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Maximum Residue Limits (MRLs) for **biocides in meat and dairy** products

Prioritisation of substances to be monitored

RIVM report 2025-0126

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Colophon

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J.M. Wezenbeek (author), RIVM
T. van der Velde-Koerts (author), RIVM
C.M. Mahieu (author), RIVM
S. ten Voorde (author), RIVM
G. van Donkersgoed (author), RIVM
E.H.W. Huiberts (author), RIVM

Contact:
Joke Wezenbeek
Centre for Safety of Substances and Products
joke.wezenbeek@rivm.nl

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Synopsis

Maximum Residue Limits (MRLs) for biocides in meat and dairy products

Prioritisation of substances to be monitored

Biocides are products used for disinfection and pest control. Biocides are often useful and necessary for cattle farming, and for the safe storage and processing of food. They are used, for example, to disinfect stables and work spaces in abattoirs or to kill cockroaches and mice in food storage areas. Biocides can leave residues of their active substances in the food.

The Netherlands Food and Consumer Product Safety Authority (NVWA) wants to measure which substances from biocides are left in meat and dairy products and whether this is harmful to human health. The NVWA is currently measuring a small number of substances from biocides, mainly in unprocessed products such as raw meat and milk. Because many different substances are used, RIVM has developed a method to determine which should preferably be measured first. The method uses information on all substances from biocides that could potentially remain in meat and dairy products. It involves aspects such as the purpose for which biocides are used and what is known about measurements in meat and dairy products and health effects.

RIVM recommends also taking measurements in processed or composite food products. This is because biocides are used during the processing of raw products into food products, to disinfect machines for example.

Additionally, it is important to determine the maximum amounts of active substance residues permitted to end up in food products. The standards used for this purpose are known as Maximum Residue Limits (MRLs). Such limits do not yet exist for some active substances from biocides. For other substances, MRLs do exist because those substances are also used in agricultural pesticides or veterinary medicines. However, these standards do not yet take into account the possibility that residues from biocides may also end up in food products. That possibility therefore still needs to be incorporated.

It is not clear yet how that is to be done in existing and new MRLs. The methods used to determine MRLs in agricultural pesticides and veterinary medicines are different, and such a method does not yet exist for biocides. Nor have the roles and partnerships been defined for the various European regulatory bodies required for this. RIVM recommends obtaining clarity on these matters.

Keywords: biocides, active substances, prioritising substances, monitoring, MRL, residue limit, meat, dairy, baby food

Publiekssamenvatting

Maximale residulimieten (MRL's) voor biociden in vlees- en zuivelproducten

Prioritering van te monitoren stoffen

Biociden zijn middelen om te ontsmetten en ongedierte te bestrijden. Biociden zijn vaak nuttig en noodzakelijk voor de veehouderij en om voedsel veilig op te slaan en te verwerken. Bijvoorbeeld om stallen en werkruimtes in slachthuizen te ontsmetten of om kakkerlakken en muizen in voedselopslagruimtes te doden. In biociden zitten werkzame stoffen waarvan resten kunnen achterblijven in het voedsel.

De Nederlandse Voedsel- en Warenautoriteit (NVWA) wil meten welke stoffen uit biociden achterblijven in vlees- en zuivelproducten en wil weten of ze schadelijk zijn voor de gezondheid. De NVWA meet nu een klein aantal stoffen uit biociden, vooral in onbewerkte producten als rauw vlees en melk. Omdat er veel verschillende stoffen worden gebruikt, heeft het RIVM een methode ontwikkeld om te bepalen welke het beste als eerste kunnen worden gemeten. De methode gebruikt informatie over alle stoffen uit biociden die zouden kúnnen achterblijven in vlees- en zuivelproducten. Er is gekeken waarvoor biociden worden gebruikt en naar wat er bekend is over metingen in vlees- en zuivelproducten en over gezondheidseffecten.

Het RIVM beveelt aan om ook in bewerkte of samengestelde voedingsmiddelen te meten. Bij de verwerking van rauwe producten tot voedingsmiddelen worden namelijk biociden gebruikt, bijvoorbeeld om machines te ontsmetten.

Verder is het belangrijk om te bepalen hoeveel resten van een werkzame stof maximaal in voedingsmiddelen terecht mogen komen. De normen die daarvoor gelden heten maximale residulimieten (MRL's). Voor sommige werkzame stoffen uit biociden bestaan deze normen nog niet. Voor andere stoffen wel, omdat ze ook worden gebruikt in bestrijdingsmiddelen in de landbouw of in geneesmiddelen voor dieren. Alleen is er bij deze normen nog geen rekening mee gehouden dat mogelijke resten van biociden ook in voedingsmiddelen kunnen terechtkomen. Dat moet er dus nog in worden verwerkt.

Het is nog niet duidelijk hoe dat in bestaande en nieuwe MRL's moet worden gedaan. Voor bestrijdingsmiddelen in de landbouw en diergeneesmiddelen gelden namelijk verschillende werkwijzen om een MRL te bepalen en voor biociden is die er nog niet. Ook liggen de rollen en samenwerkingsverbanden nog niet vast voor de verschillende Europese wetgevingsinstanties die daar voor nodig zijn. Het RIVM adviseert om hierover duidelijkheid te krijgen.

Kernwoorden: biociden, werkzame stoffen, prioritering stoffen, monitoring, MRL, residulimiet, vlees, zuivel, babyvoeding

Contents

Summary

Biocides and Maximum Residue Limits (MRLs)

To facilitate the trade in foodstuffs and to guarantee food safety, for certain substances, maximum concentrations are set for the residues that may end up in our food. These standards are called Maximum Residue Limits (MRLs).

Biocides (biocidal products) are disinfectants, preservatives or pest control products containing active substances that are used against harmful organisms. Biocides are often useful and necessary to produce safe food. Depending on their application, the use of biocides may leave residues in food or feed. The active substances used in biocides are sometimes the same as those used in plant protection products (PPP) or veterinary medicinal products (VMP). Until now, all available MRLs within the EU (European Union) for biocidal active substances have been derived under the EU regulations for PPP or VMP residues. This situation leads to the question whether additional MRLs or amended MRLs are needed in view of the use of biocides. Monitoring residues of biocidal active substances in food will provide useful information on the necessity to set additional MRLs or amend existing MRLs for food.

Questions to be answered in this project

The aim of this project is to identify and prioritise which active substances in biocides are most important to monitor through laboratory analyses on food products. An additional question is what the current EU policy is for deriving MRLs for biocide residues. To keep the current study manageable, a focus on meat and dairy products was chosen, including infant/toddler food.

Identification and prioritisation of active substances

To identify and prioritise biocidal active substances for monitoring, the following information is relevant and has been gathered:

- Identification of product types (PTs) of biocides that may end up in meat and dairy products.
- Identification of active substances with potential residues in meat and dairy products, including degradation products and disinfection by-products (DBPs).
- Existing monitoring data on the active substances in meat and dairy products.
- Existing analytical methods for the active substances in meat and dairy products.
- Existing MRLs for the active substances in meat and dairy products.
- Further information relevant for prioritisation:
  - Information on the use scale of the active substances.
  - Physical/chemical properties of the active substances.
  - Intrinsic hazard properties of the active substances related to human health.
  - Information on exceedances of the MRLs.

Prioritisation of the active substances for monitoring

PTs of biocides that potentially leave residues in meat and dairy products are disinfectants, rodenticides, insecticides, and repellents. There are 186 active substances that may be used in these PTs, particularly in disinfectants. Monitoring data on the active substances is very scarce, but there is data on insecticides, chlorinated disinfectants, and quaternary ammonium compounds (quats). Chlorate and quats were found in about 20% of the analysed samples of infant/toddler food. For only about 30% of the active substances, an analytical method exists for meat and dairy products. The available MRLs range from specific values for milk and meat products (muscle, fat, liver, kidney, other edible offals), to a default MRL of 0.01 mg/kg, or the status 'No MRL required'. For almost half the substances, there is no information on EU MRLs.

The available information on the use scale and on physical/chemical properties could not be used for prioritisation of active substances. On the basis of intrinsic hazard properties for human health, most active substances could be divided into three categories. Category 1 contains the active substances with the most severe hazard properties. The results of the identification of the PTs and active substances with potential residues in meat and dairy, the expected formation of DBPs, the availability of monitoring data and analytical methods, the availability and status of MRLs, the use in one or more PTs, the hazard category and the exceedances of MRLs are all combined in a consolidated priority table. In this table 'priority points' are assigned to certain properties. On the basis of these choices, the top of the list consists of 30 substances with 16-20 priority points. This proposed prioritisation is mainly determined by the expected formation of DBPs, MRL exceedance, and category 1 hazard substances for which no monitoring data is available. By including or excluding certain properties, or by using a different scaling per property, the top of the list may look different.

Other considerations for monitoring

The high percentage of residues of disinfectants (quats and chlorate) in infant/toddler food could be explained by the use of biocides (or cleaning products) during processing. Therefore, we recommend including processed, mixed and composite foods, such as fresh sausages, yoghurt, or soft ice cream, in a monitoring programme for biocides. To determine relevant foods for monitoring on residues, instructions for the use of biocides should be checked. Inspectors or suppliers might provide more detailed information on their applications.

For a final selection of a substance, we recommend studying available assessment reports and monitoring data in detail and performing a literature search to determine the relevant residues of that substance, including potential degradation products, metabolites, or DBPs. It might be necessary to include monitoring on isomers, degradation products, metabolites, DBPs, and/or individual substances in mixtures.

If a substance can be added to an existing multi-residue method, then this is relatively simple and cheap. Preferably, the development of a

single residue method (SRM) should be limited to substances with a high estimated human risk and/or a high probability of leaving residues in food.

Current policy for setting or amending MRLs for biocides

For biocides, the European Commission (EC) published an approach to MRLs for biocides in September 2024. This approach makes use of the legally binding and existing specific and default MRLs, and of the status 'No MRL required' relating to PPP and/or VMP use. In the case of exceedance of a default or a specific MRL, it could be decided to amend the existing MRL taking the biocidal exposure into account.

The current EC approach to MRLs for biocides relies heavily on available MRLs based on PPP and/or VMP use, rather than taking into account the potential (additional) residues in food due to biocidal use. The available specific MRLs are based on different principles, such as ALARA (As Low As Reasonably Achievable) for exposure to PPP or 'worst-case' exposure from meat, milk and eggs for VMP. An MRL of 0.01 mg/kg in animal products can be based on actual PPP and/or VMP use or on the non-approval of an active substance for PPP, but might need to be higher for biocides. In addition, the criteria used to assign the status 'No MRL required' within the PPP or VMP framework may not be applicable for biocides, because anticipated exposure patterns may differ. VMP and PPP MRLs are based on raw agricultural commodities, while biocides are often used at a later stage in the food production process, and thus biocide MRLs for processed, mixed and composite foods might be more relevant and should receive special attention.

Furthermore, clear guidance for deriving biocide MRLs and a dietary risk model for assessing the safety of biocide MRLs are lacking. The current authorisation procedure also lacks guidance for assessing potentially formed substances such as DBPs and guidance for performing tests, such as rinsing studies. Lastly, the role of the various agencies for PPP, VMP and biocides should be defined more clearly. MRLs apply to food, regardless of the policy framework in which the substances are used. As such, collaboration between different European agencies is needed to include all applications that may leave residues in food when deriving MRLs.

1 Introduction

1.1 Rationale and aim

This project was executed by the Dutch National Institute for Public Health and the Environment (RIVM) at the request of the Office for Risk Assessment & Research (BuRO) of the Netherlands Food and Consumer Product Safety Authority (NVWA).

Biocides and Maximum Residue Limits (MRLs)
Biocides (biocidal products) are disinfectants, preservatives and products for pest control containing active substances that are used against harmful organisms (for a full definition, see the box below). Sometimes the term 'biocides' is used for the active substances themselves. In this report, we use the term 'biocides' mainly for biocidal products or in general (e.g. MRLs for biocides). Pesticides used to protect plants are plant protection products (PPP). Veterinary medical products (VMP) are used to protect animals from diseases or pests. PPP and VMP may contain the same active substances as biocides.

Biocides (biocidal products)

The website of the Dutch Board for the Authorisation of Plant Protection Products and Biocides (Ctgb)[1] states that '*Biocidal products are all substances or mixtures consisting of, containing or generating one or more active substances with the intention of destroying, deterring, rendering harmless, preventing the action of, or otherwise exerting a controlling effect on harmful or undesired organisms.*'

In EU Member States, biocidal products can be used or traded only if they have been authorised. To this end, the competent authority of a Member State evaluates biocidal products regarding their effects on and risks for humans, animals and the environment. In the Netherlands, biocides are authorised by the Ctgb. To obtain authorisation, an application dossier must be compiled and submitted.

An 'active substance' means a substance or a micro-organism that has an action on or against harmful organisms.

In the Biocidal Products Regulation (BPR; (EU) 528/2012), biocides are divided into product types (PTs) on the basis of their application.

More information on biocides, active substances and their regulation can be found on the websites of ECHA[2] and Ctgb[3]. ECHA is the European Chemicals Agency, Ctgb is the Dutch Board for the Authorisation of Plant Protection Products and Biocides. Information in Dutch is available on www.biociden.nl[4].

[1] Text from https://english.ctgb.nl/biocidal-products
[2] See: https://echa.europa.eu/regulations/biocidal-products-regulation/understanding-bpr
[3] See: https://english.ctgb.nl/about-ctgb
[4] See: https://www.biociden.nl/

The authorisation of a biocidal product is based on proper use, i.e. use according to the legally binding instructions for use. In this report, use that deviates from the use instructions or use for an application other than the authorised one is called improper use. The use of biocides without an authorisation in the country concerned is called illegal use.

The use of biocides may leave residues in food or feed:

- through direct contact of food or feed with treated surfaces;
- indirectly in food of animal origin via (unintentional) contact of livestock to treated surfaces or to materials containing biocides (treated articles in the BPR);
- indirectly in food of animal origin via direct treatment of livestock;
- indirectly in food of animal origin via drinking water of livestock.

According to the Biocidal Products Regulation (BPR; (EU) 528/2012), 'residue' means '*a substance present in or on products of plant or animal origin, water resources, drinking water, food, feed or elsewhere in the environment and resulting from the use of a biocidal product, including such a substance's metabolites, breakdown or reaction products.*'

The trade and use of biocides in the EU is regulated in the BPR. Biocides are often useful and necessary for many different sectors. Safely deriving food from industrial processes or livestock farming, for example, is not possible without disinfectants. In addition, in these sectors it may be necessary to control insects or rodents by means of biocides. To facilitate the trade in foodstuffs and to guarantee the safety of our food, for certain substances, maximum concentrations are set for the residues that may end up in our food. These standards are called Maximum Residue Limits (MRLs). An MRL applies to certain food types and is linked to a residue definition. The residue definition defines the components (parent substance and/or isomers, metabolites, degradation and/or reaction products) to which the MRL applies.

MRLs for biocides

The use of veterinary medicinal products (VMP), plant protection products (PPP) and biocides may leave residues in food. The setting of MRLs ensures that the use of products according to the label instructions is safe. At the moment, MRLs are mainly set in the context of PPP and VMP. Biocides might also contribute to residues in food. However, currently, neither the methodology nor the policy for setting EU MRLs in the context of authorisation of biocides is fully in place. This makes it difficult for the enforcement agencies to include biocides in their monitoring programmes. We use the terms 'MRLs for PPP', 'MRLs for VMP' and 'MRLs for biocides', but we actually mean MRLs for certain foods that are based on the use of PPP, VMP or biocides and derived within the legal frameworks for PPP, VMP or biocides. Because MRLs relate to food products, all contributions to residues of a substance in that food product should be taken into account. As such, the resulting residue may be the result from combined uses in different legal frameworks.

Background of the project
Considering the extended use of biocides and the uncertainties of the quantity and safety of their residues in food through these uses, BuRO would like to know whether additional MRLs or amended MRLs are needed in view of the use of biocides. Monitoring residues of biocidal active substances in food might provide useful information on the necessity to set MRLs or amend existing MRLs for food. Because of the diversity of biocides and the broad range of product types, a strategic monitoring programme is needed to ascertain the need of amending existing MRLs or setting specific MRLs for biocides.

Aim of the project
The overall aim of this project is to identify and prioritise which active substances in biocides are most important to monitor through laboratory analyses of food products available on the market.

Additionally, BuRO would like to know what the current EU policy is for deriving MRLs for residues of biocides, and if and how this is regulated in case the results of a specific monitoring programme for biocides indicate that additional or amended MRLs are necessary.

Focus on the entire chain for meat and dairy
Biocides have a wide range of applications. The types of biocides that may come into contact with food or feed differ per type of food or feed and also depend on the location and timing of application of the biocides within the food/feed production chain. To keep the current study manageable, a focus on meat and dairy products was chosen. This choice also covers residues resulting from multiple use of various products, such as PPP (leaving residues in animal products through feed crops treated with PPP), VMP, feed additives and cleaning products. Initially, this project was aimed at PT04 biocides only, as these are the disinfectants used for equipment and surfaces that come into contact with food or feed, about which little seems to be known. Therefore, in some chapters, there is a stronger focus on disinfectants for food and feed (PT04). At a later stage, this project was extended to the entire chain of producing and processing meat and dairy products. Because of this, not only PT04 biocides, but a wide range of other types of biocides became part of this project.

Selection and prioritisation criteria
In order to determine which biocidal active substances would be eligible and most relevant for monitoring, the following potential selection and prioritisation criteria were identified:

- Identification of relevant product types (PTs): Only the product types of biocides that may end up in meat and dairy products should be selected.
- Identification of relevant active substances: Only the active substances that may be contained in these biocides are relevant. Related substances, such as degradation products and disinfection by-products (DBPs), can also be relevant and are identified.
- Availability of monitoring data: Available monitoring data can provide insight into exceedances of existing MRLs in meat and

dairy products. Absence of monitoring data can be used as a prioritisation criterion for monitoring.
- The ready availability of suitable analytical methods for enforcement of the substances may give insight into which compounds can easily be taken up in monitoring programmes and for which compounds methods need to be developed first. The availability of MRLs usually suggests availability of analytical methods, but these might not be applicable to meat and dairy products. In the absence of an MRL, an analytical method may still need to be developed.
- Identification of available MRLs in meat and dairy products from PPP and/or VMP use: If an MRL applies at all, this is generally a prerequisite for monitoring by enforcement agencies. However, the listed (default) MRLs could be too low to cover biocidal use. In that case, if residues could be expected, monitoring helps to decide on amending MRLs. Active substances without an MRL and without monitoring data could be given a higher priority for monitoring.
- Other options for prioritisation, based on:
  - The use scale; the higher the production and use volume of specific biocides the higher the expected use frequency and the higher the priority that should be given.
  - The physical/chemical properties of the substance.
  - Intrinsic hazard properties for human health; the more hazardous a substance the higher the prioritisation.

1.2 Determining the approach of the research project

The above steps and prioritisation criteria are based on input from experts working in the field of biocide authorisation, enforcement, or research. To gather information, we organised a workshop in September 2023 for experts from the Netherlands Food and Consumer Product Safety Authority (NVWA), Wageningen Food Safety Research (WFSR), the Board for the Authorisation of Plant Protection Products and Biocides (Ctgb) and RIVM.

The outcome yielded the following points to take into account in our approach:
- If foods are analysed for active substances in biocides, it is efficient to choose a broad analytical package of relevant active substances. It is, therefore, better to focus on a broader range of applications. In the context of residues found in meat and dairy, beside PT04 biocides, several other PTs are considered relevant and necessary to include in this project. These include disinfectants for veterinary hygiene (PT03) and disinfectants for drinking water (PT05), rodenticides (PT14), insecticides (PT18) and repellents (PT19) used in livestock farming.
- To prioritise the active substances that are most important to monitor, all biocidal active substances approved or under review in the selected PTs from the ECHA database are included. Prioritising to select part of these studied substances is important because there are no standard analysis packages that cover all active substances in biocides, and analytical methods

may need to be developed for the biocidal active substances of choice.
- Prioritisation of the active substances on the basis of hazard properties is investigated. Other options were considered as well, such as physical/chemical properties and the most commonly used active substances in authorised biocidal products.
- It is not feasible to investigate which active substances are used relatively often for all situations in which biocides can end up in meat or dairy. Therefore, only some easily accessible information on this subject is gathered.
- To provide an overview of the available results regarding monitoring of residues of biocidal active substances in meat and dairy, the database of the Dutch Quality Programme for Agricultural Products (KAP database) is consulted. However, this database does not contain all monitoring results. To obtain more monitoring data, some literature is consulted.
- WFSR is consulted about the availability of analytical methods for the active substances.
- Due to its involvement in the process of deriving MRLs and in the development of guidelines for assessing the risks of biocides, RIVM gives an overview of these subjects. The available MRLs for meat and dairy for the selected active substances are collected.

1.3 Contents of this report

Chapter 2 explores the various product types of biocidal products that have the potential to leave residues in meat and dairy products. Next, in Chapter 3, we delve into the active substances found in these biocidal products. This chapter also discusses the degradation products, metabolites, and disinfection by-products. Having established the relevant PTs and identified the relevant active substances moving forward to Chapter 4, we collected monitoring results for meat, dairy and infant formulae from a Dutch database and some literature that are available at RIVM. Chapter 5 provides an overview of the availability of analytical methods for meat and dairy products at WFSR. Chapter 6 focusses on the available Maximum Residue Limits (MRLs) for active substances in the selected PTs. This chapter also provides more information on the current status on how to set MRLs for biocides. Following this, Chapter 7 investigates several other options to prioritise the active substances to be monitored, taking into account, among others, their hazard properties for human health. Chapter 8 then brings together all the results of the study and evaluates them in detail. In this chapter, a proposal for prioritisation of the active substances, degradation products, metabolites, and disinfection by-products can be found. Finally, in Chapter 9, we present the more general conclusions and recommendations. This chapter summarises the key findings of the study on the identification and prioritisation of substances for monitoring and on the current legal status for MRLs for biocides. This chapter also offers suggestions for improving the monitoring of meat and dairy products concerning the use of biocides.

1.4 Disclaimer

Because our focus is on biocidal active substances, we use the active substance names and the CAS numbers used by ECHA[5], because ECHA is responsible for the information on biocides. Also, for other substances we mentioned (for example, isomers or individual substances in mixtures) we use the name used on the ECHA website, if available (see box below).

Example of individual substances in mixtures and used names

Active substances in biocides can be mixtures. For example, 'Alkyl (C12-18) dimethylbenzylammonium chloride (ADBAC (C12-18))' is an active substance in the ECHA database. BAC is a collective name for mixtures of substances with a C8, C10, C12, C14, C16, or C18 alkyl group and the full name is: mixture of alkyl(C8-18) benzyldimethylammonium chloride. So BAC 12 is an individual substance, that is part of the mixture Alkyl (C12-18) dimethylbenzylammonium chloride (ADBAC (C12-18)) that is an active substance in biocides. In the C&L Inventory BAC 12 is named 'Benzododecinium chloride'.

For this project, we have collected detailed information from several databases and documents that use different ways to identify a substance. In some databases and documents, only the substance name is used as an identifier, but different synonyms are used for the same substance (see box below). Within this project, we were not able to check all possible synonyms and identifiers to link information from different sources and legal frameworks to the same substance. Because of this, we may have overlooked some information. Besides, some information will change over time (during and after this study), for instance, the approval status of active substances and the available MRLs.

Example of different identifiers for 'one' substance

ECHA uses the substance name 'α-cyano-3-phenoxybenzyl 3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate'. Fortunately, ECHA mentions the name 'Cypermethrin' between brackets, but this is not always the case. The Substance Infocard on the ECHA website[6] shows that cypermethrin has 12 regulatory process names, 25 translated names, 37 IUPAC names and 14 other identifiers. IUPAC stands for International Union of Pure and Applied Chemistry. Among the other identifiers are 12 different CAS numbers. Cypermethrin has eight isomers and can appear in various isomeric compositions.

If information from this report is used for decision-making, please ensure that the information is still up to date and correct. Prior to selecting substances for monitoring in food, always check the (legal) residue definition of the biocidal active substance. In that way, the correct components of the residue (e.g. parent substance and/or metabolites and/or isomers) will be analysed. If a (legal) residue definition is not available, usually only the active substance is analysed.

[5] See: https://echa.europa.eu/nl/information-on-chemicals/biocidal-active-substances
[6] See: https://echa.europa.eu/nl/substance-information/-/substanceinfo/100.052.567#IUPAC_NAMEScontainer

2 Identification of product types of biocides potentially leaving residues in meat and dairy products

2.1 Introduction to relevant product types (PTs)

To narrow the scope of the project to meat and dairy products, it is crucial to identify which PTs have uses that may contribute to residues in meat and dairy products.

In the BPR, biocides are divided into 22 product types (PTs) on the basis of their application. Half of these PTs include applications where biocidal residues can end up in food or feed. Table 2.1 provides an overview. This overview is based on the following sources:

- The RIVM report on risk factors for biocidal use (Wezenbeek and Komen, 2023).
- Guidance and draft guidance on dietary risk assessment for biocides. There are (draft) guidance documents where PT01, PT03, PT04, PT05, PT06, PT08, PT12, PT14, PT18, PT19, and PT21 are identified as PTs relevant for dietary risk assessment. See Annex 1 for more information on guidance on dietary risk of residues of biocides in food.

Table 2.1 Applications of biocides within different product types (PTs) where residues of biocides may end up in food or feed.

PT	Description	Applications
01	Human hygiene	Disinfection of (gloved) hands where the disinfected hands (gloves) are subsequently used to process food, or where food is eaten with the disinfected hand.
03	Veterinary hygiene	Disinfection of stables and hatcheries, animal transport equipment, hooves and udders of animals, where the disinfectant can be absorbed by the farm animal and end up in the meat, milk, or eggs.
04	Food and feed area	Disinfection of equipment, containers, eating and drinking utensils, surfaces, or pipes used for the production, transport, storage, or consumption of food or feed. Cleaning in Place (CIP) and non-CIP treatments. Aseptic packaging. Disinfectant cleaners in domestic kitchens. Disinfectants in dishwasher detergents.
05	Drinking water	Disinfection of drinking water tanks for humans and animals where the water is either used as drinking water or for preparing food or feed.
06	Preservatives for products during storage	Preservation of dishwashing detergents with biocides where residues can end up in food via plates or cutlery, or preservation of lubricants used in machines with conveyor belts on which food is transported.

PT	Description	Applications
08	Wood preservatives	Preservation of wood, where the wood is used to support trees, shrubs, or vines or to make crates in which fruit or vegetables are grown and where biocide residues can be absorbed by plants via leaching into the soil. Wooden boxes for fruit or vegetables, cheese, and milk derivatives, meat and meat products. Exposure of livestock to treated wood (e.g. rubbing or nibbling on fences or stable structures)
12	Slimicides	Preventing slime formation in paper or wood pulp from the paper industry, where the paper or wood pulp is processed into packaging material for food or feed.
14	Rodenticides	Used to control rodents such as mice in areas intended for food processing or storage and in stables.
18	Insecticides, acaricides and products to control other arthropods	Used to control insects such as flies in farm animal enclosures or to control insects such as cockroaches in areas intended for food processing or storage. Insecticides used in domestic environments where food is processed, stored, or consumed.
19	Repellents and attractants	Used to repel insects from farm animal enclosures or to repel insects from the livestock animals themselves. Applied on hands used to pick food such as wild mushrooms.
21	Antifouling products	Used to prevent algae growth in fishing nets or farm fish tanks, where the agent can be absorbed by a fish and end up in the fish flesh.

2.2 Product types of biocides relevant for residues in meat and dairy

The European Commission (EC) has published an approach to the establishment of MRLs for residues of active substances contained in biocidal products for food and feed (EC, 2024). In deviation of the guidance documents on dietary risk assessment (see Annex 1), this document states that the use of biocidal products belonging to PT03, PT04, PT05, PT18, PT19, and PT21 is more prone to leaving residues in food or feed than other product types. A risk-based approach should concentrate on active substances used for those product types. The use of biocidal products belonging to other product types would not be expected to leave residues in food or feed.

To limit the amount of PTs that are relevant for meat and dairy products, this report focusses on the PTs mentioned in the EC approach, apart from PT21, since fish and shellfish fall outside the scope of this project. This approach was supported by the participants of the workshop in September 2023 (see Section 1.2). Moreover, PT14 was added due to finding residues of active substances in rodenticides in

animal products[7]. Although proper use of rodenticides (PT14) should not leave any residues in meat or dairy products. For the other selected PTs, some residues may well be unavoidable.

2.3 Conclusion on identification of relevant PTs

Ultimately, this investigation concerns biocides in PT03, PT04, PT05, PT14, PT18, and PT19. See Table 2.2 for the applications.

Table 2.2 Product types (PTs) and applications where residues of biocides may end up in meat and dairy products and which were included in this study.

PT	Description	Applications related to meat and milk production and processing
03	Veterinary hygiene	Disinfection of stables and hatcheries, animal transport equipment, hooves and udders of animals, where the disinfectant can be absorbed by the farm animal via various routes of exposure (dermal, oral, inhalation) and end up in the meat or milk.
04	Food and feed area	Disinfection of equipment, containers, eating and drinking utensils, surfaces, or pipes used for the production, transport, storage, or consumption of food or feed. Cleaning in Place (CIP) of milking machinery, ice-cream machinery, and non-CIP treatments. Aseptic packaging of milk. Disinfectant cleaners in domestic kitchens. Disinfectants in dishwasher detergents.
05	Drinking water	Disinfection of drinking water tanks for humans and livestock where the water is drunk or used to prepare food or feed.
14	Rodenticides	Used to control rodents such as mice in areas intended for food processing or storage and in stables
18	Insecticides, acaricides and products to control other arthropods	Used to control insects such as flies in farm animal enclosures or to control insects such as cockroaches in areas intended for food processing or storage. Insecticides used in domestic environments.
19	Repellents and attractants	Used to repel insects from farm animal enclosures or to repel insects from the livestock animals themselves.

[7] See https://www.nvwa.nl/nieuws-en-media/nieuws/2023/10/16/nvwa-legt-uit-voorzorg-activiteiten-46-veehouders-tijdelijk-stil

3 Identification of active substances with potential residues in meat and dairy

3.1 Introduction to active substances

A further step to narrow down the number of substances to consider for future monitoring programmes is identifying the active substances that are allowed for use in the identified PTs from Chapter 2, as well as how they are distributed across the various PTs. First, some background is given on the different regulatory statuses an active substance can have, then the active substances are identified, and lastly, the potential occurrence of degradation products, metabolites, and disinfection by-products is discussed, because these could also be relevant for food safety and/or setting MRLs.

Approval of existing and new active substances
As mentioned in Section 1.1, biocidal products contain active substances. Under the BPR, each active substance-product type (a.s.-PT) combination must be approved through an EU process. When the BPR started in 2013, existing a.s.-PT combinations were included in a review programme. Only these existing combinations may be used in biocides while under review or when approved. New active substances or new PT combinations can only be used after approval. For monitoring, new active substances and existing substances with new PTs are expected in food only after approval, while existing a.s.-PTs from the review programme may be found in food during the review process.

Active substances-PT combinations are approved for the European Union as a whole. Active substances that meet the criteria for ‘low risk substances’ are also approved for the entire European Union and listed in Annex I of the BPR. Annex I substances are allowed for use in all PTs. Biocidal products are authorised per EU Member State or for the entire European Union. In the Netherlands, Ctgb is the organisation that authorises biocides for the Dutch market.

Active substances: approved or under review
The assessment within the EU review programme results in approval or non-approval of a.s-PTs. Non-approved a.s-PTs are not allowed to be used any longer. Only the approved a.s.-PTs and the ‘existing’ a.s.-PTs in the review programme (see above) may be used in biocides. The current study takes into account the active substances in the selected PTs that are approved or under review in the EU. This means that some of the selected a.s.-PTs are not allowed to be used in biocides yet, because they were not included in the list with existing a.s.-PTs from 2013.

Over time, the list with approved substances and substances under review changes. All substances have to pass the approval process, and can be ‘not approved’ or ‘withdrawn’ in the future. The availability of authorised biocides per application also changes over time.

By choosing all a.s.-PTs that are currently allowed in the EU or may be allowed in the future, this study anticipates future developments in the authorised biocides in the Netherlands and other EU Member States. This way, potential residues in imported food from within the EU are likewise taken into account. The Netherlands also imports food from outside the EU. This food can contain residues of biocides that are not considered in this study.

Assessment reports
If active substances have been assessed at EU level, an Assessment Report (AR) is available on the ECHA website, containing information on the properties, efficacy, and risks of the active substance for humans and the environment. If active substances are still in the EU review programme, such an Assessment Report is not yet available. If any currently authorised biocides contain such an active substance in the Netherlands, information on the assessment of this active substance can be found in the Assessment Report on the biocide on the Ctgb website.

3.2 Identification and distribution of the active substances across the selected PTs

To create a list of all active substances that might end up in meat and dairy, the ECHA database on biocidal active substances[8] was used. All active substances that have been approved or are part of the review programme in the EU for PT03, PT04, PT05, PT14, PT18, and PT19 were included. This means that the substances in the selected PTs were included if they had the regulatory status ‘approved’, ‘initial application for approval in progress’, ‘approved renewal in progress’, ‘Commission decision (participant withdrawal)’, or ‘approved other updates in progress’. Substances listed in Annex I[9] of the BPR were included as well, since they are allowed in all PTs and could therefore end up in meat and dairy as well. Note that the use of Annex I substances in PT03, PT04, PT05, PT14, PT18, or PT19 depends on their properties. Annex 2 shows the results. The number of unique active substances that are approved or under review in Annex 2 (table A2.1) is 186.

At the beginning of 2024, Annex I of the BPR contained 33 active substances, out of which 29 were approved and 4 substances were under review (see Annex 2, table A2.1). A total of 13 new active substances (new a.s.-PTs) still have to pass the assessment process to be allowed for use in biocides (Annex 2, table A2.2).

On the basis of the results in Annex 2, Table 3.1 provides an overview of the number of active substances that are allowed per PT (excluding the 33 Annex I substances, but including the 13 new active substances). An active substance may be allowed for more than one PT, hence there is a difference between the total number of unique active substances (186) and the total number of active substances allowed for (one or more of) the selected PTs (223). The table shows that PT04 has the largest number of active substances. The number of active substances in PT14 and in PT19 is relatively limited.

[8] See: https://echa.europa.eu/nl/information-on-chemicals/biocidal-active-substances
[9] Annex I of the BPR lists active substances considered to be ‘low risk’, due to a low toxicity that do not give rise to concern.

RIVM provided an overview of the status of this review programme in 2023 (Wezenbeek and Komen, 2023). This overview shows how many active substances are approved per PT and how many are still in the review programme. The overview also shows how many a.s.-PTs are non-approved, expired, cancelled or no longer supported. Almost all the allowed active substances in PT14 are approved active substances. A large part of the allowed active substances in PT18 and PT19 are approved too, as are more than half of the allowed substances in PT03. A large part of the allowed active substances in PT04 and PT05 are still in the review programme to pass the EU-assessment process. Less is known about the potential risks of these active substances than about those of the approved active substances. Some of the active substances in the review programme may not pass the approval process.

Table 3.1 shows how many of the substances that are allowed for a specific PT are allowed in other PTs as well. There is a lot of overlap between the allowed substances in PT03, PT04, and PT05. There are 19 substances that may be used in PT03, PT04, and PT05. This can be explained by their corresponding purposes to disinfect. The active substances in PT14 are generally unique to this PT. Two of the substances allowed in PT14 are also allowed in PT18. They are the gases hydrogen cyanide and phosphine released from aluminium phosphide. The active substances in PT18 and PT19 are also largely unique, but 6 active substances may be used in biocides in both PTs. There is only one substance (decanoic acid) that may be used in PT18, PT19, and PT04. And there is one substance (octanoic acid) that may be used in PT18 and PT04.

Table 3.1 Number of active substances (a.s.) per PT approved or under review and overlap of uses in several of the selected PTs (situation January 2024).

	PT03	**PT04**	**PT05**	**PT14**	**PT18**	**PT19**
Number of allowed a.s.	48	65	27	14	50	19
Only in this PT	9	22	6	12	41	13
Also in PT03		39	19	0	0	0
Also in PT04	39		21	0	2	1
Also in PT05	19	21		0	0	0
Also in PT14	0	0	0		2	0
Also in PT18	0	2	0	2		6
Also in PT19	0	1	0	0	6	

A very limited part of the active substances is new, and is only allowed to be used in biocides after passing the assessment process. See Annex 2 for details.

At the moment, some of the active substances presented in Annex 2 are not used in biocidal products in the Netherlands. Because these a.s.-PTs are approved or under review under the BPR (except new active substances under review), biocides containing these active substances may be authorised in other EU Member States. Residues of these substances can then appear in imported food from these countries.

Generated active substances

Annex 2 lists a number of active substances that are generated from other substances. These other substances are the so-called precursors.

The way in which active substances are formed from precursors can vary. For example, adding two precursors together may generate another substance (such as performic acid generated from formic acid and hydrogen peroxide), or one precursor may release an active substance over time (such as aluminium phosphide releasing phosphine). Active substances can also be generated under the influence of, for instance, UV light or an electric current (such as active chlorine generated from sodium chloride by electrolysis). If active substances are generated from other substances, this is apparent from the name of the active substance. This includes the use of words such as 'releasing', 'released from', 'generated from' or 'in situ generated'. Precursors do not necessarily fully disappear. If they remain behind, they may leave residues in food.

