & \text{if Case D} \\ 0; & \text{if Case E} \end{cases} \Big/ n_{\text{Samples}_{cps}}$$

Case A: if the result for *z* is quantified, and the assignment of the residue definition to the active substance is *exclusive* (Section 6.1.1.3).
Case B: if the result for *z* is quantified, and the assignment of the residue definition to the active substance is *not exclusive* (Section 6.1.1.3).
Case C: if the result for *z* is not quantified, the use of the substance is authorised on the crop and the sample is within the randomly selected samples for which a positive concentration is imputed (Section 6.1.1.3), and the assignment of the residue definition to the active substance is *exclusive* (Section 6.1.1.3).
Case D: if the result for *z* is not quantified, the use of the substance is authorised on the crop and the sample is within the randomly selected samples for which a positive concentration is imputed (Section 6.1.1.3), and the assignment of the residue definition to the active substance is *not exclusive* (Section 6.1.1.3).

Case E: if the result for *z* is not quantified, the use of the substance is not authorised on the crop or the sample is not within the randomly selected samples for which a positive concentration is imputed (Section 6.1.1.3).

Where

- $Sample_{cps}$ is the set of samples of commodities *c* with processing type *p* analysed for the substance *s*;
- $n_{Samples_s}$ is the number of samples in the set $Sample_{cps}$;
- $VAL_{zs}$ is the quantified concentration in the sample *z* for the substance *s*;
- $LOQ_{zs}$ is the analytical limit of quantifications in the sample *z* for the substance *s*;
- $MWF_s$ is the molecular weight factor from the residue definition analysed to the substance *s*.

If the hazard quotient for individual *i* per substance *s* is above 1, the HBGV (ADI) is exceeded.
All extractions, simulations, imputations and calculations were programmed with SAS® Studio 3.82 (Enterprise Edition).

## 6.3 | Probabilistic dietary exposure assessment results

### 6.3.1 | Results of the acute exposure assessments

The acute probabilistic exposure assessment aims at estimating the probabilities of exceedance of the ARfD of a given active substance in different subpopulation groups of European consumers for which surveys (with more than 300 consumers) were reported to EFSA. Probabilistic methodology expands the scope of the acute exposure assessment by introducing the likelihood of exposure events. Results of the probabilistic assessment determine an exposure distribution, providing information both on the magnitude and frequency of individual exposures in the concerned population.

The probability of exceeding the ARfD is to be understood as a characterisation of the overall risk for each population group under assessment for the given survey considered and based on the actual consumption of 40 food commodities (see Section 6.1.1.1) by real consumers. The occurrence data considered on those 40 food commodities were those reported over the last 3-year cycle (i.e. years 2022, 2023 and 2024), where 367 active substances were quantified. For 64 active substances, the ARfD was deemed not necessary. Thus, an acute risk assessment calculation for these substances was considered unnecessary. For other 33 active substances (see Section 6.1.2.5), no ARfD was available so no assessment was carried out.

The acute probabilistic exposure assessment was therefore conducted for 270 active substances for which an ARfD was derived. Out of the 270 active substances, 55 substances resulted in a probability equal to or above 1 per million of individual consumer per day exceeding the ARfD (at the MB), in at least one survey. The results of the acute probabilistic risk assessment for these 55 substances are summarised in Table 5. It is reported as the middle bound (MB) (50th percentile) of the confidence interval for the percentage of individual consumer per day exceeding the ARfD. For each population class (adults, toddlers and other children), the minimum and the maximum value among different countries is presented in the table.

For example, for abamectin, it is shown that among the five surveys on toddlers, the middle-bound value for the percentage of individual-days exceeding the ARfD varies from a minimum of 0.0000% (i.e. less than 1 individual-day out of 1,000,000) in one country to a maximum of 0.0030% (i.e. 30 individual consumers per day out of 1,000,000) in another country. The actual countries can be retrieved from Appendix B – Annex IV – Table 4.4, where the minimum is reached in The Netherlands and in Finland, while the maximum is found in Bulgaria. This means that, in Bulgarian toddlers, the percentage of individual consumer per day exceeding the ARfD is estimated at 0.0030%. For the other toddler populations, the estimate is lower declining to 0.0000%.

Since the methodology is not fully stable among the years in which probabilistic has been applied, it is difficult to make some comparisons between the years. Maybe a simple comparison among the substance present in Table 5 for those with a probability exceeding the ARfD, accounting for 55 in 2024 vs. 59 in 2023.

In Appendix B – Annex IV and Annex V, detailed information on the probabilistic acute risk assessment is reported. In Annex III, information on the set of ARfD values used is provided and whether a primary or tentative value was selected; infographics by active substance, population group and countries are presented too.

**TABLE 5** Summary of the acute probabilistic risk assessment results.

| | Middle bound of the percentage of individual-days exceeding the ARfD[h] | | | | | |
|---|---|---|---|---|---|---|
| | Adults | | Other children | | Toddlers | |
| Active substance | Min[a] | Max[b] | Min[c] | Max[d] | Min[e] | Max[f] |
| 2-phenylphenol | 0.0000 | 0.0000 | 0.0000 | 0.0050 | 0.0000 | 0.0040 |
| Abamectin | 0.0000 | 0.0000 | 0.0000 | 0.0040 | 0.0000 | 0.0030 |
| Acetamiprid | 0.0070 | 0.0330 | 0.0660 | 0.1055 | 0.0650 | 0.2107 |
| Carbaryl | 0.0000 | 0.0040 | 0.0010 | 0.0120 | 0.0000 | 0.0400 |
| Carbendazim | 0.0000 | 0.0000 | 0.0000 | 0.0030 | 0.0000 | 0.0035 |

(Continues)

**TABLE 5** (Continued)

| | Middle bound of the percentage of individual-days exceeding the ARfD[h] | | | | | |
|---|---|---|---|---|---|---|
| | Adults | | Other children | | Toddlers | |
| Active substance | Min[a] | Max[b] | Min[c] | Max[d] | Min[e] | Max[f] |
| Carbofuran | 0.0050 | 0.0296 | 0.0115 | 0.0395 | 0.0175 | 0.0370 |
| Chlorate | 0.0000 | 0.0000 | 0.0010 | 0.0080 | 0.0125 | 0.0195 |
| Chlormequat | 0.0000 | 0.0000 | 0.0000 | 0.0010 | 0.0000 | 0.0060 |
| Cyhalothrin, gamma- | 0.0040 | 0.0240 | 0.0180 | 0.0585 | 0.0375 | 0.0840 |
| Cyhalothrin, lambda- | 0.0010 | 0.0100 | 0.0030 | 0.0140 | 0.0080 | 0.0220 |
| Cypermethrin, alpha- | 0.0940 | 0.1845 | 0.2191 | 0.4720 | 0.3125 | 0.6075 |
| Cypermethrin, zeta- | 0.0690 | 0.1415 | 0.1835 | 0.3790 | 0.2280 | 0.5167 |
| Cypermethrin, sum | 0.0080 | 0.0250 | 0.0380 | 0.1005 | 0.0505 | 0.1776 |
| Deltamethrin, cis- | 0.0000 | 0.0000 | 0.0000 | 0.0010 | 0.0000 | 0.0020 |
| Dieldrin | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0010 |
| Ethephon | 0.0160 | 0.0588 | 0.0536 | 0.1865 | 0.1485 | 0.2536 |
| Fenamiphos | 0.0000 | 0.0000 | 0.0000 | 0.0020 | 0.0010 | 0.0035 |
| Flonicamid | 0.0000 | 0.0000 | 0.0000 | 0.0020 | 0.0000 | 0.0020 |
| Fluazifop-P | 0.0000 | 0.0000 | 0.0000 | 0.0020 | 0.0000 | 0.0020 |
| Formetanate | 0.0000 | 0.0010 | 0.0005 | 0.0060 | 0.0020 | 0.0110 |
| Fosthiazate | 0.0000 | 0.0000 | 0.0000 | 0.0010 | 0.0010 | 0.0025 |
| Glufosinate | 0.0000 | 0.0060 | 0.0005 | 0.0050 | 0.0030 | 0.0120 |
| Imazalil | 0.0000 | 0.0015 | 0.0000 | 0.0040 | 0.0010 | 0.0100 |
| Indoxacarb | 0.0000 | 0.0035 | 0.0010 | 0.0090 | 0.0020 | 0.0100 |
| Mancozeb - dithios | 0.0000 | 0.0000 | 0.0010 | 0.0040 | 0.0030 | 0.0060 |
| Maneb - dithios | 0.0000 | 0.0000 | 0.0000 | 0.0020 | 0.0010 | 0.0090 |
| Methamidophos | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0010 |
| Methiocarb - dithios | 0.0000 | 0.0065 | 0.0000 | 0.0030 | 0.0000 | 0.0030 |
| Methomyl | 0.0000 | 0.0040 | 0.0000 | 0.0035 | 0.0000 | 0.0020 |
| Metiram - dithios | 0.0140 | 0.0540 | 0.0550 | 0.1132 | 0.0875 | 0.1350 |
| Nicotine | 0.0000 | 0.0000 | 0.0000 | 0.0010 | 0.0000 | 0.0020 |
| Oxamyl | 0.0090 | 0.0290 | 0.0150 | 0.0460 | 0.0210 | 0.0615 |
| Phosmet | 0.0330 | 0.1335 | 0.0920 | 0.1550 | 0.0750 | 0.1480 |
| Pirimicarb | 0.0000 | 0.0015 | 0.0000 | 0.0060 | 0.0010 | 0.0220 |
| Propiconazole | 0.0000 | 0.0000 | 0.0000 | 0.0005 | 0.0000 | 0.0010 |
| Propineb | 0.0000 | 0.0030 | 0.0050 | 0.0140 | 0.0090 | 0.0190 |
| Pyraclostrobin | 0.0000 | 0.0010 | 0.0000 | 0.0020 | 0.0000 | 0.0035 |
| Tebuconazole | 0.0000 | 0.0020 | 0.0000 | 0.0025 | 0.0010 | 0.0035 |
| Thiabendazole | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0010 |
| Thiophanate-methyl | 0.0000 | 0.0010 | 0.0000 | 0.0010 | 0.0000 | 0.0030 |
| Thiram - dithios | 0.0100 | 0.0420 | 0.0420 | 0.1010 | 0.0690 | 0.1200 |
| Ziram - dithios | 0.0000 | 0.0050 | 0.0080 | 0.0210 | 0.0120 | 0.0300 |
| Acephate[g] | 0.0000 | 0.0040 | 0.0000 | 0.0165 | 0.0000 | 0.0070 |
| Aldicarb[g] | 0.0060 | 0.0240 | 0.0080 | 0.0315 | 0.0080 | 0.0330 |
| Chlorpyrifos[g] | 0.0010 | 0.0075 | 0.0020 | 0.0095 | 0.0030 | 0.0121 |
| Dichlorvos[g] | 0.0000 | 0.0000 | 0.0000 | 0.0010 | 0.0000 | 0.0000 |
| Dimethoate[g] | 0.0280 | 0.0765 | 0.0590 | 0.1125 | 0.0500 | 0.1060 |
| Diniconazole-M[g] | 0.0000 | 0.0010 | 0.0000 | 0.0045 | 0.0000 | 0.0020 |
| Fenthion[g] | 0.0000 | 0.0010 | 0.0000 | 0.0040 | 0.0000 | 0.0040 |
| Heptachlor[g] | 0.0000 | 0.0060 | 0.0000 | 0.0050 | 0.0000 | 0.0070 |
| Omethoate[g] | 0.0000 | 0.0000 | 0.0000 | 0.0020 | 0.0000 | 0.0035 |
| Permethrin[g] | 0.0000 | 0.0020 | 0.0000 | 0.0020 | 0.0000 | 0.0030 |
| Propoxur[g] | 0.0000 | 0.0000 | 0.0000 | 0.0005 | 0.0000 | 0.0000 |