3.3 Degradation products, metabolites, and disinfection by-products (DBPs)

Active substances can be metabolised in livestock or broken down due to environmental conditions (pH, temperature, sunlight) or processing conditions (e.g. cooking, pasteurisation, sterilisation, UV-treatment). This creates metabolites and/or degradation products and/or may change an isomeric composition. Such isomers, metabolites, and/or degradation products may need to be taken into account when analysing residues in food (see Section 6.2 for more information on the residue definition). When using reactive active substances, reaction products, called disinfection by-products (DBPs) can arise. They may need to be monitored separately. Until now, it is unclear which DBPs could be relevant for food or drinking water, as guidance is under development. This is why the Ctgb only takes currently known degradation products and DBPs into account when assessing the risks of residues in food (e.g. chlorate and chlorite for active chlorine-based biocidal products). In some guidance documents and literature, degradation products such as chlorate and chlorite are also called DBPs. In this report, we sometimes use the term ‘related substances’ for the kind of substances mentioned above.

Chlorine compounds and chlorate

The ECHA database on active substances in biocides includes several active substances that are based on active chlorine, chlorine dioxide, monochloramine or tosylchloramide (see Annex 3 for details). Chlorine compounds are difficult to link to specific uses, because the end products chloride and chlorate can come from various uses and some compounds also occur in nature. Since active chlorine and chlorine dioxide are mainly intended to react with organic substances, disinfection by-products (DBPs) are important to monitor. For this purpose, a chlorine-containing marker molecule must be defined, which is often formed in food or drinking water. Marker molecules for DBPs in food have not yet been defined by ECHA or EFSA, although chlorine-related DBPs potentially found in drinking water (EC, 2020a), such as THMs (trihalomethanes, such as chloroform) and HAAs (haloacetic acids, such as chloroacetic acid), can also be expected in food. The EC writes that the discovery, in 2014, of chlorate in food by an official control

laboratory was a coincidenc[10]. Chlorate could be interesting to monitor as a degradation product. But, as mentioned, the chlorate could also come from, for example, the use of cleaning products rather than from biocides. Currently, Ctgb designates chlorate and chlorite as the substances to be assessed, when authorising biocides containing active substances that are based on active chlorine or chlorine dioxide.

Chlorite, perchlorate and chloroform
Depending on, among other things, the temperature and pH, chlorite (through reduction of chlorate) and perchlorate (through oxidation of chlorate) can also be formed as a degradation product. The EFSA CONTAM panel (EFSA Panel on Contaminants in the Food Chain) has published a scientific opinion on perchlorate in food. This document states: '*Water disinfection with chlorinated substances that potentially degrade to perchlorate could be another potential source of contamination.*' Perchlorate also occurs in fertilisers and can, therefore, end up in water, vegetables, and fruit, for example. 'Vegetables and vegetable products' and 'Milk and dairy products' were identified in the chronic exposure assessment as the most important contributors to perchlorate exposure in all age groups (EFSA CONTAM, 2014). EFSA (2017) also mentioned milk and dairy products as an important contributor to the exposure of perchlorate. They mentioned chlorinated products used for water potabilisation as a notable source and chlorinated biocides as a minor source. We assume that chlorinated products used for water potabilisation can also be biocides. Chlorinated disinfectants are mentioned in the appendices of an advice by BuRO on risks in the dairy chain relating to disinfecting the milking machine and equipment for storage and dairy processing (NVWA, 2017). The often used combination of alkaline detergents with sodium hypochlorite as a disinfectant can result in chloroform as a disinfection by-product (DBP) in milk. Moreover, there is increasing usage of chlorine dioxide in the dairy industry, which could result in the presence of chlorite, chlorate and perchlorate in dairy. So it might also be interesting to monitor chlorite, perchlorate and chloroform as potential degradation products or DBPs of disinfectants.

DBPs by using halogenated disinfectants
ECHA has developed a guidance for assessing human health risks of DBPs in swimming pools (PT02) (ECHA, 2017a). This guidance is not suitable for assessing health risks of potential DBPs in meat and dairy, but it does contain general information about the type of DBPs that can arise when using reactive active substances in disinfectants. Appendix 2 of this guidance mentions the following DBPs:

- trihalomethanes (THMs): trichloromethane (chloroform), tribromomethane (bromoform), bromodichloromethane and dibromochloromethane;
- bromate;
- chlorate and chlorite;
- halo-acetic acids (HAAs): mono-, di- and trichloroacetic acid, mono-, di- and tribromoacetic acid and dibromochloroacetic acid;
- halo-aldehydes: chloral hydrate and bromal hydrate;

[10] See: https://food.ec.europa.eu/plants/pesticides/maximum-residue-levels/chlorate_en

- haloacetonitriles: dichloroacetonitrile, dibromoacetonitrile, and bromochloroacetonitrile.

This guidance does not mention perchlorate as a potential DBP in swimming pools. Appendix 4 of this guidance states that human health risks of DBPs in the context of biocides authorisation are expected to be potentially relevant for PT03, PT04, and PT05.

DBPs in washing water of vegetables
A report was published in the EFSA Journal (Gadelha et al., 2019) about the formation of DBPs in washing water of ready-to-eat vegetables. This document contains general information that might be relevant for residues in meat and/or dairy. It gives information on potential DBPs adapted from the US EPA Drinking Water Guidance on DBPs. These are, among others:

- DBPs from active chlorine: trihalomethanes (THMs), haloacetic acids (HAAs), and bromate;
- DBPs from chlorine dioxide: chlorite, chlorate, and chloride;
- DBPs from ozone: bromate, formaldehyde, aldehydes, hydrogen peroxides, and bromomethanes;
- DBPs from chloramines: dichloramines, trichloramines, and cyanogen chloride.

Chloroform, bromodichloromethane, dibromochloromethane, and bromoform are THMs. HAAs are mono-, di-, and trichloroacetic acid and their brominated analogues (mono-, and dibromo-acetic, bromochloro-acetic acid). Which HAAs are formed depends on the bromide concentrations.

Chlorine is said to be the most common disinfectant used worldwide. Chlorate, THMs and HAAs are the DBP/degradation product classes formed at the highest concentrations after chlorination. The report pays extra attention to trihalomethanes (THM), which could be a relevant concern for human health. Bromate can be formed by reaction with bromide ions.

DBPs by using ozone generated from oxygen
The Assessment Report for ozone generated from oxygen (The Netherlands, 2022) gives some information on DBPs. Currently, more than 600 DBPs have been identified in drinking water. DBPs could be present in food and drinks after contact with treated surfaces or if drinking water is used in the production process. Mentioned DBPs are bromate, chlorate and trihalomethanes (chloroform, bromoform, dibromochloromethane, bromodichloromethane). In this Assessment Report, formaldehyde, aldehydes and hydrogen peroxides are not mentioned as potential DBPs when using ozone.

Per-compounds
Another group of substances that can form DBPs are per-compounds, such as hydrogen peroxide and peracetic acid. Per-compounds are reactive radical-forming substances that will quickly react to form water (from hydrogen peroxide) or acetic acid (from peracetic acid) or potassium hydrogen sulphate, sodium hydrogen sulphate, or sodium carbonate (from other per-compounds; see Annex 3). For such

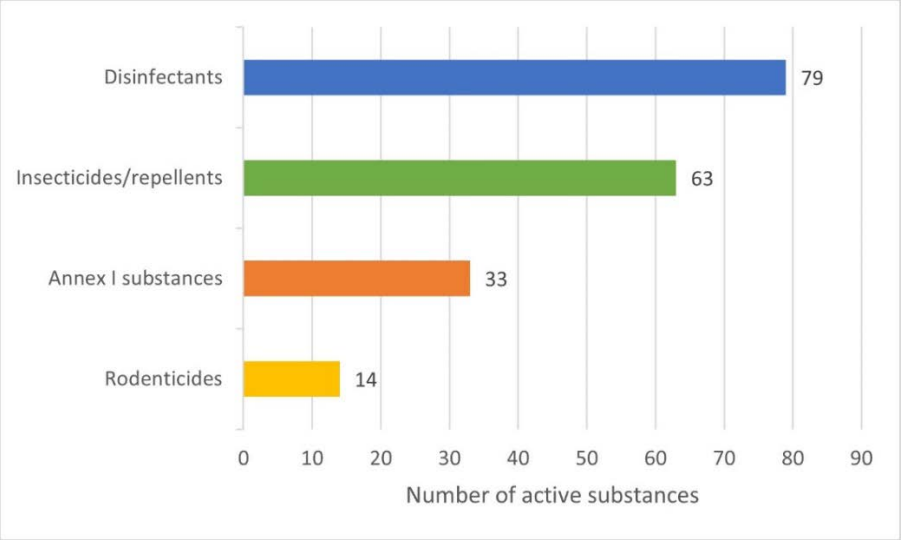
substances, the DBPs formed by reaction with the radicals from the per-compounds are probably more important to monitor. For this purpose, a marker molecule must be defined that is often formed in food. So far, neither ECHA nor EFSA has defined marker molecules for DBPs in food.

Quaternary ammonium compounds
A number of selected active substances belong to the group of the quaternary ammonium compounds. In this report we use the abbreviation 'quats'. Most of them are mixtures, such as alkyl (C12-18) dimethylbenzylammonium chloride (ADBAC (C12-18)) and didecyldimethylammonium chloride (DDAC (C8-10))[11]. The latter is also known as 'quaternary ammonium compounds, di-C8-10-alkyldimethyl, chlorides'. The Danish EPA conducted an extensive investigation into quats (Mongelli et al., 2024). They established a method to quantify 20 quats at ng/L level. They also developed a novel approach to the identification of specific transformation products, resulting in the description of a total of 23 photodegradation products and 35 biodegradation products exclusively associated with BAC 12 (benzododecinium chloride or benzalkonium chloride (alkyldimethylbenzylammonium chloride) with one dodecyl alkyl chain).

3.4 Conclusion on the identification and prioritisation of relevant active substances

Figure 3.1 shows the number of potential biocidal active substances in meat and dairy products classified into the categories disinfectants (79), rodenticides (14), insecticides/repellents (63) and Annex I substances (33).

Figure 3.1 Number of potential biocidal active substances in meat and dairy products.



The use of Annex I substances in PT03, PT04, PT05, PT14, PT18, or PT19 depends on their properties.
The total number of potential active substances is 186. Due to an overlap across different categories, with 3 substances allowed for use in more than 1 category, the total number of substances shown in this figure is 189 instead of 186.

[11] This name in the ECHA database is chemically not correct. Didecyl refers to alkyl groups of C10 and not of C8. See Annex 3 for more details.

Within PT03, PT04, PT05, PT14, PT18, and PT19, a total of 186 unique active substances was identified. Where some are unique for use in 1 PT (n=103), others are allowed for use in 2 (n=30) or even 3 (n=20) PTs. A number of substances (n=33) are included in Annex I and are allowed for use in all PTs, such as acetic acid, ascorbic acid, carbon dioxide. This does not mean that these substances are used in all PTs in practice.

Prioritisation
For the prioritisation of substances to be monitored, the use in more than one PT may be given preference over the use in only one PT. This could indicate that an active substance is used multiple times at various stages in the supply chain. In Table 3.2, an overview is given of the active substances occurring in at least two PTs. The remaining single-PT substances and the Annex I substances can be found in Annex 2 (Table A2.1). Annex I substances are 'low risk substances' and could get a lower priority for monitoring. For most (maybe all) of the 33 Annex I substances, such as carbon dioxide or concentrated apple juice, monitoring is not relevant. Also, the 13 new active substances (new a.s.-PTs) could be given a lower priority for monitoring as there are no biocides with these substances on the market yet. The remaining 186-33-13=140 unique active substances are relevant for monitoring and could be prioritised further on the basis of other criteria as mentioned in the following chapters. In addition, some other degradation products and DBPs should be included in the list of potential substances for monitoring. Because chlorate and chlorite are used as substances to be assessed in the authorisation procedure, these are relevant to add. In the information gathered, other degradation products and DBPs are mentioned that could be relevant to monitor, such as perchlorate, chloroform, bromate, bromoform, other chlorinated and/or brominated DBPs, and degradation products of quats. The information collected is too limited to decide which substance should or should not be added to the list.

Table 3.2 Overview of biocidal active substances occurring in at least two PTs (situation January 2024).

Product types		**Active substances**	
No.	**PT**	**Name from ECHA database**	**CAS no.**
3	03, 04, 05	Active chlorine generated from sodium chloride and pentapotassium bis(peroxymonosulphate) bis(sulphate)	-
	03, 04, 05	Active chlorine generated from sodium chloride by electrolysis	-
	03, 04, 05	Active chlorine released from calcium hypochlorite	7778-54-3
	03, 04, 05	Active chlorine released from hypochlorous acid	-
	03, 04, 05	Active chlorine released from sodium hypochlorite	7681-52-9
	03, 04, 05	Chlorine dioxide	10049-04-4
	03, 04, 05	Chlorine dioxide generated from sodium chlorite by acidification	-
	03, 04, 05	Chlorine dioxide generated from sodium chlorite by electrolysis	-

Product types		Active substances	
No.	**PT**	**Name from ECHA database**	**CAS no.**
	03, 04, 05	Chlorine dioxide generated from sodium chlorite by oxidation	-
	03, 04, 05	Formic acid	64-18-6
	03, 04, 05	Free radicals generated in situ from ambient air or water	-
	03, 04, 05	Hydrogen peroxide	7722-84-1
	03, 04, 05	Pentapotassium bis(peroxymonosulphate) bis(sulphate)	70693-62-8
	03, 04, 05	Peracetic acid	79-21-0
	03, 04, 05	Silver nitrate	7761-88-8
	03, 04, 05	Sodium dichloroisocyanurate dihydrate	51580-86-0
	03, 04, 05	Symclosene	87-90-1
	03, 04, 05	Tosylchloramide sodium (Tosylchloramide sodium - Chloramin T)	127-65-1
	03, 04, 05	Troclosene sodium	2893-78-9
3	04, 14, 18	Decanoic acid	334-48-5
2	03, 04	Alkyl (C12-16) dimethylbenzylammonium chloride (ADBAC/BKC (C12-16))	68424-85-1
	03, 04	Alkyl (C12-18) dimethylbenzylammonium chloride (ADBAC (C12-18))	68391-01-5
	03, 04	Alkyl (C12-C14) dimethyl(ethylbenzyl)ammonium chloride (ADEBAC (C12-C14))	85409-23-0
	03, 04	Alkyl (C12-C14) dimethylbenzylammonium chloride (ADBAC (C12-C14))	85409-22-9
	03, 04	Amines, N-C10-16-alkyltrimethylenedi-, reaction products with chloroacetic acid	139734-65-9
	03, 04	Benzoic acid	65-85-0
	03, 04	Biphenyl-2-ol	90-43-7
	03, 04	Didecyldimethylammonium chloride (DDAC (C8-10))	68424-95-3
	03, 04	Didecyldimethylammonium chloride (DDAC)	7173-51-5
	03, 04	Glutaral (Glutaraldehyde)	111-30-8
	03, 04	Glycolic acid	79-14-1
	03, 04	Glyoxal	107-22-2
	03, 04	Iodine	7553-56-2
	03, 04	L-(+)-lactic acid	79-33-4
	03, 04	N-(3-aminopropyl)-N-dodecylpropane-1,3-diamine (Diamine)	2372-82-9
	03, 04	Peracetic acid generated from tetra-acetylethylenediamine (TAED) and sodium percarbonate	-
	03, 04	Polyhexamethylene biguanide hydrochloride with a mean number-average molecular weight (Mn) of 1600 and a mean polydispersity (PDI) of 1.8 (PHMB(1600;1.8))	27083-27-8
	03, 04	Polyvinylpyrrolidone iodine	25655-41-8

Product types		Active substances	
No.	**PT**	**Name from ECHA database**	**CAS no.**
	03, 04	Reaction mass of peracetic acid and peroxyoctanoic acid	33734-57-5
	03, 04	Salicylic acid	69-72-7
2	04, 05	Ozone generated from oxygen	-
	04, 05	Silver	7440-22-4
2	04, 18	Octanoic acid	124-07-2
2	14, 18	Aluminium phosphide releasing phosphine	20859-73-8
	14, 18	Hydrogen cyanide	74-90-8
2	18, 19	Chrysanthemum cinerariaefolium extract from open and mature flowers of Tanacetum cinerariifolium obtained with supercritical carbondioxide	-
	18, 19	Chrysanthemum cinerariaefolium, extract from open and mature flowers of Tanacetum cinerariifolium obtained with hydrocarbon solvents	89997-63-7
	18, 19	Geraniol	106-24-1
	18, 19	Margosa extract from cold-pressed oil of the kernels of Azadirachta Indica extracted with super-critical carbon dioxide	84696-25-3
	18, 19	Metofluthrin; epsilon-Metofluthrin	240494-71-7

4 Monitoring data on active substances in meat and dairy products

4.1 Introduction to monitoring data on residues

The results of the monitoring data on residues can be used to establish whether or not specific biocidal active substances are monitored for. The absence of monitoring data is one of the criteria that can be used for prioritising active substances for monitoring within the framework of biocides. This chapter only concerns the availability and results of monitoring data. The availability of MRLs is reported in Chapter 6. Exceedances of MRLs or available monitoring data showing residues below MRLs are reported in Section 8.3.

An important Dutch source of monitoring data on residues in food and feed is the KAP database (Quality Programme for Agricultural Products)[12]. This database contains chemical monitoring data in food and feed, originating from various monitoring programmes on pesticide residues, residues of veterinary medicines, and several contaminants, such as acrylamide, mycotoxins, PFAS and heavy metals. The data is sent by data providers and recorded centrally in the KAP database. RIVM sends data stored in the KAP database to EFSA on a yearly basis. EFSA uses this data to check the actual dietary exposure of European consumers and considers whether additional measures are needed to reduce this exposure.

KAP collects the monitoring data on residues of annual ongoing monitoring programmes in the field of food safety in the food chains. In addition, the results of ad-hoc monitoring programmes are included in the database. In KAP annual reports[13], the amounts and types of data uploaded to EFSA can be found. The reports from 2020 to 2023 show that there is no specific programme for collecting data on active substances in biocides in meat and dairy products, nor are there any specific monitoring programmes with this aim during this period. This means that almost all monitoring data on biocides in meat and dairy products in the KAP database relates to substances that are also present as active substances in plant protection products (PPP) and/or veterinary medicinal products (VMP).

4.2 Monitoring data from the KAP database

4.2.1 Selected monitoring data for meat and dairy products from the KAP database

We have collected the available monitoring data on residues in meat and dairy products for the active substances in the selected PTs (see Section 3.2) in biocides from the KAP database for the years 2018 to 2022.

The analysis results for a certain sample in the KAP database are either reported as a quantified concentration at or above the Limit of

[12] See: https://www.rivm.nl/en/chemkap
[13] See: https://www.rivm.nl/en/chemkap/kap-annual-reports

Quantification (LOQ), or they are reported as whites (i.e. empty cells in the database). In this report, we write ‘above the LOQ’ (>LOQ), if we mean ‘at or above the LOQ’. We report the whites as monitoring data below (a certain mentioned) LOQ (<LOQ). This could either be a detected substance that could not be quantified, or no detected substance at all. If no analysis results for residues of a certain substance can be found in the KAP database, we report this as no monitoring data on the substance in question.

A bottleneck that makes the interpretation of the monitoring data difficult is that the LOQ for analytical methods may differ. The LOQ determines which concentration is quantifiable with sufficient precision. It is possible that with an analytical method with a higher LOQ ‘nothing is found’, while with an analytical method involving a lower LOQ a quantifiable concentration may have been reported.

Another problem is that no CAS numbers are included in the KAP database and that sometimes, different substance names are used than in the ECHA database. The KAP database does contain so-called ParamCodes from EFSA (see Section 6.2 for more information) and in most cases, we were able to link them to CAS numbers. We also checked the KAP database for potential DBPs/degradation products on monitoring data for chlorate, chlorite, perchlorate, chloroform, trihalomethanes, haloacetic acids, and bromate.

The selected monitoring data is divided into three groups:

- Meat: import game meat, chicken (fillet), liver (from duck, chicken, other poultry (‘overig pluimvee’), horse, beef, sheep, pig or broiler (‘slachtkuiken’ or ‘vleeskuiken’)), kidney (fat) (from beef, sheep, pig, fattened calf or horse), minced beef, beef, bacon, minced pork, pork, fat (from duck domestic, deer farmed, chicken, laying hen, other poultry or broiler), meat (from pigeon game, farmed deer, deer game, chicken, fattening calf, horse, cattle, sheep, broiler, domestic rabbit, pig, wild hare, wild roe, wild boar or wild duck), and sausage.
- Dairy products: milk, milk powder, milk products, and raw milk from goat or bovine (cattle).
- Infant/toddler food: in the KAP database, there are results for ‘baby and toddler food’, ‘follow-on formulae’ and ‘infant formulae’. Infant and follow-on formulae are milk-based drinks/powders and similar protein-based products intended for infants and young children. Baby and toddler food includes any type of ready-to-eat meal.

The data in the KAP database is derived from ‘objective’, ‘selective’, or ‘suspect’ sampling. Objective sampling is a planned strategy that is based on the selection of random samples. Selective sampling is a planned strategy whereby the selection of the sample is from previously defined ‘high-risk’ foods. Suspect sampling may be based on earlier positive samples.

From 2018 to 2022, the number of samples with one or more analyses of the selected active substances are:

- Meat: none from suspect sampling, 314 from selective sampling and 111 from objective sampling. In total 425 samples.
- Dairy products: 2 from suspect sampling (on salicylic acid in raw milk from bovine), 2187 from selective sampling of raw milk from goat and bovine, and 138 from objective sampling of milk, milk powder and milk products. In total 2327 samples. There are no samples of cheese in the KAP database.
- Infant/toddler food: none from suspect sampling, 100 from selective sampling and 331 from objective sampling. In total 431 samples.

Most samples were collected from Dutch products. For meat approximately 89% was of Dutch origin, for dairy approximately 69% and for infant/toddler food approximately 68%. The origin of samples from abroad varied:

- Meat: from Argentina, Australia, Belgium, Brazil, Czechia, Denmark, Estonia, Germany, Ireland, Luxembourg, Namibia, Paraguay, Sweden, Thailand, United Kingdom, United States, and Uruguay.
- Dairy products: from Belgium and Germany.
- Infant/toddler food: from Austria, Czech Republic, France, Germany, Hungary, New Zealand, Poland, Spain, Switzerland, and United Kingdom.

There are also samples for which the country of origin is 'Unknown'. Analyses on samples from other countries are usually limited to fewer than ten samples. In a limited number of cases, several dozens of samples of a specific product from Belgium or Germany were analysed.

4.2.2 Details for some active substances in the KAP database

For the quats, the monitoring data could not be directly linked to the active substances in the selected PTs (see Annex 2). The relevant active substances in the ECHA database are:

- alkyl (C12-C14) dimethylbenzylammonium chloride (ADBAC (C12-C14));
- alkyl (C12-16) dimethylbenzylammonium chloride (ADBAC/BKC (C12-16));
- alkyl (C12-18) dimethylbenzylammonium chloride (ADBAC (C12-18));
- alkyl (C12-C14) dimethyl(ethylbenzyl)ammonium chloride (ADEBAC (C12-C14));
- didecyldimethylammonium chloride (DDAC (C8-10))[14];
- didecyldimethylammonium chloride (DDAC);
- quaternary ammonium compounds, benzyl-C12-18-alkyldimethyl, salts with 1,2-benzisothiazol-3(2H)-one 1,1-dioxide.

In the KAP database for the quats, there is BAC monitoring data (< LOQ and/or >LOQ) in meat and raw milk on BAC 8 (CAS no. 959-55-7), BAC 10 (CAS no. 965-32-2), BAC 12 (CAS no. 139-07-01), BAC 14 (CAS no. 139-08-2), BAC 16 (CAS no. 122-18-9), and BAC 18 (CAS no.122-19-0), in milk products usually on BAC 12, BAC 14, BAC 16, and ‘BACS

[14] This name in the ECHA database is chemically not correct. Didecyl refers to alkyl groups of C10 and not of C8. See Annex 3 for more details.

(SOM)' (i.e. sum of all BACs) and in milk on BAC 12, BAC 14, and the sum of quats 'BACS (SOM)'. It is not stated whether the sum of quats is based on a common moiety method that is able to quantify all available quats in a sample or whether this is a sum parameter of quats analysed individually and which BACs belong to this sum. Sometimes, only BAC 8 has been analysed in raw milk. In infant/toddler food, there is monitoring data on BAC 12, BAC 14, BAC 16, and BACS (SOM) or only on BACS (SOM). For DDAC there is monitoring data in meat and raw milk on dioctyldimonium chloride (also known as dioctyldimethylammonium chloride or DDAC-8)(CAS no. 5538-94-3) and dilauryldimonium chloride (also known as dilauryldimethylammonium chloride or DDAC-12) (CAS no. 3401-74-9). In this report, the names DDAC-8 and DDAC-12 are used when discussing these substances. The KAP database also contains monitoring data on a broad group of BAC (Benzalkonium chloride (a mixture of alkylbenzyldimethylammonium chlorides with alkyl chain lengths of C8, C10, C12, C14, C16 and C18)) and on a broad group of DDAC (didecyldimethylammonium chloride (a mixture of alkyl-quaternary ammonium salts with alkyl chain lengths of C8, C10, and C12)).

All the substances mentioned above are quats, but not exactly the same as the active substances in biocides. For example, BAC 8, BAC 10, and DDAC 12 are not listed as individual biocides or as part of a biocide mixture and could result from improper or illegal use or maybe as a degradation product of quats with larger alkyl chains. This shows that related quats may also need to be monitored. The active substances in biocides, however, are also mixtures, for example, DDAC (C8-10) with different lengths of the alkyl chain. Monitoring data on mixtures of DDAC 8-12 cannot be compared to biocidal use of DDAC 8-10, and this shows that quats need to be analysed individually, to be able to discriminate between proper use and improper or illegal use.

For the DBPs/degradation products, only monitoring data on chlorate and perchlorate was available in the KAP database.

The KAP database includes monitoring data on 'lambda-cyhalothrin', which is an active substance of the selected PTs. But there is also monitoring data on 'cyhalothrin', which is the racemic mixture of cyhalothrin. Lambda-cyhalothrin and cyhalothrin differ in the composition of cyhalothrin isomers, so this monitoring data on 'cyhalothrin' is also relevant. Since the residue definition for cyhalothrin, lambda-cyhalothrin and gamma-cyhalothrin is cyhalothrin, the sum of isomers and the various isomers from cyhalothrin and lambda-cyhalothrin cannot be discriminated by the analytical methods used, so that the monitoring data on cyhalothrin can be interpretated as monitoring data on lambda-cyhalothrin and vice versa.

The KAP database includes the substances 'cypermethrin' and 'cypermethrin (cypermethrin, including other mixtures of constituent isomers (sum of isomers))'. The name 'cypermethrin' applies to the racemic mixture with eight isomers. But there are also alpha-cypermethrin, beta-cypermethrin, and zeta-cypermethrin. These have other isomer compositions and other CAS numbers. If an analysis report mentions cypermethrin, then according to the residue definition this is

cypermethrin, sum of isomers. Analytically, no distinction has been made. This means that an analysis result given as cypermethrin, can originate from racemic cypermethrin use (VMP, PPP, biocides), alpha-cypermethrin use (PPP, biocides), beta-cypermethrin use (PPP), and/or zeta-cypermethrin use (PPP). The extent to which alpha-cypermethrin can be quantified separately is currently being investigated within the EU (information from WFSR). The current monitoring data in the KAP database can be linked to two active substances in the selected PTs:

- (RS)-α-cyano-3phenoxybenzyl-(1RS)-cis, trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate (Cypermethrin) (CAS number 52315-07-8);
- [1.alpha.(S*),3.alpha.]-(.alpha.)-cyano-(3-phenoxyphenyl)methyl3-(2,2-dichlor-oethenyl)-2,2-dichlorovinyl)-2,2-dimethyl-cyclopropanecarboxylate (alpha-Cypermethrin); [1α(S*),3α]-(α)-cyano-(3-phenoxyphenyl)methyl3-(2,2-dichlor-oethenyl)-2,2-dichlorovinyl)-2,2-dimethyl-cyclopropanecarboxylate (αCypermethrin) (CAS number 67375-30-8).

4.2.3 Availability of monitoring data in the KAP database for the active substances

An overview of the monitoring data found in the KAP database of the active substances in the selected PTs for the categories dairy products, meat, and infant/toddler food is provided in Annex 4.

The distribution of the substances with monitoring data across the various categories of samples and PTs was as follows:

- Meat: 25 substances from PT18, 2 substances from PT03 and PT04, 1 substance from PT05, 1 substance from PT14, 1 substance from PT19, and 12 substances that are not part of the selected active substances. Out of these 12 substances, 10 are quats. The other 2 are chlorate and perchlorate.
- Dairy: 24 substances from PT18, 2 substances from PT03 and PT04, 1 substance from PT05, 1 substance from PT19, and 12 substances that are not part of the selected active substances. Out of these 12 substances, 10 are quats. The other 2 are chlorate and perchlorate.
- Infant/toddler food: 23 substances from PT18, 1 substance from PT03 and PT04, 1 substance from PT19, and 7 substances that are not part of the selected active substances. Out of these 7 substances 5 are quats. The other 2 are chlorate and perchlorate.

The reason for the overrepresentation of substances from PT18 is expected to be the broad use of these substances in PPP, beside some use in VMP, for which monitoring programmes are common. The monitored active substances from the other PTs are biphenyl-2-ol (PT03/04), salicylic acid (PT03/04), quats (PT03/04), chlorate (PT03/04/05), perchlorate (PT03/04/05), copper (PT05), brodifacoum (PT14), and N,N-diethyl-m-toluamide (DEET; PT19).

The number of active substances without monitoring data in the KAP database are (see also Figure 4.1 at the end of this chapter):

- Out of the 79 disinfectants, 52 are without monitoring data. This amounts to 66%. To calculate this number, all active substances

containing quats (7) and all active substances based on active chlorine, chlorine dioxide, monochloramine, or tosylchloramide sodium (17) that can result in chlorate were considered as active substances with monitoring data.
- Out of the 14 rodenticides, 13 are without monitoring data. This amounts to 93%.
- Out of the 63 insecticides/repellents, 37 are without monitoring data. This amounts to 59%.
- There is no monitoring data for the 33 Annex I substances.

In total, 133 out of the 186 active substances have no monitoring data in the KAP database. This amounts to 72%. Note that for most (or maybe all) of the 33 Annex I substances, such as carbon dioxide or concentrated apple juice, the absence of monitoring data is logical. For 23 of the active substances with monitoring data, this data concerns quats (7 related active substances) or chlorate (17 related active substances), which cannot be linked to the use of a specific active substance. There are 30 active substances with monitoring data specific to that substance. This amounts to 16% of all selected active substances.

The number of measurements carried out per substance within the span of five years often only amounted to several dozen and sometimes to several hundred per food category (meat, dairy, infant/toddler food). Of salicylic acid in dairy and meat and of some quats, copper, cypermethrin, cyromazine, deltamethrin, hexaflumuron, imidacloprid, indoxacarb, permethrin, pyriproxyfen and thiamethoxam in meat there was more than a thousand monitoring data in those five years. It should be noted that the monitoring data in the KAP database is intended for supervision and enforcement purposes, rather than for obtaining a representative picture of concentrations.

4.2.4 Measurement results in the KAP database for the active substances

Annex 4 provides all monitoring data on the active substances in the selected PTs for the categories meat, dairy products, and infant/toddler food in detail, including those below the LOQ. Table 4.1 gives a summary of the monitoring data equal to or above the LOQ. Table 4.1, Annex 4 and the underlying data from the KAP database show the following (Note: in the KAP database ‘meat’ is reported instead of ‘muscle’):

- For the majority of the substances, no residues were quantified ($\geq$LOQ). This concerns most insecticides, DEET, and some individual quats.
- In meat products, residues of quats, chlorate, copper, and salicylic acid found were above the LOQ. Quats were >LOQ in approximately 2% of the analysed meat products. This concerns a wide range of meat products, such as minced beef, bacon, liver of beef and of pig, meat of pig, of broiler, and of fattening calf. Most concentrations >LOQ were below 0.1 mg/kg, some were between 0.1 and 0.3 mg/kg, and there was an outlier of 16 mg/kg in one sample of pig meat. Chlorate was >LOQ in 5% of the analysed meat products, chicken fillet, minced beef, and meat of pig in average concentrations of 0.12 mg/kg (of the samples >LOQ), with a maximum of 0.68 mg/kg. Salicylic acid

was >LOQ in 1.32% of the analysed meat (muscle) samples from different animals. The concentrations found are in a range of 0.02 to 0.9 mg/kg, with exemptions of 1.1, 1.9, 3.9 and 4.8 mg/kg, all in meat of fattened calf. In meat (mainly in fat) residues of some insecticides (PT18) were also >LOQ. This concerns cyhalothrin in 0.14% of the samples, cypermethrin in 0.64% of the samples, deltamethrin in 0.24% of the samples, permethrin in 0.23% of the samples, piperonyl butoxide in 2.9% of the samples, and spinosad in 0.28% of the samples. Concentrations range from 0.01 to 0.07 mg/kg. Four of these insecticides (cyhalothrin, cypermethrin (including isomers), deltamethrin, and permethrin) belong to the group of the pyrethroids, and piperonyl butoxide is sometimes combined with pyrethroids as a synergist in pest control products for flying insects. Although this substance is a synergist, for biocides, piperonyl butoxide is regulated as an insecticide (PT18). In PPP, it is regulated as an adjuvant in pesticide formulations for synergy. So, for PPP, it is called and regulated as a synergist. The four pyrethroids with values >LOQ have authorisations in multiple frameworks, including as VMP, PPP and/or human medicinal product. For more information on pyrethroids, see Lahr et al. (2024). Spinosad also has authorisations as VMP and as PPP. Lastly, 0.011 mg/kg biphenyl-2-ol (a disinfectant in PT03 and PT04) was found in one Dutch sample of sheep kidney fat, and 0.084 mg/kg brodifacoum (a rodenticide in PT14) was found in one sample of pig liver (out of two selective samples). Note: the mentioned finding of the PT14 substance coumatetralyl in Section 2.2 in the liver of a calf was in 2023, so not yet included in these results.

- In dairy, the only monitoring data with results above the LOQ relates to quats, chlorate, copper and salicylic acid. Copper is allowed for use in PT05, but is naturally present in food as well. Therefore, higher levels of copper in dairy cannot be exclusively linked to biocidal use. Chlorate cannot exclusively be linked to biocidal use either, because there are also cleaning products that are based on chlorinated substances. Quats were >LOQ in only three milk samples (1.1%) of several dozen per type of quat measurement. The concentrations of these three quats >LOQ were approximately 0.1, 0.3 and 9.7 mg/kg in milk products. Chlorate was >LOQ in 12% of the analysed milk samples in concentrations ranging from 0.01 to 0.03 mg/kg. Salicylic acid was >LOQ in 1.99% of the analysed raw milk samples in concentrations in a range of 0.005 to 0.05 mg/kg in selective samples and 0.04 mg/kg in one of the two suspect samples. Salicylic acid also has uses other than biocidal uses (Jongerman, 2023).
- In infant/toddler food, there was monitoring data on quats and chlorate above the LOQ as well, and also on perchlorate. Quats were quantified in approximately 18% of the analysed infant/toddler food samples. The average concentrations of quats ranged between 0.002 and 0.007 mg/kg, with a maximum of 0.012 mg/kg. Chlorate was quantified in 22% of the analysed infant/toddler food samples in an average concentration of 0.05 mg/kg, with a maximum of 0.3 mg/kg. The high percentages of

samples where quats and chlorate were quantified, may be explained by the fact that infant/toddler food is processed food, for which relatively high hygiene standards are expected. For quats, a factor influencing these results is the fact that LOQs for the analysis of infant/toddler food are a lot lower than the LOQs for the analysis of meat and dairy products. For chlorate, this is not the case. For chlorate, the LOQ used in part of the analyses of meat and milk is lower than the LOQ used for the analyses of infant/toddler food (see Annex 4 for details). Perchlorate was only analysed in two samples, with concentrations of 0.010 and 0.013 mg/kg. Lastly, 0.042 mg/kg piperonyl butoxide (regulated as insecticide in PT18, as insecticide synergist for PPP) was found in one sample of baby and toddler food.

Table 4.1 PTs and monitoring data (mg/kg) in which the LOQ was exceeded for the active substances (a.s.) of the selected PTs in biocides in meat, dairy, and infant/toddler food.

Substance name **E: from ECHA database** **K: from KAP database** **R: name used in this report**	**CAS no.**	**Biocidal a.s.? [5]**	**PT(s)**	**LOQ**	**No. per LOQ [6]**	**No. ≥ LOQ**	**Product(s) ≥ LOQ**	**Average [7]**	**Maximum**
E: Biphenyl-2-ol K: 2-phenylphenol	90-43-7	Yes	03 04	0.01	26	1	Meat	0.011	0.011
E: N/A K: BAC 12 R: Benzododecinium chloride	139-07-1	No	N/A	0.05	1125	2	Meat	0.054	0.089
E: N/A K: Benzalkonium chloride (mixture of alkylbenzyldimethylammonium chlorides with alkyl chain lengths of C8, C10, C12, C14, C16 and C18) [4] R: BAC C8-18	-	No	N/A	0.001	60	2	Meat	0.052	0.069
E: Brodifacoum K: Brodifacoum	56073-10-0	Yes	14	0.01	2	1	Meat	0.084	0.084
E: N/A K: Chlorates [3]	-	No	N/A	0.001	47	1	Meat	0.032	0.032
				0.01	85	6	Meat	0.14	0.68
E: Copper K: Copper (Cu)	7440-50-8	Yes	05	0.13	1364	1359	Meat	4.8	65
				0.4	1	1	Meat	3.8	3.8
E: N/A K: Cyhalothrin [1]	68085-85-8	No	N/A	0.01	697	1	Meat	0.016	0.016
E: (RS)-α-cyano-3phenoxybenzyl-(1RS)-cis, trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate (Cypermethrin) K: Cypermethrin [2]	52315-07-8	Yes	18	0.01	17,24	11	Meat	0.018	0.031
E: Deltamethrin K: Deltamethrin (cis-deltamethrin)	52918-63-5	Yes	18	0.01	2066	5	Meat	0.022	0.043

Substance name **E: from ECHA database** **K: from KAP database** **R: name used in this report**	**CAS no.**	**Biocidal a.s.? [5]**	**PT(s)**	**LOQ**	**No. per LOQ [6]**	**No. ≥ LOQ**	**Product(s) ≥ LOQ**	**Average [7]**	**Maximum**
E: N/A K:Didecyldimethylammonium chloride (mixture of alkyl-quaternary ammonium salts with alkyl chain lengths of C8, C10 and C12)) R: DDAC C8-12	-	No	N/A	0.01	77	30	Meat	0.61	16
				0.02	714	6	Meat	0.22	0.48
E: Permethrin K: Permethrin (sum of isomers)	52645-53-1	Yes	18	0.01	1710	4	Meat	0.041	0.07
E: 2-(2-butoxyethoxy)ethyl 6-propylpiper-onyl ether (Piperonyl butoxide/PBO) K: Piperonyl Butoxide	51-03-6	Yes	18	0.01	275	8	Meat	0.012	0.027
E: Salicylic acid K: Salicylic acid	69-72-7	Yes	03 04	N/A	2803	37	Meat	0.41	4.8
E: Spinosad K: Spinosad (Spinosad, sum of spinosyn A and spinosyn D)	168316-95-8	Yes	18	0.01	710	2	Meat	0.040	0.057
E: N/A K: BAC 12 R: Benzododecinium chloride	139-07-1	No	N/A	0.01	57	1	Dairy	0.14	0.137
E: N/A K: BAC 14 R: Miristalkonium chloride	139-08-2	No	N/A	0.01	57	1	Dairy	0.26	0.263
E: N/A K: Chlorates [3]	-	No	N/A	0.001	20	4	Dairy	0.016	0.022
				0.01	20	1	Dairy	0.033	0.033
E: Copper K: Copper (Cu)	7440-50-8	Yes	05	0.0029	44	44	Dairy	0.057	0.13

Substance name **E: from ECHA database** **K: from KAP database** **R: name used in this report**	**CAS no.**	**Biocidal a.s.? [5]**	**PT(s)**	**LOQ**	**No. per LOQ [6]**	**No. ≥ LOQ**	**Product(s) ≥ LOQ**	**Average [7]**	**Maximum**
E: N/A K:Didecyldimethylammonium chloride (mixture of alkyl-quaternary ammonium salts with alkyl chain lengths of C8, C10 and C12)) R: DDAC C8-12	-	No	N/A	0.01	91	1	Dairy	9.67	9.67
E: Salicylic acid K: Salicylic acid	69-72-7	Yes	03 04	N/A	2708	54	Dairy	0.011	0.052
E: N/A K: BAC 12 R: Benzododecinium chloride	139-07-1	No	N/A	0.001	17	3	Infant/toddler food	0.0030	0.0054
				0.002	1	1	Infant/toddler food	0.002	0.002
				0.0034	1	1	Infant/toddler food	0.0034	0.0034
E: N/A K: BAC 14 R: Miristalkonium chloride	139-08-2	No	N/A	0.001	17	1	Infant/toddler food	0.0036	0.0036
				0.0027	1	1	Infant/toddler food	0.0027	0.0027

Substance name **E: from ECHA database** **K: from KAP database** **R: name used in this report**	**CAS no.**	**Biocidal a.s.? [5]**	**PT(s)**	**LOQ**	**No. per LOQ [6]**	**No. ≥ LOQ**	**Product(s) ≥ LOQ**	**Average [7]**	**Maximum**
E: N/A K: Benzalkonium chloride (mixture of alkylbenzyldimethylammonium chlorides with alkyl chain lengths of C8, C10, C12, C14, C16 and C18) R: BAC C8-18	-	No	N/A	0.0005	35	4	Infant/toddler food	0.007	0.012
				0.001	65	15	Infant/toddler food	0.0043	0.0099
				0.0061	1	1	Infant/toddler food	0.0061	0.0061
E: N/A K: Chlorates [3]		No	N/A	0.01	169	37	Infant/toddler food	0.052	0.3
E: N/A K:Didecyldimethylammonium chloride (mixture of alkyl-quaternary ammonium salts with alkyl chain lengths of C8, C10 and C12)) R: DDAC C8-12	-	No	N/A	0.0005	35	4	Infant/toddler food	0.003	0.004
E: N/A K: Perchlorate	14797-73-0	No	N/A	0.01	1	1	Infant/toddler food	0.01	0.01
				0.013	1	1	Infant/toddler food	0.013	0.013
E: 2-(2-butoxyethoxy)ethyl 6-propylpiper-onyl ether (Piperonyl butoxide/PBO) K: Piperonyl Butoxide	51-03-6	Yes	18	0.005	258	1	Infant/toddler food	0.042	0.042

These values come from the KAP database for the years 2018 to 2022. The substance name behind 'E:' is used in the ECHA database on active substances in biocides. The substance name behind 'K:' is used in the KAP database. The substance name behind 'R:' is a name used in this report: a

common name in literature or a name used in the C&L Inventory. Monitoring data on substances that may have a relation to the use of biocidal active substances are also included. Then there is no name in the ECHA database on active substances (E: N/A = Not Applicable).

1. In the KAP database, the substances ‘Cyhalothrin’, ‘Cyhalothrin, lambda-’ and ‘Lambda-cyhalothrin (includes gamma-cyhalothrin) (sum of R,S and S,R isomers)’ are included. We linked ‘Cyhalothrin’ to the CAS number of cyhalothrin and the other two to the CAS number of lambda-cyhalothrin. However, as far as we know, the various isomers from cyhalothrin and lambda-cyhalothrin cannot be discriminated by the analytical methods used.
2. In the KAP database, the substance ‘Cypermethrin (Cypermethrin including other mixtures of constituent isomers (sum of isomers))’ is included. We linked this to the CAS number of cypermethrin.
3. The KAP database reports ‘Chlorates’, but the measured substance is chlorate.
4. In the Netherlands, there are authorised biocides under transitional law with the active substance ‘quaternaire ammoniumverbindingen, benzyl-C8-18-alkyldimethyl, chlorides’. It was decided that this is the same mixture as one of the active substances in the review programme, which is under assessment. This illustrates the confusion about names of active substances with a mixture of quats.
5. The biocidal active substances are the ones in the ECHA database on biocides that we selected in Section 3.2. The substances with ‘No’ are degradation products, individual quats, or quat mixtures other than the active substances with quats in the ECHA database on biocides, and possibly other isomers of insecticides.
6. No. per LOQ is the number of measurements performed using the mentioned LOQ.
7. The average is calculated on the basis of the measurement results $\geq$ LOQ only.

4.3 Other sources of monitoring data

The data in the KAP database is collected from Dutch national plans to monitor residues of VMP in animal products and to monitor residues of PPP in plant and animal products. The other EU Member States also collect such data. EFSA manages the total overview of VMP[15] and PPP[16]. For this project, we are focusing on the Dutch monitoring data on biocidal residues in meat and dairy that were present in the KAP database. So we did not study the EFSA data.

To determine whether there is more monitoring data on residues apart from the KAP database, we asked the Dutch trade association for importers and manufacturers of disinfectants (NVZ – Schoon | Hygiënisch | Duurzaam) for information on monitoring data on residues in meat and dairy. We received the following response:
'*In general, current practice in food production is to rinse until there is no residue left. This is not always necessary for all active substances, for example, because they evaporate easily, such as alcohols. Many food buyers work with certified manufacturers because, among other things, they impose requirements on residues. The protocols of that certification generally contain rules about rinsing and production controls. Examples of certification schemes are BRC [British Retail Consortium] and IFS [International Featured Standards]. Furthermore, this is also related to national requirements: some countries always require rinsing, while other countries are more flexible.*
The food manufacturers (users of disinfectants) take measurements during disinfection to know whether the correct concentration is achieved. They work according to HACCP [Hazard Analysis and Critical Control Points], and periodic checks for residues are carried out on this basis. Food buyers also regularly check residues. The suppliers of disinfectants are involved if there are any problems. The residue data is held by the food manufacturers and/or food buyers and not by the suppliers of disinfectants. Therefore, this data is not available to us.'

BRC and IFS are certification programmes to reduce food safety risks. HACCP is a mandatory food safety management process, based on EC 178/2002 (EP, 2002), to ensure that the production process of all foodstuffs involves the least possible risk of contamination with microorganisms. In the Netherlands, there are 'IKB' (Integrale Keten Beheersing) certification schemes for all kinds of animal species. They must also guarantee food quality. Measurements take place within such schemes. We do not know to what extent controls on biocidal residues are part of these schemes and programmes.

4.4 Monitoring data in public literature

Because of our work in other projects and working groups, some literature on residues in food is known to us. In this section, we summarise this literature. Annex 5 provides detailed information including references. In the context of this study, we did not perform a literature search for monitoring of residues of biocides in meat and dairy products.

[15] See, for example, for 2021: https://www.efsa.europa.eu/en/data-viz/results-monitoring-vmpr-2021
[16] See, for example, for 2021: https://multimedia.efsa.europa.eu/pesticides-report-2021/

The information in Annex 5 with emphasis on concentrations of residues of biocides in meat and dairy products can be summarised as follows:

- In a scientific opinion of the EFSA CONTAM panel, in samples of milk from China, Japan and the USA, the 'weighted mean' concentration of perchlorate was 0.0068 mg/L and in infant formulae (powder) 0.010 mg/kg. In a dataset from EFSA, in milk and dairy samples, 22% of the values were above the LOQ with a P95 of 0.014 mg/kg (P95 means that 95% of the measured values are below 0.014 mg/kg).
- In a NVWA-BuRO advisory report, data from EFSA is mentioned. Chlorate and perchlorate were found in dairy products (cheese, cream, milk powder and ice cream) in concentrations ranging between 0.01 and 0.1 mg/kg. Chlorate concentrations in dairy products range between '0 and 0.5 mg/kg'.
- In the above mentioned NVWA-BuRO advisory report, data from COKZ is also included. The standard of 0.002 mg/kg for chloroform was exceeded in cheese brine several times. Incidental 'exceedance of the standard' of chloroform occurred in milk.
- In an article on DBPs in frozen foods purchased in Spain, common DBPs were analysed. Concentrations of THMs: 0.0012 – 0.0036 mg/kg in canned meat and 0.0015-0.0064 mg/kg in frozen meat. Concentrations of HAAs: 0.0005 – 0.0023 mg/kg in frozen meat. The individually quantified DBPs were trichloromethane (chloroform), maximum 0.0042 mg/kg, bromodichloromethane, maximum 0.0022 mg/kg, dichloroacetic acid, maximum 0.0011 mg/kg, and trichloronitromethane, maximum 0.0021 mg/kg.
- NVWA-BuRO reported 'High concentrations' of hydrogen peroxide in butter and milk, which were probably incidental. RIKILT reported 'too high levels' of hydrogen peroxide in butter and desserts from France, Germany and Czech Republic.
- NVWA-BuRO reported high concentrations of quats in cream and ice cream (up to 16 mg/kg), which were probably incidental.
- RIVM reported concentrations of quats higher than 0.5 mg/kg and of p-toluenesulfonamide higher than 0.1 mg/kg in mixed products such as soft ice-cream, milkshakes, whipped cream, cream cakes, minced meat, minced beef, minced steak, and sausages.
- NVWA-BuRO reported data from COKZ on 'exceedance of the action limit' for cyanuric acid in a 'powdery end product'.
- RIVM reported data from COKZ on iodine in Dutch milk. The iodine content in raw milk is 0.149 mg/kg. Iodine in mixed samples of farm milk: median 0.169 mg/kg, minimum 0.138 mg/kg and maximum 0.214 mg/kg.
- EFSA reported data on fipronil in chicken eggs, meat and fat from EU Member States. Only one of the random samples of poultry fat had a concentration of fipronil above the LOQ (Limit of Quantification). Fipronil was also found above a concentration of 0.006 mg/kg in 133 suspect samples of poultry fat and above a concentration of 0.005* mg/kg in 5 suspect samples of poultry muscle, due to the use of an illegal product against red mite for poultry. This could be a biocide or a VMP, which left residues in

meat and fat (and also in eggs). Note: The approval of fipronil for use in PT18 biocides expired in September 2023.
- The NVWA investigated salicylic acid in Dutch milk. Salicylic acid is used in human and veterinary medicinal products, in teat dip biocides (PT03) and it is present in natural sources such as willow bark. There is a (not significant) trend that the use of teat dip with salicylic acid is positively associated with the finding of this substance in milk samples.

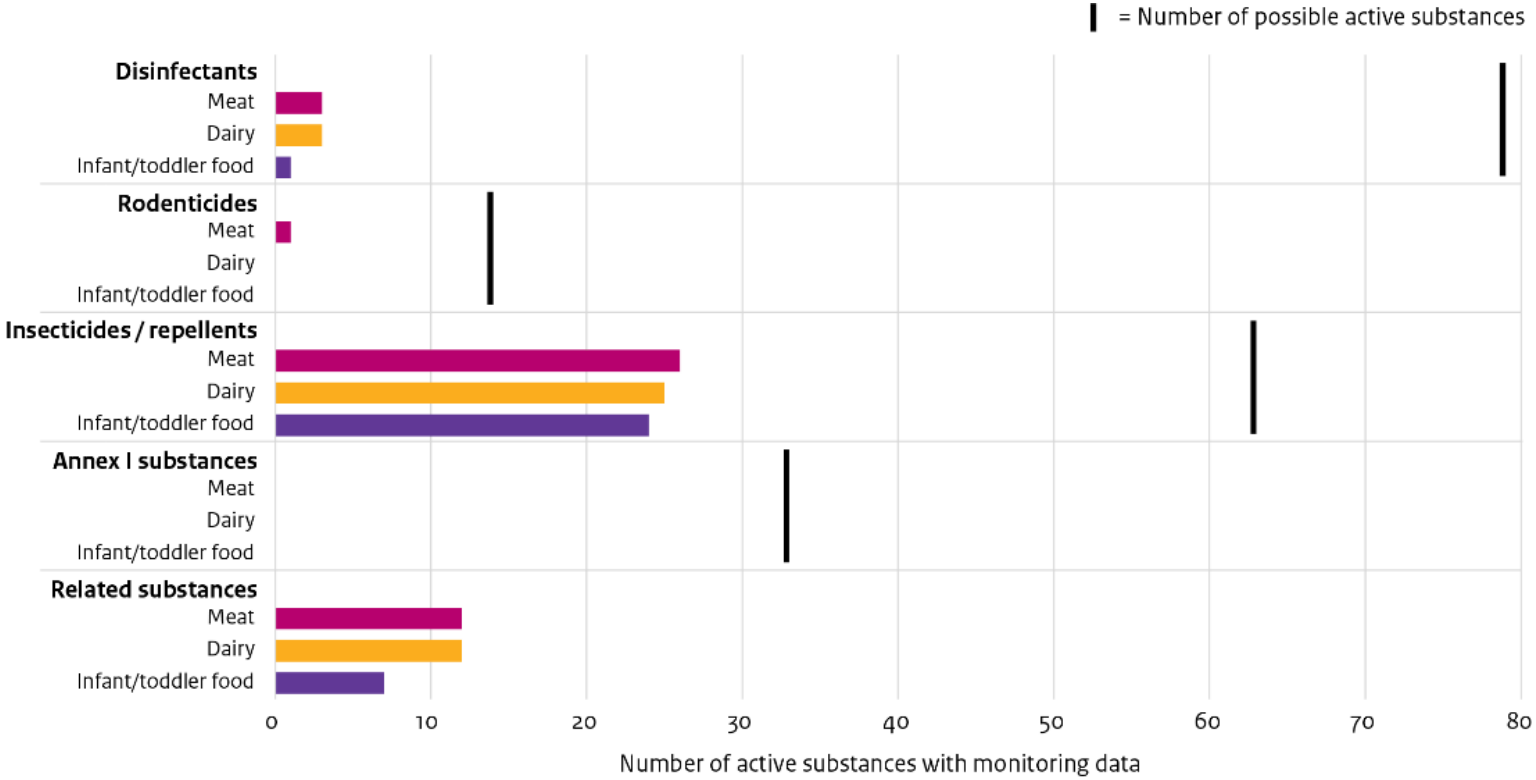
Most of the information provided above is based on a limited amount of samples and only one or two studies. The information shows that residues of several active substances and DBPs can be found in meat and dairy products.

4.5 Conclusion on the use of monitoring data for prioritisation

There are only 30 active substances with specific monitoring data in the KAP database. This concerns 26 insecticides, for which monitoring programmes are common, mainly due to their use as PPP. Besides, the monitoring data on chlorate can be linked to 17 active substances that are based on active chlorine, chlorine dioxide, monochloramine or tosylchloramide sodium, and the monitoring data on quats can be linked to 7 active substances containing quats. Figure 4.1 shows the details of the availability of monitoring data for active substances in meat, dairy and infant/toddler food for the various use categories (insecticides/repellents, rodenticides, disinfectants and Annex I substances), compared to the number of potential active substances. For 133 out of the 186 active substances the KAP database does not include any monitoring data in meat, dairy or infant/toddler food, so that could be a criterion to prioritise monitoring of these substances. However, note that they include 33 Annex I substances. For most of these (or all of these) monitoring is not relevant.

Quats, chlorate, copper, salicylic acid, and some insecticides were found at levels above the LOQ in meat and dairy products. In infant/toddler foods, quats, chlorate and perchlorate were found above the LOQ as well. Other uses and/or natural background levels may have had an impact on these levels.

Figure 4.1 Difference between the number of active substances with potential residues in meat, dairy and infant/toddler food and the number of those substances with monitoring data in meat, dairy and infant/toddler food.



Related substances are chlorate, perchlorate and quats (other than the active substances with quats). Monitoring data on chlorate (and possibly on perchlorate) can be linked to 17 chlorinated active substances and the monitoring data on quats can be linked to 7 active substances containing quats.

5 Availability of analytical methods for biocides at WFSR

5.1 Types of analytical methods and availability for biocides

As the official laboratory and National Reference Laboratory, WFSR has methods available for the determination of pesticides in a wide variety of food and feed commodities, including commodities of animal origin such as milk and dairy products, meat, liver, kidney, etcetera. At WFSR, the focus is on active substances in pesticides regulated under EC 396/2005. While most of these are PPP-based, a number of them were or still are also used as biocides. Hence, methods are currently available for a number of biocidal active substances. Anticipating the increased interest in residues arising from biocidal use, in 2022, a start was made to develop/extend methods with active substances that were/are only used in biocides.

For analysis of food/feed, two types of methods are distinguished:

1) Quantitative methods. These are validated and have specified limits of quantification (LOQs). Multi-residue methods covering >100 pesticides in one method are routinely used. For pesticides that are not amenable to multi-residue methods, several dedicated 'Single residue methods' (SRMs) are available, covering 1-15 pesticides each.
2) Chemical screening methods (non-target measurement, target screening). These methods have a much wider scope and are capable of detecting >800 pesticides. They only include pesticides that are amenable to multi-residue methods. Chemical screening methods are qualitative or semi-quantitative at best. Detectability depends on the individual pesticide-matrix combination and has not been established through full validation, but in general, concentrations around 0.05 mg/kg (in some cases, down to 0.001 mg/kg) can be detected.

Currently, four types of methods are available at WFSR:

A) Quantitative pesticides (PPP, and biocides in case of dual use). Routinely used for analysis of samples received from the NVWA in the framework of the National Plan Residues (products of animal origin).
B) Chemical screening of pesticides (PPP, and biocides, mostly dual use). Routinely used for analysis of samples received from the NVWA in the framework of the National Plan Residues (products of animal origin). For example, with this method, coumatetralyl and other rodenticides were initially found.
C) Quantitative pesticides (biocides, and a number of PPP in case of dual use). This method was developed and validated in 2022-2023. So far, application has been limited to a small survey of dairy products, fish, and slurry feeds, as there is currently no dedicated monitoring programme in place for biocides.
D) Dedicated methods (SRM methods). These are methods covering one active substance or substance class. Some of the available methods cover active substances from biocides. The methods are

quantitative, but as yet not necessarily validated for products of animal origin.

Annex 6 provides an overview of active substances from biocides for which WSFR has a method available for the analysis of dairy products and/or meat (often for other products as well). For each active substance, it is indicated whether it is included in:

- method A: quantitative, routine application [PPP/dual use biocides];
- method B: chemical screening, routine application [PPP/dual use biocides];
- method C: quantitative, not routinely used [biocides/dual use PPP];
- method D: quantitative, SRM method [PPP/biocides/other].

Annex 6 shows 58 measurable active substances. They only make up 31% of the 186 active substances in the selected PTs. Note that this number of 186 substances contains 33 Annex I substances and 13 new active substances which were still under review (at the beginning of 2024) and could not have come in contact with food. Monitoring does not seem relevant for most (or all) of them. Out of the 58 measurable active substances, there are 14 disinfectants (PT03 and/or 04 and/or 05), 10 rodenticides (PT14), 28 insecticides (PT18), 2 repellents (PT19), 1 rodenticide/insecticide (PT14 and PT18), and 1 insecticide/repellent (PT18 and PT19). For 9 of the measurable active substances, only a qualitative method is available (Method B), 3 from PT14 and 6 from PT18. Besides, WFSR has also quantitative analytical methods for the individual BAC with alkyl chain lengths of C8, C10, C12, C14, C16, and C18 and for chlorate and perchlorate in meat, dairy, and infant/toddler food.

Annex 6 is based on information provided by WFSR. The availability of monitoring data on meat and dairy in literature (see Section 4.4) regarding active substances, degradation products, metabolites, DBPs, or individual substances in mixtures that are not included in Annex 6, indicates that there are analytical methods available for more substances than those mentioned in Annex 6. Analysis of substances will also be part of certification programmes and schemes, so it may well be that further analytical methods are available at other laboratories.

5.2 Conclusion on the availability of analytical methods for prioritisation

As an element of prioritisation of substances for monitoring, the availability of analytical methods could be considered. A total of 58 substances are eligible from this perspective (see Annex 6 for details). However, if the overall prioritisation indicates that analytical methods should be extended to include more active substances, these analytical methods need to be developed and validated. If a substance can be added to an existing multi-residue method, this is relatively simple and budget-friendly. A single residue method (SRM) should only be developed for substances that are estimated to pose a high human health risk and have a high probability of leaving residues in food.

6 Available MRLs for active substances

6.1 Introduction to MRLs for active substances

The Maximum Residue Limit (MRL) is the legally permitted maximum residue (residual content) of a substance in or on food. Foods can be raw products such as vegetables, fruit, muscle, fat tissue and milk, or processed products such as yoghurt and sausages. MRLs for plant protection products (PPP) and veterinary medicinal products (VMP) are only established for raw agricultural products. However, these MRLs also cover the presence of residues of PPP or VMP in processed products derived from raw agricultural products. MRLs for processed products can be derived from the MRLs for raw agricultural products by using substance-specific processing factors, if available. MRLs for PPP and VMP are based on proper use. Maximum Levels (MLs) for contaminants are based on monitoring data, since it concerns historical use or comes from (as yet) undefined or uncontrollable sources (e.g. aflatoxins). For biocides, the methodology for the derivation of MRLs is not in place yet, but should also be based on proper use.

The availability of MRLs for active substances from other legal frameworks can contribute to determining the relevance of monitoring specific active substances used in the biocide framework. An established MRL at or above LOQ may also cover for biocidal use, unless the MRLs in monitoring programmes are often exceeded without proper cause through the PPP or VMP framework. This might indicate that biocidal use(s) add to the residue level and that the MRL needs to be amended. It is noted that MRLs for PPP and VMP are often set for specific raw agricultural commodities, such as bovine milk, bovine muscle, bovine fat or porcine liver. If the use of insecticides (PT18) in animal housings (through contact with live animals) resembles the exposure routes for PPP and/or VMP, MRLs for raw agricultural commodities for PPP and/or VMP may cover residues derived from the biocidal use as well. But there could also be different exposure routes for insecticides for live animals. For instance, chickens may be exposed to PPP via feed, and to biocides because they eat dead insects. It is important to realise that biocides may enter the food chain at later stages in the food preparation. Residues of biocides used as disinfectants (PT03, PT04, PT05) are (also) expected in processed foods such as sausages and ice cream, because of biocidal use during or after processing.

MRLs and MLs facilitate international trade in foodstuffs. During the establishment of an MRL, it is ensured that the foods with residues at MRL are safe for human health. Establishing MRLs for PPP or VMP allows for monitoring whether these products have been used according to Good Agricultural Practices (GAP), i.e. whether the PPP or VMP has been used according to the instructions for use. The Netherlands Food and Consumer Product Safety Authority (NVWA) uses MRLs and MLs to check for improper or illegal use of PPP or VMP or contaminants, respectively. Products exceeding the MRL require further investigation whether the product may pose a risk for consumers.

When it is feasible for a biocidal product to come into contact with food and feed, an EU Member State assesses during its authorisation procedure whether an MRL or ML should be established for the active substance of the biocidal product. First, this Member State checks whether the active substance appears in the list of PPP or VMP, and subsequently, it checks whether those MRLs sufficiently cover the use of biocides. If the substance does not appear in those lists or the uses are not covered, MRLs for biocides may be derived.

The term 'residue definition' for enforcement/monitoring refers to the substances generated from the presence of a PPP or VMP in or on food that need to be analysed (so-called marker compounds). A residue definition may be simple (i.e. one substance only, usually the parent substance) or complex (i.e. more than one substance). In the latter case, the residue definition may also contain isomers, metabolites, and/or degradation products. Residue definitions for enforcement/monitoring can be found in the legislation for PPP and VMP. At present, a residue definition is not (yet) officially established within the context of biocides (according to Ctgb). Usually, only the active substance is monitored, but sometimes degradation products such as chlorate are monitored as well. In order to monitor whether the active substances used in biocidal products do not end up in food in unwanted concentrations, an MRL and a residue definition are required.

If a biocide is only used by private individuals (non-professional uses within a household), with residues potentially ending up in food, then no MRL needs to be set. The food is not marketed and therefore, it cannot be enforced. The risk assessment that is carried out when authorising biocides should guarantee that it is safe to use those biocides.

The following sections discuss how MRLs for biocides can be derived (Section 6.2) and which MRLs are available from other legal frameworks for active substances in biocides with specific details on MRLs for disinfectants (Section 6.3).

6.2 Deriving MRLs for active substances in biocides

Legislation for deriving MRLs for biocides

If residues of active substances are found in meat or dairy products, they can originate from (proper, improper or illegal) biocidal use, but they may also be the result of PPP and/or VMP use, or, especially for disinfectants, a cleaning product or a FCM (Food Contact Material)[17]. Figure 6.1 gives an example of potential sources of residues of an insecticide measured in chicken muscle, and Figure 6.2 presents potential sources of residues of a disinfectant measured in meat and dairy products.

[17] See: https://wetten.overheid.nl/BWBR0034991/2025-01-01 (in Dutch).

Figure 6.1 Different uses of insecticides that may leave residues of insecticides in chicken muscle.

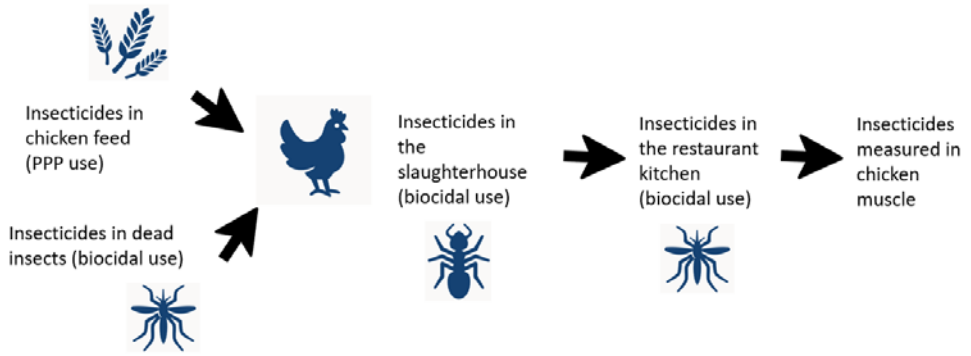
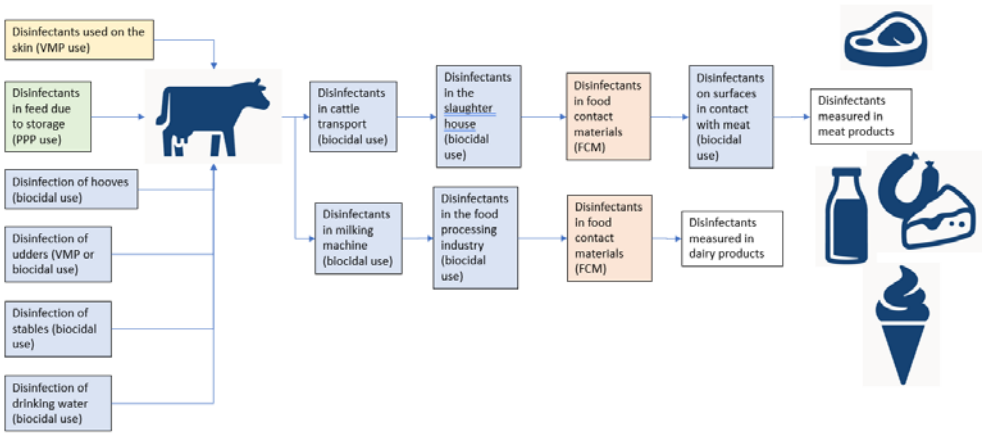


Figure 6.2 Different uses of disinfectants that may leave residues of disinfectants in meat and dairy products.



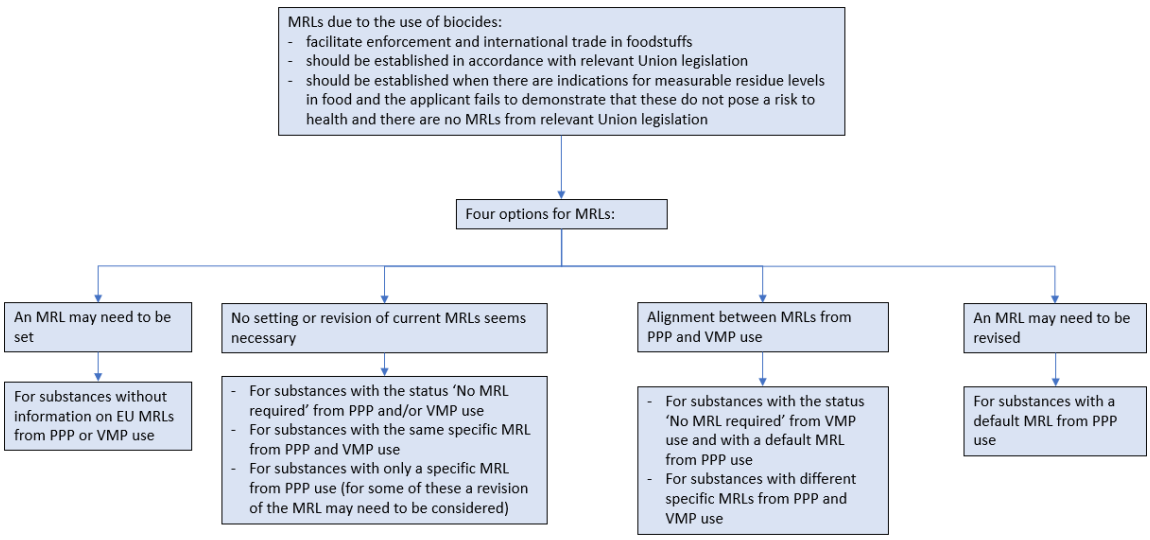
An enforcement laboratory cannot see whether the source of the residue is from a biocide, PPP or VMP application. Therefore, harmonisation of MRLs is important. Most MRLs are derived under the Regulation on Residues of Plant Protection Products (EC 396/2005; RRPPP) or the Regulation on Residues of Veterinary Medicinal Products (EC 470/2009; RRVMP). MRLs under the RRPPP and MRLs under the RRVMP, are derived on the basis of different principles. Moreover, for some substances, MRLs derived under the RRPPP differ from those derived under the RRVMP (see Section 5.3). These differences complicate the enforcement of MRLs in food and feed.

It has not yet been legally established how MRLs for biocides should be derived and in which legislation they will be included. Since 2017, there has been an interim approach (EC, 2017), which has been prolonged in 2021 (EC, 2021). If an MRL already exists for the biocidal active substance under the RRPPP or RRVMP, the biocide residues must comply with the MRL currently established in the other frameworks. Also, so-called Specific Migration Limits (SMLs) derived under the Regulation on Food Contact Materials (EC 1935/2004; RFCM) may be used for biocides on a surface that may come into contact with food. For biocidal active substances for which an MRL is considered necessary and which cannot be classified as an FCM, PPP or VMP, a Maximum Level (ML) can be

derived in accordance with the legislation for contaminants in food. To this end, as much monitoring data as possible is collected for the foodstuffs and/or feeds in which biocides are expected to occur. On the basis of this data, the EU Commission will decide on an ML. Annex 7 gives a complete overview of the development of the interim approach to deriving MRLs for biocides.

In 2024 the discussion on MRLs for biocides was held again by the Competent Authorities for biocides (CA meeting) and the European Commission. This resulted in a final approach to setting MRLs for biocides in the EU (EC, 2024), which does not deviate much from the prior interim approach. The EC document states: '*MRLs for biocidal active substances should be established when there are indications that measurable residue levels can be found in food as a result of the use of the biocidal product for which authorisation is requested and the applicant fails to demonstrate that these residue levels do not pose a risk to health and there is no MRL established in accordance with relevant Union legislation. In such cases, a specific MRL for the biocidal active substance(s) contained in the product can be established in accordance with relevant Union legislation, based on information submitted by stakeholders and authorities. The MRL should sufficiently protect consumers on the possible exposure to residues due to the use of the substance in biocidal products.*' Setting MLs instead of setting MRLs is not mentioned anymore. Details are discussed in Annex 7. Figure 6.3 gives an overview of approach to setting MRLs for biocides in the EU according to EC (2024).

Figure 6.3 Deriving or amending MRLs related to biocidal use (on the basis of EC, 2024).



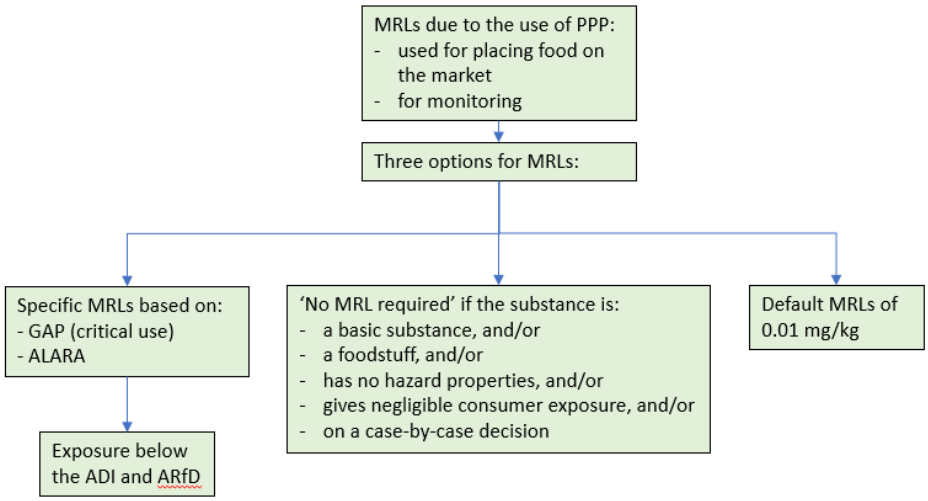
The EC document also states that if an exceedance of existing specific MRLs under the RRPPP or RRVMP is expected from the additional use of the biocidal product containing the same active substance(s), the biocidal product cannot be authorised. Food commodities would, in that case, be non-compliant with the relevant applicable legislation on MRLs. The document states that further consideration is required to decide if

such MRLs need to be modified to take into account the overall exposure by use as a VMP and/or PPP and biocide before the authorisation may be granted. Despite the tenor of the EC document, Ctgb notes that the legislation for biocides, contrary to that for PPP, does not contain a legal basis for refusing authorisation of a biocidal product if it is expected that an MRL will be exceeded.