**TABLE 5** (Continued)

| Active substance | Middle bound of the percentage of individual-days exceeding the ARfD[h] | | | | | |
|---|---|---|---|---|---|---|
| | Adults | | Other children | | Toddlers | |
| | Min[a] | Max[b] | Min[c] | Max[d] | Min[e] | Max[f] |
| Prothiofos[g] | 0.0000 | 0.0010 | 0.0000 | 0.0075 | 0.0010 | 0.0030 |
| Triazophos[g] | 0.0000 | 0.0010 | 0.0000 | 0.0020 | 0.0000 | 0.0020 |

[a]Lowest estimated probability of exceeding the ARfD among the 15 adult populations.
[b]Highest estimated probability of exceeding the ARfD among the 15 adult populations.
[c]Lowest estimated probability of exceeding the ARfD among the 10 child populations.
[d]Highest estimated probability of exceeding the ARfD among the 10 child populations.
[e]Lowest estimated probability of exceeding the ARfD among the 5 toddler populations.
[f]Highest estimated probability of exceeding the ARfD among the 5 toddler populations.
[g]Active substance with a *tentative* ARfD.
[h]Even if the estimated probability is 0.0000% by the model, it does not mean the true probability on the real population is 0. Therefore, the probability should be considered close to zero.

The 10 pesticides with the highest estimated probability for an individual consumption-day to exceed the ARfD are discussed below, sorted in decreasing order of the maximum results for toddlers. A summary of the most contributing RPCs by substance is also discussed below but the reader is referred to Appendix B – Annex IV and Annex V for detail information by country.

*Cypermethrins (sum of isomers), alpha-cypermethrin and zeta-cypermethrin*

Cypermethrin is a mixture of eight isomers, consisting of four diastereomeric pairs of enantiomers: alpha, beta, theta and zeta. Three of these enantiomers, alpha-, beta- and zeta-cypermethrin, are active substances.

Cypermethrin (sum of isomers) was renewed for use in the EU in 2022.[101] Alpha-cypermethrin and zeta-cypermethrin are no longer approved in the EU, having been withdrawn in 2021 and 2020, respectively. However, according to the EFSA comprehensive MRL review of the authorised uses of cypermethrins (EFSA, 2023a), there are currently several MRLs based on codex maximum residue limits (CXLs) related to the uses of cypermethrin, alpha-cypermethrin and zeta-cypermethrin, and import tolerances related to the uses of zeta-cypermethrin. Beta-cypermethrin was never approved in the EU and as such not considered in the assessment.

Since the four active substances share the same unspecific residue definition – *cypermethrin including other mixtures of constituent isomers (sum of isomers)*, different exposure scenarios were built by imputing the concentrations reported in monitoring data to each active substance individually. This approach is considered conservative[102] for alpha-cypermethrin – the scenario resulting in the most critical estimations, as it is no longer approved in the EU and represents roughly 20% of the content in cypermethrin (sum of isomers).

Given the unspecific residue definition for these substances with varying potencies and approval status, EFSA was mandated to recalculate the MRL values of cypermethrin (sum of isomers) and zeta-cypermethrin into alpha isomer taking into account the isomeric composition in the technical mixtures (EFSA, 2025c). Thus, the EURLs[103] developed a chiral method to quantify the alpha isomer individually. Proficiency tests at EU level (EUPTs) are currently ongoing to ensure that enforcement laboratories are capable of quantifying the different isomers.[104]

Regarding the approved *cypermethrins (sum of isomers)*, the exposure estimation is mainly driven by barley malt and wheat (in the form of semolina, or flour semi-refined), for which PF were available. There is also a substantial contribution from unprocessed foods such as apple, spinaches and lettuces. Table grape juice also contributes to the risk in a number of population groups despite the availability of a processing factor (see Appendix B – Annex IV).

In the EFSA comprehensive MRL review (EFSA, 2023a) of the authorised uses of cypermethrins, the lowering of the MRLs for barley, wheat and table grapes is proposed for risk managers' consideration. No safe uses were identified for apples, lettuces and spinaches, so EFSA recommended to lower the MRLs for these commodities to the LOQ value.

These recommendations will enable risk managers to implement targeted measures to reduce the exposure to these substances.

[101]Regulation (EU) 2021/2049 of 24 November 2021 renewing the approval of the active substance cypermethrin as a candidate for substitution in accordance with Regulation (EC) No 1107/2009 of the European Parliament and of the Council concerning the placing of plant protection products on the market and amending the Annex to Commission Implementing Regulation (EU) No 540/2011. OJ L 420, 25.11.2021, p. 6–13.
[102]EFSA is exploring a possible refinement of this methodology by using the information available from the EFSA MRL review (EFSA, 2023a) to impute monitoring data in a manner that reflects the currently authorised uses, import tolerances and CXLs of cypermethrins (sum of isomers), alpha- and zeta-cypermethrin.
[103]https://www.eurl-pesticides.eu/library/docs/srm/EurlSrm_Observation_Cypermethrins_with_LC-MSMS.pdf.
[104]https://food.ec.europa.eu/document/download/a775e38d-ca62-44bf-a000-1f239a454e67_en?filename=sc_phyto_20251124_ppr_sum.pdf.

*Ethephon*

The exposure estimates are mainly driven by bananas followed by tomatoes, sweet/bell peppers and table grapes. Consumption events of unprocessed commodities contributed more to the overall exposure than those of the processed ones.

According to EFSA, only uses on tomatoes and table grapes were authorised (EFSA, 2009, 2024b).

The MRL of 1 mg/kg on table grapes is based on an EU use with the highest field trial concentration reported at 0.56 mg/kg. Over the 3-year period, 270 samples were reported with concentration values ranging from 0.014 mg/kg to 3 mg/kg. Of those, results above 0.56 mg/kg but below the MRL value may lead to exceedances of the ARfD according to the IESTI equation methodology applied.[105]

The MRL of 2 mg/kg on tomatoes is supported by JMPR supervised field trials, where the highest residue reported was 0.79 mg/kg. Over the 3-year period, 132 samples were reported with concentrations ranging from 0.017 mg/kg to 5.2 mg/kg. Of those, results above 0.79 mg/kg but below the MRL value may lead to exceedances of the ARfD according to IESTI equation methodology applied.[105]

For bananas[106] and sweet/bell peppers,[107] no authorisation was granted nor any emergency authorisation.[108] The Regulation PLAN/2024/1305 not yet applicable drops the MRL from 0.05* to 0.01* (both at the LOQ). Competent authorities are recommended to investigate further these findings, especially France in the case of bananas and Poland in the case of sweet/bell peppers.

*Acetamiprid*

The probability of exceeding the ARfD of acetamiprid is driven the most by apples, pears, table grapes, mandarins, tomatoes, spinach, cucumbers, peaches and sweet/bell peppers. This substance was authorised for these uses in the 3-year cycle.

Among the five surveys on toddlers, the middle-bound value for the percentage of individual-days exceeding the ARfD varied from a minimum of 0.0650% to a maximum of 0.2107%. However, the calculations were conducted with the new HBGV endorsed in September 2024 (EFSA, 2024d) – nearly towards the end of the monitoring period covered by this report (2022–2024). If the previous HBGV value, five times higher than the new one, had been applied, the MB percentages would have resulted in lower values. Based on the new toxicological assessment, risk managers agreed on the lowering of the MRL on apples, pears, table grapes, tomatoes, spinaches, cucumbers, peaches and sweet/bell peppers, among others with entry into force in 2025 under Regulation (EU) 2025/158[109] and Regulation (EU) 2025/1212,[110] replacing Regulation (EU) 2019/88.[111]

*Phosmet*

The probability of exceeding the ARfD of phosmet is driven by olive oil, apples (raw and juice), followed by peaches (raw and juice) and raw pears.

Processing factor is available for apple juice, while none is available for peach juice. Given that the active substance is not systemic, not accounting for the effect of the eventual washing or peeling of those commodities when eaten raw may lead to an overestimation in the risks.

A decrease of the percentage of individuals-day exceeding the ARfD is observed compared with previous two last year results. On the 15th of September 2023, Regulation (EU) 2023/1029[112] lowered all MRLs to the LOQ, including those based on CODEX,[113] and the substance was moved to Annex V of Regulation (EC) 395/2005.

All quantified results[114] were reported on samples with EU as origin. Despite the decreasing tendency on the findings, EFSA recommends MSs to be vigilant to the presence of this pesticide on their markets.

[105]This divergency is resulting from the methodology in place in the IESTI equation (EFSA, 2015c; FAO, 2017), and from the gap between the highest residue used in supervised field trials and the MRL derived.

[106]Thirty-four samples in 2022 and three samples in 2024 were quantified on ethephon ranging the concentration values from 0.082 to 42 mg/kg with origin France, mainly from their overseas territories. All had administrative consequences.

[107]In 2024, 12 samples were quantified mostly all with origin Poland. In 2023, the two samples reported were coming one from Germany and the other from Türkiye. From the 14 samples reported in 2022, all had origin Poland. The range of concentrations reported went from 0.027 to 27.2 mg/kg, all with administrative consequences, lot recall from the market or RASFF notification.

[108]https://ec.europa.eu/food/plant/pesticides/eu-pesticides-database/ppp/screen/home.

[109]Commission Regulation (EU) 2025/158 of 29 January 2025 amending Annex II to Regulation (EC) No 396/2005 of the European Parliament and of the Council as regards maximum residue levels for acetamiprid in or on certain products. OJ L, 2025/158, 30.1.2025.

[110]Commission Regulation (EU) 2025/1212 of 24 June 2025 amending Annex II to Regulation (EC) No 396/2005 of the European Parliament and of the Council as regards maximum residue levels for acetamiprid in or on certain products. OJ L, 2025/1212, 31.7.2025.