A problem will arise when the overall exposure to a specific substance with dual or triple use from PPP, VMP and biocides is higher than the Acceptable Daily Intake (ADI) or the Acute Reference Dose (ArfD). Lifelong exposure may not exceed the ADI and short-term exposure may not exceed the ArfD. In the end, it is unclear whether the VMP, PPP, or biocide should (continue to) be authorised, or not. Which part of the ADI or ARfD is available for exposure to residues of PPP, VMP, and/or biocides? Furthermore, no setting or revision of MRLs seems necessary when the active substance has the status 'No MRL required' under the RRPPP or RRVMP. However, this status is linked to the specific use as a VMP and can be linked to the specific use as a PPP, which does not leave significant residues. It is possible that biocidal use does leave residues (see Annex 7). In such cases, the status 'No MRL required' will not be applicable to biocidal use. Lastly, the new approach to setting MRLs for biocides in the EU states that different MRLs for the same active substance/food combination derived under the RRPPP and the RRVMP should be aligned. We agree that there should only be one MRL for one type of food. This MRL should take the uses as PPP, VMP and biocides into account. However, biocidal use is not mentioned in this statement. A procedure to set MRLs that takes into account the overall exposure due to different uses has not yet been developed.

Underpinning of MRLs under the RRPPP
If specific MRLs have been established under the RRPPP, they are based on the ALARA (As Low As Reasonably Achievable) principle and on Good Agricultural Practice (GAP). Besides, the ADI and the ArfD may not be exceeded. Because of use of the ALARA principle, exceedance of most specific MRLs derived under the RRPPP does not pose a health risk. There are several reasons to give a PPP the 'No MRL required' status. This status applies to basic substances, 'foodstuff' substances without hazard properties and substances with negligible or no consumer exposure. It can also be based on a case-by-case decision; see Annex 7 for more details. See Figure 6.4 for an overview on deriving MRLs related to PPP use.

Figure 6.4 Deriving MRLs related to PPP use.

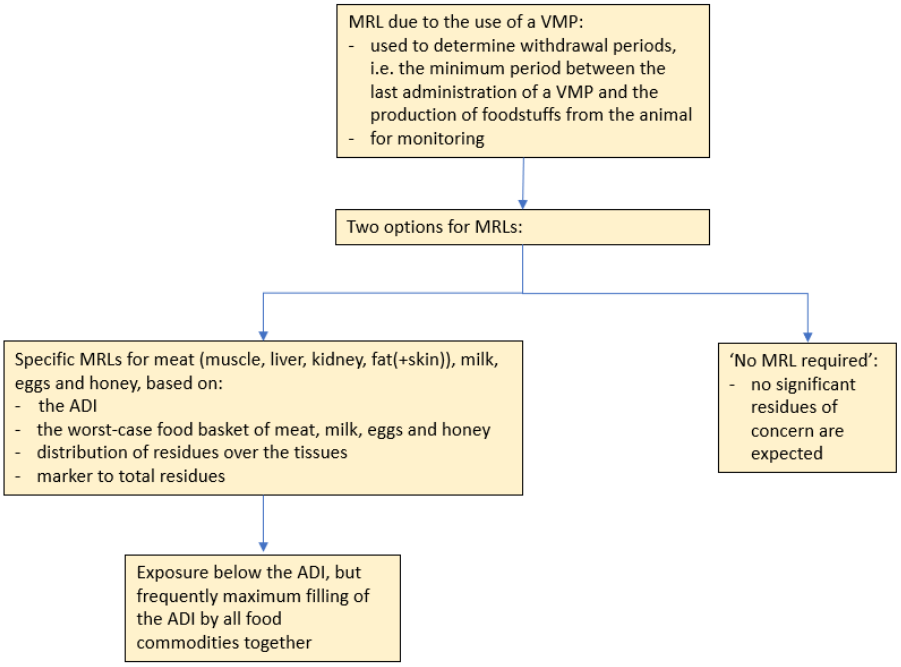


Underpinning of MRLs under the RRVMP

Where specific MRLs have been established under the RRVMP, they are often based on maximum filling of the ADI if it includes MRLs for all food commodities with a 'worst-case' consumption of meat, milk, and eggs, the so-called food basket. This means that an exceedance of most MRLs under the RRVMP could pose a health risk. In some cases, for instance, if MRLs are established for meat and offal only, an adequate portion of the ADI is reserved for potential future exposure via milk, eggs, or honey. Then, exceedance of the MRL for meat or offal would not pose a direct health risk. MRLs for substances used in VMP for food producing animals are in place to determine withdrawal periods between the use of the VMP and the slaughter of the animal or the release of milk or eggs for human consumption. The MRLs are also used to control the residues in food of animal origin. So, MRLs are in place for the purpose of monitoring and establishing withdrawal periods relating to the use of specific VMP. For VMP use where no significant residues of concern are expected, a 'No MRL required' status is given. When establishing MRLs for substances to be used in VMP, which are also used in PPP – the so-called dual use substances –, only 45% of the ADI is available for the VMP (Commission Regulation (EU) 2018/782; EC, 2018). The other 55% of the ADI is available for exposure due to PPP use. This regulation states that the derivation of MRLs for biocidal substances used in animal husbandry, laid down in in Article 10 of RRVMP, shall be the same as for VMP. A larger portion than 45% of the ADI may be used for VMP exposure if data is available on the intake from plant protection use, taking into account the approved MRL for the PPP. The EMA (European Medicines Agency) developed guidance on deriving MRLs for pharmacologically active substances in biocides used in animal husbandry (EMA, 2015). A stepwise approach, based on exposure estimates, is used to determine whether the establishment of MRLs is considered necessary. The initiation of an MRL procedure starts if the 'Worst-Case Consumer Exposure Estimate' is higher than 30% of the ADI. Residues that occur as a result of all possible exposure pathways (e.g. oral, dermal, etcetera) and other uses (e.g. as a PPP) are taken into account for this exposure estimate. If MRLs for pharmacologically active substances in

biocides are required and MRLs for other applications are already available, for example, due to use as PPP, VMP, or feed additives, it is checked whether they can be used. If it cannot be ensured that consumer exposure to residues will remain below the ADI, even after reduction measures, the substance may be banned from use in animal husbandry. See Annex 7 for more details on deriving MRLs. See Figure 6.5 for an overview on deriving MRLs related to VMP use.

Figure 6.5 Deriving MRLs related to VMP use.



Default value for the MRL

The Limit of Quantification (LOQ) is the lowest validated residue concentration of the analyte, which can be quantified and reported by routine monitoring with validated methods. Under the RRPPP, for many substances, a standard default value of 0.01 mg/kg is set as MRL. This actually means that the concentration should be lower than the LOQ of the analytical methods commonly used by enforcement laboratories. This is indicated in legislative texts as 0.01* mg/kg. In this report, we used a database with MRLs where the '*' is not included. Therefore, the '*' is not used in our texts and tables. It is, therefore, possible that food is safe for consumers and animals, while the default MRL is exceeded. In exceptional cases, however, it is possible that a default MRL (based on an achievable LOQ) is not safe for human health (e.g. for compounds with genotoxic degradation products).

MRLs based on local effects

Exposure to some active substances may result in local effects, such as skin corrosion/irritation (H314/H315) and eye damage/irritation (H318/H319). Residues in food are usually assessed against acute (ARfD) or chronic (ADI) toxicity on the basis of systemic effects (as mg/kg body weight). In principle, there are no ARfDs or ADIs for local effects. This makes it difficult to assess the risks for substances causing

local effects. Examples of these kind of substances are quats. For local effects, normally threshold values are derived (as % or ppm), but there is no accepted assessment method to use such a value for a food safety assessment. For quats, an intermediate solution was chosen: for ADBAC and DDAC, an ADI and an ARfD were derived on the basis of local effects reported in a one-year dog study, in spite of the fact that these are not fully appropriate in the absence of primary systemic effects (Italy, 2020).

ParamCodes
EFSA uses so-called ParamCodes as an identification code for active substances. These codes correspond to the residue definition that applies to the substance in question. This ensures that there is clarity about the actual monitoring data that the EU Member States should provide to EFSA. The ParamCodes end in a 3-letter code: PPP = Plant Protection Product; VET = Veterinary Medicinal Product; ADD = food additive; CHE = chemical contaminant; ORG = organic contaminant; NTR = nutrient; and PAR = parameter. The letters PAR have been used since 2015, because a substance can belong to one or more domains. Therefore, the previously used 3-letter codes could sometimes prove misleading. One active substance can have different ParamCodes, for example, for animal products and for plant products.

Decisions on MRLs, (R) and (F)
MRLs are laid down in decisions by the European Commission. In the decisions on MRLs for PPP, and in the public database on these MRLs (see Section 6.3), sometimes (R) and/or (F) is noted after the substance name. (R) means that there are different residue definitions for plant and animal products. Therefore these substances have different ParamCodes. (F) means that the substance is fat-soluble and will mainly leave residues in the fat edges of meat, bacon, butter and cream.

Dutch MRLs for biocides
The information on MRLs in this chapter concerns MRLs derived in a European process. Beside these, there are some ‘Dutch MRLs’. Dutch MRLs have been set in the Dutch ‘Warenwetregeling residuen van bestrijdingsmiddelen’ (Commodities Act Regulation on Pesticide Residues). The idea was that the use of biocides should not leave quantifiable residues in foods or drinks. The values were based on the LOQ of the analysis method at the time. This regulation was last modified in 2016. Almost all of the substances in this regulation are or were also used as disinfectants. This includes p-toluenesulfonamide (PTSA; from sodium p-toluenesulfonchloramide or chloramine-T), cetryltrimethylammonium chloride (from quats) and peroxides (from, for example, peracetic acid or hydrogen peroxide). Annex 8 provides the complete overview.

Reference values for intra EU trade
Some active substances used in insect repellents turned out to end up in crops during handpicked harvesting. No MRLs were available. This made it unclear whether these products could be traded. The Standing Committee on Plants, Animals, Food and Feed (SCoPAFF) decided to determine ‘Reference values for intra EU trade’. In 2018, Reference values for intra EU trade have been set for DEET (N,N-diethyl-meta-

toluamide, CAS no. 134-62-3) and for icaridin (sec-butyl 2-(2-hydroxyethyl)piperidine-1- carboxylate, CAS no. 119515-38-7). If the concentration is below this value, there are no trade barriers within the EU. If the concentration exceeds this value, it is up to the competent authorities to undertake any action. There are no risks below these values for consumers, but it is still unclear how high MRLs that are based on the ALARA principle should be. These reference values are only available for some specific plant-based products, so not for meat or dairy products.

6.3 Available MRLs for active substances in biocides

Used method to find available MRLs
Detailed information on the used method to find available MRLs is given in Annex 9. In the first instance, we gathered the information on MRLs for active substances in biocides from a non-public EFSA database (the Legal Limits Data Base: LLDB). Information on substances with the status 'No MRL required' are not included in the LLDB. Because of this, we subsequently checked the public EU Pesticides Database[18], searching for the active substances for MRLs for PPP by name. This way, we also included the active substances with a 'Default MRL of 0.01 mg/kg according to Art 18(1)(b) Reg 396/2005'. For MRLs for VMP, we consulted the Commission Regulation (EU) No 37/2010 (EC, 2009). We may have overlooked some MRLs because of differences in the substance names used by EFSA or EMA and by ECHA.

Available MRLs
Annex 9 provides an overview of the MRLs found for the active substances used in biocides for PT03, PT04, PT05, PT14, PT18, and PT19 for milk, liver, kidney, edible offals, fat, muscle, and other (meat) products. The only available MRLs for dairy apply to milk. Edible offal includes liver, heart, kidney, tongue, and sweetbreads. For some insecticides, there are specific MRLs for 'terrestrial invertebrate animals'. MRLs for meat products sometimes apply to specific animal species, especially for MRLs derived under the RRVMP. Under the RRPPP, the MRL for poultry often variates from those set for other animal species because of a different feed diet. On the basis of Art 18(1)(b) of the RRPPP, the default MRL of 0.01 mg/kg applies to any pesticide residue of PPP for which no MRLs are set. This also applies to active substances that are evaluated for use in PPP and that are not, or no longer, approved. Set MRLs for PPP can be MRLs with specific values or temporary MRLs with specific values; alternatively, the status 'no MRL required' applies.

Beside the MRLs, Annex 9 shows the substance name, CAS number, ParamCode, PTs for biocides and the Regulation in which the MRLs are laid down. Infant formulae are milk-based drinks and similar protein-based products intended for infants and young children. For infant and follow-on formulae, an MRL of 0.01 mg/kg applies to pesticide residues, based on Commission Delegated Regulation (EU) 2016/127 (version 17.03.2023) (EC, 2015a). This regulation does not apply to baby and toddler food (ready-to-eat meals). The MRLs for pesticide residues in infant and follow-on formulae are not included in Table A9.1 of Annex 9. On the basis of the letters in the ParamCodes, Annex 9 shows that most

[18] See: https://ec.europa.eu/food/plant/pesticides/eu-pesticides-database/start/screen/active-substances

available MRLs originate from the use of the relevant active substances as PPP.

For cyromazine and permethrin, for example, the MRLs for VMP have the same value as the MRLs for PPP for the same food products. This harmonisation of MRLs has not yet been achieved for all active substances. Inconsistent MRLs with different values derived under the RRPPP and the RRVMP are available for:

- Cypermethrins (sum of isomers): for example, due to the use of PPP, the MRL is 2 mg/kg in muscle and fat of bovine, sheep, and goat and 0.05 mg/kg in milk of these animals. Due to the use of VMP, the MRL is 0.02 mg/kg in muscle and milk of all ruminants and 0.2 mg/kg in fat of all ruminants.
- Cyfluthrins (sum of isomers): for example, due to the use of PPP, the MRL is 0.2 mg/kg in bovine fat, and due to the use of VMP, it is 0.05 mg/kg.
- Deltamethrin: for example, due to the use of PPP, the MRL is 0.5 mg/kg in fat of cattle (=bovine) and 0.05 mg/kg in milk of cattle (= bovine). Due to the use of VMP, the MRL is 0.05 mg/kg in bovine fat and 0.02 mg/kg in bovine milk.
- Cyhalothrins (sum of isomers): for example, due to the use of PPP, the MRL is 3 mg/kg in bovine fat and 0.02 mg/kg in bovine milk. Due to the use of VMP, the MRL is 0.5 mg/kg in bovine fat and 0.05 in bovine milk.

As explained in Section 4.2, monitoring data on cypermethrin concerns all isomers. The MRLs for all cypermethrins are the same because analytically, no distinction can be made. As we also explained in Section 4.2, analytically, no distinction can be made between the various isomers of cyhalothrin. Therefore, the MRLs for ‘cyhalothrin’ also apply to ‘lambda-cyhalothrin’.

Table 6.1 summarises the information from Annex 9, the information on Dutch MRLs from Annex 8, and the information on MRLs and MLs for disinfectants from Annex 3. The information is summarised by presenting the range of the MRLs for meat products and the MRLs for milk.

Table 6.1 presents EU MRL information for 101 out of the 186 active substances relevant to this study (see Section 3.2 and Annex 2). For the other 85 active substances, no information on EU MRLs is available. Most EU MRLs are set at the standard value of 0.01 mg/kg. This applies to 49 active substances, including all rodenticides with information on MRLs. For 41 out of these 49 substances, the value of 0.01 mg/kg is the default value, based on the RRPPP (Art 18(1)(b)). For 12 out of these 49 substances, the value of 0.01 mg/kg is recorded in other regulations. 4 of these 12 substances have a default MRL (bromadiolone, difenacoum, diflubenzuron and warfarin), but for 8 the MRL of 0.01 mg/kg is a specific MRL based on animal tests where no residues were found or expected. This applies to aluminium phosphide, biphenyl-2-ol, imidacloprid, indoxacarb, magnesium phosphide, margosa extract, pyriproxyfen, and sulfuryl fluoride. Beside a default MRL of 0.01 mg/kg under the RRPPP, one rodenticide (cholecalciferol) has the status ‘No MRL required’ under the RRVMP. This substance is the same as vitamin

D3, a substance that is formed in the skin of humans and animals, and therefore occurs naturally in animal products. In total, there are 8 substances to which the default MRL of 0.01 mg/kg applies due to the (former) use as PPP, while the status ‘No MRL required’ applies due to the use as VMP. There are 30 active substances with only the status ‘No MRL required’, out of which 13 are Annex I substances within the BPR (‘low-risk’ substances). Out of these 30 active substances, 8 have the status ‘No MRL required’ under the RRVMP, 17 under the RRPPP, and 5 under both regulations. There are 22 active substances with specific values for MRLs higher than 0.01 mg/kg. This applies to 15 insecticides (PT18), 5 quats (BAC (including ADBACs) and DDAC), copper and salicylic acid. Out of these 22 substances, 14 have MRLs derived under the RRPPP, 1 under the RRVMP and 7 under both regulations.

Only one of the active substances in the selected PTs has an MRL lower than 0.01 mg/kg. This concerns the (VMP) MRL for marker residue salicylic acid for milk of 0.009 mg/kg when administered as aluminium salicylate to bovine, caprine and equidae. For meat and offals different MRLs were established for the marker residue salicylic acid depending on the species and tissue. For turkey, the MRLs range from 0.15 to 2.5 mg/kg depending on the tissue (when administered as sodium salicylate). For poultry other than turkey, the MRLs range from 0.25 to 1 mg/kg depending on the tissue (when administered as sodium salicylate). For bovine, caprine, equidae and rabbit, the MRLs range from 0.2 to 1.5 mg/kg depending on the tissue (when administered as aluminium salicylate). Besides, salicylic acid itself also has the status ‘No MRL required’ when used topically as a VMP (‘for topical use only’). The fact that these MRLs are derived in view of the use as a Veterinary Medicinal Product can be seen from the ParamCode that ends in VET.

For quats, the available MRLs are quite confusing. There is a value of 0.01 mg/kg for quats as a group, but there are higher MRLs for BAC and DDAC, which are part of this group. We applied the MRL for BAC to the three ADBAC active substances. Annex 3 discusses the details of this topic. Besides, there are MRLs for chlorate in most meat products of 0.05 mg/kg, in fat of 0.1 mg/kg, and in milk of 0.1 mg/kg. Regulation (EU) 2020/749 speaks of MRLs for ‘chlorate’, while the EU Pesticides Database speaks of ‘Chlorates (incl. Mg, Na, K chlorates)’. Chlorate can be a degradation product of various biocides (see Annex 3 for details), but it can also be a residue of cleaning products. The availability of an MRL for chlorate shows that some degradation products need their own MRLs, because the degradation substance cannot be linked to the use of a specific active substance.

Most of the Dutch MRLs apply to active substances without a EU MRL or with only the ‘No MRL required’ status, except for chlorocresol, peracetic acid and quats. The Dutch MRLs were based on the LOQ at the time they were set. It is expected that current LOQs will be lower. Note: the substance trichloroisocyanuric acid appears to be the same as symclosene. This shows that the use of identifiers like CAS numbers is crucial.

The insecticides with MRLs for terrestrial invertebrate animals are not included in Table 6.1, because this does not fit within the scope of this

report. For the sake of completeness, they have been included in Annex 9.

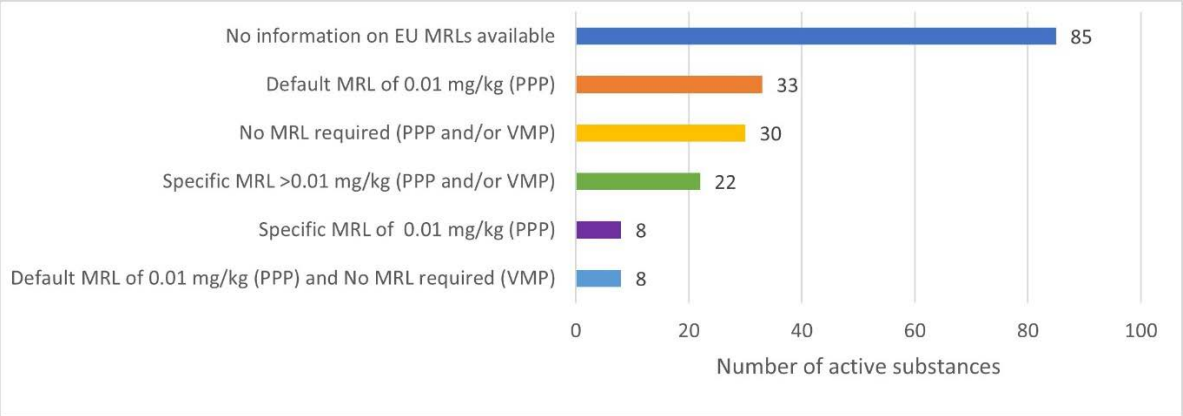
Currently (at the beginning of 2025), there is no national or EU procedure available for setting or amending MRLs for biocides. In the current EC Regulation on MLs in food (EC, 2023b), no MLs for active substances in biocides are available. There are only MLs for perchlorate in, for example, leafy vegetables and in baby and toddler food (ready-to-eat meals) (not for perchlorate in meat or milk), which can be a result of using chlorinated biocides. The ML for perchlorate in baby and toddler food (ready-to-eat meals) is 0.02 mg/kg. For infant and follow-on formulae an ML for perchlorate of 0.01 mg/kg applies.

6.4 Conclusion on the use of the availability of MRLs for prioritisation

The available MRLs for dairy apply to milk. MRLs for raw meat products sometimes apply to specific animal species, especially for MRLs derived under the RRVMP. The default MRL of 0.01 mg/kg applies to any pesticide residue of PPP for which no MRLs are set. This also applies to any active substances that are being evaluated for use in PPP or that are not or no longer approved. Set MRLs for PPP can be MRLs with specific values, temporary MRLs with specific values, or MRLs with 'No MRL required' status. Set MRLs for VMP can be MRLs with specific values or 'No MRL required' status. Figure 6.6 gives an overview of the availability of EU MRLs for the active substances in the selected PTs. Table 6.1 presents an overview of all the MRLs listed within PPP and VMP that are applicable to substances allowed for use in the biocide framework. The table combines the outcomes of the PT identification (Chapter 2), the identification of relevant active substance identification (Chapter 3), and the availability of MRLs (Chapter 6).

The information on MRLs can be used for prioritisation when it is combined with the information on the availability and the results of the monitoring data. For example, if monitoring data demonstrates exceedances of MRLs, this can be a criterion to prioritise monitoring of these substances, because biocidal use may contribute to the residue concentration. The absence of MRLs or MLs usually coincides with a lack of monitoring data, since MRLs are needed for enforcement purposes. In Section 8.5.3, a proposed prioritisation is presented, based on all combinations of MRL information and available or lacking monitoring data.

Figure 6.6 Availability of EU MRLs for the selected active substances, including the Annex I substances.



The numbers indicate the amount of active substances per category. The 17 active substances that can have chlorate as a degradation product are in the category 'No information on EU MRLs available' because these substances will generate more DBPs for which no information on EU MRLs is available.

Table 6.1 PTs and MRLs (mg/kg) for the selected active substances in biocides in meat products (excluding terrestrial invertebrate animals) and milk.

Substance name from ECHA database	CAS no.	PT(s)	MRLs for meat products	MRLs for milk	Dutch MRLs
(+)-Tartaric acid	87-69-4	Annex I	NR (VMP)	NR (VMP)	
(13Z)-Hexadec-13-en-11-yn-1-yl acetate	78617-58-0	19	0.01 (PPP)	0.01 (PPP)	
(9Z,12E)-tetradeca-9,12-dien-1-yl acetate	30507-70-1	Annex I	NR (PPP)	NR (PPP)	
E)-1-(2-Chloro-1,3-thiazol-5-ylmethyl)-3- methyl-2-nitroguanidine (Clothianidin)	210880-92-5	18	0.01–0.2 (PPP)	0.02 (PPP)	
(RS)-α-cyano-3phenoxybenzyl-(1RS)-cis, trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate (Cypermethrin)	52315-07-8	18	0.02-2 (PPP) (VMP)	0.05 (PPP) (VMP)	
[1.alpha.(S*),3.alpha.]-(.alpha.)-cyano-(3-phenoxyphenyl)methyl3-(2,2-dichlor-oethenyl)-2,2-dichlorovinyl)-2,2-dimethyl-cyclopropanecarboxylate (alpha-Cypermethrin); [1α(S*),3α]-(α)-cyano-(3-phenoxyphenyl)methyl3-(2,2-dichlor-oethenyl)-2,2-dichlorovinyl)-2,2-dimethyl-cyclopropanecarboxylate (αCypermethrin)	67375-30-8	18	0.02-2 (PPP) (VMP)	0.05 (PPP) (VMP)	
1-(3,5-dichloro-4-(1,1,2,2-tetrafluoroethoxy)phenyl)-3-(2,6-difluorobenzoyl) urea (Hexaflumuron)	86479-06-3	18	0.01 (PPP)	0.01 (PPP)	
1R-trans phenothrin	26046-85-5	18	0.05 (PPP)	0.05 (PPP)	
2-(2-butoxyethoxy)ethyl 6-propylpiper-onyl ether (Piperonyl butoxide/PBO)	51-03-6	18	NR (VMP)	NR (VMP)	0.05*
4-bromo-2-(4-chlorophenyl)-1-ethoxy- methyl-5-trifluoromethylpyrrole-3-carbonitrile (Chlorfenapyr)	122453-73-0	18	not defined (PPP) [11]	not defined (PPP) [11]	
Acetamiprid	135410-20-7	18	0.02-1 (PPP)	0.2 (PPP)	
Acetic acid	64-19-7	Annex I	NR (PPP)	NR (PPP)	
Active chlorine generated from sodium chloride by electrolysis	-	03, 04, 05	0.01 (PPP) 0.05-0.1 (PPP) [3]	0.01 (PPP) 0.1 (PPP) [3]	
Active chlorine released from sodium hypochlorite	7681-52-9	03, 04, 05	0.01 (PPP) 0.05-0.1 (PPP) [3]	0.01 (PPP) 0.1 (PPP) [3]	

Substance name from ECHA database	CAS no.	PT(s)	MRLs for meat products	MRLs for milk	Dutch MRLs
Alkyl (C12-16) dimethylbenzylammonium chloride (ADBAC/BKC (C12-16)) [2]	68424-85-1	03, 04	0.1 (PPP) [8]	0.1 (PPP) [8]	
Alkyl (C12-18) dimethylbenzylammonium chloride (ADBAC (C12-18)) [2]	68391-01-5	03, 04	0.1 (PPP) [8]	0.1 (PPP) [8]	
Alkyl (C12-C14) dimethylbenzylammonium chloride (ADBAC (C12-C14)) [2]	85409-22-9	03, 04	0.1 (PPP) [8]	0.1 (PPP) [8]	
Alphachloralose	15879-93-3	14	0.01 (PPP)	0.01 (PPP)	
Aluminium phosphide releasing phosphine	20859-73-8	14, 18	0.01 (PPP) [10]	0.01 (PPP) [10]	
Arnica montana, ext.	68990-11-4	Annex I	NR (VMP)	NR (VMP)	
Ascorbic acid	50-81-7	Annex I	NR (PPP)	NR (PPP)	
Bacillus amyloliquefaciens	-	03	NR (PPP)	NR (PPP)	
Bacillus sphaericus 2362, strain ABTS-1743	143447-72-7	18	0.01 (PPP)	0.01 (PPP)	
Bacillus thuringiensis subsp. israelensis Serotype H14, Strain AM65-52	-	18	0.01 (PPP)	0.01 (PPP)	
Bacillus thuringiensis subsp. kurstaki, strain ABTS-351	-	18	0.01 (PPP)	0.01 (PPP)	
Baculovirus	-	Annex I	0.01 (PPP)	0.01 (PPP)	
Benzoic acid	65-85-0	03, 04	NR (PPP)	NR (PPP)	
Biphenyl-2-ol	90-43-7	03, 04	0.01 (PPP) [10]	0.01 (PPP) [10]	
Brodifacoum	56073-10-0	14	0.01 (PPP)	0.01 (PPP)	
Bromadiolone	28772-56-7	14	0.01 (PPP)	0.01 (PPP)	
Bromoacetic acid	79-08-3	04			0.05*
Calcium dihydroxide/calcium hydroxide/caustic lime/hydrated lime/slaked lime (Calcium hydroxide)	1305-62-0	03	NR (PPP) (VMP)	NR (PPP) (VMP)	
Calcium oxide/lime/burnt lime/quicklime	1305-78-8	03	0.01 (PPP)/NR (VMP)	0.01 (PPP)/NR (VMP)	
Carbon dioxide	124-38-9	Annex I	NR (PPP)	NR (PPP)	
Chlorine dioxide	10049-04-4	03, 04, 05	0.01 (PPP) 0.05-0.1 (PPP) [3]	0.01 (PPP) 0.1 (PPP) [3]	
Chlorocresol	59-50-7	03	NR (VMP)	NR (VMP)	0.1*

Substance name from ECHA database	CAS no.	PT(s)	MRLs for meat products	MRLs for milk	Dutch MRLs
Chlorophacinone	3691-35-8	14	0.01 (PPP)	0.01 (PPP)	
Cholecalciferol	67-97-0	14	0.01 (PPP)/ NR (VMP)	0.01 (PPP)/ NR (VMP)	
Chrysanthemum cinerariaefolium extract from open and mature flowers of Tanacetum cinerariifolium obtained with supercritical carbon dioxide	89997-63-7	18, 19	NR (VMP)	NR (VMP)	
Cis-tricos-9-ene (Muscalure)	27519-02-4	19	0.01 (PPP)	0.01 (PPP)	
Citronellal	106-23-0	Annex I	NR (PPP)	NR (PPP)	
Copper	7440-50-8	05	5-30 (PPP)	2 (PPP)	
Coumatetralyl	5836-29-3	14	0.01 (PPP)	0.01 (PPP)	
Deltamethrin	52918-63-5	18	0.01-0.5 (PPP) (VMP)	0.02-0.05 (PPP) (VMP)	
D-Fructose	57-48-7	Annex I	NR (PPP)	NR (PPP)	
Didecyldimethylammonium chloride (DDAC (C8-10)) [2]	68424-95-3	03, 04	0.1 (PPP)	0.1 (PPP)	
Didecyldimethylammonium chloride (DDAC) [2]	7173-51-5	03, 04	0.1 (PPP)	0.1 (PPP)	
Difenacoum	56073-07-5	14	0.01 (PPP)	0.01 (PPP)	
Difethialone	104653-34-1	14	0.01 (PPP)	0.01 (PPP)	
Diflubenzuron	35367-38-5	18	0.01 (PPP)	0.01 (PPP)	
Dinotefuran	165252-70-0	18	0.02–0.1 (PPP)	0.1 (PPP)	
Ethanol	64-17-5	04	0.01 (PPP)/ NR (VMP)	0.01 (PPP)/ NR (VMP)	
Etofenprox	80844-07-1	18	0.01-2 (PPP)	0.04–0.07 (PPP)	
Eucalyptus citriodora oil, hydrated, cyclized	1245629-80-4	19	0.01 (PPP)	0.01 (PPP)	
Flocoumafen	90035-08-8	14	0.01 (PPP)	0.01 (PPP)	
Formaldehyde	50-00-0	03	0.01 (PPP)/ NR (VMP)	0.01 (PPP)/ NR (VMP)	
Formic acid	64-18-6	03, 04, 05	0.01 (PPP)/ NR (VMP)	0.01 (PPP)/ NR (VMP)	
Garlic, ext.	8008-99-9	19	NR (PPP)	NR (PPP)	
Geraniol	106-24-1	18, 19	NR (PPP)	NR (PPP)	
Glutaral (Glutaraldehyde)	111-30-8	03	0.01 (PPP)/	0.01 (PPP)/	

Substance name from ECHA database	CAS no.	PT(s)	MRLs for meat products	MRLs for milk	Dutch MRLs
			NR (VMP)	NR (VMP)	
Glyoxal	107-22-2	03, 04	0.01 (PPP)	0.01 (PPP)	
Hydrogen peroxide	7722-84-1	03, 04, 05	NR (PPP) (VMP)	NR (PPP) (VMP)	1* [1]
Imidacloprid [4]	138261-41-3	18	0.01 (PPP) [10]	0.01 (PPP) [10]	
Indoxacarb (enantiomeric reaction mass S:R 75:25)	144171-61-9	18	0.01 (PPP) [10]	0.01 (PPP) [10]	
Iodine	7553-56-2	03, 04	NR (PPP) (VMP)	NR (PPP) (VMP)	0.3 [6]
Iron sulphate	7720-78-7	Annex I	NR (PPP) (VMP)	NR (PPP) (VMP)	
Lactic acid	50-21-5	Annex I	NR (PPP) (VMP)	NR (PPP) (VMP)	
Lambda-cyhalothrin	91465-08-6	18	0.01-3 (PPP) (VMP)	0.02-0.05 (PPP) (VMP)	
Lauric acid	143-07-7	19	NR (PPP)	NR (PPP)	
Magnesium phosphide releasing phosphine	12057-74-8	18	0.01 (PPP) [10]	0.01 (PPP) [10]	
Margosa extract from cold-pressed oil of the kernels of Azadirachta Indica extracted with super-critical carbon dioxide	84696-25-3	18, 19	0.01 (PPP) [10]	0.01 (PPP) [10]	
Methyl nonyl ketone [5]	112-12-9	19	NR (PPP)	NR (PPP)	
N-cyclopropyl-1,3,5-triazine-2,4,6-triamine (Cyromazine)	66215-27-8	18	0.01–0.3 (PPP) (VMP)	0.01 (PPP) (VMP)	
Nitrogen	7727-37-9	Annex I	0.01 (PPP)	0.01 (PPP)	
Octanoic acid	124-07-2	04, 18	NR (PPP)	NR (PPP)	
Orange, sweet, ext.	8028-48-6	19	NR (PPP)	NR (PPP)	
Ozone generated from oxygen	-	04, 05	0.01 (PPP)	0.01 (PPP)	
Pentapotassium bis(peroxymonosulphate) bis(sulphate)	70693-62-8	03, 04, 05	0.01 (PPP)	0.01 (PPP)	
Peracetic acid	79-21-0	03, 04, 05	0.01 (PPP)/ NR (VMP)	0.01 (PPP)/ NR (VMP)	1* [1]
Permethrin	52645-53-1	18	0.05-0.5 (PPP) (VMP)	0.05 (PPP) (VMP)	
Polyvinylpyrrolidone iodine	25655-41-8	03, 04	NR (VMP)	NR (VMP)	
Potassium (E,E)-hexa-2,4-dienoate (Potassium Sorbate)	24634-61-5	Annex I	NR (PPP)	NR (PPP)	
Powdered egg [9]	-	Annex I	0.01 (PPP)	0.01 (PPP)	

Substance name from ECHA database	CAS no.	PT(s)	MRLs for meat products	MRLs for milk	Dutch MRLs
Propan-2-ol	67-63-0	04	0.01 (PPP)/ NR (VMP)	0.01 (PPP)/ NR (VMP)	
Propionic acid	79-09-4	Annex I	0.01 (PPP)	0.01 (PPP)	
Pyriproxyfen	95737-68-1	18	0.01 (PPP) [10]	0.01 (PPP) [10]	
Quaternary ammonium compounds, benzyl-C12-18-alkyldimethyl, salts with 1,2-benzisothiazol-3(2H)-one 1,1-dioxide [7]	68989-01-5	04	0.01 (PPP)	0.01 (PPP)	0.5* [1]
S-[(6-chloro-2-oxooxazolo[4,5-b]pyridin-3(2H)-yl)methyl] O,O-dimethyl thiophosphate (Azamethiphos)	35575-96-3	18	0.01 (PPP)	0.01 (PPP)	
Saccharomyces cerevisiae (yeast)	68876-77-7	Annex I	NR (PPP)	NR (PPP)	
Salicylic acid	69-72-7	03, 04	0.15–2.5 (VMP)/ NR (VMP)	0.009 (VMP)/ NR (VMP)	
Silver nitrate	7761-88-8	03, 04, 05	0.01 (PPP)	0.01 (PPP)	
S-Methoprene	65733-16-6	18	0.05-0.2 (PPP)	0.05 (PPP)	
Sodium dichloroisocyanurate dihydrate	51580-86-0	03, 04, 05	NR (VMP)	NR (VMP)	
Sodium dimethylarsinate (Sodium Cacodylate)	124-65-2	18	0.01 (PPP)	0.01 (PPP)	
Spinosad	168316-95-8	18	0.02-3 (PPP)	0.2 (PPP)	
Sulfuryl fluoride	2699-79-8	18	0.01 (PPP) [10]	0.01 (PPP) [10]	
Symclosene	87-90-1	03, 04, 05			1*
Tetramethrin	7696-12-0	18	0.01 (PPP)	0.01 (PPP)	
Thiamethoxam	153719-23-4	18	0.01–0.02 (PPP)	0.05 (PPP)	
Tosylchloramide sodium (Tosylchloramide sodium – Chloramin T)	127-65-1	03, 04, 05	NR (VMP) 0.05-0.1 (PPP) [3]	NR (VMP) 0.1 (PPP) [3]	0.1* [1]
Transfluthrin	118712-89-3	18	0.01 (PPP)	0.01 (PPP)	
Vinegar	8028-52-2	Annex I	NR (PPP)	NR (PPP)	
Warfarin	81-81-2	14	0.01 (PPP)	0.01 (PPP)	
α-cyano-4-fluoro-3-phenoxybenzyl3-(2,2-dichlorovinyl)-2,2-dimethylcyclo-propanecarboxylate (Cyfluthrin)	68359-37-5	18	0.01-0.2 (PPP) (VMP)	0.01-0.02 (PPP) (VMP)	

The information in this table is a summary of the information and tables in Annexes 3, 8, and 9; see those annexes for more details. See Annex 9 for the consulted sources for EU MRLs. ‘NR’ in the columns on MRLs means ‘Not Required’, so the substance has the status ‘No MRL required’. Whether this status or the default or specific MRLs are set in view of the use of PPP or VMP is shown between brackets. Sometimes, MRLs concern a broader group of substances (e.g. all isomers) than the active substances in biocides. This is not shown in this table. MRLs for pesticide residues in infant formulae and follow-on formulae are always 0.01 mg/kg and are not shown in this table.
* The indication * after a permissible amount means that a pesticide may only be used on a food or drink without leaving a demonstrable residue. The specified value, which indicates the LOQ of the analysis method at the time, is considered to be the highest concentration at which this requirement is still considered to be met.
1) Only applies to residues resulting from the use as a biocide.
2) See Annex 3 for more information.
3) These MRLs refer to chlorate. Chlorate is a degradation product of active chlorine compounds. The MRL for chlorate applies to:
Active chlorine generated from sodium chloride and pentapotassium bis(peroxymonosulphate) bis(sulphate) (no CAS no.);
Active chlorine generated from sodium chloride by electrolysis (no CAS no.);
Active chlorine generated from sodium N-chlorosulfamate (no CAS no.);
Active chlorine released from calcium hypochlorite (CAS no. 7778-54-3);
Active chlorine released from chlorine (CAS no. 7782-50-5);
Active chlorine released from hypochlorous acid (no CAS no.);
Active chlorine released from sodium hypochlorite (CAS no. 7681-52-9);
Chlorine dioxide (CAS no. 10049-04-4);
Chlorine dioxide generated from sodium chlorate and hydrogen peroxide in the presence of a strong acid (no CAS no.);
Chlorine dioxide generated from sodium chlorite by acidification (no CAS no.);
Chlorine dioxide generated from sodium chlorite by electrolysis (no CAS no.);
Chlorine dioxide generated from sodium chlorite by oxidation (no CAS no.);
Chlorine dioxide generated from Tetrachlorodecaoxide complex (TCDO) by acidification (no CAS no.);
Monochloramine generated from ammonia and a chlorine source (no CAS no.);
Monochloramine generated from ammonium hydroxide and a chlorine source (no CAS no.);
Monochloramine generated from sodium hypochlorite and an ammonium source (no CAS no.);
Tosylchloramide sodium (CAS no. 127-65-1).
4) In EFSA's LLDB, higher values are also available, but these are indicated as ‘previous’ in the EU Pesticides Database and not as ‘applicable’.
5) This substance is not allowed anymore (expired per 30 April 2024).
6) Only applies to milk.
7) Several active substances belong to the group of quaternary ammonium compounds; see Annex 3 for more information on this MRL.
8) The mentioned MRL is for Benzalkonium chloride of 0.1 mg/kg according to EC 2023/377 in the EU Pesticides Database. The EU Pesticides Database also lists a default MRL of 0.01 mg/kg for the substances ‘alkyldimethylbenzylammonium chloride’ according to article 18. This is an error in the EU Pesticides Database, as alkyldimethylbenzylammonium chloride and benzalkonium chloride are synonyms for the same substances, also abbreviated as BAC or ADBAC, and this should be corrected in the EU Pesticides Database.
9) The mentioned default MRL of 0.01 mg/kg is for the substance ‘eggshell powder’ in the EU Pesticides Database. Powdered egg is a foodstuff, for which no MRL is required. It is not clear whether the ECHA entry refers to egg powder or eggshell powder.
10) The MRL of 0.01 mg/kg is not a default MRL under Art 18 of the RRPPP, but this value is based on animal tests where no residues were found or expected.
11) MRLs for plant commodities only, MRLs for animal commodities not listed.