[111]Commission Regulation (EU) 2019/88 of 18 January 2019 amending Annex II to Regulation (EC) No 396/2005 of the European Parliament and of the Council as regards maximum residue levels for acetamiprid in certain products. OJ L 22, 24.1.2019, pp. 1–12.

[112]Commission Regulation (EU) 2023/1029 of 25 May 2023 amending Annexes III and V to Regulation (EC) No 396/2005 of the European Parliament and of the Council as regards maximum residue levels for phosmet in or on certain products. OJ L 139, 26.5.2023, p. 15–27.

[113]https://www.fao.org/fao-who-codexalimentarius/codex-texts/dbs/pestres/pesticide-detail/en/?p_id=103.

[114]Total quantified results for the given exposure estimates in the 3-year cycle were 194 results in 2022, 52 results in 2023 and 20 results in 2024.

*Dithiocarbamates (maneb, mancozeb, metiram, propineb, thiram and ziram, expressed as $CS_2$)*

The six active substances share a common unspecific residue definition 'dithiocarbamates (expressed as $CS_2$, including maneb, mancozeb, metiram, propineb, thiram and ziram)'.

In 2024, only ziram was approved in the EU. On 28 November 2024, the grace period for the use of metiram expired in accordance with the decision of non-renewal of the approval.[115] According to the EFSA comprehensive MRL review of dithiocarbamates (EFSA, 2023c), import tolerances for mancozeb and CXLs for maneb were also in place. Thus, only the four approved precursors were considered.

Lacking a specific analytical method for determining each precursor individually, $CS_2$ concentrations reported in the occurrence data were assigned to each active substance, resulting in four exposure scenarios.

The highest exposure estimation was calculated for metiram. The results were mainly driven by apple and pears, head cabbages, lettuces, broccoli and cauliflowers. In the MRL review (EFSA, 2023c), no EU uses nor import tolerances on head cabbages, broccoli and cauliflower were reported for metiram, meaning that these results might be an overestimation. In any case, a lowering of the MRL was proposed for head cabbage, apples, pears and lettuces in the EFSA's reasoned opinion. Broccoli and cauliflowers are known for containing $CS_2$ background levels accounted in the MRLs. The outcome of the MRL review is still under discussion by risk managers and risk management decisions are expected to reduce the exposure in the upcoming years.

*Dimethoate*

Dimethoate was not renewed since 2019[116] and all MRLs were lowered at the LOQ (EFSA, 2016), because a genotoxic potential could not be ruled out (EFSA, 2017; EFSA, 2018d) preventing the setting of HBGVs. Nevertheless, a '*tentative*' risk assessment using an ARfD based on acetylcholinesterase inhibition was performed and exceedances of this ARfD were driven by apples, oranges and mandarins followed by peaches, cucumbers, sweet/bell peppers and olive oil for a number of population groups (see Appendix B – Annex IV). However, any quantification[117] of this active substance can be considered as a misuse and a potential health risk. EFSA recommends risk managers to take the necessary measures[97] to ensure that food containing this substance is either not placed or withdrawn from the market.

*Gamma-cyhalothrin*

Gamma-cyhalothrin and lambda-cyhalothrin share the same residue definition, *lambda-cyhalothrin (includes gamma-cyhalothrin) (sum of R,S and S,R)*. As for other active substances sharing an unspecific residue definition, EFSA has built two scenarios, one assigns the reported concentrations to gamma-cyhalothrin and the other to lambda-cyhalothrin. For gamma-cyhalothrin, the exposure estimates are mainly driven by mandarin juice, peaches, lettuce and apple juice, followed by bananas and spinaches. However, in the MRL review of gamma-cyhalothrin (EFSA, 2024c), no uses on these commodities were notified to EFSA. Only a CXL on mandarins was legally implemented. These results are mentioned to cover unlikely cases of Member States granting an authorisation on gamma-cyhalothrin covered by the established MRL based on lambda-cyhalothrin.

*Oxamyl*

The exposure estimation for oxamyl was mainly driven by potatoes, carrots and cucumbers, followed by head cabbages and strawberries.

The withdrawal by Member States of authorisations on this substance (EFSA, 2023b; EFSA, 2024a) accounting for the grace period was set on 30 September 2023.[118] Regulation (EU) 2024/331[119] lowering the MRLs for oxamyl at LOQ values (further than 0.01 mg/kg for most of the commodities) entered into force on 11 May 2024. Therefore, a reduced presence of this substance in products placed in the EU market and the corollary decrease in exposure estimations is expected in future reference periods. In the meanwhile, competent authorities are recommended to stay vigilant to this not approved active substance.

[115]Commission Implementing Regulation (EU) 2023/2455 of 7 November 2023 concerning the non-renewal of the approval of the active substance metiram, in accordance with Regulation (EC) No 1107/2009 of the European Parliament and of the Council and amending Commission Implementing Regulation (EU) No 540/2011. OJ L, 2023/2455, 8.11.2023.

[116]SANTE/11494/2018. https://ec.europa.eu/food/plant/pesticides/eu-pesticides-database/backend/api/active_substance/download/112.

[117]Dimethoate was quantified over the 3-year cycle in 47 samples in 18 different commodities among the 40 selected under this assessment.

[118]Commission Implementing Regulation (EU) 2023/741 of 5 April 2023 concerning the non-renewal of the approval of the active substance oxamyl, in accordance with Regulation (EC) No 1107/2009 of the European Parliament and of the Council and amending Commission Implementing Regulation (EU) No 540/2011. OJ L 98, 11.4.2023, p. 1–3.

[119]Commission Regulation (EU) 2024/331 of 19 January 2024 amending Annexes II and V to Regulation (EC) No 396/2005 of the European Parliament and of the Council as regards maximum residue levels for oxamyl in or on certain products. OJ L, 2024/331, 22.1.2024.

*Carbaryl*

The probability of exceeding the ARfD for carbaryl is driven by the consumption of rice,[120] with a minor contribution to the exposure of raw dried beans and apples (raw and juice).

Carbaryl is a non-approved substance since 2007. Regulation (EU) 1096/2014[121] sets the MRLs for most commodities at the LOQ, including those of rice, beans (dry) and apples. It was quantified in 17 samples in 2022, five samples in 2023 and five samples in 2024. All samples, except four, originated from third countries or had origin unknown.

Carbaryl will be included in a mandate to EFSA[122] to provide a targeted review of MRLs of several non-approved active substances, where the quality of the existing HBGV will be screened together with an investigation of the current MRLs. Meanwhile, competent authorities are recommended to stay vigilant to the presence of this non-approved substance on the market and to take the necessary measures if quantified in any product.

*Carbofuran*

For carbofuran, the exposure estimates are driven by beans with pods, strawberries, tomatoes and sweet/bell peppers. Most of the samples have as origin a third country. EFSA recommends Member States to monitor this substance on import control checks.

Regulation (EU) 2015/399[123] lowered the MRLs for this non-approved active substance to the lowest achievable analytical LOQ, which, for some commodities, was below the default MRL of 0.01* mg/kg. Thus, EFSA recommends risk managers to take the necessary measures to ensure that food containing this substance is either not placed or withdrawn from the market.

*Summary*

Among the 367 quantified active substances considered in this probabilistic acute risk assessment, for 33, no ARfD value was available at the time of the assessment, and for 64 substances, an ARfD was deemed not necessary. For 215 active substances, the probability of exceeding the ARfD was less than one individual consumer per day out of 1,000,000 based on the middle bound (median estimate) of the confidence interval. For the remaining 45 substances, aside from the cases handled above, the probability of exceedance of the ARfD ranges from 0.001% to 0.033%.

The probabilistic approach is modelling the sampling variability to give a plausible confidence interval for the estimates analysed. The details on the confidence interval are reported in Appendix B – Annexes IV and V.

It is important to note that the assessment is still subject to additional uncertainties that may either overestimate or underestimate the exposure estimates provided above.

For cypermethrins and dithiocarbamates – substances among those with the highest estimated probability of an individual consumer per day to exceed the ARfD – some of the exposure scenarios presented might be overestimations as their isomers or precursors share a common unspecific residue definition and are under different approval status. EFSA still needs to improve the methodology to better account for this uncertainty. However, the availability of specific analytical methods to determine each of the isomers or precursors of these substances would particularly help to reflect exposure estimates more realistically. These substances are also under discussion by risk managers and the measures to be taken are expected to decrease the estimated exposure.

Recent (i.e. in 2023) withdrawal authorisations and lowering of MRLs below the default LOQ of 0.01 mg/kg for phosmet and oxamyl, as well as the lowering of MRLs of some approved active substances (e.g. acetamiprid) are expected to decrease the exposure estimates by the year-cycle 2024–2026.

There are, however, some considerations that might lead to an underestimation of the probability of exceeding the ARfD, such as the restriction of the consumption data to only 36 highly consumed commodities,[124] instead of whole diets; and the use of the residue definition for enforcement and not for risk assessment (where additional metabolites may contribute to the toxicity e.g. phosmet) in the calculations.

The uncertainty related to the representativeness of the consumption data used in the model could either increase or decrease the calculated exposure estimates; the lack of processing factors for consumption events of processed foods and the use of the yield factors converting the quantity of RPCD into RPC could overestimate these too.

EFSA is finalising an update on the RPC model. It will include a more refined and complete list of raw primary commodities (RPCs) and derivatives (RPCDs), a more accurate disaggregation of composite food into their RPCs and RPCDs, an

[120]Contribution of rice is presented in Table 4.6 of the Annex IV only. Extreme upper tail consumers are not presented in Table 4.7 of the Annex IV as it is the case for the one sample of rice driving every exceedance with a concentration of 16 mg/kg, being of the origin Madagascar. The MRL for rice is 0.01*.

[121]Commission Regulation (EU) No 1096/2014 of 15 October 2014 amending Annexes II, III and V to Regulation (EC) No 396/2005 of the European Parliament and of the Council as regards maximum residue levels for carbaryl, procymidone and profenofos in or on certain products. OJ L 300, 18.10.2014, pp. 5–38.

[122]https://food.ec.europa.eu/document/download/18c6408f-86d3-4dda-b89f-b3438998c99e_en?filename=sc_phyto_20221121_ppr_sum.pdf.

[123]Commission Regulation (EU) 2015/399 of 25 February 2015 amending Annexes II, III and V to Regulation (EC) No 396/2005 of the European Parliament and of the Council as regards maximum residue levels for 1,4-dimethylnaphthalene, benfuracarb, carbofuran, carbosulfan, ethephon, fenamidone, fenvalerate, fenhexamid, furathiocarb, imazapyr, malathion, picoxystrobin, spirotetramat, tepraloxydim and trifloxystrobin in or on certain products. OJ L 71, 14.3.2015, p. 1–55.

[124]36 in respect of the 40 taken, not considering food for infants and young children.

updated list of surveys covering any up-to-date food consumption survey reported to EFSA until 2025 and a faster update methodology for including new surveys when reported to EFSA. In future years, this new model will be used.

Moreover, the non-consideration of the effect of washing of commodities eaten raw and the allocation of an unspecific residue definition to the different active substance in a given proportion that may not be the real one may also overestimate the exposure calculations.

### 6.3.2 | Results of the chronic exposure assessments

In the chronic probabilistic modelling, the risk of real consumers is calculated based on their own individual dietary pattern. This allows capturing the distribution of the exposure, including the high end of the distribution for extreme levels of exposure within consumer population subgroups. The probability of exceeding the ADI is, therefore, to be understood as the percentage of high consumers in the population group under assessment exceeding the ADI in a long-term period (Section 6.2).

The assessment covered 367 active substances quantified in the 3-year cycle. For 33 of these active substances, no ADI was available at the time of this assessment (see Section 6.1.2.5). Therefore, the chronic probabilistic exposure assessment was finally conducted for 334 active substances for which an ADI was derived (or any other HBGV for chronic intake assessment such as TDI).

The only substance for which at least one subject out of 1,000,000 has an exposure exceeding the ADI at the MB in at least one population group was pyrimethanil. For all the other substances (i.e. 333), the model shows that less than one subject out of 1,000,000 exceeds the ADI at the MB.

Pirimiphos-methyl showed for some population groups a percentage of consumers exceeding the ADI above or equal to 1 subject out of 1,000,000 at the upper bound of the confidence interval, i.e. 0.584% for toddlers in Bulgaria and 0.024% for adults in Germany.

To describe the magnitude of the exposure to those two active substances, Table 6 provides the exposure levels obtained from this analysis at 50th, 95th, 99th, 99.9th percentiles. Only the above two substances and the population groups with identified exceedances are reported. A value of 100% in the columns dedicated to the exposure at the four percentiles of interest corresponds to an exposure equal to the ADI. In the last two columns of the table, the percentage of consumers exceeding ADI at the middle bound of the 95% confidence intervals is also reported (for both middle bound and upper bound scenarios; Section 6.2). The table has been extracted from Appendix B – Annex VI – Table 6.4.

For the remaining 333 active substances, the percentage of consumers exceeding the ADI is estimated to be less than 1 subject out of 1,000,000 for every population group analysed.

**TABLE 6** Exposure of median (50th Pctl) and high-end consumers (P95th Pctl, 99th Pctl, 99.9th Pctl) in terms of percentage of ADI and percentage of individuals exceeding the ADI for pyrimethanil and pirimiphos-methyl; MB and UB describe the 50th and 97.5th percentiles of the 95% confidence interval of the chronic exposure estimate.

| Substance | Population class | Country | 50th Pctl exposure (MB) (% of ADI) | 50th Pctl exposure (UB) (%of ADI) | 95th Pctl exposure (MB) (%of ADI) | 95th Pctl exposure (UB) (%of ADI) | 99th Pctl exposure (MB) (%of ADI) | 99th Pctl exposure (UB) (%of ADI) | 99.9th Pctl exposure (MB) (%of ADI) | 99.9th Pctl exposure (UB) (%of ADI) | Percentage of consumers exceeding ADI (MB) (%) | Percentage of consumers exceeding ADI (UB) (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pyrimethanil | Other children | BE | 2.9 | 3.4 | 15.9 | 24.2 | 42.7 | 75.5 | 182.8 | 344.1 | 0.3200 | 0.8000 |
| Pyrimethanil | Other children | BG | 1.1 | 1.2 | 32.3 | 45.4 | 67.6 | 107.0 | 161.8 | 220.3 | 0.4619 | 1.2702 |
| Pyrimethanil | Other children | FI | 6.2 | 11.4 | 64.1 | 72.4 | 97.4 | 132.3 | 160.8 | 176.6 | 0.8000 | 1.6667 |
| Pyrimethanil | Other children | NL | 3.6 | 4.2 | 31.1 | 35.3 | 59.9 | 80.2 | 98.8 | 127.7 | 0.1045 | 0.5747 |
| Pyrimethanil | Toddlers | BG | 1.4 | 1.8 | 38.7 | 51.7 | 82.7 | 109.5 | 127.8 | 158.1 | 0.9346 | 1.8692 |
| Pyrimethanil | Toddlers | FI | 1.6 | 1.9 | 15.1 | 26.4 | 56.6 | 83.2 | 154.5 | 237.3 | 0.2000 | 0.6000 |
| Pyrimethanil | Toddlers | NL | 4.6 | 5.4 | 29.1 | 53.1 | 101.7 | 133.4 | 127.0 | 137.7 | 1.2422 | 2.7950 |
| Pirimiphos-methyl | Adults | DE | 0.71 | 0.88 | 1.92 | 2.78 | 2.90 | 4.55 | 5.27 | 9.83 | 0.0000 | 0.0240 |
| Pirimiphos-methyl | Toddlers | BG | 3.4 | 4.1 | 6.2 | 8.0 | 8.2 | 14.2 | 48.4 | 121.7 | 0.0000 | 0.5841 |

Focus is put in the below considerations to the commodities contributing the most to the exceedance of the ADI. To have an overview to the contributors of the exposure above the 99th percentile please check Appendix B – Annex VI – Table 6.7.

*Pyrimethanil*

The exposure to pyrimethanil is mainly due to consumption events of mandarin juice, with an average concentration of 0.524 mg/kg in raw mandarins, for which a processing factor is not available in the PF database (Kittelmann et al., 2025). The new HBGV derived by EFSA (EFSA, 2024e), but not yet legally implemented, was used in the calculations. If the previous ADI had been used (13 times higher), the estimations would have resulted in a lower probability of exceedances. It is expected that EFSA will review the MRLs for this active substance.

Pyrimethanil is an approved active substance, used as post-harvest treatment. According to the MRL review (EFSA, 2011b), an import tolerance is authorised as a post-harvest use on citrus fruits with an MRL of 8 mg/kg. Pyrimethanil is not a systemic substance; hence, it is expected that residues will decrease after washing and peeling. However, since the probability of exceeding the ADI in the seven populations included in Table 6 is due to consumption of juice, processing factors for mandarin juice should be provided to refine the exposure calculations. Nonetheless, a PF of 0.05 was derived for peeled mandarin (Kittelmann et al., 2025) and another one of 0.01 by JMPR (FAO, 2007), which indicates the possibility of refining this exceedance.

*Pirimiphos-methyl*

The only two exceedances of the ADI at the upper bound are linked to wheat germ[125] (for which a processing factor was not available) and its high consumption in the following surveys by one consumer:

- For adults in Germany, the exceedance is linked to a high consumption (180 g/day) of wheat germ by one consumer.
- For toddlers in Bulgaria, the exceedance is linked to a high consumption of wheat germ (30 g/day) by one consumer.

Despite the percentage of consumers exceeding the ADI for this substance is less than 1 subject out of 1,000,000 in the MB, in view of the ongoing renewal, EFSA recommends FBO deriving PF for processed wheat.

*Summary*

Among the 367 quantified active substances considered in this probabilistic chronic risk assessment, for 33, no ADI (or other HBGV for chronic intake) was available at the time of the assessment. For the remaining 334 active substances, an individual chronic probabilistic exposure assessment was conducted.

For 333 of the 334 assessed active substances, the probability of consumers exceeding the ADI was estimated to be less than 1 subject out of 1,000,000 for all population groups analysed, based on the middle bound of the confidence interval. This indicates that, for most substances, long-term dietary exposure is unlikely to pose a concern for European consumers.

However, as is the case in the acute exposure results (Section 6.3.1), these estimates are subject to multiple uncertainties that may either underestimate or overestimate the exposure.

For pyrimethanil, exceedances of the ADI were identified at the middle bound in several surveys (i.e. other children and toddlers), driven mainly by the consumption of mandarin juice, for which processing factor was not available. For pirimiphos-methyl, exceedances were observed only at the upper bound of the confidence interval and were linked to single high-consumer individuals in two surveys, associated with wheat germ consumption for which no processing factor is available.

The probabilistic approach models sampling variability and provides plausible confidence intervals around the exposure estimates. Detailed information on the exposure distributions, confidence intervals and contributing food commodities is reported in Appendix B – Annex VI.

*Overall*

The probabilistic approach analyses the exposure of real consumers. Therefore, it provides realistic estimates for extreme consumers and gives a clearer view on the probability that certain consumers within the population might be at risk. It has been found a precise model to estimate European consumers' risk to single pesticide despite still some uncertainties remain.

In the samples analysed in the framework of 2022–2024 monitoring programmes, the estimated acute and chronic dietary exposure to individual substances for which HBGVs are available is below these values for most of the 30 EU subpopulation groups assessed including adults, children and toddlers. Thus, the risk to EU consumer' health associated with individual pesticide substances is considered to be low. There is a given number of substances for which the estimated exposure exceeded the HBGV for certain consumers. Multiple uncertainties that can underestimate or overestimate the exposure are not accounted for. Previous assessments on the risk derived from cumulative exposure to pesticides affecting the nervous system (EFSA, 2020a), the thyroid (EFSA, 2020b) and the craniofacial alterations (EFSA, 2022), where these uncertainties were accounted, concluded that the threshold for regulatory consideration established by risk managers, was not exceeded.

[125]Wheat germ is converted to wheat by a factor of 50. Appendix B – Annex VI, Table 6.7 provides the amount consumed and the correspondent amount in the raw primary commodity conversion.

# 7 | CONCLUSIONS AND RECOMMENDATIONS

The 2024 EU report on pesticide residues in food, prepared by EFSA in accordance with Article 32 of Regulation (EC) No 396/2005, provides an overview of the official control activities on pesticide residues carried out in the EU Member States,[1] Iceland and Norway. Visuals of the results are presented in Appendix B – Annex I.[2]

A total of 125,882 samples were analysed (including EU MACP, MANCP and increased import control programmes).

EU MACP and MANCP accounted for 86,449 samples, a decrease of 17% compared to the 104,400 samples in 2023. 96.7% of these samples (83,591) fell within the legal limits, being the same figure as in previous years (96.3% in 2023 and in 2022); 58.4% (50,524 samples) did not contain quantifiable residues (results below the LOQ for each pesticide analysed), while 38.3% contained quantified residues not exceeding the legal limits (33,067 samples). The MRL exceedance rate (3.3%) slightly decreased compared with 2023 (3.7%) (2858 samples). When considering measurement uncertainty, 1.8% (1591 samples) were non-compliant, triggering legal sanctions or enforcement actions. When comparing the non-compliance rate in 2024 with that of the previous year (not accounting for samples from the increased import control programmes), it was slightly higher than in 2023 (1.5%), but lower than in earlier years (2.1% in 2022 and 2.4% in 2021).