7 Other information on prioritisation of the active substances

7.1 Introduction

Chapters 3, 4, 5, and 6 provide information that can be used to prioritise monitoring of biocidal active substances. Chapter 7 explores various other approaches to prioritising the active substances in the selected PTs. These options are based on the frequency with which active substances are used (Section 7.2), on physical/chemical properties of active substances (Section 7.3), and on hazard properties of the active substances (Section 7.4).

The underlying ideas for these approaches are:

- The more often a substance is used in biocides, the higher the chance of exposure (depending on various factors), and the more important monitoring could be (Section 7.2).
- Physical/chemical properties might influence the transfer of residues to food (Section 7.3). For example, volatile substances could be unlikely to end up in food, while fat-soluble substances are likely to end up in fatty foods.
- The more harmful the substance properties are, the greater the possible health consequences in case of exposure, and the more important it is to monitor those substances (Section 7.4).

7.2 Prioritisation based on most commonly used active substances per application

7.2.1 General

In the Netherlands, there is no registration of the quantities of active substances in biocides sold and/or used. The Dutch government is currently (2025) having Statistics Netherlands (Centraal Bureau voor de Statistiek) investigate the possibilities of creating a national sales register for biocides[19]. Information on most commonly used active substances per application in other countries would also be relevant, because part of our food products are imported.

The information in Chapter 3 shows that a PT often comprises dozens of allowed active substances. Knowledge about the specific situations in which certain active substances are more frequently used in contact with livestock, meat, or dairy products could help with their prioritisation. Knowledge about which active substances are not used in contact with livestock, meat, or dairy products is also relevant, because for them, monitoring is not necessary.

Residues could be the unavoidable result of proper use, but they could also result from improper or illegal use. As explained in Chapter 2, there are many situations in which the use of biocides may leave residues in meat or dairy. These situations occur (see Figure 7.1):

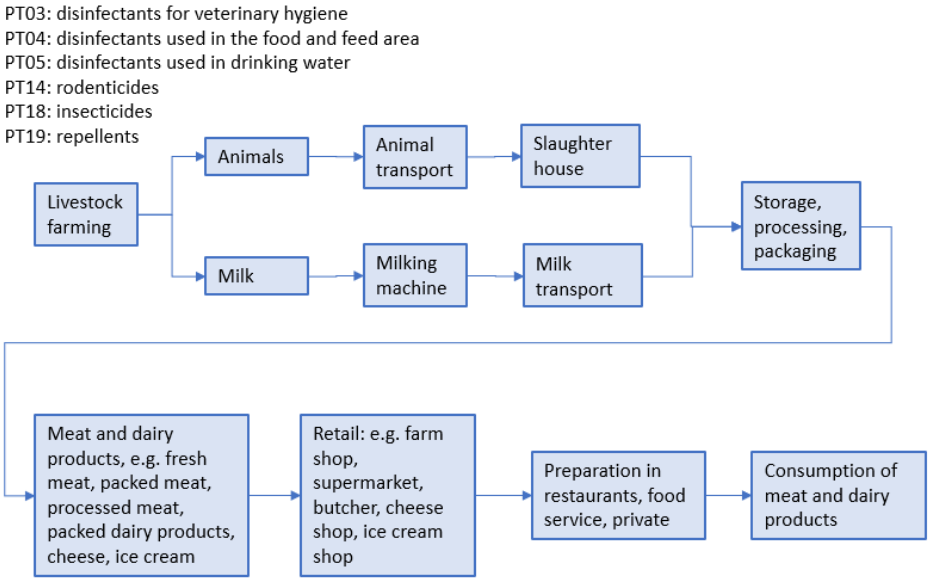
- in production, for example, in livestock farming and milking machines on farms;

[19] See: https://www.rijksoverheid.nl/documenten/kamerstukken/2025/01/21/uitvoering-van-verschillende-acties-bij-beleid-chemische-stoffen

- when transporting livestock or milk;
- during processing, for example, in slaughterhouses, the meat processing industry, cheese factories, or the dairy processing industry. Think of aseptic packaging of milk;
- during application and processing at points of sale. Think of butchers who make sausages and cut slices of meat, cheese shops that cut slices of cheese and grate cheese, and soft ice cream and milkshake machines;
- in food packaging materials made of wood or paper;
- in kitchens during disinfection of cutting boards, knives, and worktops.

Furthermore, dishwashing detergents may contain biocides for preservation where residues can end up in food via plates or cutlery.

Figure 7.1 Biocidal uses in the production chain of meat and dairy products for PT03, PT04, PT05, PT14, PT18, or PT19.



This wide range of situations and applications in which biocides can be used, as well as the large numbers of authorised biocides per PT, make it relevant to know which substances are widely used for which application. We have taken a number of actions to collect information about this. These are discussed below. Our actions were focussed on PT04 biocides only, because of the initial aim of our research project. In view of the conclusions (see Section 7.2.6) we have drawn from these results, we did not repeat this for the other selected PTs.

7.2.2 *The number of biocides with the same active substance*

As an example, for PT04 biocides, we looked at the number of products containing the same active substance and with an authorisation in the Netherlands. At the beginning of 2023, there were more than 600 Dutch-authorised PT04 biocidal products, according to the information in the ECHA and Ctgb databases. These PT04 biocides contained 1 or more of 38 active substances. A large number (22) of

these active substances were only found in a few (up to 10) products. But there were also active substances that were contained in dozens to a maximum of approximately 150 biocides authorised in the Netherlands. For PT04 biocides, the latter applied to hydrogen peroxide and DDAC.

During the workshop in September 2023 (see Section 1.2), it was concluded that the number of authorised products with a certain active substance says little or nothing about how often an active substance is used. Active substances that are only found in a few products can also be widely and most commonly used. Therefore, the number of biocides with the same active substance was not further examined.

7.2.3 Information on the application of certain active substances

During the 2023 workshop (see Section 1.2), it was concluded that it was not a realistic option for the current study to collect information on the application of certain active substances provided by food safety inspectors. This could be an option for the future.

We have examined whether it is an option to approach authorisation holders with the question which type(s) of active substance(s) they mainly trade for which type(s) of application. For PT04, there appeared to be 176 authorisation holders in the Netherlands, according to the Ctgb database. Approaching all these authorisation holders individually would require a lot of effort, especially when including the other PTs as well. It is also uncertain to what extent authorisation holders know who their end users are and how their products are used specifically. In view of this information, we did not investigate this further via this route.

We have checked for some of the active substances that are only contained in a few PT04 biocides in the Netherlands whether those products have a specific application. This was done by looking up the instructions for use per product on the Ctgb website. It showed, for example, that glycolic acid, bromoacetic acid, and salicylic acid contained within PT04 are only permitted for Cleaning in Place (CIP) in breweries and the (soft) drinks industry. Therefore, these substances do not appear to be relevant for Dutch meat and dairy via application within PT04. However, salicylic acid and glycolic acid also have approvals for PT03 applications. For salicylic acid, these are all intended for udder disinfection. That makes this active substance relevant for monitoring in milk or dairy products. Glycolic acid has an approval for use in stables, so this could be relevant for meat and dairy.

Some other Annex I or PT04 active substances with only a few authorised biocides appeared to be widely applicable. Lavender oil and peppermint oil appeared to have a very broad use. Sodium persulphate is permitted for contact surfaces of food and drink and for drinking water systems in livestock farming. This shows that it is not possible to connect a specific application to active substances with only a few authorised biocides.

The conclusion is that checking the instructions for use may be relevant to determine whether the use of a biocide can leave residues in meat or dairy. However, since this was a lot of work, as all individual instructions

for use must be reviewed, the work was not proceeded beyond the few PT04 biocides listed above. The permitted use can be specific, such as udder disinfection, but it can also result in a very broad use, which does not contribute to determining relevant foods, so that residues in meat or dairy products cannot be excluded.

7.2.4 *Most commonly used active substances in disinfectants in the food sector*

We asked the Dutch trade association for importers and manufacturers of disinfectants (NVZ – Schoon | Hygiënisch | Duurzaam) if they could collect information for us about the active substances in biocides that are commonly used in the food sector. They answered that the main active substances used, in no particular order, are sodium hypochlorite, peracetic acid, lactic acid, hydrogen peroxide, ethanol, isopropanol, glutaraldehyde, DDAC, ADBAC, and alkylamines. Table 7.1 presents an overview with the names used in the ECHA database and the CAS numbers.

Table 7.1 Most commonly active substances used in the food sector according to the Dutch trade association for importers and manufacturers of disinfectants (NVZ – Schoon | Hygiënisch | Duurzaam).

Name active substance in ECHA database	**CAS no.**	**Active substance in disinfectants mentioned by NVZ**
Active chlorine released from sodium hypochlorite	7681-52-9	Sodium hypochlorite
Alkyl (C12-16) dimethylbenzylammonium chloride (ADBAC/BKC (C12-16)) Alkyl (C12-18) dimethylbenzylammonium chloride (ADBAC (C12-18)) Alkyl (C12-C14) dimethylbenzylammonium chloride (ADBAC (C12-C14))	68424-85-1 68391-01-5 85409-22-9	ADBAC
Amines, N-C10-16-alkyltrimethylenedi-, reaction products with chloroacetic acid N-(3-aminopropyl)-N-dodecylpropane-1,3-diamine (diamine)	139734-65-9 2372-82-9	Alkylamines
Didecyldimethylammonium chloride (DDAC (C8-10)) Didecyldimethylammonium chloride (DDAC)	68424-95-3 7173-51-5	DDAC
Ethanol	64-17-5	Ethanol
Glutaral (glutaraldehyde)	111-30-8	Glutaraldehyde
Hydrogen peroxide	7722-84-1	Hydrogen peroxide
Lactic acid L-(+)-lactic acid	50-21-5 79-33-4	Lactic acid
Peracetic acid	79-21-0	Peracetic acid
Propan-2-ol	67-63-0	Isopropanol

Use of chlorinated disinfectants
In an advice by BuRO from 2017 (NVWA, 2017), the DBP chloroform is mentioned as the result of the often used combination of alkaline detergents with sodium hypochlorite. Also, an increasing use of chlorine dioxide in the dairy industry is reported, which could result in the presence of chlorite, chlorate and perchlorate in dairy. The NVZ did not mention chlorine dioxide as commonly.

Use of iodine
According to the Ctgb, iodine is used mainly for udder disinfection. Special attention is paid to monitoring iodine in milk (see Annex 5). We do not know if iodine is the most commonly used active substance for udder disinfection. Searching for the Dutch words for ‘udder’ in the instructions for use in the Ctgb database yields a lot of hits (41 for *uier* and 76 for *spenen*). These hits also concern the disinfection of udder wipes and may concern hits on ‘do not use to disinfect udders’. This makes it clear that all instructions for use must be viewed to get reliable information on allowed uses. According to information from the Ctgb, iodine is rarely used for disinfection of stables, because products containing this substance are relatively expensive.

7.2.5 WFSR supply chain studies

WFSR carried out several supply chain studies. In 2020, the studies ‘Cleaning and disinfection in the Dutch red meat and game meat supply chains’ (Hoffmans et al., 2020) and ‘Cleaning and disinfection in the poultry, eggs, leafy greens and sprouts supply chains’ (Banach et al., 2020) were published. These supply chain studies are relevant to our study. WFSR has also performed supply chain studies on chemical hazards of mushrooms, leafy vegetables, fruiting vegetables, bulbs, tubers, stem and root vegetables.

Disinfection in the red meat supply chain
The WFSR supply chain study ‘Cleaning and disinfection in the Dutch red meat and game meat supply chains’ provides a good picture of the disinfectants (active substances) in PT01, PT03, and PT04 used in the red meat supply chain. These disinfectants are used in the following parts of the red meat chain: primary production, transport, slaughterhouse, cutting plant, cold storage, processing, and butchering.

Active substances used for disinfection in the red meat supply chain, as mentioned in the literature, were chlorohexidine digluconate, DDAC, ethanol (70%), hydrogen peroxide, and lactic acid. Carbon dioxide was also mentioned but this is used as dry ice in a new physical technique and is not as a biocide.

Alcohol-based products, chlorine-based products, DDAC, hydrogen peroxide, sodium hypochlorite, and peracetic acid are ingredients for disinfection in the red meat chain that were frequently reported in interviews and questionnaires.

The used names for disinfectants in the WFSR studies are not always the same as the names used in the ECHA database. Table 7.2 provides both names. The WFRS names are in the third column. In total, the following twenty active substances (see Table 7.2) used for disinfection in the red

meat supply chain were mentioned in the WFSR interviews and questionnaires: alcohol-based products (isopropyl alcohol, ethanol, 2-phenoxyethanol, 1-propanol), acids (lactic acid) chlorine-containing compounds (sodium hypochlorite, chlorohexidine, chlorohexidine digluconate, chlorocresol, sodium chloride, sodium dichloroisocyanurate(dihydrate) and sodium p-toluene sulfonchloramide), quats (BAC, DDAC), peroxides (hydrogen peroxide, peracetic acid, pentapotassium bis(peroxymonosulphate) bis(sulphate), and other substances (formaldehyde, glutaraldehyde, N-(3-aminopropyl)-N-dodecylpropane-1,3-diamine). These results are based on 17 answered questionnaires and 5 interviews. In total, 136 questionnaires or invitations for interviews were sent. Overall, there was a 16% relevant response rate.

WFSR concluded that all active substances used in the red meat chain, as indicated in the literature, questionnaires and interviews are allowed active substances present in authorised disinfection products. Investigation of online sales of disinfection products was not part of the WFSR study, so it is unknown if unauthorised disinfection products (with non-allowed active substances) are offered and used in the red meat chain.

Disinfection in the poultry supply chain
The WFSR supply chain study ‘Cleaning and disinfection in the poultry, eggs, leafy greens and sprouts supply chains’ provides a good picture of the disinfectants (active substances) in PT01, PT03, and PT04 used in the poultry supply chain.

Active substances used for disinfection in the poultry supply chain as mentioned in the literature were chlorine-containing compounds, iodine compounds, quats, acids, and other substances (e.g. formaldehyde and glutaraldehyde).

Seventeen active substances (see Table 7.2) used for disinfection in the poultry supply chain were reported in interviews and questionnaires. They include alcohol-based products (isopropylalcohol, ethanol), acids (lactic acid, acetic acid) chlorine-containing compounds (sodium hypochlorite, chlorohexidine digluconate, chlorocresol, sodium dichloroisocyanurate, sodium p-toluene sulfonchloramide), quats (BAC, DDAC) peroxides (hydrogen peroxide, peracetic acid, pentapotassium bis(peroxymonosulphate) bis(sulphate)), and other substances (iodine, formaldehyde, glutaraldehyde). These results are based on 6 answered questionnaires and 4 interviews. In total, 72 questionnaires and 7 invitations for interviews were sent. Overall, there was a 13% relevant response rate.

Unauthorised products
According to WFSR, the results of the interviews and questionnaires indicate that unauthorised products could be used (illegal use) or products could be used for the wrong application (improper use). However, information about the actual use of unauthorised products (including possible use of products authorised outside the Netherlands and the EU) is lacking. All active substances mentioned in Table 7.2 are part of the selection we made (see Section 3.2).

Table 7.2 All active substances (a.s.) reported in interviews and questionnaires in the red meat and poultry supply chains (WFSR studies Hoffmans et al., 2020 and Banach et al., 2020).

Name active substance in ECHA database	**CAS no.**	**Active substance in disinfectants mentioned in WFSR studies**	**Red meat supply chain**	**Poultry supply chain**
2-Phenoxyethanol	122-99-6	2-Phenoxyethanol	√	
Acetic acid	64-19-7	Acetic acid		√
Active chlorine generated from sodium chloride by electrolysis	-	Sodium chloride	√	
Active chlorine released from sodium hypochlorite	7681-52-9	**Sodium hypochlorite**	√	√
Alkyl (C12-16) dimethylbenzylammonium chloride (ADBAC/BKC (C12-16))	68424-85-1	Benzalkoniumchloride (BAC)	√	√
Chlorocresol	59-50-7	Chlorocresol	√	√
Didecyldimethylammonium chloride (DDAC (C8-10)) Didecyldimethylammonium chloride (DDAC)	68424-95-3 7173-51-5	**DDAC**	√	√
D-gluconic acid, compound with N,N''-bis(4-chlorophenyl)-3,12-diimino-2,4,11,13-tetraaza-tetradecanediamidine (2:1) (CHDG)	18472-51-0	Chlorohexidine digluconate	√	√
No a.s.*	55-56-1	Chlorohexidine*	√	
Ethanol	64-17-5	**Ethanol**	√	√
Formaldehyde	50-00-0	Formaldehyde	√	√
Glutaral (glutaraldehyde)	111-30-8	**Glutaraldehyde**	√	√
Hydrogen peroxide	7722-84-1	**Hydrogen peroxide**	√	√
Iodine	7553-56-2	Iodine		√
Lactic acid L-(+)-lactic acid	50-21-5 79-33-4	**Lactic acid**	√	√
N-(3-aminopropyl)-N-dodecylpropane-1,3-diamine (diamine)	2372-82-9	N-(3-aminopropyl)-N-dodecylpropane-1,3-diamine	√	

Name active substance in ECHA database	CAS no.	Active substance in disinfectants mentioned in WFSR studies	Red meat supply chain	Poultry supply chain
Pentapotassium bis(peroxymonosulphate) bis(sulphate)	70693-62-8	Pentapotassium bis(peroxymonosulphate) bis(sulphate)	√	√
Peracetic acid	79-21-0	**Peracetic acid**	√	√
Propan-1-ol	71-23-8	1-Propanol	√	
Propan-2-ol	67-63-0	**Isopropyl alcohol / 2-propanol**	√	√
Sodium dichloroisocyanuratedihydrate	51580-86-0	Sodium dichloroisocyanurate(dihydrate)	√	√
Tosylchloramide sodium, chloramin T	127-65-1	Sodium p-toluene sulfonchloramide	√	√

The bold active substance names are most commonly used active substances mentioned by NVZ (see previous section).
* Chlorohexidine is not an active substance, but it is the substance that will be analysed; the experts probably mean chlorohexidine digluconate.

Overlap and differences between the red meat and poultry supply chains
There is a lot of overlap (15 active substances) between the active substances mentioned by experts for disinfection in the red meat and the poultry supply chains, as can be seen in Table 7.2. But there are some active substances that are only mentioned in the interviews and questionnaires of one of the supply chains:

- The active substances 2-phenoxypropanol and chlorohexidine are mentioned by experts from the red meat supply chain as active substances in a disinfecting hand soap, but not by experts from the poultry supply chain. Chlorohexidine digluconate is probably the source of the mentioned chlorohexidine.
- 1-propanol, N-(3-aminopropyl)-N-dodecylpropane-1,3-diamine) and sodium chloride (most probably as precursor) are not specifically mentioned by experts from the poultry supply chain, in contrast to experts from the red meat supply chain.
- On the other hand, experts from the poultry supply chain mentioned iodine and acetic acid. Iodine is not mentioned by experts from the red meat supply chain. One reason for this could be that the questionnaire and the interviews did not focus on the disinfection of udders of milk-producing animals for which it is widely used. For which purpose iodine is exactly used in the poultry supply chain does not become clear from the report.

7.2.6 Conclusion

There is no information on the volumes of biocides sold and/or used. The Dutch government currently (2025) investigates the possibilities to collect information on this. The number of authorised biocidal products with a specific active substance cannot be an indicator for most commonly used active substances. Gathering information on the application of biocides via authorisation holders would require a lot of

effort, and we do not know to what extent they have this information. Nor is checking instructions for use an achievable option to decide on the application of the active substances and their relevance for possible residues in meat and dairy. Our only useful results are that:

- Salicylic acid in the Netherlands is only authorised for biocides for udder disinfection, which could leave residues in dairy.
- Iodine also seems to be most commonly used for udder disinfection.
- Bromoacetic acid is only authorised for biocides for CIP treatment in breweries, so not for the processing of milk.

Information from the Dutch trade association for importers and manufacturers of disinfectants NVZ provides some insight into most commonly used disinfectants in the food sector. The substances (groups) mentioned are quats, compounds based on active chlorine, alcohols, alkylamines, lactic acid, peracetic acid, hydrogen peroxide, and glutaraldehyde. Specific information on the type of application per active substance is not available. The WFSR supply chain studies for red meat and poultry mention the same as well as some more used active substances. The number of respondents is too low to draw conclusions on how often specific substances are used per type of application. Overall, the information gathered in this section cannot be used for prioritisation, but may be relevant as background information.

7.3 Prioritisation based on physical/chemical properties

7.3.1 General

This section explores whether physical/chemical properties can be used to prioritise the active substances in the selected PTs.

Physical/chemical properties that might affect the ease to remove biocide residues from treated surfaces are: water solubility, volatility, surface tension, and fat solubility. These physical/chemical properties are assessed as part of the approval procedure for a biocidal active substance, and numerical values should be available for each biocidal active substance that is approved.

The water solubility (hydrophilicity) of a substance is the saturation mass concentration of the substance in water at a given temperature (OECD test 105). A water solubility above 30 g/L (at 20 °C) is an indication that the biocidal active substance is soluble in water, which could imply that the biocide residue can be rinsed off with water and is not expected in food. In practice, this appears not to be the case for quats. Although quats have a good water solubility (400 g/L at 10-30 °C), they tend to stick to treated surfaces because of their long carbon chains. Because of this, quats end up in food at appreciable amounts. Therefore, it was decided that water solubility is not a good criterion for prioritisation.

Volatility is a measure of how readily a substance vaporises, i.e. turns from a liquid or solid phase to a gas phase. The volatility of a substance is indicated by its vapour pressure, which is defined as '*the saturation pressure above a solid or liquid substance at a given temperature'* (OECD test 104). A vapour pressure of 10 kPa or higher (at 20 to 25 °C)

is an indication that the biocide active substance is volatile. This could be an indication that the biocide residue evaporates easily from the treated surface, does not require rinsing and is not expected in food. In practice, this appears not to be the case for formaldehyde. Although formaldehyde is volatile (549 kPa at 27 °C), the formaldehyde vapour may redissolve in water or food when used in an enclosed space, and formaldehyde does not readily vaporise from water (Germany, 2019). Therefore, it was decided that volatility is not a good criterion for prioritisation.

The surface tension of a substance is the force which causes a layer of liquid to behave like an elastic sheet or skin. The determination of surface tension is based on the '*measurement of the force which is necessary to exert vertically on a stirrup or ring, in contact with the surface of the liquid, in order to separate it from the surface, or on a plate, with an edge in contact with the surface, in order to draw up the film that has formed'* (OECD test 115). A surface tension above 30 mN/m (milli Newton per meter, at 20 °C) is an indication that the biocidal active substance tends to stick to a surface and cannot easily be removed. However, it is not clear how this physical/chemical property could predict whether the biocide residue will end up in food or will stay in place on the surface. Therefore, it was decided that surface tension is not a good criterion for prioritisation.

The fat solubility (lipophilicity) of a substance is indicated by the octanol-water partition coefficient (log K_{ow}). The K_{ow} is defined as the ratio of the equilibrium concentrations of a dissolved substance in a two-phase system consisting of two largely immiscible solvents: n-octanol and water. The ratio is usually expressed as its logarithm to base ten, hence log K_{ow} or P_{ow} (OECD tests 107, 117, 123). A log K_{ow} above 3 is an indication that the biocide active substance has a tendency to sequester into fat matrices and does not easily mix with water. However, it is not clear how this physical/chemical property could predict whether a biocide residue sticks to a treated fatty surface and subsequently to fatty foods or can be washed off with water. The log K_{ow} can be used for the choice of which kind of samples are the best to monitor, but it is not a good criterion for the overall prioritisation of active substances.

When deriving MRLs for PPP, 'fat-solubility' (noted as 'F' after the substance name, see Section 6.2) has been assessed. This could also be relevant for biocides taken up by livestock, such as PT18 biocides used in livestock premises. For PPP, fat solubility/persistence in livestock is triggered by a log K_{ow} above 3 and is usually confirmed by livestock metabolism studies, where the radiolabelled active substance is fed to livestock. Fat solubility is confirmed when the marker residue appears at higher levels in fat tissues than in muscle tissues, at higher levels in cream than in skimmed milk and at higher levels in egg yolk than in egg white. If fat solubility (F) is determined for PPP, this is an indication of persistence in livestock, whereby a substance's residues tend to bioaccumulate in the fat of livestock, when livestock is (orally) exposed to such a substance.

7.3.2 *Some specific examples*

Rinsing

When applying PT04 biocides in the food processing industry, for most products, rinsing with water is prescribed to prevent residues from ending up in the food (see also Section 4.3). The above mentioned WFSR supply chain study on poultry (Banach et al., 2020) reports that rinsing with water after disinfections is illegally skipped in some cases. It also states that people tend to use higher concentrations of chemical agents than recommended. The WFSR supply chain study on red meat (Hoffmans et al., 2020)does mention a rinsing step after disinfection, unless this is not necessary according to the instructions for use. One respondent indicated that there are more and more products for which rinsing is not necessary. These are mainly based on isopropyl alcohol (propan-2-ol), hydrogen peroxide, and lactic acid.

Large organic molecules

Substances with long carbon chains or large organic molecules are more likely to remain in food with high fat and protein content, such as meat or dairy, than in water. They are difficult to rinse off. That is why, for example, quats are interesting to monitor. An extensive RIVM study on food safety (Mengelers et al., 2017) pays special attention to quats: '*They tend to stick to the walls of food equipment and are difficult to remove with water. If the disinfectant is not rinsed off properly, it may end up in food products. QACs [quats] are often found in mixed foods like soft ice-cream and minced meat.*'

Other large molecules interesting to monitor within PT04 biocides include:

- mixture of 5-chloro-2-methyl-2H- isothiazol-3-one (EINECS 247-500-7) and 2-methyl-2H-isothiazol-3-one (EINECS 220-239-6) (mixture of CMIT/MIT);
- polyhexamethylene biguanide hydrochloride with a mean number-average molecular weight (Mn) of 1415 and a mean polydispersity (PDI) of 4.7 (PHMB(1415;4.7));
- polyhexamethylene biguanide hydrochloride with a mean number-average molecular weight (Mn) of 1600 and a mean polydispersity (PDI) of 1.8 (PHMB(1600;1.8));
- 5-chloro-2-(4-chlorphenoxy)phenol (DCPP);
- Amines, N-C10-16-alkyltrimethylenedi-, reaction products with chloroacetic acid;
- N-(3-aminopropyl)-N-dodecylpropane-1,3-diamine (Diamine).

Formaldehyde

During the 2023 workshop (see Section 1.2), the use of the volatile active substance formaldehyde for the disinfection of floors in stables was mentioned as an example (PT03). Formaldehyde is applied when dissolved in water, after which the stable is heated. Formaldehyde is then released and disinfects the stable, which is subsequently ventilated. However, sometimes puddles of water remain, as a result of which animals could still be exposed to formaldehyde via inhalation. This shows that the use of a volatile substance can also potentially leave residues in food. We do not know whether this could leave residues in food in practice.

7.3.3 Conclusion

Physical/chemical properties such as water solubility, volatility, surface tension, and fat solubility (log K_{ow}) cannot be used to draw conclusions on the presence or absence of biocide residues in various kinds of food and are not suitable as criterion for prioritisation of biocide monitoring in animal commodities. This was also the conclusion from the 2023 workshop (see Section 1.2).

Volatile substances used in an enclosed space may still occur in foods as the vapour may redissolve in foods, and can thus not be excluded from monitoring. Substances with long carbon chains or large organic molecules are more likely to leave residues in meat or dairy as they are difficult to rinse off with water. This makes quats and other large molecules interesting to monitor. However, since the small inorganic molecule chlorate has also been found in dairy and meat in quantified values, prioritisation cannot be based on molecule length. If substances have the notification of fat soluble (F) in the MRL legislation for PPP and these substances are also used in biocides, fatty tissues and cream may be the best samples for monitoring, as these substances tend to concentrate in those matrices.

7.4 Prioritisation based on hazard properties

7.4.1 Hazard properties of the selected active substances

The third approach to prioritisation in this chapter is based on the hazard properties of the active substances. The principle behind this prioritisation is that the more hazardous substances are considered to be, the more important it becomes to monitor in case of (potential) exposure. For this prioritisation approach, only the human health aspects are taken into account, as hazard properties may also entail explosive properties or environmental hazards.

It is noted that health-based guidance values (HBGVs), such as the acute reference dose (ARfD), the acceptable daily intake (ADI), or the tolerable daily intake (TDI), take into account the hazard properties of a substance as well as the level at which the effects may occur, resulting in higher or lower values depending on the toxicity. However, these values are not derived for all active substances, either because they are not deemed necessary due to lack of toxicity, or for instance, because of their classification as a mutagenic carcinogen. As such, the use of HBGVs as a tool for prioritisation is not considered applicable.

Using the classification system of hazard properties for prioritisation is considered a more suitable tool than prioritising on the basis of HBGVs. Using the classification (hazard statements) of an active substance takes into account the type of hazard and, to a certain extent, also the potency of the hazard (e.g. fatal if swallowed or toxic if swallowed). It should be noted, however, that exposure to substances with mutagenic, carcinogenic or reproductive toxicity properties should be avoided at any cost, as these substances should not end up in food.

Information on hazard properties of the substances was derived from the European Classification & Labelling (C&L) Inventory [20]. The C&L

[20] See: https://echa.europa.eu/information-on-chemicals/cl-inventory-database

Inventory is a database available on the ECHA website, containing classification and labelling information on notified and registered substances. It also includes a list of harmonised classifications (Annex VI of the CLP Regulation[21]). Manufacturers and importers of notified and registered substances provide ECHA with classification and labelling information, which is not verified or reviewed by ECHA. Harmonised classifications for active substances in biocides are developed by independent authorities of EU Member States and are assessed in a European process. The European Commission decides on them. Harmonised classifications are legally binding minimum classifications for substances. Classification information consists of so-called hazard statement codes, along with a hazard class and category code, and a corresponding hazard-phrase ('H-phrase'). They describe the nature and severity of a hazard.

We used a 2021 RIVM study as a basis for prioritisation of substances on the basis of hazard properties (Geraets et al., 2021). In this study, the human health hazard statements for substances were divided into three categories in order to distinguish and prioritise them. Geraets et al. based their choices for creating Category 1 of hazardous substances on several regulations, including the BPR. Category 1 is considered the category with the highest priority. It contains substances with the most severe hazard properties. The border between categories 2 and 3 is not based on regulations. It is arbitrarily based on the relative seriousness of the hazard properties. Category 1 contains substances with the following hazard statement codes: H-300, 310, 330, 334, 340, 341, 350, 351, 360, 361, and 362. This is followed by category 2, consisting of substances with the codes: H-301, 311, 314, 318, 331, 370, and 372. Lastly, category 3 contains substances with codes: H-302, 304, 312, 315, 317, 319, 332, 335, 336, 371, and 373. Classified substances without a human health hazard statement are also included in category 3. See Table 7.3 for the hazard statement codes and their corresponding class and category code, hazard description (H-phrase), and designated prioritisation category. See Table A10.1 in Annex 10 for a full overview, including information on physical and environmental hazards that applies to some active substances.

Table 7.3 Overview of human health hazard statement codes and their corresponding class and category code, hazard description (H-phrase), and prioritisation category.

Hazard statement code	Hazard class and category code	H-phrase	Prioritisation category
H300	Acute Tox. 1 or 2	Fatal if swallowed	1
H310	Acute Tox. 1 or 2	Fatal in contact with skin	1
H330	Acute Tox. 1 or 2	Fatal if inhaled	1
H334	Resp. Sens. 1	May cause allergy or asthma symptoms or breathing difficulties if inhaled	1
H340*	Muta. 1A or 1B	May cause genetic defects	1
H341*	Muta. 2	Suspected of causing genetic defects	1

[21] See: https://echa.europa.eu/information-on-chemicals/annex-vi-to-clp

Hazard statement code	Hazard class and category code	H-phrase	Prioritisation category
H350*	Carc. 1A or 1B	May cause cancer	1
H351*	Carc. 2	Suspected of causing cancer	1
H360*	Repr. 1A or 1B	May damage fertility or the unborn child	1
H361*	Repr. 2	Suspected of damaging fertility or the unborn child	1
H362	Lact.	May cause harm to breast-fed children	1
H301	Acute Tox. 3	Toxic if swallowed	2
H311	Acute Tox. 3	Toxic in contact with skin	2
H314	Skin Corr. 1A, 1B or 1C	Causes severe skin burns and eye damage	2
H318	Eye Dam. 1	Causes serious eye damage	2
H331	Acute Tox. 3	Toxic if inhaled	2
H370*	STOT SE 1	Causes damage to organs	2
H372*	STOT RE 1	Causes damage to organs through prolonged or repeated exposure	2
H302	Acute Tox. 4	Harmful if swallowed	3
H304	Asp. Tox. 1	May be fatal if swallowed and enters airways	3
H312	Acute Tox. 4	Harmful in contact with skin	3
H315	Skin Irrit. 2	Causes skin irritation	3
H317	Skin Sens. 1	May cause an allergic skin reaction	3
H319	Eye Irrit. 2	Causes serious eye irritation	3
H332	Acute Tox. 4	Harmful if inhaled	3
H335	STOT SE 3	May cause respiratory irritation	3
H336	STOT SE 3	May cause drowsiness or dizziness	3
H371*	STOT SE 2	May cause damage to organs	3
H373*	STOT RE 2	May cause damage to organs through prolonged or repeated exposure	3

* These hazard codes may apply to specific exposure routes only, which need to be stated if it is conclusively proven that no other routes of exposure cause the hazard. For some H-phrases, specific effects (e.g. may damage the unborn child (D), may damage fertility (F), suspected of damaging the unborn child (d), suspected of damaging fertility (f): applies to H360 and H361) or affected organs (H370, H371, H372, H373) need to be specified as well, if known.
** STOT RE/SE stands for Specific Target Organ Toxicity Repeated Exposure / Single Exposure.