Of the 86,449 samples, 66.6% (57,574) were reported as produced in one of the reporting countries, while 21.0% (18,184 samples) were reported as produced in a third country. The MRL exceedance (8.3%) and non-compliance rates (5.2%) in food coming from third countries were four times higher than in food products grown in one of the reporting countries. The remaining 12.4% (10,691 samples) were reported as of origin unknown, a high rate compared to last year (4%). Of these, 0.5% (54 samples) led to non-compliances.

By food products, the quantification and MRL exceedance rates were lower in organic food compared to conventionally produced food (i.e. non-organic) for all food product categories except for animal products. This finding was, however, due to copper, a substance authorised in organic farming, having other uses such as feed supplement and fertiliser, and for which the quantifications are more frequent.

Regarding samples of food for infants and young children in addition to copper, fosetyl and chlorate were responsible for most of the exceedances. These three substances have uses other than as plant protection products.

The 2024 EU MACP random sampling programme of 12 of the most consumed commodities by European citizens listed in Regulation (EU) 2023/731 (i.e. aubergines/eggplants, bananas, broccoli, cultivated fungi, grapefruits, melons, sweet peppers/bell peppers, table grapes, virgin olive oil, wheat grain, bovine fat and chicken eggs) provides a snapshot of the level of pesticide residues in those food products aiming to represent the EU market. These were compared with the same food products as sampled in 2021 and 2018 EU monitoring programmes.

Of the total, 9842 samples were reported under the EU MACP and analysed on average for 200 pesticide residues. In 43.1% of those (4241 samples), no quantifiable residues were reported (residues were below the LOQ). The number of samples with pesticide residues within legally permitted levels (at or above the LOQ but below or at the MRL) was 54.5% (5367 samples). MRLs were exceeded in 2.4% (234 samples), of which 1.2% (113 samples) were found to be non-compliant after considering measurement uncertainty (the same compliance rate as in 2021 for the same commodities sampled).

The overall MRL exceedance rate increased from 1.4% in 2018 to 2.1% in 2021 and 2.4% in 2024. Among individual food commodities, the MRL exceedance rate rose the most in sweet peppers/bell peppers (from 2.4% in 2018 to 3.4% in 2021, to 4.7% in 2024) followed by table grapes (from 2.6% in 2018 to 2.1% in 2021, to 4.3% in 2024), virgin olive oil (from 0.6% in 2018 to 0.3% in 2021, to 2.5% in 2024), aubergines/eggplants (from 1.6% in 2018 to 2.1% in 2021, to 2.2% in 2024) and chicken eggs (from 0.1% in 2018 to 0% in 2021 to 1.4% in 2024). In cultivated fungi, the MRL exceedance rate increased from 2018 (1.2%) to 2021 (2.2%) and remained unchanged in 2024 (2.2%). The exceedance rate in grapefruit was still high in 2024 (3.7%) but much lower than in 2021 (9.9%).[126] In broccoli, the MRL exceedance rate in 2024 (2.2%) was the highest compared to the previous two cycles (2.0% in 2018 and 1.7% in 2021). The same was observed in bovine fat where the highest rate was in 2024 (0.2%) compared to 0.1% in 2018 and 0.05% in 2021. An increase in the melons' exceedance rate of 1.8% was also observed in 2024 compared to 1.3% in 2021, but lower than in 2018 (2.2%). In bananas and in wheat, the rates were lower in 2024 (1.6% and 0.5%, respectively) than in 2021 (2.3% and 1.5%, respectively) and in 2018 (1.7% and 0.6%, respectively).

On average, out of the total EU MACP samples, 75.9% were from one of the reporting countries, 20.1% from third countries and 4.0% of unknown origin. The percentages were similar to results in 2021 (76.1%, 19.6% and 4.3%, respectively), where the same food products were sampled. The MRL exceedance (4.8%) and non-compliance rates (2.6%) in samples coming from third countries were three times higher than in food products grown in one of the reporting countries.

From the increased import control programme, 39,433 samples were reported to EFSA, an increase of 39% when compared to 2023. A shift towards more import controls is, therefore, noticed. 3.6% were found to be non-compliant when considering the measurement uncertainty. These controls are applied to consignments still not having entered the EU market. Thus, they were stopped at the border if results were found to exceed the EU MRLs.

The results from the monitoring programmes are a valuable source of information for estimating the dietary exposure of EU consumers. An analysis of the acute and chronic estimated intake of residues to consumers was performed using probabilistic exposure modelling. The results provide the probability for different subpopulations of European consumers to exceed the HBGV when exposed to pesticide residues in their diet. Unlike deterministic calculations, probabilistic modelling reflects better the actual exposure resulting from consumption events.

[126]In 2021, the exceedance rate of 9.9% was due to high findings in grapefruits coming from Türkiye (EFSA, 2023d). This combination of commodity and country of origin remains since then under Regulation (EU) 2019/1793 on increased import control (see Section 5).

The number of active substances subject to dietary exposure assessment amounted to 367, corresponding to the number of substances that were quantified at least once in any of the 40 raw commodities of plant origin in the 2022–2024 monitoring programmes.

The probabilistic acute risk assessment could not be calculated for 33 active substances for which no ARfD value was available at the time of the assessment. Out of the 334 active substances assessed, for 279, the probability of exceeding the ARfD is estimated to be less than one individual consumer per day out of 1,000,000 for the 40 commodities and 30 surveys covering 30 European sub-population groups in 17 EU MSs.

The highest estimated probability of exceeding the ARfD was calculated for cypermethrins residue definition (when all quantifications were imputed to either alpha-, zeta- isomers or cypermethrin sum of isomers), ethephon, acetamiprid, phosmet, dithiocarbamates residue definition (when all quantifications were imputed to either metiram or ziram), dimethoate, gamma-cyhalothrin, oxamyl, carbaryl and carbofuran. Risk manager discussions are ongoing for cypermethrins and dithiocarbamates, while actions for phosmet and oxamyl have already been taken as well as for gamma-cyhalothrin. For substances with long-standing non-approval status (dimethoate, carbaryl and carbofuran), actions from MS are required. For the remaining substances, the probability of exceedance ranged from 0.001% to 0.033%.

In the chronic probabilistic risk assessment based on the surveys used and their size, the probability to exceed the ADI at the middle bound was estimated to be less than one subject out of 1,000,000 for 333 out of 334 active substances. For the remaining substance, pyrimethanil, exceedances of the ADI resulted in a fraction of population equal to or above one subject per million in seven population groups. For pirimiphos-methyl, two populations exceeded the ADI only at the upper bound.

Overall, in the samples analysed in the framework of 2022–2024 monitoring programmes, the estimated dietary exposure to single pesticide residues for the substances for which a HBGV is available is unlikely to pose a health risk for most of the EU subpopulation groups assessed. Thus, the risk to EU consumers' health associated with individual substances is low. There are some substances for which the estimated exposure exceeded the HBGV for certain consumers. Previous assessments on cumulative exposure to pesticides affecting the nervous system, the thyroid and the craniofacial alterations concluded that the threshold for regulatory consideration established by risk managers was not exceeded.

Based on the 2024 findings of the pesticide monitoring programmes, EFSA draws the following recommendations:

- Wheat and virgin olive oil did not reach the minimum number of samples set in Annex II of the 2024 EU MACP Regulation. EFSA reiterates its previous years' recommendations to reporting countries to take the necessary measures to fulfil the minimum number of samples and the type of products regarding the 12 food commodities as well as the specific provisions on food for infants and young children and organic (as applicable).
- For samples reported under the 2024 EU MACP, the proportions of those quantified within legally permitted levels (54.5%) and those exceeding MRLs (2.4%) were higher than in 2021 (41.9% and 2.1%, respectively), while the non-compliance rate remained essentially unchanged (1.2% in 2024 vs. 1.3% in 2021). Sweet/bell peppers, table grapes and grapefruits were the commodities with the highest reported MRL exceedances, nearly 4% or higher, while chicken eggs and virgin olive oil were those where the MRL exceedance rates increased the most in comparison with 2021 and 2018. It is recommended to keep monitoring these commodities and to elucidate the reasons for these findings. Moreover, the misuse of non-approved active substances – nicotine and glufosinate – in the EU, and of approved ones on non-authorised commodities like ethephon in sweet/bell peppers and flonicamid in broccoli, should be further investigated.
- In the context of the EU MACP, the following pesticide/crop combinations leading to non-compliances should be further investigated by Member States and monitored over the different years to confirm their decrease in frequency:

  From findings on authorised uses in food products grown within the EU market:

  - copper in chicken eggs,
  - cypermethrin and formetanate in table grapes.

  From findings on non-authorised uses in food products grown within the EU market:

  - flonicamid in broccoli,
  - cyromazine in cultivated fungi, thiamethoxan in cultivated fungi – oyster mushrooms variety,
  - ethephon and iprovalicarb in sweet/bell peppers.

From findings on non-approved active substances with CXLs implemented in the EU legislation for food products originating from countries outside the EU internal market, the most frequent combination was glufosinate in grapefruits from South Africa.

From findings on non-authorised uses (neither in EU import tolerances nor CXLs), the combinations that most frequently lead to non-compliant results, all in food products with origin in Morocco, were:

- clofentezine, formetanate and tebufenpyrad in sweet peppers/bell peppers,
- thiabendazole in melons.

- The number of pesticides listed in the EU MACP Regulation that did not meet the minimum required number of analyses increased from 19 in 2021 to 86 in 2024. Compared with the previous year, the figure in 2024 is five times higher. EFSA recommends that reporting countries should intensify their efforts to ensure that all pesticides included in the EU MACP are properly monitored and clarify the reasons for the limited coverage observed this year.
- Considering the results of the national monitoring programmes (EU MACP and MANCP and excluding those of the temporary increased import controls), samples imported from third countries showed a fivefold higher non-compliance rate (5.2%) compared with food produced within the EU (1%). This rate has increased with respect to 2023, when it was 3.4%. The highest non-compliance rate was on pomegranates, lemons and tomatoes with origin Türkiye. Member State national authorities are recommended to keep monitoring pesticide residues in samples imported from third countries with a wide analytical scope.
- The proportion of samples with country of origin unknown increased over the last year, from 4% in 2023 to 12.4% in 2024. Among samples labelled as EU MACP, this proportion was equal to or above 10% for virgin olive oil and wheat, both bulked products. For samples taken under the national programmes, a 3.3% rate for unknown origin was reported for honey. Competent authorities and food business operators are recommended to take the necessary measures to comply with Regulation (EU) 1169/2011, Regulation (EU) 1308/2013 and Regulation (EU) 2023/2429, which set out the obligation of reporting the country of origin and guaranteeing traceability of the food placed on the market.
- When increased imported control samples are excluded, a decrease in the trend of non-compliance is observed over the years, 1.8% in 2024 vs. 2.2% in 2023 and 2.5% in 2022. Yet non-approved ethylene oxide (RD), chlorate (RD) and chlorpyrifos (RD) presented MRL exceedances higher than 0.5%. National competent authorities should consider the following pesticide/sample combinations in their monitoring programmes:

    - ethylene oxide (RD) in paprika powder and other processed products,
    - chlorpyrifos (RD) in kales, wheat, table grapes, bananas, oranges, olives for oil production, sweet/bell peppers and sunflower seeds from EU and third countries (Ukraine, India and Egypt).