For some active substances, CAS numbers were not available and/or their substance name was not traceable in the C&L Inventory. In such cases, information on their hazard classification could not be identified. Therefore. they are not included in categories 1, 2, or 3. Most of these substances are generated or released from other active substances (e.g. ‘active chlorine generated from sodium chloride by electrolysis’), or listed in Annex I of the BPR (substances with a low health risk, e.g.

‘peanut butter’ or ‘concentrated apple juice’). If this concerns approved active substances, information about the classification can be found in the Assessment Report (AR) and Biocidal Products Committee (BPC) opinion on the website of ECHA. For example, the Assessment Report (The Netherlands, 2022) and the BPC opinion regarding ozone generated from oxygen (ECHA, 2022c) show that this is a category 1 substance due to the hazard statement codes H330, H341, and H351. For this study, we based the categorisation only on the C&L Inventory. We did not further investigate or process ARs or BPC opinions for information on classifications.

For notified classifications (of substances without a harmonised classification), only classifications were included that were notified by the arbitrarily chosen cut-off of >10% notifiers. Note that the number of notifiers may vary greatly between compounds, implying that a classification notified by 100% of, for example, 1500 notifiers will be more convincing than a classification notified by 100% of just 2 notifiers. The number of notifiers for each compound is not included in Annex 10 (Tables A10.2 and A10.3), nor is the percentage of notifiers for each classification. This was a pragmatic approach to categorising (and thereby prioritising) the biocidal active substances. Since notified classifications are not reviewed or verified by, for example, ECHA, they are less reliable than the legally binding harmonised classifications. Some notifiers may state that no classification applies, while others do notify hazard properties. It is likely that substances with notified classifications would receive fewer, more, or other classifications when harmonised. Consequently, they could be categorised and prioritised differently in the future.

Table A10.2 in Annex 10 presents an overview of all active substances in biocides allowed for PT03, PT04, PT05, PT14, PT18, and PT19, together with information on their hazard properties and designated prioritisation category. Hazard classifications are presented for each substance if available, on the basis of harmonised (‘Harmonised C&L’) or notified (‘Notified C&L’) classifications.

Out of the total of 186 active substances, 35 were classified into category 1 on the basis of their hazard properties (see Table 7.4 and Figure 7.2). Apart from 3 substances, they all have a harmonised classification. These 35 substances are mostly allowed for use in biocides for PTs 04, 14, and 18, but PTs 03 and 05 also have substances in category 1. No PT19 substances or Annex I substances are classified into category 1. Category 2 contains 53 active substances, the majority of which are allowed for PTs 03 and 04. Around half the substances in category 2 have a harmonised classification. Most active substances were classified into category 3, 62 substances in total. The majority (39 substances) have a notified classification. Most substances in category 3 are allowed for use in PT18, followed by substances listed in Annex I (that are allowed in biocides for all PTs). Finally, 36 substances could not be categorised and are not included in category 1, 2, or 3. These substances do not have a harmonised or notified classification, which is why no information on their hazard properties is available. This is either because of a lack of a CAS number in the ECHA database and a substance name that could not be identified in the C&L Inventory,

and/or because these substances are generated or formed from precursors.

Theoretically, one could argue in favour of classifying, for example, ‘Active chlorine released from hypochlorous acid’ (no CAS number, not categorised) into a similar category as ‘Active chlorine released from calcium hypochlorite’ (CAS no. 7778-54-3), ‘Active chlorine released from chlorine’ (CAS no. 7782-50-5) or ‘Active chlorine released from sodium hypochlorite’ (CAS no. 7681-52-9), since all these substances have active chlorine as their active substance. However, attention should be paid to their different precursors and their potential residues and hazard properties. The harmonised C&L classifications of the three substances releasing active chlorine are slightly different, but they are all classified into category 2.

The substances that could not be categorised are mainly disinfectants (PT03, PT04, and PT05). From the substances allowed for use in PT05, 44% could not be categorised. For PT04 this is 28% and for PT03 this is 23%. In contrast, nearly all rodenticides (PT14, 86%), insecticides (PT18, 96%) and repellents (PT19, 95%) could be categorised.

Some of the 36 substances that could not be categorised can be linked to other substances that can be categorised. In Table A10.2 in Annex 10 this is listed as ‘Not (or 1)’ or ‘Not (or 2)’. This concerns 22 substances:

- Five of the disinfectants that could not be categorised are substances generating chlorine dioxide from different precursors or in different ways. Because chlorine dioxide itself is classified into category 2 on the basis of its harmonised classification, these five substances could potentially also be added to category 2.
- Four of the disinfectants that could not be categorised are substances generating or releasing active chlorine. Because three other substances that release active chlorine are classified into category 2 on the basis of their harmonised classifications, these four not categorised substances could potentially also be added to category 2. However, as mentioned above, different precursors or ways of generating active substances could result in different classifications.
- Three disinfectants that generate monochloramine could have the same classification as chloramide (monochloramine). If so, they are category 2 substances.
- The disinfectant free radicals generated in situ from ambient air or water could be added to category 2, as this substance is expected to form radicals similar to hydrogen peroxide, which is classified into category 2.
- The disinfectant hydrogen peroxide released from sodium percarbonate could also be added to category 2 because of the categorisation of hydrogen peroxide.
- The disinfectant ozone generated form oxygen could potentially be added to category 1, because of the potential formation of carcinogenic DBPs.
- The disinfectant in-situ generated peracetic acid could potentially be added to category 2, because of the categorisation of peracetic acid.

- For the same reason, the disinfectant reaction mass of peracetic acid and peroxyoctanoic acid could potentially be added to category 2.
- The disinfectant in-situ generated performic acid could potentially be added to category 2, as similar compounds, such as hydrogen peroxide and peracetic acid, were also classified into category 2.
- The disinfectant quaternary ammonium compounds, benzyl-C12-18-alkyldimethyl, salts with 1,2-benzisothiazol-3(2H)-one 1,1-dioxide could potentially be added to category 2, because of the classification of the other quats.
- The disinfectant Reaction mass of N,N-didecyl-N-(2-hydroxyethyl)-N-methylammonium propionate, N,N-didecyl-N-(2-(2-hydroxyethoxy)ethyl)-N-methylammonium propionate, and N,N-didecyl-N-(2-(2-(2-hydroxyethoxy)ethoxy)ethyl)-N-methylammonium propionate could potentially be added to category 2, because of the categorisation of propionic acid and other quats.
- The disinfectant that generates sulfur dioxide could have the same classification as sulfur dioxide. If so, this is a category 2 substance.
- The rodenticide alpha-bromadiolone might have the same hazard properties as bromadiolone. If so, this substance will be a category 1 substance.

Out of the 36 non-classified substances, 8 are listed in Annex I of the BPR. It could be assumed that these 8 substances with a low toxicity will not give rise to concern and would not need to be prioritised. However, when looking at the categorised Annex I substances, 5 are classified into category 2 (out of which 2 have a harmonised classification and 3 have a notified classification). These are all acids that may cause serious eye damage (H318), or severe skin burns and eye damage (H314).

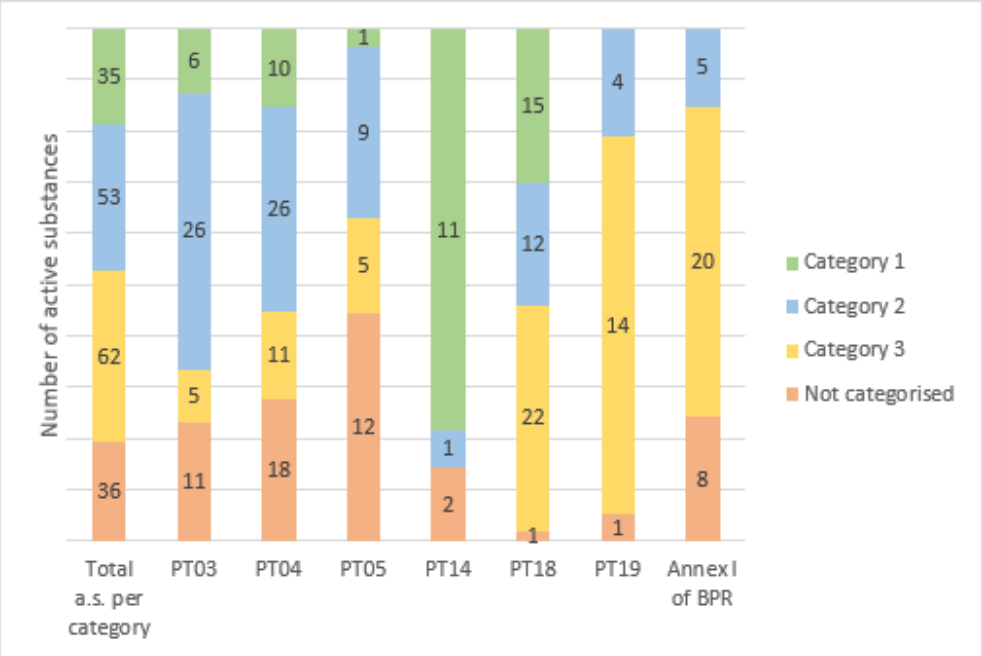
Relative to all active substances that are allowed for a specific PT, most active substances classified into category 1 belong to PT14. For this PT, 11 out of 14 allowed substances are classified into category 1. One of the PT14 substances classified into category 1 is cholecalciferol, because this substance is classified as fatal if swallowed, fatal in contact with skin and fatal if inhaled. However, cholecalciferol is the same as vitamin D3, used as a dietary supplement to maintain adequate health. This shows that information on hazard properties alone, cannot be directly linked to potential health risks due to residues in food. The PT14 substance in category 2 is alphachloralose. For PT14, there are two substances that could not be categorised due to the lack of a harmonised or notified classification: alpha-bromadiolone and powdered corn cob. If alpha-bromadiolone (CAS no. lacking) has similar properties to bromadiolone (CAS no. 28772-56-7, harmonised classification), this substance will also be classified into category 1. These results show that substances in biocides used for PT14 are considered more hazardous than biocides in other PTs.

Table 7.4 For each prioritisation category, the following is presented: the total number of active substances (a.s.) that fall within each category (or not categorised ('not cat.'), as not all substances could be assigned a category due to lack of classification information), the total number of active substances that are allowed for a specific product type, that are listed in Annex I of the BPR as a low-risk active substance, that have a harmonised classification, and that have a notified classification.

Category	**Total a.s. per cat.**	**Product type**						**Annex I of BPR**	**Harmonised classification**	**Notified classification**
		03	**04**	**05**	**14**	**18**	**19**			
1	35	6	10	1	11	15	0	0	31	4
2	53	26	26	9	1	12	4	5	28	25
3	62	5	11	5	0	22	14	20	24	38
Not cat.	36	11	18	12	2	1	1	8	N/A	N/A
Total a.s. per PT		*48*	*65*	*27*	*14*	*50*	*19*	*33*		

Active substances may be allowed for more than one PT. N/A: Not Applicable.

Figure 7.2 The number of active substances (a.s.) allowed for a specific product type (PT) or listed in Annex I of the BPR that are assigned to prioritisation categories 1, 2, or 3.



Not all substances could be assigned a category due to lack of hazard classification information. This is depicted as 'not categorised'.

Table A10.2 in Annex 10 also shows whether substances are classified as Candidates for Substitution (CfS) under the BPR. CfS meet the exclusion criteria (Art. 5(1) BPR) or the substitution criteria (Art. 10(1) BPR). The exclusion criteria are:

- Carcinogens, mutagens, or reprotoxic substances in category 1A or 1B according to the CLP Regulation.
- Endocrine disruptors.
- Persistent, bioaccumulative and toxic (PBT) substances.
- Very persistent and very bioaccumulative (vPvB) substances.

The substitution criteria are (among others):

- At least one of the exclusion criteria.
- Respiratory sensitisers.
- Two of the PBT criteria.

Normally, active substances meeting the exclusion criteria will not be approved. However, derogations are possible (Art. 5(2) of BPR) if, for example, there is evidence that the active substance is essential to prevent or control a serious danger to human health, animal health or the environment. Most active substances approved for rodenticides (PT14) meet the exclusion criteria. This explains the high number of PT14 substances that are classified into category 1.

The information on CfS was downloaded from the ECHA database (see Section 3.2). Supporting information on the criteria that determine the CfS status can be found in a document by the Coordination Group (CG) of the BPR[22]. There has been discussion in the CA meeting on the CfS status of polyvinylpyrrolidone iodine or iodine[23], because iodine is an essential element in food, and is also classified as an endocrine disruptor. The CfS status is based on this property.

As explained above, substances can be CfS under the BPR on the basis of certain hazard properties for humans and/or for the environment. Table A10.2 in Annex 10 shows the following results on CfS:

- Out of the 34 substances in category 1: 17 are CfS, 7 are under assessment, and 10 are not CfS. Out of the 17 CfS, 5 are allowed for PT03 and/or PT04, 9 for PT14, and 3 for PT18.
- Out of the 53 substances in category 2: 4 are CfS, 21 are under assessment and 28 are not CfS, out of which 5 are listed in Annex I and can be considered not CfS. The 4 CfS are: cyphenothrin (CAS no. 39515-40-7), imidacloprid (CAS no. 138261-41-3), polyvinylpyrrolidone iodine (CAS no. 25655-41-8), and DCPP (CAS no. 3380-30-1). The first two are allowed for PT18, the third for PT03 and PT04, and the last for PT04.
- Out of the 62 substances in category 3: 7 are CfS, 17 are under assessment and 38 are not CfS, out of which 20 are listed in Annex I. Out of the 7 CfS, 6 are CfS due to meeting two or three of the PBT criteria or being vP or vB and are allowed for PT18. The 7th CfS is iodine, which is listed as a CfS due to endocrine disruption (see section above).
- Out of the 37 substances that could not be assigned into a category, 18 are under assessment and 19 are not CfS, out of which 8 substances are listed in Annex I.
- Substances listed in Annex I of the BPR can only be included there if, among other things, there is enough evidence that a substance does not give rise to concerns, such as fulfilling any of the exclusion or substitution criteria set out in Article 10(1) or 5(1). Active substances listed in Annex I are therefore considered ‘not CfS’.

[22] See: https://circabc.europa.eu/ui/group/e947a950-8032-4df9-a3f0-f61eefd3d81b/library/7149b88b-d49c-4f42-ae76-0e37f1aeafb0/details
[23] See: https://www.biociden.nl/nieuws/kort-verslag-99e-ca-meeting and https://www.biociden.nl/nieuws/kort-verslag-100e-ca-vergadering

In accordance with the amendment of the CLP Regulation, the C&L Inventory will be expanded by means of hazard statement codes for endocrine disruption, PBT/vPvB and PMT/vPvM. From 2027 onwards, it will become easier to collect this information. This could be relevant for prioritisation of the active substances to be monitored in food.

7.4.2 Hazard properties of substances related to the active substances

Table A10.3 in Annex 10 shows the hazard properties and designated prioritisation categories of potential degradation products, metabolites, DBPs, or individual substances in mixtures of some active substances in biocides reported in the KAP database.

DBPs by using halogenated disinfectants and ozone

Annex 2 of the ECHA guidance for assessing the risks of DBPs by using halogenated disinfectants (ECHA, 2017a) gives information on the human toxicological basis for water limits for DBPs. Mentioned substances associated with carcinogenicity are: bromodichloromethane (a THM), bromate, and dichloroacetic acid (a HAA). Chlorate is associated with a thyroid effect, chlorite with an effect on brain weight and liver weight. According to the C&L Inventory, bromodichloromethane (CAS no. 75-27-4) has a notified classification for ‘Carc. 2’ (H351). Sodium bromate (CAS no. 7789-38-0) has a notified classification for ‘Carc. 1B’ (H350). Dichloroacetic acid (CAS no. 79-43-6) has a harmonised classification for ‘Skin Corr. 1A’ (H314), and bromoform for ‘Acute Tox 3’ (H331). Sodium chlorate (CAS no. 7775-09-9) has a harmonised classification for ‘Acute Tox 4’ (H302). On the basis of this, bromodichloromethane and sodium bromate would be classified into category 1, dichloroacetic acid and bromoform into category 2, and sodium chlorate into category 3.

We did not investigate under what conditions the mentioned category 1 DBPs bromodichloromethane and bromate could be formed. Information on this is not known to us. The formation of the mentioned category 1 DBPs could potentially occur when applying the three substances releasing active chlorine and chlorine dioxide that are classified into category 2 on the basis of their harmonised classification, and when applying the twelve not categorised substances that generate or release active chlorine, chlorine dioxide or monochloramine. Also, ozone generated from oxygen is a not categorised substance that could result in the formation of the category 1 DBPs bromate and formaldehyde (see Section 3.3). Because of the association of chlorate with thyroid effects, as mentioned in the ECHA guidance, this substance might be classified as an endocrine disruptor for human health in the future. If so, this substance would meet the exclusion criteria under the BPR. Note: the exclusion criteria under the BPR apply to active substances. Degradation products or DBPs are not mentioned in the BPR article concerned.

An EFSA study (Gadelha et al., 2019; see also Section 3.3) states that THMs have been defined as carcinogenic compounds, which makes them a relevant concern for public health. Chloroform (trichloromethane; CAS no. 67-66-3) has a harmonised classification, with the H-phrases H351 and H361d in the C&L Inventory and therefore falls into category 1. We do not know whether chloroform could be formed when applying

biocides that generate or release active chlorine, chlorine dioxide, monochloramine, tosylchloramide, or ozone.

Chlorohexidine
Wezenbeek and Komen (2023) describe a signal about the effects of chlorohexidine in meat products. The RIVM received a signal from an internist-allergologist/immunologist in 2022. The doctor indicated that a number of people could not tolerate butcher's meat. This may have been caused by the presence of the allergen chlorohexidine in the meat products. This substance is used in certain disinfectants, but also occurs in cleaning products, VMP, and human medicines. For one of the patients, the butcher indeed indicated that he was cleaning his counter and instruments with chlorohexidine.

The substance chlorohexidine (CAS no. 55-56-1) does not occur on the list of active substances in the selected PTs (Annex 2). A substance that does occur there is chlorohexidine digluconate (CAS no. 18472-51-0). In accordance with the methodology described above, this substance falls into category 2. Chlorohexidine could end up in food, when the salt chlorohexidine digluconate is used. Chlorohexidine has the H-phrase H334 in the notified classification in the C&L Inventory and therefore falls into category 1. This shows that degradation products of a substance can have different hazard properties than the parent substance. If there are any signals about this, it is important to take them into account.

Note: Chlorohexidine digluconate is in the review programme for PT01, PT02, and PT03. So it is not allowed to use a biocide with this substance for disinfecting a butcher's counter and instruments, because this is a PT04 application.

Note: in the ECHA database, the substance with CAS no. 18472-51-0 is called 'D-gluconic acid, compound with N,N′′-bis(4-chlorophenyl)-3,12-diimino-2,4,11,13-tetraazatetradecanediamidine(2:1) (CHDG)'. Between several IUPAC names 'chlorohexidine digluconate' is mentioned. Therefore, it is important to carefully check CAS numbers (or, if these are lacking, EC numbers).

Quaternary ammonium compounds
Chapter 4 presented monitoring data for a number of quats that are not included in the list of active substances (see Annex 2). These may be individual substances in applied mixtures of this type of active substances. Table A10.3 in Annex 10 contains the available information from the C&L Inventory of these substances. This shows that most quats for which information is available would be classified into category 2 on the basis of notified classifications due to the hazard property 'Causes severe skin burns and eye damage' (Skin Corr. 1B, H314). DDAC-8 (CAS no. 5538-94-3) would be classified into category 1 on the basis of notified classifications, due to the hazard property 'Fatal in contact with skin' (Acute Tox 2, H310). We did not investigate whether there is information on which application of which quat under which conditions could result in the presence of DDAC-8 in food.

7.4.3 Conclusion

For most of the active substances in the selected PTs, information is available on hazard properties in the C&L Inventory. We used harmonised classifications or, if not available, notified classifications. For the notified classifications, only classifications were included that had been notified by more than 10% of the notifiers. Prioritisation of the active substances on the basis of their hazard properties is a feasible option. Since notified classifications are not reviewed or verified by, for instance, ECHA, they are less reliable than the legally binding harmonised classifications. It is likely that substances with notified classifications would receive fewer, more, or other classifications when harmonised. Consequently, they could be categorised and prioritised differently in the future.

On the basis of their hazard properties, we classified the active substances into categories 1, 2, and 3. Category 1 is considered the category with the highest priority. It contains substances with the most severe hazard properties. For PT14 (rodenticides), most active substances are classified into category 1. For PT18 (insecticides), most active substances are classified into category 3, but there are also more than 10 PT18 substances in category 1 and in category 2. For the disinfectants (PT03, PT04, and PT05) most active substances are classified into category 2, but some are part of category 1 and others are part of category 3. For PT19 (repellents), most active substances are classified into category 3, but some are part of category 2. The same applies to Annex I substances.

A limitation is that for some substances there is no information on their hazard properties due to the lack of an identifiable substance name or CAS number. These are therefore ‘not categorised’. This is especially the case for disinfectants. Most of these substances are generated or released from other active substances. The substances generating chlorine dioxide and the substances generating or releasing active chlorine could potentially be added to category 2. Different precursors or ways of generating active substances could, however, result in different classifications. A number of Annex I substances could also be not categorised.

The categorisation is most reliable if a harmonised classification is available. This applies to 31 out of the 35 substances in category 1. Around half the substances in category 2 have a harmonised classification. In category 3, most substances only have a notified classification.

Classification into category 1 is not the same as the status as CfS under the BPR. For category 1, only human health hazard statements were taken into account, mainly in a somewhat broader way than for CfS (e.g. including CMR 2 statements), but excluding endocrine disruptors. CfS can also be based exclusively on environmental hazard statements. The current C&L Inventory does not contain hazard statement codes on endocrine disruption and environmental hazard statements. This information will be available from 2027 onwards.

Hazard properties of degradation products, metabolites, DBPs, or substances that are part of a mixture can be a reason to classify substances into a higher (more hazardous) category than the classification of the parent substance would give rise to. So could chlorohexidine digluconate be added to category 1 because of the classification of chlorohexidine. Also, all halogenated disinfectants might be classified into category 1 due to the possible formation of potentially carcinogenic DBPs. This applies to 3 substances releasing active chlorine and chlorine dioxide that are classified into category 2 on the basis of the parent substance and to 13 not categorised substances that generate active chlorine, chlorine dioxide, monochloramine, or ozone. Quats could be classified into category 1 if DDAC-8 would be present in foods. Otherwise, quats could be classified into category 2 due to possible effects on skin and eyes.

The hazard classification for the selected 186 active substances and the relevant degradation products, metabolites, and DBPs are reported in Annex 10. A total of 35 category 1 substances (and 2 ‘not (or 1)’), 53 substances in category 2 (and 20 ‘not (or 2)’), 62 in category 3, and 14 not assigned at all.

7.5 Conclusion on the use of other options for prioritisation

The information on most commonly used active substances is too limited to be used for prioritisation.

Physical/chemical properties cannot be used to draw conclusions on the presence or absence of biocide residues in all kinds of food and therefore, they are not suitable as prioritisation criteria for active substances.

Information on hazard properties of the active substances is used to classify the active substances into categories 1, 2, and 3. Category 1 is considered the category with the highest priority, because this contains substances with the most severe hazard properties. Hazard properties of degradation products, metabolites, DBPs, or substances that are part of a mixture can be a reason to classify substances into a higher (more hazardous) category than the classification of the parent substance would give rise to.

8 Integration and evaluation of the study results

8.1 General

This chapter summarises, links and discusses the results of the various aspects of prioritisation of the active substances researched in this project.

It is important to keep in mind the question that BuRO ultimately wants to answer: Are additional or amended MRLs necessary in view of the use of biocides? This project cannot answer this question yet, but this report should contribute to answering this question in the future.

Monitoring residues of biocidal active substances in food might provide useful information on this. This chapter answers the main question: For which active substances, degradation products, metabolites, DBPs, and/or individual substances in mixtures that can end up in meat, dairy products, and/or infant/toddler food should monitoring be given higher priority?

Ultimately, if monitoring indicates that additional or amended MRLs are necessary in view of the use of biocides, BuRO cares to know what the process and policy is for deriving MRLs for biocides. This is discussed in Chapter 9, beside the main conclusions and recommendations of our study.

It is noted that MRLs are not necessary for enforcement of not allowed substances or not allowed applications. The question whether or not to perform measurements on these substances in order to demonstrate illegal use or improper use falls outside the scope of this project.

Since the use of biocides covers a very broad spectrum of uses, the scope for this study was restricted to meat and dairy products. During the investigation, the scope has been slightly modified. Infant/toddler food was added, because infant and follow-on formulae are milk-based drinks/powders and similar protein-based products intended for infants and young children. Baby and toddler food (ready-to-eat meals) may contain meat and/or dairy products.

Also, attention is paid to degradation products, metabolites, DBPs, and individual substances in mixtures, because these can be more toxic than the parent active substance, especially if this is a (highly) reactive substance.

In order to come to an answer to the main question, in this chapter the following questions are answered:

1. Which product types are relevant for leaving potential residues in meat, dairy products, and infant/toddler food?
2. Based on the selected product types, which biocidal active substances, degradation products, metabolites, DBPs, and/or individual substances in mixtures can end up in meat, dairy products, and/or infant/toddler food?

3. Is monitoring data currently available for these substances in meat, dairy products, and/or infant/toddler food?
4. Are suitable analytical methods available?
5. Are any MRLs currently available for these substances in meat, dairy products, and/or infant/toddler food?
6. Which other information can be used to prioritise these active substances, including degradation products, metabolites, DBPs, and/or individual substances in mixtures, for instance, use scale, physical-chemical properties, or hazard properties?
7. Which active substances, degradation products, metabolites, DBPs, and/or individual substances in mixtures that can end up in meat, dairy products, and/or infant/toddler food should be given higher priority to monitor?

Section 8.2 summarises the answers on the first six questions above. This section starts off with the selection of relevant product types (PTs) and biocidal active substances allowed for use in the selected PTs and other relevant degradation products, metabolites, and DBPs, as reported in Chapter 2 and Chapter 3 (Section 8.2.1). Then, the availability of monitoring data from Chapter 4 (Section 8.2.2), analytical methods from Chapter 5 (Section 8.2.3), and MRLs from Chapter 6 (Section 8.2.4) are summarised. Finally, Section 8.2.5 summarises the information on the other prioritisation options from Chapter 7.

Section 8.3 verifies the available monitoring data for compliance with the available MRLs. This section integrates the results from Chapter 4 and Chapter 6. For prioritisation, it is important to know whether available monitoring data shows exceedances of available MRLs, or whether all measured values are below the associated MRLs.

Section 8.4 describes our first approach to answering the seventh question above on prioritisation. This approach only focusses on the substances from hazard category 1 and on the substances with monitoring data above the LOQ. A disadvantage of this approach is that all the other identified relevant active substances are not prioritised and that the gathered information on these substances is not being used. Because of this, we developed a ‘consolidated priority table’ comprising possible choices for prioritisation by giving ‘priority points’ for certain (combinations of) properties. This approach concerns all identified relevant active substances and other related substances, such as DBPs. Section 8.5 reports on this second approach to answer the seventh question above.

8.2 Studied substances, monitoring data, analytical methods and available MRLs

8.2.1 Active substances, degradation products, metabolites, and DBPs in the selected PTs

Biocides of which the active substances are most likely to end up in meat and dairy products are disinfectants (PT03, PT04, and PT05), rodenticides (PT14), insecticides (PT18), and repellents (PT19) (see Chapter 2). All 186 active substances that have been approved or are under review in the EU for biocides in these PTs were included in this study. This includes 33 Annex I substances that may be used in all PTs

and that meet the criteria for ‘low-risk substances’. This also includes 13 new active substances for which no biocides are on the market yet. The group of the disinfectants contains the most active substances (79 substances), followed by the insecticides (50 substances). For rodenticides, 14 active substances are allowed and for repellents, there are 19 active substances. Beside the active substances, related substances, such as degradation products, metabolites, and DBPs, were also included in this study. DBPs are mainly formed through the use of reactive active substances, such as chlorinated disinfectants (formation of chlorine DBPs), ozone, and per-compounds (formation of non-chlorine DBPs). Bromine DBPs such as bromate can be generated by chlorinated disinfectants and ozone. See Chapter 3 and Annex 12 for more details.

For prioritisation, the use in more than one PT could indicate that an active substance is used multiple times at various stages in the supply chain. There are 20 active substances that are allowed for use in 3 PTs. These are mainly disinfectants. Another 30 active substances are allowed for use in 2 PTs. See Section 3.4 for more details.

8.2.2 Monitoring data on the studied foods

Availability of monitoring data in the KAP database

For meat, dairy products, and infant/toddler food, we collected monitoring data from 2018 to 2022 on the active substances, degradation products, metabolites, DBPs, and potential individual substances in mixtures in the Dutch KAP database (see Section 4.2). The number of monitoring data sets per food category ranged between dozens and several hundreds or even thousands. There is relatively a lot of monitoring data on insecticides, but this still only concerns half of the 50 allowed active substances in PT18. Insecticides used as biocides can also be used as plant protection products (PPP), and sometimes as veterinary medicinal products (VMP), for which monitoring programmes are common. This explains the relatively large amount of insecticide monitoring data. Insecticides can end up in feed through the use of PPP, which causes oral exposure of animals. Animals can also be exposed to insecticides, when they are used in stables as biocides or through use as VMP. The mentioned exposure routes may potentially leave residues in meat and dairy products.

Beside the monitoring data on insecticides, there was monitoring data on only three disinfectants, one rodenticide, one repellent and some degradation products, metabolites, DBPs, or individual substances in mixtures from chlorinated disinfectants (chlorate and perchlorate) and from quats. In the KAP database, monitoring data on disinfectants, rodenticides, and repellents in the studied foods is very scarce. For 133 out of the 186 active substances, this database contains no monitoring data in meat, dairy products, or infant/toddler food at all. Note that these include 33 Annex I substances that meet the criteria for ‘low-risk substances’ as well as 13 biocides with new active substances that are still under review and have not yet been released on the market. For most (or all) of these, monitoring is not (or not yet) relevant.

Monitoring data in the KAP database below, equal to or above the LOQ

For the majority of the substances for which monitoring data is available, no residues were quantified. This concerns most insecticides,

one repellent (DEET) and some individual quats. Substances with monitoring data equal to or above the LOQ are other quats, chlorate, perchlorate, salicylic acid, biphenyl-2-ol, brodifacoum, coumatetralyl, and six insecticides. The percentage of samples with a concentration equal or above the LOQ is usually very limited. These percentages are highest in infant/toddler food for quats (18% of the samples) and for chlorate (22%). For the analyses of quats in infant/toddler food, these results may be caused or influenced by the used analytical method with a lower LOQ compared to the LOQ of the analytical method used for the analyses in meat and dairy products. This is not the case for chlorate. See Section 4.2.4 for more details.

Other information on monitoring data in the studied foods
The data on residues in the KAP database is sent to EFSA, which collects this data from all EU Member States. We did not study the EFSA data on PPP and VMP residues yet. Biocides and contaminants are included in the VMP database. Besides, there is bound to be information on residues of the active substances, degradation products, metabolites, DBPs, and individual substances in mixtures in food from food safety management programmes and schemes, but these are not public. We did not perform an extensive literature search for monitoring data, but we did report some monitoring data available at RIVM (see Section 4.4). This data from public literature concerns chlorate, perchlorate, chloroform, bromodichloromethane, dichloroacetic acid, trichloronitromethane, hydrogen peroxide, quats, iodine, and salicylic acid.

8.2.3 Analytical methods for active substances

With regard to meat, dairy products, and infant/toddler food, WFSR has quantitative analytical methods for approximately 26% of the active substances in the selected PTs, for chlorate and perchlorate, and for some individual substances of quat mixtures. Besides, WFSR has screening methods for a further ~5% of the active substances in the selected PTs (see Chapter 5). Because of the current monitoring programmes, these are mainly insecticides, but WFSR also has analytical methods available for most rodenticides. Analytical methods for disinfectants and repellents are scarce at WFSR. On the basis of literature, some more of the active substances, degradation products, metabolites, and DBPs of the selected PTs can be analysed in the studied foods with a sufficiently low LOQ.

8.2.4 Available MRLs for the active substances in biocides

The MRLs for ‘pesticide residues’ in infant and follow-on formulae are always 0.01 mg/kg. This does not apply to baby and toddler food (ready-to-eat meals). MRLs for PPP and VMP are only established for raw agricultural products. However, MRLs for raw agricultural products also cover the presence of residues of PPP or VMP in the processed products derived from them. Section 6.3 provides details on available MRLs for meat and milk. For meat, there are MRLs for specific parts of the animal and sometimes also for specific animal species. For dairy products, there are only MRLs for milk. There is EU MRL information on 101 out of the 186 studied active substances and on 3 substances related to biocidal use (BAC, chlorate and quats). Section 6.4 provides an overview. There are 41 substances with a default MRL of 0.01 mg/kg due to their (former) use as PPP, sometimes combined with the status ‘No MRL

required' due to their use as VMP. There are 30 substances with only the status 'No MRL required'. Furthermore, there are 22 substances with a specific MRL higher than 0.01 mg/kg and 8 substances with a specific MRL of 0.01 mg/kg.

For quats as a group, there is an MRL of 0.01 mg/kg, but there are higher MRLs amounting to 0.1 mg/kg for BAC and DDAC, which are part of this group. There are specific MRLs for chlorate in meat and in milk. For perchlorate, there are MLs for infant/toddler food. Only salicylic acid has an MRL lower than 0.01 mg/kg for milk (namely 0.009 mg/kg) and higher MRLs for meat.

There are also Dutch MRLs for eight disinfectants. They range from 0.05 to 1 mg/kg and were based on the LOQ at the time they were set. Some of these substances have the European status 'No MRL required'.

8.2.5 *Other options for prioritisation of the active substances*

Most commonly used active substances per application

The best basis for prioritisation would be information on which active substances are most commonly used for which application. Unfortunately, there is hardly any useful information available on this subject for biocides. In the Netherlands, there is no registration of the quantities of active substances in biocides sold. The number of authorised biocidal products with a specific active substance says little or nothing about how often an active substance is used. The studied active substances are used in a wide range of situations and applications. Information on prioritising active substances on the basis of their occurrence in biocides for specific applications is very scarce. Information from the Dutch industry organisation for disinfectants, NVZ, states that the most commonly used (groups) of disinfectants in the food sector are quats, chlorinated compounds, alcohols, alkylamines, acids, hydrogen peroxide, and glutaraldehyde. This information cannot be linked to specific applications. WFSR supply chain studies for red meat and poultry mention the use of the same and some more active substances. The responses in the WFSR studies are too low to draw conclusions on the most commonly used substances for specific applications. We did not collect information on the most commonly used insecticides, rodenticides, or repellents. See Section 7.2 for more details. Due to a lack of information, prioritisation based primarily on the most commonly used substances per application is not feasible.

Physical/chemical properties of the active substances

Physical/chemical properties, such as volatility or water or fat solubility, do not appear to be suitable conditions to draw conclusions on the potential presence or absence of residues in food. For example, volatile substances used in an enclosed space may still occur in foods as the vapour may redissolve in foods and can thus not be excluded from monitoring. Substances with long carbon chains or large organic molecules are more likely to be absorbed in meat or dairy products, and they are difficult to rinse off with water. That is why large molecules are interesting to monitor. However, since the small inorganic molecule chlorate has also been found in quantified values in dairy and meat, prioritisation cannot be exclusively based on molecule length. Compounds that have the notification of fat soluble (F) in the MRL

legislation for PPP and that are also biocides, may be interesting to monitor in fatty tissues and cream, as they tend to concentrate in those matrices. See Section 7.3 for more details. All in all, the physical/chemical properties were not suitable as criteria for prioritisation of biocide monitoring in animal commodities.

Hazard properties of the active substances and related substances
The hazard properties of most active substances and some related substances, such as degradation products, metabolites, DBPs, and individual substances in mixtures, were derived from the CLP Inventory. The hazard information is based on harmonised and notified classifications. Harmonised classifications are more reliable, because (unlike notified classifications) they are legally binding minimum classifications developed by independent authorities of EU Member States. If harmonised classifications were not available, notified classifications were used. For those, only hazard information notified by more than 10% of the notifiers was included. On the basis of the hazard properties, 80% of the active substances could be classified into prioritisation categories 1, 2, or 3. Category 1 contains the active substances with the most severe hazard properties, for instance, may cause cancer or genetic defects or may damage fertility or the unborn child. The categorisation based on hazard properties can be used for prioritisation of the active substances.

The remaining 20% of the active substances could not be categorised on the basis of the CLP Inventory, often because they are generated by, formed by, or released from precursors. These are mainly disinfectants (PT03, PT04, and PT05). Out of the 36 substances that could not be categorised, 22 can be linked to other substances that can be categorised.

Apart from the active substances, some related substances could also be classified into category 1. These may leave residues in food during the use of halogenated disinfectants, ozone, quats, or chlorohexidine digluconate. We do not know whether information is available on which application under which conditions could result in the presence of these category 1 degradation products, metabolites, DBPs, or individual substances in mixtures in meat and/or dairy products.

Category 1 contains 35 active substances, consisting of 11 disinfectants, 9 rodenticides, 13 insecticides, and 2 active substances that can be used as rodenticides and as insecticides. There are 25 other active substances that can be considered category 1 substances due to the potential formation in meat and/or dairy products of category 1 degradation products, metabolites, DBPs, or individual substances in mixtures. They include the 17 active substances generating or releasing active chlorine, chlorine dioxide, monochloramine, or ozone, the 7 quats, and chlorohexidine digluconate. On the basis of the C&L Inventory, most of them are classified into category 2 (or ‘Not (or 2)’. See Section 7.4 and Annex 10 for more details.

8.3 Monitoring data verified for compliance with existing MRLs

Results from monitoring data can be used to establish whether or not specific biocidal active substances are being monitored (see Chapter 4), but they can also be compared with existing MRLs (see Chapter 6) to assess whether exceedances have occurred or not. It is noted that whether or not additional proper biocidal use has resulted in an exceedance of the MRL from the PPP or VMP framework, cannot easily be established at the end of the production chain. Exceedance of the MRL can also be caused by improper use of a biocide or improper use of another product containing the same substance. Monitoring data from the KAP database and from public literature was verified for compliance with the existing MRLs.

Monitoring data from the KAP database verified for compliance with existing MRLs

Table 8.1 shows the maximum measured values from the KAP database (see Annex 4) verified for compliance with the associated MRL (see Annex 9). Note: in the KAP database, 'meat' is reported instead of 'muscle':

- The biphenyl-2-ol concentration exceeds the MRL in 1 sample (in kidney fat) out of 26 in meat products.
- Salicylic acid exceeds the MRL in 21 out of the 2708 analysed samples of raw milk and in 8 out of the 2803 analysed meat (muscle) samples (4 of fattened calf, 2 of horse and 2 of broiler). For the meat samples, the MRL of 0.2 mg/kg was used, although this does not apply to broiler.
- The only measured rodenticide, brodifacoum, exceeds the MRL in meat in 1 selective sample of pig liver out of 2.
- For 5 out of the 6 insecticides with values >LOQ in meat products, specific MRLs are available. All measured concentrations of these insecticides were below the associated MRLs. These five insecticides are cyhalothrin, cypermethrin, permethrin, deltamethrin, and spinosad. They have only little monitoring data above the LOQ: for cyhalothrin 1 (in fat) out of 697, for cypermethrin 4 (in fat) out of 397, for permethrin 4 (in fat) out of 2150, for deltamethrin 5 (in fat) out of 2141 and for spinosad 2 (1 in fat, 1 in meat) out of 710. Piperonyl butoxide has the status 'No MRL required' for VMP use and a Dutch MRL of 0.05 mg/kg. In meat products, this insecticide (or synergist) was found >LOQ in 8 samples (1 in kidney fat, 7 in fat) out of 326, all below the Dutch MRL. In infant/toddler food, this insecticide was found above the (standard) MRL of 0.01 mg/kg in 1 sample out of 258.
- In some samples of dairy products, meat, and infant/toddler food, the concentrations of quats exceed the MRLs. Incidentally, the concentrations are high (9.7 mg/kg in dairy products and 16 mg/kg in meat (muscle)).
- Also, exceedance of the MRL for chlorate is shown in some samples of meat (muscle) and infant/toddler food.

Monitoring from literature verified for compliance with MRLs

The above-mentioned monitoring data from the literature (see Section 4.4) indicates that the MRL for chlorate in dairy products is

exceeded. Furthermore, there are ‘too high concentrations’ of hydrogen peroxide in dairy products. Quats and p-toluenesulfonamide are found in meat and dairy products at levels above the Dutch MRLs. The above-mentioned measured values of chloroform, bromodichloromethane, dichloroacetic acid, and trichloronitromethane in meat, cannot be verified for compliance with any MRL, because MRLs for these DBPs are lacking. Iodine has been measured in milk. These values are below the Dutch MRL.

Table 8.1 Maximum measured values (mg/kg), from the KAP database in meat products, dairy products, and infant/toddler food of active substances (a.s.) in biocides allowed for product type (PT) 03, 04, 05, 14, 18, and/or 19 and their potential degradation products, metabolites, DBPs, or individual substances in mixtures, verified for compliance with the associated MRL.

Substance name **E: from ECHA database** **K: from KAP database** **R: common name used in this report**	**CAS no.**	**Biocidal a.s.?**	**PT(s)**	**Max. meat product**	**>MRL meat product?**	**Max. dairy**	**>MRL milk?**	**Max. infant / toddler food**	**>MRL infant / toddler food?**
E: Biphenyl-2-ol K: 2-phenylphenol	90-43-7	Yes	03 04	0.011 (kidney fat)	Yes	-	N/A	-	N/A
E: N/A K: BAC 12 R: Benzododecinium chloride [1]	139-07-1	No	N/A	0.089 (muscle)	No	0.137	Yes	0.0054	No
E: N/A K: BAC 14 R: Miristalkonium chloride [1]	139-08-2	No	N/A	-	N/A	0.263	Yes	0.0036	No
E: N/A K: Benzalkonium chloride (mixture of alkylbenzyldimethylammonium chlorides with alkyl chain lengths of C8, C10, C12, C14, C16 and C18) R: BAC C8-18 [1]	-	No	N/A	0.069 (muscle)	No	-	N/A	0.012	Yes
E: Brodifacoum K: Brodifacoum	56073-10-0	Yes	14	0.084 (liver)	Yes	-	N/A	-	N/A
E: N/A K: Chlorates	-	No	N/A	0.68 (muscle)	Yes	0.033	No	0.3	Yes
E: N/A K: Cyhalothrin [2]	68085-85-8	No	N/A	0.016 (fat)	No	-	N/A	-	N/A
E: (RS)-α-cyano-3-phenoxybenzyl-(1RS)-cis, trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate (Cypermethrin) K: Cypermethrin	52315-07-8	Yes	18	0.031 (fat)	No	-	N/A	-	N/A

Substance name **E: from ECHA database** **K: from KAP database** **R: common name used in this report**	**CAS no.**	**Biocidal a.s.?**	**PT(s)**	**Max. meat product**	**>MRL meat product?**	**Max. dairy**	**>MRL milk?**	**Max. infant/ toddler food**	**>MRL infant/ toddler food?**
E: Deltamethrin K: Deltamethrin (cis-deltamethrin)	52918-63-5	Yes	18	0.043 (fat)	No	-	N/A	-	N/A
E: N/A K: Didecyldimethylammonium chloride (mixture of alkyl-quaternary ammonium salts with alkyl chain lengths of C8, C10 and C12) R: DDAC C8-12 [1]	-	No	N/A	16 (muscle)	Yes	9.67	Yes	0.004	No
E: N/A K: Perchlorate	14797-73-0	No	N/A	-	N/A	-	N/A	0.013	No [3]
E: Permethrin K: Permethrin (sum of isomers)	52645-53-1	Yes	18	0.07 (fat)	No	-	N/A	-	N/A
E: 2-(2-butoxyethoxy)ethyl 6-propylpiperonyl ether (Piperonyl butoxide/PBO) K: Piperonyl Butoxide	51-03-6	Yes	18	0.027 (kidney fat)	No	-	N/A	0.042	Yes
E: Salicylic acid K: Salicylic acid	69-72-7	Yes	03 04	4.8 (muscle)	Yes	0.052	Yes	-	N/A
E: Spinosad K: Spinosad (Spinosad, sum of spinosyn A and spinosyn D)	168316-95-8	Yes	18	0.057 (fat)	No	-	N/A	-	N/A

N/A: Not Applicable

1) Verified for compliance with the MRL for BAC and DDAC (both in Regulation (EU) 2023/377).
2) In this table, it is assumed that this is not lambda-cyhalothrin (CAS no. 91465-08-6), because the KAP database also includes monitoring data on 'cyhalothrin, lambda-'. However, as far as we know, the various isomers from cyhalothrin and lambda-cyhalothrin cannot be distinguished by the analytical methods used.
3) For perchlorate, not MRLs but MLs are applicable; the sample was of baby and toddler food (ready-to-eat meals).

8.4 Evaluation of substances from hazard category 1 and substances with monitoring data above the LOQ

The substances in hazard category 1 have the most severe hazard properties. It might be an option to prioritise the active substances, degradation products, metabolites, DBPs, and individual substances in mixtures from category 1. In Annex 12, all collected information on these substances is presented in two tables. Table A12.1 gives an overview of the active substances. Table A12.2 gives an overview of degradation products, metabolites, or DBPs. These two tables include the available information on monitoring data, analytical methods, and MRLs. The tables also show whether the substance is mentioned as an active substance most commonly used in disinfectants, is mentioned by WFSR in the supply chain studies, and/or is mentioned by RIVM as large molecules that are not easy to rinse off. In Annex 12, the combined information in the tables is evaluated and some additional information is provided, for example, on the availability of biocides containing the evaluated substance. This can result in a higher or lower priority for the evaluated substances. Even the conclusion that a certain substance should not have priority for monitoring is possible, for example, because the substance has recently ceased to be approved. All details on the evaluation of the category 1 substances are available in Annex 12.

In Annex 13, the other substances (not category 1) with monitoring data above the LOQ in meat, dairy products, and infant/toddler food are evaluated, because this might also be an indication that monitoring could be given priority. For these substances, information on their use in PPP, VMP and biocides is given and the monitoring data is verified for compliance with existing MRLs.

In Annexes 12 and 13, the results of the evaluation are presented in detail per substance. The general conclusions of the evaluations are:

- Rodenticides were found in meat but this should not be possible when the rodenticides are used properly. The available guidances also take proper use as a starting point (see Annex 1). Therefore, its presence is an indication of improper use of rodenticides. This makes monitoring relevant in order to find out whether this is an incident or whether improper use is more common. When residues are found regularly, it could be assessed whether the current MRLs of 0.01 mg/kg are protective enough.
- For most insecticides, information on the application is necessary to decide for which animal species monitoring meat and/or dairy products is relevant. Use instructions for the authorised biocides could be studied.
- For insecticides on which enough monitoring data in relevant foods is available and which show concentrations below the LOQ only, extra monitoring due to biocidal use does not seem necessary.
- Some active substances in disinfectants lost their approval during this study. For some others, there are no authorised biocides in the selected product types. This study focusses on allowed substances and authorised biocides. As a result,

monitoring of substances that may not be used is not at stake, but may be included in the future, for example, when there is an indication for illegal use of substances. For one disinfectant without Dutch authorised biocides, a measured concentration in Dutch meat above the applicable standard MRL was found. In this case, monitoring can give insights into improper use or illegal use of biocides.

- For most disinfectants, more information on their application is needed to assess in which type of (processed) meat, dairy products, or infant/toddler food they should be monitored. For example, it may be concluded that disinfectants used for fumigation are not expected in meat, dairy products, and infant/toddler food, if it turns out that these biocides are not used in the presence of these types of food or in livestock farming.
- For some disinfectants, rinsing off will be difficult. Monitoring is recommended for applications for which rinsing off is part of the instructions for use. This could be investigated.
- For a number of commonly used disinfectants, the formation of related substances (degradation products, metabolites, and/or DBPs) can be expected. This mainly concerns reactive active substances, such as chlorinated disinfectants, ozone, and per-compounds. Some of the substances formed were classified as category 1 substances. DBPs and/or degradation products that are often formed can be used as markers. There should be international agreement on which markers to use. In our view, the lack of information on the formation of degradation products, metabolites, and/or DBPs and the lack of markers to be monitored are very important knowledge gaps. The current authorisation procedure lacks guidance to assess degradation products, metabolites, and/or DBPs.
- Chlorate and quats were >LOQ in approximately 20% of the analysed samples of infant/toddler food. These could origin from chlorinated disinfectants and from quat-containing disinfectants, respectively. For quats, these results may be caused or influenced by the analytical method, which uses a lower LOQ for infant/toddler food than the analytical method used for meat and dairy products. For chlorate, this is not the case. Studying how these disinfectants are used, why residues are often found in infant/toddler food, and whether there are other sources seems highly relevant.
- For quats, the available MRLs and the available monitoring data (sometimes on individual quats) cannot be connected to the active substances used in biocides. Clear EU-agreements are needed on what to monitor, how to report the results, and how to test the results against which MRL.

8.5 Prioritisation of all active substances and related substances

8.5.1 Prioritisation in a consolidated priority table

The results of prioritisation of all active substances and degradation products, metabolites, DBPs, and individual substances in mixtures are summarised and discussed below. We investigated the possibilities for prioritisation (the prioritisation criteria) on the basis of

most commonly used substances per application (see Section 8.5.2), expected DBPs, availability of MRLs, monitoring data, and analytical methods (see Section 8.5.3), and hazard properties (see Section 8.5.4). We developed a ‘consolidated priority table’, comprising possible prioritisation choices by giving ‘priority points’. These choices, which can serve as suggestions, are based on the gathered information. The final choices for prioritisation are policy choices. By using the consolidated table presented in Annex 11, which is also provided electronically for further use, the criteria can be selected and amended as required.

8.5.2 *Prioritisation based on most commonly used substances per application*

As explained in Section 8.2.5, due to lack of information, prioritisation based on most commonly used substances per application is not feasible. However, the use of active substances in more than one PT could indicate that an active substance is used multiple times at various stages in the supply chain (see Section 8.2.1). This might support prioritisation across all the aspects under consideration. A use in 1 PT (priority points ‘1’), in 2 PTs (priority points ‘3’), 3 PTs (priority points ‘5’), or all PTs (priority points ‘0’, because listed in Annex I (‘low risk’ substances)) was included in the consolidated priority table. The 13 new substances still under review were also given priority points ‘0’ because they are not on the market yet.

8.5.3 *Prioritisation based on expected DBPs, availability of MRLs, monitoring data, and analytical methods*

A combination of the information in Sections 8.2 and 8.3 can be used for prioritisation. The use of reactive active substances may result in the formation of a wide range of DBPs. This can be considered a criterion for prioritisation. Even though the available monitoring data was mainly directed at PPP and VMP use, this data can be used to support prioritisation. Substances with monitoring data above the MRL could get a higher priority. Substances with no monitoring data at all could also be given a higher priority. Substances with monitoring data below the MRL or below the LOQ could get a lower priority. The availability or the absence of an MRL might be a suitable prioritisation criterion, depending on the reason for the absence. Substances for which an analytical method is available could be given a higher priority, because the method makes it easier to start monitoring.

As the presence of monitoring data and/or analytical methods for certain substances often relates to the availability of MRLs in the legislation, the proposed prioritisation is based on a combination of all three parameters. In addition the expected formation of related substances, such as DBPs, is taken into account. The following points were assigned (see Annex 11):

- 10 points were assigned to active substances expected to generate chlorine and bromine DBPs. These substances include (in-situ generated) active chlorine, (in-situ generated) chlorine dioxide, and tosylchloramide sodium. These substances get high priority, as little is known about the formation of these DBPs. A wide range of DPBs may be formed

during use. The identity or hazardous properties of the various DPBs are unclear. Furthermore, depending on the conditions during use, different compositions will occur. The need to set specific MRLs for (marker) DBPs of these active substances should be investigated. In addition, monitoring data indicated that the specific MRL for chlorate (which is used as a marker residue for active chlorine compounds) was exceeded for dairy and for infant/toddler food. Therefore, chlorate needs to be monitored on a regular basis. Furthermore, the source of perchlorate residues (see Annex 4) needs to be investigated, because the relation between perchlorate in food and the use of chlorinated biocides is unclear.

- 10 points were assigned to active substances expected to generate DBPs other than chlorine DBPs (non-chlorine DBPs) and potentially bromine DBPs. These substances include (in situ-generated) ozone, hydrogen peroxide, peracetic acid, and other per-compounds. In literature, 'high concentrations' of hydrogen peroxide in butter, milk, and desserts are reported. Per-compounds are reactive and could result in a wide range of DBPs, which is not well characterised (see Annex 13). These substances get high priority, as little is known about the formation of these DBPs. The need to set specific MRLs for (marker) DBPs of these active substances should be investigated.
- 10 points were assigned to quaternary ammonium compounds, as some dairy samples and some infant/toddler food samples exceeded the specific PPP MRLs. In addition, there appears to be a mismatch between the quaternary ammonium compounds released on the market and the MRLs listed in the PPP legislation. Also, the MRL legislation needs to make clear how to enforce individual quats and mixtures of quats. Furthermore, the PPP MRL legislation needs to be updated, as different MRLs exist for the same substances under different names (see Annex 3) and the sources of BAC 8, BAC 10, and DDAC-12 residues (see Annex 4) need to be investigated as these are not approved or under review in the BPR. Finally, MRLs may need to be set for ADEBAC mixtures.
- 10 points were assigned to salicylic acid. Some meat and dairy samples exceeded the specific VMP MRLs. There appears to be a mismatch within the VMP regulation (specific MRLs versus 'No MRL required' status). The possibility of the contribution made by biocide use and the need to modify these MRLs should be investigated. The MRL legislation needs to make clear how to enforce salicylic acid.
- 10 points were assigned if at least one sample of meat, dairy, or infant/toddler food exceeded the MRL (specific PPP MRL, specific VMP MRL, default infant/toddler food MRL, or default Art 18 MRL). Such substances need to be monitored on a regular basis. Although a legal basis is in place to act in case of MRL exceedance, the possibility of the contribution made by biocide use and the need to modify these MRLs needs to be investigated.
- 10 points were assigned if some samples of infant/toddler food exceeded the default MRL of 0.01 mg/kg for infant/toddler

food, but the substance has a ‘No MRL required status’ in the VMP legislation. For these substances, the necessity of a biocide MRL needs to be assessed. One example of this case is piperonyl butoxide (PT18).

- 10 or 9 points were assigned if no monitoring data is available and the active substance is not mentioned in any MRL or ML legislation. Such active substances should get high priority as little is known about their presence in any food: 10 points were assigned if an analytical method is available at WFSR and 9 points were assigned if such a method still needs to be developed and validated.
- 8 or 7 points were assigned if no monitoring data is available and the substance has a default MRL of 0.01 mg/kg according to Art. 18 of the PPP legislation. Such substances might be interesting to monitor, as these substances have never been assessed by EFSA and little is known about their presence in food. Since a legal basis to act in case of exceedance of the default MRL is in place, a lower priority was assigned: 8 points were assigned if an analytical method is available at WFSR and 7 points were assigned if such a method still needs to be developed and validated.
- 8 or 7 points were assigned if no monitoring data is available and the substance has a specific MRL in the PPP legislation (Annex II, III, or V). Since a legal basis to act in case of exceedance of the MRL is in place, a lower priority was assigned: 8 points were assigned if an analytical method is available at WFSR and 7 points were assigned if such a method still needs to be developed and validated.
- 6 or 5 points were assigned if MRLs (specific PPP MRL, specific VMP MRL, default infant/toddler food MRL) were not exceeded for 1 or 2 of the 3 matrices analysed, but monitoring data is not available for all 3 matrices (meat, dairy, and infant/toddler food). The missing matrices are interesting to monitor. 5 points were assigned when there is no mismatch between VMP and PPP MRLs, or when there is only a specific VMP MRL or only a specific PPP MRL. 6 points were assigned when there is a mismatch between PPP and VMP MRLs. In this case, harmonisation of MRLs is desirable.
- 4 or 3 points were assigned if no monitoring data is available and the substance has a default MRL of 0.01 mg/kg according to Art 18 of the PPP legislation, but also has a ‘No MRL required’ status in the VMP legislation. As the VMP assessment indicates that no significant residues are expected while these substances are applied directly to animals, these substances get a lower priority: 4 points were assigned if an analytical method is available at WFSR and 3 points were assigned if such a method still needs to be developed and validated. As there is a mismatch between the PPP and VMP regulations, harmonisation of MRLs is desirable.
- 4 or 3 points were assigned if no monitoring data is available and the substance has a ‘No MRL required’ status in the VMP legislation only. As the VMP assessment indicates that no significant residues are expected while these substances are applied directly to animals, these substances get a lower

priority: 4 points were assigned if an analytical method is available at WFSR and 3 points were assigned if such a method still needs to be developed and validated.

- 2 points were assigned if the substance has a default MRL of 0.01 mg/kg according to Art 18 in the PPP legislation and monitoring data in all three matrices (meat, dairy, and infant/toddler food) is <LOQ. Lower priority was given, as monitoring data indicates that biocide residues are not expected. Listing the LOQ of the analytical method in annex V of the PPP legislation might be considered, especially for those cases where the technically feasible LOQ of the analytical method is higher than 0.01 mg/kg.
- 2 points were assigned if the substance is not listed in any MRL legislation and monitoring data in all three matrices (meat, dairy, and infant/toddler food) is <LOQ. Lower priority was given as monitoring data indicates that biocide residues are not expected. An MRL at the LOQ could be considered for biocide residues in animal commodities. One example of this case is DEET (PT19).
- 2 points were assigned if the substance is listed in a specific MRL legislation but no MRLs were listed for animal commodities and monitoring data in all three matrices (meat, dairy, and infant/toddler food) is <LOQ. This applies only to chlorfenapyr (PT18). Lower priority was given as monitoring data indicates that biocide residues are not expected. Adding an MRL at the LOQ (0.01 mg/kg) for animal commodities in the PPP legislation might be considered.
- 2 or 1 points were assigned if specific VMP and PPP MRLs (at or above LOQ) were not exceeded for all three matrices (meat products, dairy products, and infant/toddler food). 1 point was assigned when there is no mismatch between VMP and PPP MRLs, or when there is only a specific VMP MRL or only a specific PPP MRL. 2 points were assigned when there is a mismatch between PPP and VMP MRLs. In this case, harmonisation of MRLs is desirable.
- 1 point was assigned if the substance is not listed in any MRL or ML legislation, but the active substance concerns a food such as peanut butter (PT19) or powdered corn cob (PT14). Monitoring is not relevant for foods, but it is desirable to list those active substances in the legislation with a ‘No MRL required’ status (comparable to Annex IV in the PPP legislation).
- 0 points were assigned if the substance has a ‘No MRL required’ status in the PPP legislation only, or if it has a ‘No MRL required’ status in both the PPP and the VMP legislation. Monitoring is generally not relevant for these substances, as they are often used as food stuffs or because they are basic substances[24] under the PPP legislation. About half of these

24 Basic substances are substances that are not predominantly used for plant protection purposes but are nevertheless useful in plant protection. Further criteria according to article 23 of Regulation (EC) No 1107/2009 are that they are not substances of concern, that they do not have the capacity to cause endocrine disrupting, neurotoxic or immunotoxic effects, and that they are not placed on the market as plant protection products. Prerequisites for an approval are that the substance has neither immediate or delayed harmful effects on human or animal health, nor an unacceptable effect on the environment.

substances are also Annex I substances under the BPR (low-risk substances). One exception is hydrogen peroxide, but this is covered under substances expecting to generate DBPs (10 points). For example, a substance like geraniol has natural background concentrations and direct treatment according to good plant protection practice has no harmful effects on human or animal health. Indirect biocidal use of geraniol is expected to result in even lower concentrations. For substances such as benzoic acid and lactic acid, exposure of consumers due to the use as PPP or biocide is expected to be negligible when compared to exposure via their regular diet.

- 0 points were assigned if the substance is a micro-organism, because monitoring is not (yet) possible for these active substances. It is noted that some *Bacillus thuringiensis* strains cannot be distinguished from more toxic strains and should never occur at levels above 10^5 Colony Forming Units (CFUs). Measuring CFUs is not part of the regular monitoring programme.
- 0 points were assigned if the substance belongs to the 33 Annex I substances in the BPR. Monitoring seems not relevant for these low-risk substances.
- 0 points were assigned if the substance belongs to the 13 new active substances which are still under review. This applies, for example, to substances generating monochloramine. As these a.s.-PTs are not on the market yet, monitoring is not currently relevant, but might become relevant in the future.

8.5.4 Prioritisation based on hazard properties

The categorisation based on hazard properties can be used for prioritisation of the active substances (see Section 8.2.5). Category 1 substances were given 5 priority points. Category 2 substances were assigned 3 priority points and category 3 substances received 1 priority point in the consolidated priority table. Substances that were not classified and that could not be linked to other substances were assigned 0 priority points.

8.5.5 Integration of results on prioritisation of substances for monitoring

The results of PT identification, the relevant active substances, the expected formation of related substances such as DBPs, the use in one or more PTs, the availability of MRLs and monitoring data, the exceedances of MRLs, the hazard category, and the availability of an analytical method are all combined in the consolidated priority table in Annex 11. By assigning priority classes to the various criteria, an overall priority can be calculated. Priorities ranging from 0 (lowest) to 5 (highest) were assigned to the use in one or more PTs and to hazard categories. Priorities ranging from 0 (lowest) to 10 (highest) were assigned to a combination of the availability of monitoring data, presence, absence, and status of an MRL, availability of an analytical method, formation of DBPs, and MRL exceedance. The physical/chemical properties were not included in the prioritisation.

The consolidated priority table is included in Annex 11 and provided electronically for further use. On the basis of hazard category 1 only, a total of 35 substances would be selected (see Section 8.4 and

Annex 12). The proposed total priority classification in the table yields a totally different distribution, still including category 1 substances at the top of the list, but also including a substantial amount of category 2 substances. Some category 3 substances are listed higher in the ranking than some category 1 substances.

On the basis of the proposed choices in the consolidated priority table, the top of the list consists of 30 substances with 16-20 priority points. This proposed prioritisation is mainly driven by their use in more PTs (mainly for disinfectants), the expected formation of DBPs (from chlorine compounds, ozone and per-compounds), MRL exceedance (chlorate, quats, salicylic acid, brodifacoum), and hazard category 1 substances without any monitoring data (hydrogen cyanide, aluminium phosphide releasing phosphine, CMIT/MIT). By including or excluding certain properties, or by using a different scaling per property, the top of the list may look different.

9 Conclusions and recommendations

9.1 General

In this chapter, we provide general conclusions and recommendations. They help to make well-founded decisions about which substances to monitor in various types of food. This is important for setting or amending MRLs in view of biocidal use.

The aim of this study is to provide answers to the two main questions:

- For which active substances, degradation products, metabolites, DBPs, and/or individual substances in mixtures that can end up in meat, dairy products, and/or infant/toddler food should monitoring be given high priority?
- What is the process and policy for deriving MRLs for residues of chemical substances, and how this is regulated for biocides?

The answer to the first question on prioritisation is addressed in Section 9.2 and the answer to the second question on the legal status in Section 9.3. Some issues that were identified in the process and may be relevant to future investigations have been addressed in Section 9.4.

Particularly for disinfectants, it is important to keep in mind that without these biocides, safe food production and food processing is not possible. Contamination with, for example, Salmonella must be prevented. Depending on the application, this means that, sometimes, residues of disinfectants are unavoidable. In some cases, residues of insecticides in meat or dairy products cannot be avoided (see the guidance in Annex 1). The same applies to repellents. It is, of course, important that the residue concentration is not so high that it poses risks. The prospective authorisation assessment of biocides, PPP, and VMP must prevent too high residue concentrations in food. For rodenticides, we assume that, when following the instructions for use, exposure of livestock does not take place. The available guidance also uses the instructions for use as a starting point (see Annex 1). Thus, there should be no residues of rodenticides in meat, dairy products, and infant/toddler food.

9.2 Identification and prioritisation of substances to monitor

9.2.1 Prioritisation of substances for monitoring

Active substances and related substances in the selected PTs

In this study, we identified 186 active substances in biocides in 6 product types (PTs) that potentially leave residues in meat, dairy products, and/or infant/toddler food. These are disinfectants used for veterinary hygiene (PT03), in the food and feed area (PT04) and for drinking water (PT05), rodenticides (PT14), insecticides used during production of feed or in livestock farming (PT18), and repellents used in livestock farming (PT19). The potential residues are not only these active substances, but also related substances, such as their isomers,

degradation products, metabolites, DBPs, and/or individual substances in mixtures.

Most commonly used active substances
Some active substances are only used within one PT, whereas others are allowed for use in two or three PTs. Use in more than one PT may be indicative for more wide spread use than use in just one PT. This could be used for prioritisation. However, only actual commercial data on used volumes per application can verify that assumption. Unfortunately, data on sold or used volumes is not available. In the absence of commercial data on national market volumes (sold and/or use) and of specific information on the application of biocides (more detailed than product types), the NVZ provided information on the disinfectants that are most commonly used in the food sector. Information on used disinfectants in the red meat and poultry supply chains was extracted from WFSR studies. This information can only be supportive of prioritisation.

Monitoring data
Monitoring data is available for some active substances, but mainly for insecticides because of their use in other regulatory frameworks (PPP and VMP). No MRLs for single biocidal use are in place in the EU. An overview of MRLs for the substances used in both biocidal and PPP and/or VMP frameworks was provided. It is noted that in the absence of MRLs for specific compounds, these compounds are generally not taken up in monitoring programmes. The monitoring data from the KAP database does not provide clear indications for future-directed monitoring from biocidal use, but can be used in support of prioritisation.

Availability and exceedances of MRLs and analytical methods
The presence, absence, and status of an MRL may be used as a criterion for prioritisation. Exceedances of MRLs require further investigation. No distinction can be made between exceedances as a result of improper use and those caused by dual/triple use where biocidal use is not yet taken into account. If all measured concentrations are below the associated MRLs, a lower priority can be assigned. WFSR provided an overview of which analytical methods are available for monitoring. Quantitative analytical methods are available for approximately 26% of the active substances in the selected PTs. Besides, WFSR has screening methods for a further ~5% of the active substances in the selected PTs.

Physical/chemical properties
It was concluded that prioritisation based on physical/chemical properties such as volatility was not favoured. Since substances with long carbon chains, such as quats, and small inorganic molecules, such as chlorate, have been found in meat and dairy products in quantified values, prioritisation cannot be based on molecule length. Compounds that have the notification of being fat soluble (F) in the MRL legislation for PPP and that are also biocides may be interesting to monitor in fatty tissues and cream, as they tend to concentrate in those matrices.

Hazard properties
Prioritisation of the substances based on their hazard properties seems to be a more promising way to proceed. The substances were divided into three categories. Category 1 contains the active substances with the most severe hazard properties, for example, may cause cancer or genetic defects, or may damage fertility or the unborn child. Category 2 includes the categories such as '*Toxic if swallowed, in contact with skin or if inhaled*' and '*Causes damage to organs through prolonged or repeated exposure*'. Whereas category 3 substances are substances that are '*Harmful if swallowed, inhaled or in contact with skin'*, '*Causes skin irritation'*, '*May cause an allergic skin reaction'*, '*May cause damage to organs through prolonged or repeated exposure'* etcetera.

Within 'category 1', 35 active substances were identified as candidates for priority for monitoring. Also, 5 degradation products, metabolites, DBPs, or individual substances in mixtures were identified as cadidates for priority to monitor. The latter group of 5 could potentially be formed when using active substances generating or releasing active chlorine, chlorine dioxide, monochloramine or ozone, quats, or chlorohexidine digluconate. Approximately 20% (36) of the active substances could not be categorised on the basis of information in the CLP Inventory, but 20 could be categorised on the basis of classification of other substances.

It is noted that this is a hazard-based approach, and not a risk-based approach. The information presented here provides an indication of the severity of potential effects if the substances end up in food and are absorbed. It does not provide information on the chance that residues of these substances will actually occur in foods at levels that may impact public health.

Evaluation of category 1 substances and substances with monitoring data above the LOQ
We evaluated the collected information on category 1 substances and the substances with monitoring data above the LOQ in detail. This led to some general conclusions:

- The presence of rodenticides in meat indicates improper use. This makes monitoring relevant.
- Information on the precise application is necessary to decide for which animal species tissues, dairy products, or processed foods monitoring on insecticides, repellents, and disinfectants is relevant.
- For reactive active substances, such as chlorinated disinfectants, ozone and per-compounds, markers should be defined to monitor degradation products, metabolites, and/or DBPs. The lack of these markers and the lack of guidance to assess these potentially formed substances are important knowledge gaps.
- Chlorate and quats were >LOQ in approximately 20% of the analysed samples of infant/toddler food. We recommend studying the use and residues of disinfectants for these kinds of products.

- For quats, there are default MRLs and specific MRLs, and sometimes it is not clear which MRL applies to which biocidal active substance. The monitoring data on quats cannot be linked directly to the use of specific biocidal active substances. Because of this, verifying monitoring data for compliance with MRLs and connecting these data to biocidal active substances requires attention.

Consolidated priority table
To prioritise the 186 active substances, they were awarded priority points on the basis of various criteria and included in a consolidated Excel table (see Annex 11).

Priority points were assigned for their use in one or more PTs. A use in 1 PT led to 1 point, in 2 PTs to 3 points, and in 3 PTs to 5 points. Use in all PTs gave 0 points, because this concerns Annex I ('low risk') substances. The 13 new substances, still under review, were also given priority points '0' because they are not on the market yet.

A combination of the availability of monitoring data, presence, absence, and status of an MRL, availability of an analytical method, expected formation of DBPs, and MRL exceedance has been included in the prioritisation table with levels ranging from 0 (low priority) to 10 (high priority) (see 8.3.3 and the explanation sheet on the table in the consolidated priority table and in Annex 11).For instance, if there is enough monitoring data[25] below the MRL in suitable matrices, this is a reason to give the substance fewer priority points (e.g. 1). On the other hand, in case the MRL is exceeded or substances are known to form DBPs, a higher priority was given, as this asks for further investigation (e.g. 10 points). If the active substance has not been assigned a specific MRL and monitoring had not been performed, a high priority was given (9 or 10 points). In this case, the availability of an analytical method resulted in a higher priority of 10 points, as monitoring can start right away, while a lack of an analytical method resulted in 9 points. Lower priority points (of zero (0) to 1) are assigned to active substances that are foods themselves (e.g. peanut butter, powdered egg, powdered corn cob, or cheese) and substances for which MRLs are not required in the PPP legislation or for which monitoring is not yet applicable (new active substances under evaluation and micro-organisms such as some *Bacillus thurigiensis* strains).

The categorisation based on hazard properties resulted in 5 points for category 1 substances, 3 points for category 2 substances, 1 point for category 3 substances and 0 points for substances that could not be categorised.

This proposed prioritisation is mainly driven by the use in more PTs (mainly for disinfectants), the expected formation of DBPs (from chlorine compounds, ozone and per-compounds), MRL exceedance (chlorate, quats, salicylic acid, brodifacoum), and hazard category 1

[25] Note: we did not assess what would be 'enough data' per food item.

substances without any monitoring data (hydrogen cyanide, aluminium phosphide releasing phosphine, CMIT/MIT).

By using the consolidated table, enforcement agencies can assess and prioritise which substances to select for monitoring, taking into account all aspects, or for instance, just the hazard categories.

9.2.2 Other considerations for monitoring

Currently (2025), the Dutch government investigates the possibilities of creating a national sales register for biocides. This would be very helpful in making well-founded choices for monitoring. Also, information on the precise application is often missing. As a result, we do not know exactly in which types of unprocessed or processed meat and/or dairy products residues could occur. Information on volumes used and precise applications in other countries is also relevant, because of the import of food products.

If substances are measured above the LOQ, this often concerns a limited percentage of the samples, often less than 1%. If no or little monitoring data is available, hundreds or thousands of samples of a certain product are needed to get a good picture of the concentrations in that product. The KAP database does not contain this information. There is a significant amount of monitoring data on insecticides because they are also used as PPP or VMP. However, the monitored insecticides in the KAP database are still only half of the used active substances for insecticides in biocides. Another limitation of the data in the KAP database is that it mainly concerns relatively unprocessed foods, such as raw meat and milk. Particularly disinfectants will be used when making processed foods, such as sausages and ice-cream. The high percentage of residues of disinfectants (quats and chlorate) in infant/toddler food could be explained by the use of biocides (or cleaning products) during processing. Therefore, we recommend including processed, mixed, and composite foods in the anticipated monitoring programme for biocides.

For the final decision on whether or not performing (extra) measurements on a substance, we recommend the following:

- If the active substances have been assessed at European level, check the Assessment Report on the ECHA website. It provides a lot of information on, for instance, physical and chemical properties, applications of biocides with the substance, degradation products, risks, and analytical methods. Also, the necessity of an ADI and ARfD is discussed, and values for them might be reported. If the active substance is still in the review programme and biocides containing this substance are authorised in the Netherlands, check the assessments of these biocidal products on the Ctgb website.
- Some biocidal active substances are also used as active substances in PPP or VMP. Therefore, check if there are assessment reports and/or monitoring data on residues included in the EFSA databases on residues from PPP and from VMP. The latter database includes some biocides and contaminants.

- Perform a literature search on residues of the substance in question and on potential degradation products, metabolites, DBPs, and/or individual substances in mixtures in food, to help decide which substances to measure.
- Determine the specific uses of the biocides containing the substance, to decide which foods are relevant to be monitored on residues. See the options below to obtain this information.

Determining relevant foods for monitoring on residues
Clear and reliable information on the uses of individual active substances per application is not available. Options to collect information are:

- A first step should be checking whether there are authorised biocides containing the active substance and if so, checking the instructions for use. Instructions for use can be found in the databases on authorised biocides from Ctgb[26] and ECHA. This approach can reveal specific uses, such as udder disinfection, but it can also result in a very broad use that does not result in determining relevant foods.
- A potentially relevant approach appears to be to actually check what is used during the production or processing of food and to ask whether analyses are performed in the context of food safety management processes and/or certification schemes. Various NVWA and COKZ inspectors visit many relevant locations. They might be instructed to ask which products are used against micro-organisms, insects, and rodents. They can check whether authorised biocides are used and whether these biocides are used according to the instruction for use. This approach could also reveal improper use or illegal use of biocides. If disinfection is performed, information on substances in used cleaning products is relevant as well, because some biocidal active substances are also contained in cleaning products. If inspections take place in livestock farming, information on substances in used VMP is relevant, too, because of the overlap with active substances in biocides. This information should make clear for which biocide residues and for which foods (extra) control is relevant.
- Another option to gain this kind of information might be contacting suppliers who actually deliver biocides to be used for specific applications or suppliers of certain equipment that must be cleaned and/or disinfected such as mincers for meat, meat slicers, and milking or soft ice machines.