  Regarding chlorate, the EFSA recommendation is for FBOs to revise their sanitisation practices to ensure that residues do not lead to non-compliant results.
- Among the pesticides with high quantification rates (copper (RD), bromide ion (RD), fosetyl (RD) and trichlamide), competent authorities are recommended to stay vigilant to the following combinations and to ensure adequate coverage in their analytical scope:

    - copper (RD) (quantification rate of 64.7%) – approved in EU – in plant and animal commodities, both from organic and conventional farming and in food intended for infants and young children, in particular in wheat, dried and fresh lentils, bananas, oats, chicken eggs, apples, sweet peppers/bell peppers, cultivated fungi, cocoa beans, broccoli, aubergines/eggplants, grapefruits and bovine muscle;
    - fungicide trichlamide (quantification rate of 14.1%) – never approved in EU – mostly reported in oranges coming from Egypt and analysed only by three reporting countries.

- EFSA recommends reporting countries adding TFA to their analytical scope of analysis and report findings to EFSA, in accordance with the working document on inclusion of pesticides in the MANCP analytical scope.
- Glyphosate metabolites AMPA and AMPA-N-acetyl were quantified at 0.6% and 0.2% rate, respectively, in cultivated fungi. EFSA recommends MSs to inquire with FBOs about the type of substrate (from conventional or GMO crops) used to cultivate fungi and to implement proper risk mitigation measures to avoid future cross-contamination.
- The number of quantified substances in honey has increased from 23 to 31 over the last year, together with the MRL exceedance rate (1.7% in 2023 vs. 2.1% in 2024). However, the non-compliance rate (0.8% in 2024 vs. 1.2% in 2023) decreased. Acetamiprid led to the highest non-compliance rate (1.1%) and together with amitraz, copper, coumaphos, thiacloprid, glyphosate and azoxystrobin were the most frequently quantified. Reporting countries are recommended to keep monitoring honey and other apicultural products in their national programmes, with a wide analytical scope and investigate the reasons for the presence of these substances. Regarding the other animal commodities, the highest number of pesticides were found in muscle and liver, all related to copper findings.
- Contrary to previous year results, the MRL exceedance (3.3%) and non-compliance (1.9%) rates observed in unprocessed food were in the same range as those reported in processed (3.3% and 1.6%, respectively). Overall, MRL exceedances and non-compliance rates in processed foods were the lowest of the last 2 years. The processed products presenting the highest non-compliance rate were grape leaves and similar species, pickled/marinated vegetables (40.0%), dried parsley (21.1%) and blended honey (11.1%). Regarding unprocessed food products, those with the highest non-compliance rate were granate apples/pomegranates (29.2%), passion fruits/maracujas (16.6%) and kales (15.1%). It is recommended to continue monitoring these food items in the national programmes designed by the different reporting countries.
- The number of samples with multiple pesticide residues (25.5%) was in the same range as in 2023 (24.8%). Unprocessed oranges, table grapes, strawberries and apples were the commodities presenting the highest frequency of multiple residues. Among the processed products, dried vine fruits, wine, paprika powder and wheat wholemeal flour were those with the highest multiple residues quantified. EFSA recommends reporting countries to continue monitoring these foodstuffs under their programmes.

- Some of the highest probabilities of an individual consumer per day to exceed the ARfD were estimated for non-approved pesticides, namely phosmet and oxamyl (for which decisions of lowering all MRLs to the LOQ were taken in 2023), together with carbaryl and carbofuran (not approved in the EU for almost 20 years). Competent authorities are recommended to follow up on the presence of these substances on their market despite the low frequency of quantification in some cases. Moreover, the presence of ethephon in bananas and sweet peppers in the EU, where no uses are authorised, should be investigated.
- Dimethoate and chlorpyrifos for which the approval criteria were not met are still being quantified. All MRLs were set to the lowest achievable LOQ years ago. EFSA recommends risk managers to take the necessary measures to assure that food containing these substances is either not placed or withdrawn from the market.
- Given the outcome of the chronic exposure calculations where exceedances of the HBGV were driven by food products consumed processed, i.e. pyrimethanil in mandarins and pirimiphos-methyl in wheat, authorisation holders of these active substances are recommended to generate processing factors on mandarin juice and processed wheat to further refine the risk assessment.
- Reporting countries may consider strengthening the monitoring of pesticide residues in processed food commodities.

## ACKNOWLEDGEMENTS

EFSA wishes to thank Álvaro Rol Rúa from the Spanish Agency for Food Safety and Nutrition (AESAN) for his valuable proposals and his independent scientific review of this report. EFSA wishes to thank too Valentina Bocca, Ricardo Miguel Carvalho Rodrigues, Elisa Corsini, Bruno Dujardin, Elisa Fasanelli, Rubén Fuertes, Luna Greco, Sofia Ioannidou, Luc Mohimont, Andrea Nironi, Luca Pasinato, Manuela Tiramani and Giuseppe Antonio Triacchini for their support provided in this scientific output. A particular recognition to Emanuela Marchese for her hard work as well as a special appreciation to Hypertech for their contribution. Lastly, EFSA wishes to acknowledge all European Competent Authorities and Member State bodies that provided data to generate this scientific output.

## REQUESTOR

European Commission

## QUESTION NUMBER

EFSA-Q-2025-00297



## MAP DISCLAIMER

The designations employed and the presentation of material on any maps included in this scientific output do not imply the expression of any opinion whatsoever on the part of the European Food Safety Authority concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Any designation of Palestine shall not be construed as recognition of a State of Palestine and is without prejudice to the individual positions of the Member States on this issue. Any designation of Kosovo is without prejudice to positions on status and is in line with United Nations Security Council Resolution 1244 and the International Court of Justice Opinion on the Kosovo Declaration of Independence.

## ABBREVIATIONS

### Reporting country codes

| | |
|---|---|
| AT | Austria |
| BE | Belgium |
| BG | Bulgaria |
| CY | Cyprus |
| CZ | Czechia |
| DE | Germany |
| DK | Denmark |
| EE | Estonia |
| EL | Greece |
| ES | Spain |
| FI | Finland |
| FR | France |
| HR | Croatia |
| HU | Hungary |
| IE | Ireland |

| | |
|---|---|
| IS | Iceland |
| IT | Italy |
| LT | Lithuania |
| LU | Luxembourg |
| LV | Latvia |
| MT | Malta |
| XI | Northern Ireland |
| NL | The Netherlands |
| NO | Norway |
| PL | Poland |
| PT | Portugal |
| RO | Romania |
| SE | Sweden |
| SI | Slovenia |
| SK | Slovak Republic |

### Other abbreviations

| | |
|---|---|
| ADI | Acceptable Daily Intake |
| ARfD | Acute Reference Dose |
| BAC | Benzalkonium Chloride |
| BCP | Border Control Posts |
| BW | Body weight |
| CAG | Cumulative Assessment Group |
| CP | Control Point |
| CRA | Cumulative Risk Assessment |
| $CS_2$ | Carbon disulfide |
| DDAC | Didecyldimethylammonium chloride |
| DNT | Developmental Neurotoxicity |
| DWH | EFSA's scientific Data Warehouse |
| EEA | European Economic Area |
| EFTA | European Free Trade Association |
| EU MACP | EU-coordinated multiannual control programme |
| EUPT | European Proficiency Test |
| EURL | European Union Reference Laboratory |
| FAO | Food and Agriculture Organization of the United Nations |
| GAP | Good Agricultural Practice |
| HBGV | Health-based guidance value |
| HCH | Hexachlorocyclohexane |
| HQ | Hazard quotient |
| HRM | Highest Residue Measured |
| LOD | Limit of Detection |
| LOQ | Limit of Quantification |
| MANCP | Multiannual National Control Programme |
| MRL | Maximum Residue Level |
| POP | Persistent Organic Pollutants |
| pTDI | Provisional Tolerable Daily Intake |
| PRIMo | Pesticide Residue Intake Model |
| RD | Residue Definition |
| SSD | Standard Sample Description |
| VMPR | Veterinary medicinal product residues |
| WHO | World Health Organization |

## REFERENCES

EFSA (European Food Safety Authority). (2009). Review of the existing maximum residue levels (MRLs) for ethephon on request of EFSA. *EFSA Journal*, *7*(10), 1347. https://doi.org/10.2903/j.efsa.2009.1347

EFSA (European Food Safety Authority). (2011a). Guidance of EFSA on the use of the EFSA comprehensive European food consumption database in intakes assessment. *EFSA Journal*, *9*(3), 2097. https://doi.org/10.2903/j.efsa.2011.2097

EFSA (European Food Safety Authority). (2011b). Review of the existing maximum residue levels (MRLs) for pyrimethanil according to article 12 of regulation (EC) No 396/2005. *EFSA Journal*, *9*(11), 2454. https://doi.org/10.2903/j.efsa.2011.2454

EFSA (European Food Safety Authority). (2012a). Guidance on the use of probabilistic methodology for modelling dietary exposure to pesticide residues. *EFSA Journal*, *10*(10), 2839. https://doi.org/10.2903/j.efsa.2012.2839

EFSA (European Food Safety Authority). (2012b). A European tool for usual intake distribution estimation in relation to data collection by EFSA. *EFSA Supporting Publications*, EN-300. https://doi.org/10.2903/sp.efsa.2012.EN-300
EFSA (European Food Safety Authority). (2013). Guidance of EFSA on the standard sample description ver. 2.0. *EFSA Journal*, *11*(10), 3424. https://doi.org/10.2903/j.efsa.2013.3424
EFSA (European Food Safety Authority). (2014). Scientific Opinion on the essential composition of infant and follow-on formulae. *EFSA Journal*, *12*(7), 3760. https://doi.org/10.2903/j.efsa.2014.3760
EFSA (European Food Safety Authority). (2015a). Pesticide monitoring program: Design assessment. *EFSA Journal*, *13*(2), 4005. https://doi.org/10.2903/j.efsa.2015.4005
EFSA (European Food Safety Authority). (2015b). Reasoned opinion on the revision of the review of the existing maximum residue levels for lambda-cyhalothrin. *EFSA Journal*, *13*(12), 4324. https://doi.org/10.2903/j.efsa.2015.4324
EFSA (European Food Safety Authority). (2015c). The food classification and description system FoodEx2 (revision 2). *EFSA Supporting Publications*, EN-804. https://doi.org/10.2903/sp.efsa.2015.en-804
EFSA (European Food Safety Authority). (2015d). EFSA Scientific Workshop, co-sponsored by FAO and WHO: Revisiting the International Estimate of Short-Term Intake (IESTI equations) used to estimate the acute exposure to pesticide residues via food. *EFSA Supporting Publications*, EN-907. https://doi.org/10.2903/sp.efsa.2015.en-907
EFSA (European Food Safety Authority). (2016). Reasoned opinion on the prioritised review of the existing maximum residue levels for dimethoate and omethoate according to article 43 of regulation (EC) No 396/20 05. *EFSA Journal*, *14*(11), 4647. https://doi.org/10.2903/j.efsa.2016.4647
EFSA (European Food Safety Authority). (2017). Scientific Opinion on the clarification of some aspects related to genotoxicity assessment. *EFSA Journal*, *15*(12), 5113. https://doi.org/10.2903/j.efsa.2017.5113
EFSA (European Food Safety Authority). (2018a). Guidance on use of EFSA pesticide residue intake model (EFSA PRIMo revision 3). *EFSA Journal*, *16*(1), 5147. https://doi.org/10.2903/j.efsa.2018.5147
EFSA (European Food Safety Authority). (2018b). Scientific opinion on pesticides in foods for infants and young children. *EFSA Journal*, *16*(6), 5286. https://doi.org/10.2903/j.efsa.2018.5286
EFSA (European Food Safety Authority). (2018c). Conclusion on the peer review of the pesticide risk assessment of the active substance fosetyl. *EFSA Journal*, *16*(7), 5307. https://doi.org/10.2903/j.efsa.2018.5307
EFSA (European Food Safety Authority). (2018d). Conclusion on the peer review of the pesticide risk assessment of the active substance dimethoate. *EFSA Journal*, *16*(10), 5454. https://doi.org/10.2903/j.efsa.2018.5454
EFSA (European Food Safety Authority). (2019a). Statement on the available outcomes of the human health assessment in the context of the pesticides peer review of the active substance chlorpyrifos. *EFSA Journal*, *17*(8), 5809. https://doi.org/10.2903/j.efsa.2019.5809
EFSA (European Food Safety Authority). (2019b). Statement on the available outcomes of the human health assessment in the context of the pesticides peer review of the active substance chlorpyrifos-methyl. *EFSA Journal*, *17*(8), 5810. https://doi.org/10.2903/j.efsa.2019.5810
EFSA (European Food Safety Authority). (2019c). Technical report on the raw primary commodity (RPC) model: strengthening EFSA's capacity to assess dietary exposure at different levels of the food chain, from raw primary commodities to foods as consumed. *EFSA Supporting Publications*, EN-1532. https://doi.org/10.2903/sp.efsa.2019.EN-1532
EFSA (European Food Safety Authority). (2019d). Review of the existing maximum residue levels for glyphosate according to article 12 of regulation (EC) No 396/2005 – Revised version to take into account omitted data. *EFSA Journal*, *17*(10), 5862. https://doi.org/10.2903/j.efsa.2019.5862
EFSA (European Food Safety Authority). (2020a). Cumulative dietary risk characterisation of pesticides that have acute effects on the nervous system. *EFSA Journal*, *18*(4), 6087. https://doi.org/10.2903/j.efsa.2020.6087
EFSA (European Food Safety Authority). (2020b). Cumulative dietary risk characterisation of pesticides that have chronic effects on the thyroid. *EFSA Journal*, *18*(4), 6088. https://doi.org/10.2903/j.efsa.2020.6088
EFSA (European Food Safety Authority). (2020c). The 2018 European Union report on pesticide residues in food. *EFSA Journal*, *18*(4), 6057. https://doi.org/10.2903/j.efsa.2020.6057
EFSA (European Food Safety Authority). (2021). Reasoned opinion on the joint review of maximum residue levels (MRLs) for fosetyl, disodium phosphonate and potassium phosphonates according to articles 12 and 43 of regulation (EC) No 396/2005. *EFSA Journal*, *19*(8), 6782. https://doi.org/10.2903/j.efsa.2021.6782
EFSA (European Food Safety Authority). (2022). Scientific Report on retrospective cumulative dietary risk assessment of craniofacial alterations by residues of pesticides. *EFSA Journal*, *20*(10), 7550. https://doi.org/10.2903/j.efsa.2022.7550
EFSA (European Food Safety Authority). (2023a). Reasoned opinion on the review of the existing maximum residue levels for cypermethrins according to article 12 of regulation (EC) No 396/2005. *EFSA Journal*, *21*(3), 7800. https://doi.org/10.2903/j.efsa.2023.7800
EFSA (European Food Safety Authority). (2023b). Statement on the risk assessment of maximum residue levels (MRLs) for oxamyl in view of consumer protection. *EFSA Journal*, *21*(3), 7823. https://doi.org/10.2903/j.efsa.2023.7823
EFSA (European Food Safety Authority). (2023c). Reasoned opinion on the review of the existing maximum residue levels for dithiocarbamates according to article 12 of regulation (EC) No 396/2005. *EFSA Journal*, *21*(5), 7987. https://doi.org/10.2903/j.efsa.2023.7987
EFSA (European Food Safety Authority). (2023d). The 2021 European Union report on pesticide residues in food. *EFSA Journal*, *21*(4), 7939. https://doi.org/10.2903/j.efsa.2023.7939
EFSA (European Food Safety Authority). (2024a). Targeted review of the maximum residue levels (MRLs) for ethephon. *EFSA Journal*, *22*(2), e8757. https://doi.org/10.2903/j.efsa.2024.8757
EFSA (European Food Safety Authority). (2024b). Review of the existing maximum residue levels for gamma-cyhalothrin according to article 12 of regulation (EC) No 396/2005. *EFSA Journal*, *22*(2), 8758. https://doi.org/10.2903/j.efsa.2024.8758
EFSA (European Food Safety Authority). (2024c). Statement on the toxicological properties and maximum residue levels of acetamiprid and its metabolites. *EFSA Journal*, *22*(2), e8759. https://doi.org/10.2903/j.efsa.2024.8759
EFSA (European Food Safety Authority). (2024d). Prioritisation of pesticides and target organ systems for dietary cumulative risk assessment based on the 2019–2021 monitoring cycle. *EFSA Journal*, *22*(2), 8554. https://doi.org/10.2903/j.efsa.2024.8554
EFSA (European Food Safety Authority). (2024e). Peer review of the pesticide risk assessment of the active substance pyrimethanil. *EFSA Journal*, *23*(2), e8998. https://doi.org/10.2904/j.efsa.2024.8998
EFSA (European Food Safety Authority). (2025a). Risks to human and animal health from the presence of bromide in food and feed. *EFSA Journal*, *23*(2), e9121. https://doi.org/10.2903/j.efsa.2025.9121
EFSA (European Food Safety Authority). (2025b). Statement on the update of maximum residue levels (MRLs) for copper compounds. *EFSA Journal*, *23*(2), e9271. https://doi.org/10.2903/j.efsa.2025.9271
EFSA (European Food Safety Authority). (2025c). Statement on MRLs for alpha-cypermethrin and screening of the existing EU MRLs for cypermethrin. *EFSA Journal*, *23*(2), 9386. https://doi.org/10.2903/j.efsa.2025.9386
EFSA (European Food Safety Authority). (2025d). Findings of not authorised substances in organic production. *EFSA Supporting Publications*, EN-9524. https://doi.org/10.2903/sp.efsa.2025.EN-9524

EFSA (European Food Safety Authority). (2025e). Harmonized terminology for scientific research [Data set], version v9. *Zenodo*. https://doi.org/10.5281/zenodo.14778056
EFSA (European Food Safety Authority). (2025f). Chemical monitoring reporting guidance: 2025 data collection. *EFSA Supporting Publications*, *22*(1), EN-9245. https://doi.org/10.2903/sp.efsa.2025.EN-9245
EFSA (European Food Safety Authority). (2025g). The 2023 European Union report on pesticide residues in food. *EFSA Journal*, *23*(5), 9398. https://doi.org/10.2903/j.efsa.2025.9398
EFSA (European Food Safety Authority). (2026a). Report for 2024 on the results from the monitoring of residues of veterinary medicinal products in live animals and animal products. *EFSA Supporting Publications*, EN-9913. https://doi.org/10.2903/sp.efsa.2026.EN-9913
EFSA (European Food Safety Authority). (2026b). Approach for the dietary risk assessment of copper compounds under different plant protection product (PPP) regulatory frameworks. *EFSA Supporting Publications*, EN-9993. https://doi.org/10.2903/sp.efsa.2026.EN-9993
EFSA (European Food Safety Authority). (2026c). National summary reports on pesticide residue analysis performed in 2024. *EFSA Supporting Publications*, EN-10002. https://doi.org/10.2903/sp.efsa.2026.EN-10002
European Commission. (2018). Working document on the summing up of LOQs in case of complex residue definitions. SANCO/12574/2015. rev. 5(1). Application date: 1 January 2018. 30/11-01/12 2015.
European Commission. (2021). Analytical Quality Control and Method Validation Procedures for Pesticide Residues Analysis in Food and Feed. SANTE/11312/2021 V2026.
European Commission. (2025). Directorate-General for Health and Food Safety, Alert and Cooperation Network – 2024 annual report, Publications Office of the European Union, 2025. ISBN 978-92-68-27532-0. ISSN 2363-0965. https://doi.org/10.2875/0397221
FAO (Food and Agriculture Organization of the United Nations). (2003). Pesticide residues in food – 2005. Report of the Joint Meeting of the FAO Panel of Experts on Pesticide Residues in Food and the Environment and the WHO Expert Group on Pesticide Residues. FAO Plant Production and Protection Paper 176.
FAO (Food and Agriculture Organization of the United Nations). (2007). Pyrimethanil Evaluation Report JMPR No. (226). https://www.fao.org/fileadmin/templates/agphome/documents/Pests_Pesticides/JMPR/Evaluation07/Pyrimethanil.pdf.
FAO (Food and Agriculture Organization of the United Nations). (2017). *Submission and evaluation of pesticide residues data for the estimation of maximum residue levels in food and feed. Pesticide residues. 3rd Edition* (p. 286). FAO Plant Production and Protection Paper 225.
Kittelmann, A., Scholz, R., Tietz, E., Zincke, F., & Michalski, B. (2025). Third update of the EU database of processing factors for pesticide residues. *EFSA Supporting Publications*, EN-9477. https://doi.org/10.2903/sp.efsa.2025.EN-9477
OECD (Organisation for Economic Co-operation and Development). (2014). *MRL calculator: Users guide and white paper, series on pesticides and biocides, No. 56*. OECD Publishing. https://doi.org/10.1787/9789264221567-en
Scholz, R., Kittelmann, A., & Michalski, B. (2025). Compendium of Representative Processing Techniques Investigated in Regulatory Studies for Pesticides (Version 3). Zenodo. https://zenodo.org/records/15363334
UNEP. (2001). Stockholm Convention on Persistent Organic Pollutants, United Nation Environment Program, Stockholm Convention Secretariat. https://chm.pops.int/TheConvention/Overview/tabid/3351/
Zincke, F., Kittelmann, A., Scholz, R., Tietz, E., & Michalski, B. (2025). European Database of Processing Factors for Pesticides Residues in Food ver. 5. *Zenodo*. https://doi.org/10.5281/zenodo.15363279

## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

**How to cite this article:** EFSA (European Food Safety Authority), Medina Pastor, P., Carrasco Cabrera, L., Di Piazza, G., & González Ciria, C. (2026). The 2024 European Union report on pesticide residues in food. *EFSA Journal*, *24*(5), e10054. https://doi.org/10.2903/j.efsa.2026.10054

# APPENDIX A

## Authorities responsible for reporting pesticide residues by country

| Country | National competent authority | Web address for published national monitoring reports |
|---|---|---|
| **Austria** | Federal Ministry of Social Affairs, Health, Care and Consumer Protection | www.verbrauchergesundheit.gv.at/Lebensmittel/Pestizidruek_Kontami/pestizid.html |
| | Austrian Agency for Health and Food Safety | www.ages.at/pflanze/pflanzenschutzmittel/pflanzenschutzmittel-rueckstaende |
| **Belgium** | Federal Agency for the Safety of the food Chain (FASFC) | www.favv-afsca.be/fr/publications/brochures/pesticide-residue-monitoring-food-plant-origin-belgium-summary |
| **Bulgaria** | Risk Assessment Centre on Food Chain | www.babh.government.bg/en/ |
| **Croatia** | Ministry of Agriculture | www.mps.hr/ |
| **Cyprus** | Ministry of Health, Pesticides Residues Laboratory of the State General Laboratory | www.moh.gov.cy/sgl |
| | Ministry of Health, Department of Medical and Public Health Services (MPHS) | |
| **Czech Republic** | Czech Agriculture and Food Inspection Authority | www.szpi.gov.cz |
| | State Veterinary Administration | www.svscr.cz |
| **Denmark** | Danish Veterinary and Food Administration | foedevarestyrelsen.dk/publikationer |
| | National Food Institute, Technical University of Denmark | www.food.dtu.dk/publikationer/kemikaliepaavirkninger/pesticider-i-kosten |
| **Estonia** | Veterinary and Food Board | www.vet.agri.ee |
| **Finland** | Finnish Food Authority, Finnish Customs and National Supervisory Authority for Welfare and Health | www.ruokavirasto.fi/en/companies/food-sector/production/common-requirements-for-composition/residues-of-plant-protection-products/control-of-plant-protection-product-residues-in-food/ |
| **France** | Ministère de l'économie et des finances/Direction générale de la concurrence, de la consommation et de la répression des fraudes (DGCCRF) | www.economie.gouv.fr/dgccrf/securite/produits-alimentaires |
| | Ministère de l'Agriculture et de l'Alimentation, Direction générale de l'alimentation (DGAL) | agriculture.gouv.fr/plans-de-surveillance-et-de-controle |
| **Germany** | Federal Office of Consumer Protection and Food Safety (BVL) | www.bvl.bund.de/berichtpsm |
| **Greece** | Ministry of Rural Development and Food | www.minagric.gr/index.php/en/citizen-menu/foodsafety-menu |
| | | www.minagric.gr/index.php/el/for-farmer-2/crop-production/fytoprostasiamenu/ypoleimatafyto |
| **Hungary** | National Food Chain Safety Office | www.nebih.gov.hu |
| **Iceland** | MAST – The Icelandic Food and Veterinary Authority | www.mast.is |
| **Ireland** | Department of Agriculture Food and the Marine | www.pcs.agriculture.gov.ie |
| **Italy** | Ministero della Salute – Direzione Generale per l'Igiene e la Sicurezza degli Alimenti e la Nutrizione – Ufficio 7 | www.salute.gov.it/portale/fitosanitari/dettaglioContenutiFitosanitari.jsp?lingua=italiano&id=1105&area=fitosanitari&menu=vegetali |
| **Latvia** | Ministry of Agriculture | www.zm.gov.lv |
| | Food and Veterinary Service of Latvia | |
| **Lithuania** | National Food and Veterinary Service (SFVS) | www.nmvrvi.lt |
| **Luxembourg** | Luxembourg Veterinary and Food Administration (ALVA), Division of Food chain Safety (Secualim) | www.securite-alimentaire.public.lu |
| **Malta** | Malta Competition and Consumer Affairs Authority | www.mccaa.org.mt |
| **Netherlands** | Netherlands Food and Consumer Product Safety Authority (NVWA) | www.nvwa.nl |
| **Norway** | Norwegian Food Safety Authority | www.mattilsynet.no |
| | | www.mattilsynet.no/mat_og_vann/uonskede_stofferimaten/rester_av_plantevernmidler_i_mat/#overvakings_og_kartleggingsprogrammer |
| **Poland** | The State Sanitary Inspection | www.gis.gov.pl |

(Continued)

| Country | National competent authority | Web address for published national monitoring reports |
|---|---|---|
| **Portugal** | Direção-Geral de Alimentação e Veterinária (DGAV) | www.dgv.min-agricultura.pt/portal/page/portal/DGV/genericos?generico=4217393&cboui=4217393t |
| **Romania** | National Sanitary Veterinary and Food Safety Authority | www.ansvsa.ro |
| | Ministry of Agriculture and Rural Development | www.madr.ro |
| | Ministry of Health | |
| **Slovakia** | State Veterinary and Food Administration of the Slovakian Republic | www.svps.sk/ |
| | Public Health Authority of the Slovakian Republic | |
| **Slovenia** | Administration of the Republic of Slovenia for Food Safety, Veterinary Sector and Plant Protection | www.uvhvvr.gov.si/si/delovna_podrocja/ostanki_pesticidov |
| | Health Inspectorate of the Republic of Slovenia | www.gov.si/drzavni-organi/organi-v-sestavi/zdravstveni-inspektorat/ |
| **Spain** | Spanish Agency for Food Safety and Nutrition (AESAN) | www.aecosan.msssi.gob.es/AECOSAN/web/seguridad_alimentaria/subseccion/programa_control_residuos.htm |
| **Sweden** | Swedish Food Agency | www.livsmedelsverket.se |
| **Northern Ireland** | Department of Agriculture, Environment and Rural Affairs (DAERA). Sanitary and Phytosanitary Policy and Logistics Division | www.daera-ni.gov.uk/ |

## APPENDIX B

### Supporting Information

Annex I – The data visualisation (EU MACP and MANCP) of 2024 ARPR: https://multimedia.efsa.europa.eu/pesticides-report-2024/.

**Annexes** published in Zenodo https://doi.org/10.5281/zenodo.18327006

Annex II – Supporting data for enforcement of the 2024 EU pesticide residues report on food.

Table 2.1 – The residue definitions under 2024 EU coordinated multiannual programme of the Union.
Table 2.2 – List of samples exceeding the MRLs, including information on the measured residue concentrations and the origin of the samples under the national control programmes and the EU MACP.
Table 2.3 – Scope of analysis of pesticides reported, excluding EU increased import control programme results.
Table 2.4 – Regulation (EU) 2019/1793 on the temporary increase of official controls – extract of the controls to be performed of pesticides in food.
Table 2.5 – List of samples exceeding the MRLs in the EU increased control programme on imported food.

Annex III – Supporting data of the probabilistic risk assessment.

Table 3.1 – List of residue definitions and active substances quantified in the last 3-year-cycle: 2022–2024.
Table 3.2 – List of health-based guidance values (HBGV).
Table 3.3 – Processing factors used.
Table 3.4 – List of authorisation status.

Annex IV – Acute probabilistic exposure assessment to single substance, Primary of 2024 ARPR.

Figure 4.1: Histogram presenting the distribution of the hazard quotient per active substance and survey.
Figure 4.2: Box plot presenting the 95% confidence intervals of the hazard quotient at different percentiles per active substance and survey.
Figure 4.3: Pie chart presenting the average contributions of RPCs to the exposures exceeding the 99th percentile.
Table 4.4: Estimated 95% confidence intervals of the hazard quotient at different percentiles per active substance and survey.
Table 4.5: Distribution of the hazard quotient calculated per active substance, survey and bootstrap.
Table 4.6: Average contributions of RPCs to the exposures exceeding the 99th percentile per active substance and survey.
Table 4.7: Detailed records for consumers with exposures closer to the 99th percentile.
Table 4.8: Overview of RPCs and active substances with limited occurrence data.

Annex V – Acute probabilistic exposure assessment to single substance, Tentative of 2024 ARPR.

Figure 5.1: Histogram presenting the distribution of the hazard quotient per active substance and survey.
Figure 5.2: Box plot presenting the 95% confidence intervals of the hazard quotient at different percentiles per active substance and survey.
Figure 5.3: Pie chart presenting the average contributions of RPCs to the exposures exceeding the 99th percentile.
Table 5.4: Estimated 95% confidence intervals of the hazard quotient at different percentiles per active substance and survey.
Table 5.5: Distribution of the hazard quotient calculated per active substance, survey and bootstrap.
Table 5.6: Average contributions of RPCs to the exposures exceeding the 99th percentile per active substance and survey.
Table 5.7: Detailed records for consumers with exposures closer to the 99th percentile.
Table 5.8: Overview of RPCs and active substances with limited occurrence data.

Annex VI – Chronic probabilistic exposure assessment to single substance, Primary of 2024 ARPR.

Figure 6.1: Histogram presenting the distribution of the hazard quotient per active substance and survey.
Figure 6.2: Box plot presenting the 95% confidence intervals of the hazard quotient at different percentiles per active substance and survey.
Figure 6.3: Pie chart presenting the average contributions of RPCs to the exposures exceeding the 99th percentile.
Table 6.4: Estimated 95% confidence intervals of the hazard quotient at different percentiles per active substance and survey.
Table 6.5: Distribution of the hazard quotient calculated per active substance, survey and bootstrap.
Table 6.6: Average contributions of RPCs to the exposures exceeding the 99th percentile per active substance and survey.
Table 6.7: Detailed records for consumers with exposures closer to the 99th percentile.

## ANNEX A

### Outcome of the European Commission, EU Member State, IS, NO and EURLs consulation

Annex A is available under the Supporting Information section on the online version of the scientific output.