The best approach would be to collect the information on uses per application within a EU network and to make the results on the specific applications of individual active substances available in a public database. In the Netherlands, foods from all over the world are consumed, so insight into the application of biocides abroad is relevant to us. Moreover, to collect the desired information means a lot of work. If we work together, this can be divided across several EU Member States.

[26] In the Ctgb database, derived authorisations (‘afgeleide toelatingen’) are visible when downloading the selected biocides. These could be skipped, because their use will be the same as the original authorisation (‘moedertoelating’).

Residue definitions and markers
Once the decision to monitor has been made, a problem that will occur is that no residue definitions are available for substances without an MRL. For example, the current situation for quats is that monitoring data on several individual quats and mixtures is reported, which cannot be compared with each other and which cannot be verified for compliance with the associated MRLs. Molecules that are often formed could potentially be defined as markers. There should be international agreement on the markers to be used. In some cases, a separate MRL/residue definition for degradation products, metabolites, DBPs, and/or individual substances in mixtures could be the best option, for chlorate for instance. There should be consensus about the residue definition to be used in all EU Member States in order to make all monitoring data relating to the same active substance comparable.

There is little data and knowledge on degradation products, metabolites, and DBPs in food due to the use of biocides. The competent authorities on biocides need guidance to assess the risks of residues of degradation products, metabolites, and DBPs in food, but as yet, such guidance has not been developed. To take actions on these knowledge gaps, commitment and actions at European level are required. ECHA working groups are working on this, but there are no applicable results yet. In our view, this is highly relevant for food safety in relation to the use of biocides, particularly with regard to reactive disinfectants.

Analytical methods
Another problem that may occur is the absence of validated analytical methods for the residues in the relevant foods. By now, WFSR has reported quantitative or screening analytical methods for certain foods that comprise only 31% of the active substances in the selected PTs. The lacking methods should be developed before monitoring activities are started. If a substance can be added to an existing multi-residue method, this is relatively simple and financially feasible. A single residue method (SRM) should only be developed for substances that are estimated to pose a high human risk and have a high probability of occurring as residues in food.

9.3 The current legal status for setting or amending MRLs for biocides

9.3.1 The current policy for setting or amending MRLs

An enforcement laboratory cannot identify the source of a residue. That is why the legislation on residues should be harmonised. The desired harmonisation has not been reached yet. In this study, we show that for four insecticides, inconsistent MRLs with different values for meat products and/or milk derived under the RRPPP and the RRVMP are available. Also, linking MRLs for VMP to specific VMP use results in inconsistent MRLs. One disinfectant has the status ‘No MRL required’ for topical use only and at the same time it is the marker residue to be analysed to control the use of other VMP, for which a very strict MRL for milk applies.

Until now, all MRLs are derived under the regulations for residues of PPP or VMP. MRLs derived under the RRPPP are based on the ALARA (As Low As Reasonably Achievable) principle. Lifelong exposure may not exceed the Acceptable Daily Intake (ADI) and short-term exposure may not exceed the Acute Reference Dose (ARfD). MRLs for VMP are there to determine waiting periods between the use of the VMP and the slaughter of the animal. That is why MRLs for VMP are linked to the use of a specific VMP. Some of these apply to ‘topical use only’. If an MRL has been established under the RRVMP, it is (often) based on maximum filling of the ADI, with a ‘worst-case’ consumption of meat, milk and eggs.

There are several reasons to give the ‘No MRL required’ status to a PPP. This status applies, among others, to basic substances, ‘foodstuffs’, substances without hazard properties, and substances with negligible or no consumer exposure. For VMP, a ‘No MRL required’ status is given if no significant residues are expected due to the use of a specific kind of VMP.

Since 2017, there has been an interim approach to setting MRLs for biocides, which has been prolonged in 2021. In 2024, the discussion on MRLs for biocides was held again by the Competent Authorities for biocides and the European Commission. This resulted in a new approach in September 2024. This approach states that in the case of exceedance of default or specific MRLs, a biocidal product cannot be authorised, because these MRLs are legally binding. In such cases, further consideration is required to decide if such MRLs need to be modified to take into account the overall exposure due to biocidal use and other uses of the same substance. It should be noted that, although the option of adaption is included in this approach, no procedure is currently in place. This needs to be developed. The available guidance for PPP and VMP regarding the studies required for MRL derivation primarily focusses on unprocessed foods. Particularly for MRL derivation for disinfectants, guidance should be developed to assess processed, mixed, and composite foods.

Furthermore, according to the approach from September 2024, no setting or revision of MRLs seems necessary when the active substance has the status ‘No MRL required’ under the RRPPP or RRVMP. In our view, the new EC approach to taking over the ‘No MRL required’ status of active substances is not a suitable approach, because this can be based on specific PPP or VMP applications with negligible exposure, which may differ from biocidal applications. We think the new EC approach leans too much on available MRLs derived in view of the use of PPP or VMP. The underpinning of these MRLs can provide useful information on risks, but the presence of residues in food due to the use of PPP or VMP tells us nothing about the presence of residues in food due to biocidal use. Clear guidance is needed on how to assess the presence of residues in food due to biocidal use. Also, guidance is needed on which part of the ADI is available for exposure to residues from PPP, VMP, FCM, cleaning products, and/or biocides. It should be agreed which principle should underpin MRLs for biocides. Should this be ALARA or filling a certain part of the ADI? What would be ALARA for biocides? We think the role of the various

European agencies in developing such guidance is not clear. Maybe this could be a 'joint inter-agency activity' of the 'One Health' framework[27] of five EU agencies, including ECHA, EMA, and EFSA. MRLs apply to food, regardless of the policy framework in which the substances are used. Collaboration between several European agencies is needed to include all applications that may leave residues in food when deriving MRLs.

Currently, no EU procedure is available for setting or amending MRLs for biocides. The roles of the various agencies for PPP, VMP, and biocides should be defined more clearly. WFSR suggests setting all lacking MRLs for biocides on the technically feasible default value of 0.01* mg/kg. This allows food inspection services to report on exceedances. If there are exceedances, it should be checked whether this is because of proper, improper, or illegal use. If the exceedance is caused by proper use, the MRL could be increased if no health risks occur. The data from the inspections could create a database for future MRL setting at higher levels. The final approach will have to be determined at European level and laid down in regulations.

In 2023, an International Akademie Fresenius Workshop took place about 'Dietary Risk Assessment for Biocides' (Fresenius, 2023). Almost all speakers mentioned the lack of guidance. Particularly guidance for conducting rinsing studies would be helpful, because the solubility of substances varies widely. A representative of ECHA stated that applicants lack a handle on which studies to perform. And that different eCAs (evaluating Competent Authorities) perform completely different assessments.

There is a draft 'Guidance on Estimating Dietary Risk from Transfer of Biocidal Active Substances into Food – Professional Uses'. This guidance has been published on the ECHA website as a draft proposal. According to a cover page from ECHA, the organisation has not established this guidance yet, and it cannot be used (yet) as a basis for drawing conclusions on the need to set an MRL. The process of finalising this guidance appears to have stalled. Finalising this guidance and including it in ECHA guidance would help to assess the risks of residues in food due to biocidal use.

9.3.2 *Considerations for setting or amending MRLs*

All measured values below the LOQ

If relevant foods are checked for residues from biocides (active substances, isomers, degradation products, metabolites, DBPs, and individual substances in mixtures) and if all values are still below the LOQ, there is no reason to set MRLs for substances without any MRL, to add MRLs for specific (e.g. processed) foods, or to amend existing MRLs in view of the use of biocides. However, in such a case, it would be desirable to have those substances listed in the legislation with a 'No MRL required' status for biocides, comparable to VMP and PPP.

[27] See: https://www.efsa.europa.eu/en/news/one-health-joint-framework-action-published-five-eu-agencies

Measured values above the LOQ
If the measured values are above the LOQ, important questions are:

- Are these residues present due to the proper use of authorised biocides? This could apply to disinfectants, insecticides, and repellents. Setting or amending MRLs for these substances might be necessary. Currently, there is no EU procedure available for setting or amending MRLs for biocides.
- Are these residues present due to improper use of authorised biocides or to the use of illegal biocides? Improper use applies, for example, to rodenticides when this is found in meat or dairy products. Livestock should not be exposed to rodenticides when they are used properly. One example of illegal use was the use of fipronil as (an unauthorised) anti-red mite agent for poultry (biocide or VMP) leaving residues in eggs, meat and fat. Enforcement authorities do not need MRLs to take action against improper use or against illegal use. However, the kinds of measures that can be taken depends on the exceedance of MRLs. For some measures, MRLs can be helpful or necessary. For most active substances for rodenticides, MRLs are in force at the standard value of 0.01 mg/kg. Because such values are not based on risks, the question remains: are these values protective enough? When a risk is identified at the default value of 0.01 mg/kg, it means that analytical methods are needed with a lower LOQ, and this may not always be possible. Increasing the standard MRL is not appropriate, because exposure to rodenticides is due to improper use.
- Are these residues (also) present due to the use of PPP or VMP? This can be the case for insecticides. Also, some disinfectants, and maybe repellents, may be used as VMP. For PPP, it can be checked for which crops they may be used and whether they could leave residues in meat or dairy via feed. For VMP, it can be checked for which animal species they may be used.
- Are these residues present due to the use of cleaning products? There are also cleaning products that are based on chlorinated or other reactive substances. Therefore, potential degradation products, metabolites, or DBPs cannot be exclusively linked to biocidal use.

If residues that result from the proper use of biocides cannot be excluded, it should be assessed whether they could pose risks and whether they can be avoided or decreased in a feasible way by changing the instructions for use. If residues are unavoidable, MRLs may be set, amended, or added as a result of the use of biocidal products. However, as no EU procedures are currently available, this needs to be developed.

9.4 Issues relevant to future investigations

In the course of performing this study we identified some knowledge gaps, future developments, ideas, or other issues relevant for food safety, but not directly related to questions to be answered in this

study. Because these issues might be relevant to future investigations, they are reported below.

Database with residues in food due to biocidal use
This study clearly shows that the current monitoring data on residues of biocidal active substances in meat and dairy products is focussed on the use of these substances in PPP and VMP. The available data mainly concerns unprocessed food, while particularly disinfectants should be monitored in processed, mixed, and composite foods. In a European study, sometimes fewer than 10 and a maximum of a few hundred monitoring data sets were available for this type of foods. This is not enough, because most of the time, less than 1% of the results are above the LOQ. More data from specific projects on residues of biocides in various kinds of meat and dairy products is desirable. A publicly accessible European database where this kind of data is collected would be very helpful. Information about the use of biocides in relation to residues in food should be added. This provides insight into the cause of biocidal residues in food: do the residues result from improper or illegal use, or from proper use?

Identification of substances
The ECHA database on active substances in biocides and the C&L Inventory can be searched by using CAS numbers. In this study, we used CAS numbers as identifiers. However, the Ctgb database on authorised biocides, the KAP database, and the EFSA databases on residues and MRLs can only be searched by using substance names. Substances often have various substance names, which makes searching for information difficult. The EC approach to MRLs for biocides (EC, 2024) does not provide guidance on the identification of substances. It would help if the same identifier was used in all substance databases. This is also one of the aims of the European effort to achieve ‘One Substance One Assessment’.

Illegal biocides or improper use of biocides
This study focusses on residues of allowed biocides. Active substances that were once used as a biocide and have now been banned in the EU, may still be used illegally in the EU or may be present in imported foods from non-EU countries, where the substance has legal or illegal uses. Not allowed active substances were not included in this study, because if there are signs that illegal substances are being used, enforcement authorities can intervene immediately, without an MRL. However, for food safety it is relevant to investigate which substances might still occur, for example, in imported foods. Monitoring whether substances that are illegal in the EU are still used inside or outside the EU is an option for a prospective follow-up project.

Often consumed foods
In this study, we focussed on the active substances to be monitored in meat and dairy products. Relevant foods to be monitored should be selected on the basis of the application of the biocides containing the active substance. We also recommend focussing on often consumed foods other than meat and dairy products. Information on the composition of the Dutch diet and the diets in other EU Member States is available, and the EFSA comprehensive database contains

consumption data for foods (including mixed and composite foods). However, the models currently used for dietary exposure assessment in the PPP and the VMP frameworks are based on raw agricultural commodities only and cannot be used for processed, mixed or composite foods. Dietary models based on processed, mixed or composite are particularly relevant to assess the risks of the use of disinfectants, as they may enter the food chain during or after food processing.

New information on hazard properties
Due to the amendment of the CLP Regulation, it will be easier to collect information on persistency, mobility, bioaccumulation, and endocrine disruption of the active substances from 2027 onwards. This information could be relevant to prioritise the active substances to be monitored in food.

Substances that can be easily included in analytical methods
WFSR carries out the laboratory analyses for the Quality Programme for Agricultural Products. They can be asked to assess which analytical method could be used for the relevant substances, degradation products, metabolites, and DBPs in the category 1 biocidal active substances as defined in this report. It is also valuable to determine whether other active substances, isomers, degradation products, metabolites, DBPs, and individual substances in mixtures identified in this study can be easily included in methods that are currently being applied. In this way, information about biocidal residues in currently available samples can be collected with relatively little effort.

Dutch MRLs for biocides
Dutch legislation still includes a number of MRLs for biocides. These national MRLs date back to the time when PPP were evaluated EU-wide, but biocides were not. At that time, it was decided to keep the Dutch MRLs for biocides, until EU-wide biocide MRLs were agreed upon. Although biocides are evaluated EU-wide, there is still no agreed guidance in place to set EU-wide biocide MRLs, and thus, the Dutch MRLs are still in place. The underpinning of the Dutch MRLs at an LOQ of 0.05*mg/kg or higher is based on the idea that biocide residues should not be found in food. The usefulness of the LOQs above 0.01* mg/kg could be reconsidered, or it should at least be assessed whether the LOQs above 0.01* mg/kg are still relevant, in view of developments in analytical performance. According to WFSR, LOQs of 0.01* mg/kg are technically feasible for most biocides. It should be kept in mind that safe food production and livestock farming, for example, are not possible without disinfectants and insecticides. Sometimes, depending on the application, some residues of disinfectants or insecticides are unavoidable. Because of this, setting all Dutch MRLs for biocides on the technically feasible LOQ of 0.01* mg/kg is a policy choice, which needs to be assessed first.

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Abbreviations

ARTFood	Assessment of Residue Transfer to Food
A.s.	Active substance
ADBAC	Alkyldimethylbenzylammonium chloride
ADD	Food additive
ADI	Acceptable Daily Intake
ALARA	As Low As Reasonably Achievable
AR	Assessment Report
ARfD	Acute Reference Dose
BAC	Benzalkonium chloride
BfR	German Federal Institute for Risk Assessment
BPR	Biocidal Products Regulation
BPC	Biocidal Products Committee
BRC	British Retail Consortium
BuRO	The Office for Risk Assessment and Research
C&L	Classification & Labelling
CA	Competent Authorities (for biocides)
CAS	Chemical Abstracts Service (in CAS number)
CBG MEB	Medicines Evaluation Board
CHE	Chemical contaminant
CIP	Cleaning in Place
CLP	Classification, Labelling and Packaging
CMIT/MIT	5-chloro-2-methyl-2H- isothiazol-3-one (EINECS 247-500-7) and 2-methyl-2H-isothiazol-3-one (EINECS 220-239-6)
COKZ	Stichting Controle Orgaan Kwaliteits Zaken (Central Body for Quality Affairs)
CONTAM	EFSA Panel on Contaminants in the Food Chain
Ctgb	Board for the Authorisation of Plant Protection Products and Biocides
DBP	Disinfection by-products
DDAC	Didecyldimethylammonium chloride
DEET	Diethyltoluamide
EC	European Commission
eCA	evaluating Competent Authority (for biocides)
ECHA	European Chemicals Agency
EFSA	European Food Safety Authority
EMA	European Medicines Agency
F	Fat solubility
FCM	Food Contact Materials
HAA	Haloacetic acid
HACCP	Hazard Analysis Critical Control Points
IFS	International Featured Standards
IKB	Integrale Keten Beheersing (Dutch)
IUPAC	International Union of Pure and Applied Chemistry
KAP	Quality Programme for Agricultural Products
Kow	Octanol/water partition coefficient
LLDB	Legal Limits Data Base
LOQ	Limit of Quantification
ML	Maximum Level
MRL	Maximum Residue Limit

NEVO	Nederlands Voedingsstoffenbestand (Dutch Nutrient Database)
NGZO	Nederlandse Geiten Zuivel Organisatie (Dutch Goat Dairy Organisation)
NTR	Nutrient
NVWA	The Netherlands Food and Consumer Product Safety Authority
NVZ	Dutch trade association for importers and manufacturers of disinfectants
NZO	Dutch Dairy Organisation
ORG	Organic contaminant
PAR	Parameter
PFAS	Per- and polyfluoroalkyl substances
PHMB	Polyhexamethylene biguanide hydrochloride
PPP	Plant Protection Product(s)
PT	Product type
PTSA	p-toluenesulfonamide
QAC	Quaternary ammonium compounds
Quats	Quaternary ammonium compounds
R	Different residue definitions for plant and animal products
RFCM	Regulation on Food Contact Materials
RIKILT	Rijks-Kwaliteitsinstituut voor Land- en Tuinbouwproducten (current name: WFSR)
RIVM	Dutch National Institute for Public Health and the Environment
RMM	Risk Mitigation Measures
RRPPP	Regulation on Residues of Plant Protection Products
RRVMP	Regulation on Residues of Veterinary Medicinal Products
SCoPAFF	Standing Committee on Plants, Animals, Food and Feed
SML	Specific Migration Limit
SRM	Single residue method
TAED	Tetra-acetylethylenediamine
TCDO	Tetrachlorodecaoxide
THM	Trihalomethane
VET	Veterinary Medicinal Product
VMP	Veterinary Medicinal Product(s)
VWS	Dutch Ministry of Health, Welfare and Sport
WFSR	Wageningen Food Safety Research

Annex 1 Guidance on residues of biocides in food

The ECHA Ad hoc Working Group on the Assessment of Residue Transfer to Food (ARTFood) supports the Biocidal Products Committee with issues related to human exposure to biocides via food. The mandate of this working group is limited to drawing up guidelines for estimating biocide residues in food. The exposure calculations and risk assessments for consumers do not fall within the mandate of ECHA (or ARTFood), but within those of the European Medicines Agency (EMA; for Veterinary Medical Products (VMP)) and the European Food Safety Authority (EFSA; for all other frameworks).

Since 2017, this group has established the following guidance documents on dietary risk assessment:

- Guidance on Estimating Dietary Risk from Transfer of Biocidal Active Substances into Foods – Non-professional Uses. This guidance is implemented in the ECHA guidance for the assessment of human risks under the BPR (Chapter 5 of ECHA, 2017b). This document provides guidance for assessing the risk of residues in food via:
  - Disinfectant cleaners in domestic kitchens (PT04).
  - Drinking water disinfection (PT05).
  - In-can preservatives and disinfectants in dishwashing detergents (PT04, PT06).
  - Insecticides in domestic environments (PT18).
- Guidance on Estimating Livestock Exposure to Active Substances used in Biocidal Products. This guidance is also implemented in the above-mentioned ECHA guidance (Chapter 6 of ECHA, 2017b). This document provides guidance for assessing the risk of residues in food via:
  - Treatment of animal housing (mainly PT03, PT18, PT19 and PT21). Examples are spray treatment for combatting flies, fogging treatment for the disinfection of stables or hatcheries, and the treatment of transport vehicles.
  - Treatment of feed and drinking water or of storage facilities (mainly PT04, PT05 and PT12). PT12 because of packaging materials of feed.
  - Treatment of materials that livestock animals may come in contact with (mainly PT08), such as exposure of horses to treated wood.
  - Direct treatment of livestock animals (mainly PT03, PT18 and PT19). Examples are udder disinfection through dipping, hoof disinfectant baths and ear tags against flies;
  - Treatment of aquaculture (mainly PT03 and PT21).
- Guidance on Estimating Dietary Risk from Transfer of Biocidal Active Substances into Food – Professional Uses. This guidance has been published on the ECHA website as an ARTFood draft proposal (ARTFood, undated). According to a cover page from ECHA (ECHA, 2022a), the organisation has not established this guidance yet and therefore, it cannot be used as a basis for drawing conclusions on the need to set a Maximum Residue

Limit (MRL). This document provides guidance for assessing the risk of residues in food via:
  - Disinfectants and preserved cleaners in the food and drink industry (PT04, PT01). This includes Cleaning in Place (CIP) and non-CIP treatments and hand disinfection.
  - Aseptic packaging (PT04). Packaging material is treated with a disinfectant prior to being filled with food.
  - Food contact materials treated with or incorporating biocides (e.g. PT04, PT12).
  - In-can preservatives (PT06).
  - Pest control in the food and drink industry (PT14, PT18).
  - Storage protection in the food and drink industry (PT18).
  - Treated wood (PT08), such as wooden boxes for fruit or vegetables, cheese and milk derivatives, meat and meat products.
  - Drinking water disinfectants and water used in food processing (PT05).
- A draft scenario to estimate the indirect exposure via food by using insect repellents developed by the ARTFood ad hoc Working Group of the Biocidal Product Committee (ARTFood, 2019) with a cover page from ECHA (ECHA 2022b). This scenario concerns the risk of residues in food via:
  - Repellents with skin application (PT19).

The EMA (European Medicines Agency) developed guidance on deriving MRLs for pharmacologically active substances in biocides used in animal husbandry (EMA, 2015). See Section 6.2 and Annex 7 for more details.

BfR (German Federal Institute for Risk Assessment) made web applications to estimate the exposure of consumers when using biocidal products and to estimate the external exposure of livestock to biocidal active substances[28]. The calculator for consumer exposure is based on the available ECHA guidance (ECHA, 2017b). The calculator for the exposure of livestock is based on the EMA guidance (EMA, 2015), the EFSA calculation model PRIMo, and the EMA 'Food Basket'.

A biocide can have statements on the label, indicating how the product should be used to minimise risks to the user, other people, and/or the environment. These kinds of statements are called Risk Mitigation Measures (RMMs). Adhering to these statements should prevent residues from ending up in food. These RMMs must be easy to follow for the user.

Part of the authorisation process of biocides, is assessing the risk of biocidal residues in food. When estimating biocide residues in food, the hazard sentences and RMMs of the biocides are taken into account and proper biocidal use is assumed. The estimates are based on the use as applied for by the applicant; any potential illegal use or improper use is not taken into account.

[28] See: https://www.bfr.bund.de/en/exposure_estimation_for_biocides-239939.html and https://www.bfr.bund.de/cm/349/bfr-calculator-for-estimating-consumer-exposure-to-biocide-residues-in-food.pdf

Annex 2 Active substances in PT03, PT04, PT05, PT14, PT18, and PT19 that have been approved or are under review

Note: the information in this annex was extracted from the ECHA database at the beginning of 2024. The information changes over time, for instance, because of non-approval of a.s.-PTs in the review programme or through the withdrawal by the applicant. If this information is used for decision-making, please ensure that the information is still up to date and correct.

Table A2.1 gives an overview of all active substances in PT03, PT04, PT05, PT14, PT18, and PT19 that are approved or under review (including the existing active substances – new PT combinations and new active substances PT combinations under review) at the beginning of 2024. Substances approved or under review for Annex I of the BPR are also included, because they are allowed to be used in all PTs.

Table A2.2 shows new a.s.-PT combinations under review at the beginning of 2024. In contrast to existing a.s.-PT combinations, these may only be used in biocides after approval.

Table A2.1 Active substances in PT03, PT04, PT05, PT14, PT18, and PT19 and substances listed in Annex I of the BPR that have been approved or are under review (from the ECHA database at the beginning of 2024).

Active substance name from ECHA database	CAS no.	Product type						Annex I
		03	04	05	14	18	19	
(+)-Tartaric acid	87-69-4							x
(1,3,4,5,6,7-hexahydro-1,3-dioxo-2H-isoindol-2-yl)methyl (1R-trans)-2,2-dimethyl-3-(2-methylprop-1-enyl)cyclo-propanecarboxylate (d-Tetramethrin)	1166-46-7					x		
(13Z)-Hexadec-13-en-11-yn-1-yl acetate	78617-58-0						x	
(9Z,12E)-tetradeca-9,12-dien-1-yl acetate	30507-70-1							x
(E)-1-(2-Chloro-1,3-thiazol-5-ylmethyl)-3- methyl-2-nitroguanidine (Clothianidin)	210880-92-5					x		
(RS)-α-cyano-3phenoxybenzyl-(1RS)-cis, trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate (Cypermethrin)	52315-07-8					x		
[1.alpha.(S*),3.alpha.]-(.alpha.)-cyano-(3-phenoxyphenyl)methyl3-(2,2-dichlor-oethenyl)-2,2-dichlorovinyl)-2,2-dimethyl-cyclopropanecarboxylate (alpha-Cypermethrin); [1α(S*),3α]-(α)-cyano-(3-phenoxyphenyl)methyl3-(2,2-dichlor-oethenyl)-2,2-dichlorovinyl)-2,2-dimethyl-cyclopropanecarboxylate (αCypermethrin)	67375-30-8					x		
[2,4-Dioxo-(2-propyn-1-yl)imidazolidin-3-yl]methyl(1R)-cis-chrysanthemate;[2,4- Dioxo-(2-propyn-1-yl)imidazolidin-3-yl] methyl(1R)-trans-chrysanthemate (Imiprothrin)	72963-72-5					x		
1-(3,5-dichloro-4-(1,1,2,2-tetrafluoroethoxy)phenyl)-3-(2,6-difluorobenzoyl) urea (Hexaflumuron)	86479-06-3					x		
1R-trans phenothrin	26046-85-5					x		
2-(2-butoxyethoxy)ethyl 6-propylpiper-onyl ether (Piperonyl butoxide/PBO)	51-03-6					x		
2,2-dibromo-2-cyanoacetamide (DBNPA) [1]	10222-01-2		x					
2-methyl-4-oxo-3-(prop-2-ynyl)cyclopent-2-en-1-yl 2,2-dimethyl-3-(2-methylprop-1-enyl)cyclopropanecarboxylate (Prallethrin)	23031-36-9					x		
2-phenoxyethanol	122-99-6		x					
4-bromo-2-(4-chlorophenyl)-1-ethoxy- methyl-5-trifluoromethylpyrrole-3-carbonitrile (Chlorfenapyr)	122453-73-0					x		
5-chloro-2-(4-chlorphenoxy)phenol (DCPP)	3380-30-1		x					

Active substance name from ECHA database	CAS no.	Product type						Annex I
		03	04	05	14	18	19	
Acetamiprid	135410-20-7					x		
Acetic acid	64-19-7							x
Active chlorine generated from sodium chloride and pentapotassium bis(peroxymonosulphate) bis(sulphate)	-	x	x	x				
Active chlorine generated from sodium chloride by electrolysis	-	x	x	x				
Active chlorine generated from sodium N-chlorosulfamate	-		x					
Active chlorine released from calcium hypochlorite	7778-54-3	x	x	x				
Active chlorine released from chlorine	7782-50-5			x				
Active chlorine released from hypochlorous acid	-	x	x	x				
Active chlorine released from sodium hypochlorite	7681-52-9	x	x	x				
Alkyl (C12-16) dimethylbenzylammonium chloride (ADBAC/BKC (C12-16))	68424-85-1	x	x					
Alkyl (C12-18) dimethylbenzylammonium chloride (ADBAC (C12-18))	68391-01-5	x	x					
Alkyl (C12-C14) dimethyl(ethylbenzyl)ammonium chloride (ADEBAC (C12-C14))	85409-23-0	x	x					
Alkyl (C12-C14) dimethylbenzylammonium chloride (ADBAC (C12-C14))	85409-22-9	x	x					
Alpha-bromadiolone	-				x			
Alphachloralose	15879-93-3				x			
Aluminium phosphide releasing phosphine	20859-73-8				x	x		
Amines, N-C10-16-alkyltrimethylenedi-, reaction products with chloroacetic acid	139734-65-9	x	x					
Arnica montana, ext.	68990-11-4							x
Ascorbic acid	50-81-7							x
Bacillus amyloliquefaciens	-	x						
Bacillus sphaericus 2362, strain ABTS-1743	143447-72-7					x		
Bacillus thuringiensis subsp. israelensis Serotype H14, Strain AM65-52	-					x		
Bacillus thuringiensis subsp. israelensis, strain SA3A	-					x		
Bacillus thuringiensis subsp. kurstaki, strain ABTS-351	-					x		
Baculovirus	-							x
Bentonite	1302-78-9							x
Benzoic acid	65-85-0	x	x					

Active substance name from ECHA database	CAS no.	Product type						Annex I
		03	04	05	14	18	19	
Biphenyl-2-ol	90-43-7	x	x					
Brodifacoum	56073-10-0				x			
Bromadiolone	28772-56-7				x			
Bromoacetic acid	79-08-3		x					
Calcium dihydroxide/calcium hydroxide/caustic lime/hydrated lime/slaked lime	1305-62-0	x						
Calcium magnesium oxide/dolomitic lime	37247-91-9	x						
Calcium magnesium tetrahydroxide/calcium magnesium hydroxide/hydrated dolomitic lime	39445-23-3	x						
Calcium oxide/lime/burnt lime/quicklime	1305-78-8	x						
Carbon dioxide	124-38-9							x
Carbon dioxide generated from propane, butane or a mixture of both by combustion	-							x
Cheese	-							x
Chlorine dioxide	10049-04-4	x	x	x				
Chlorine dioxide generated from sodium chlorate and hydrogen peroxide in the presence of a strong acid	-			x				
Chlorine dioxide generated from sodium chlorite by acidification	-	x	x	x				
Chlorine dioxide generated from sodium chlorite by electrolysis	-	x	x	x				
Chlorine dioxide generated from sodium chlorite by oxidation	-	x	x	x				
Chlorine dioxide generated from Tetrachlorodecaoxide complex (TCDO) by acidification	-		x					
Chlorocresol	59-50-7	x						
Chlorophacinone	3691-35-8				x			
Cholecalciferol	67-97-0				x			
Chrysanthemum cinerariaefolium extract from open and mature flowers of Tanacetum cinerariifolium obtained with supercritical carbon dioxide	89997-63-7					x	x	
Chrysanthemum cinerariaefolium, extract from open and mature flowers of Tanacetum cinerariifolium obtained with hydrocarbon solvents	-					x	x	
Cis-tricos-9-ene (Muscalure)	27519-02-4						x	
Citric acid	77-92-9							x

Active substance name from ECHA database	CAS no.	Product type						Annex I
		03	04	05	14	18	19	
Citronellal	106-23-0							x
Concentrated apple juice	-							x
Copper	7440-50-8			x				
Coumatetralyl	5836-29-3				x			
Cymbopogon winterianus oil, fractionated, hydrated, cyclized	-						x	
Decanoic acid	334-48-5		x			x	x	
Deltamethrin	52918-63-5					x		
D-Fructose	57-48-7							x
D-gluconic acid, compound with N,N''-bis(4-chlorophenyl)-3,12-diimino-2,4,11,13-tetraazatetradecanediamidine(2:1) (CHDG)	18472-51-0	x						
Didecyldimethylammonium chloride (DDAC (C8-10))	68424-95-3	x	x					
Didecyldimethylammonium chloride (DDAC)	7173-51-5	x	x					
Difenacoum	56073-07-5				x			
Difethialone	104653-34-1				x			
Diflubenzuron	35367-38-5					x		
Dinotefuran	165252-70-0					x		
Disodium peroxodisulphate/Sodium persulphate	7775-27-1		x					
Epsilon-Metofluthrin	1065124-65-3					x		
Ethanol	64-17-5		x					
Ethyl butylacetylaminopropionate	52304-36-6						x	
Etofenprox	80844-07-1					x		
Eucalyptus citriodora oil, hydrated, cyclized	1245629-80-4						x	
Flocoumafen	90035-08-8				x			
Formaldehyde	50-00-0	x						
Formic acid	64-18-6	x	x	x				
Free radicals generated in situ from ambient air or water	-	x	x	x				
Garlic, ext.	8008-99-9						x	
Geraniol	106-24-1					x	x	
Glutaral (Glutaraldehyde)	111-30-8	x	x					
Glycolic acid	79-14-1	x	x					

Active substance name from ECHA database	CAS no.	Product type						Annex I
		03	04	05	14	18	19	
Glyoxal	107-22-2	x	x					
Honey	8028-66-8							x
Hydrogen cyanide	74-90-8				x	x		
Hydrogen peroxide	7722-84-1	x	x	x				
Hydrogen peroxide released from sodium percarbonate	-	x						
Imidacloprid	138261-41-3					x		
Indoxacarb (enantiomeric reaction mass S:R 75:25)	144171-61-9					x		
Iodine	7553-56-2	x	x					
Iron sulphate	7720-78-7							x
L-(+)-lactic acid	79-33-4	x	x					
Lactic acid	50-21-5							x
Lambda-cyhalothrin	91465-08-6					x		
Lauric acid	143-07-7						x	
Lavender oil (Natural oil)	8000-28-0							x
Lavender, Lavandula hybrida, ext./Lavandin oil	91722-69-9						x	
Linseed oil	8001-26-1							x
Magnesium phosphide releasing phosphine	12057-74-8					x		
Margosa extract from cold-pressed oil of the kernels of Azadirachta Indica extracted with super-critical carbon dioxide	84696-25-3					x	x	
Methyl nonyl ketone [2]	112-12-9						x	
Metofluthrin; epsilon-Metofluthrin [4]	240494-71-7					x	x	
Mixture of 5-chloro-2-methyl-2H- isothiazol-3-one (EINECS 247-500-7) and 2-methyl-2H-isothiazol-3-one (EINECS 220-239-6) (Mixture of CMIT/MIT)	55965-84-9		x					
Monochloramine generated from ammonia and a chlorine source	-			x				
Monochloramine generated from ammonium hydroxide and a chlorine source	-			x				
Monochloramine generated from sodium hypochlorite and an ammonium source	-			x				
N-(3-aminopropyl)-N-dodecylpropane-1,3-diamine (Diamine)	2372-82-9	x	x					
N,N-diethyl-meta-toluamide	134-62-3						x	
N-cyclopropyl-1,3,5-triazine-2,4,6-triamine (Cyromazine)	66215-27-8					x		

Active substance name from ECHA database	CAS no.	Product type						Annex I
		03	04	05	14	18	19	
Nitrogen	7727-37-9							x
Nitrogen generated from ambient air	-							x
Oct-1-en-3-ol	3391-86-4							x
Octanoic acid	124-07-2		x			x		
Orange, sweet, ext.	8028-48-6						x	
Ozone generated from oxygen	-		x	x				
Peanut butter	-						x	
Pentapotassium bis(peroxymonosulphate) bis(sulphate)	70693-62-8	x	x	x				
Peppermint oil (Natural oil)	8006-90-4							x
Peracetic acid	79-21-0	x	x	x				
Peracetic acid generated from tetra-acetylethylenediamine (TAED) and sodium percarbonate	-	x	x					
Performic acid generated from formic acid and hydrogen peroxide	-		x					
Permethrin	52645-53-1					x		
Poly(oxy-1,2-ethanediyl), α-[2-(dide- cylmethylammonio)ethyl]- .omega.-hydroxy-, propanoate (salt) (Bardap 26)	94667-33-1		x					
Polyhexamethylene biguanide hydrochloride with a mean number-average molecular weight (Mn) of 1415 and a mean polydispersity (PDI) of 4.7 (PHMB(1415;4.7))	1802181-67-4		x					
Polyhexamethylene biguanide hydrochloride with a mean number-average molecular weight (Mn) of 1600 and a mean polydispersity (PDI) of 1.8 (PHMB(1600;1.8))	27083-27-8	x	x					
Polyvinylpyrrolidone iodine	25655-41-8	x	x					
Potassium (E,E)-hexa-2,4-dienoate (Potassium Sorbate)	24634-61-5							x
Powdered corn cob	-				x			
Powdered egg [5]	-							x
Propan-1-ol	71-23-8		x					
Propan-2-ol	67-63-0		x					
Propionic acid	79-09-4							x
Pyriproxyfen	95737-68-1					x		

Active substance name from ECHA database	CAS no.	Product type						Annex I
		03	04	05	14	18	19	
Pyrogenic, synthetic amorphous, nano, surface treated silicon dioxide	68909-20-6					x		
Quaternary ammonium compounds, benzyl-C12-18-alkyldimethyl, salts with 1,2-benzisothiazol-3(2H)-one 1,1-dioxide	68989-01-5		x					
Reaction mass of N,N-didecyl-N-(2-hydroxyethyl)-N-methylammonium propionate and N,N-didecyl-N-(2-(2-hydroxyethoxy)ethyl)-N-methylammonium propionate and N,N-didecyl-N-(2-(2-(2-hydroxyethoxy)ethoxy)ethyl)-N-methylammonium propionate	-		x					
Reaction mass of peracetic acid and peroxyoctanoic acid	33734-57-5	x	x					
Reaction products of: glutamic acid and N-(C12-C14-alkyl)propylenediamine (Glucoprotamin) [3]	164907-72-6		x					
S-[(6-chloro-2-oxooxazolo[4,5-b]pyridin-3(2H)-yl)methyl] O,O-dimethylthiophosphate (Azamethiphos)	35575-96-3					x		
Saccharomyces cerevisiae (yeast)	68876-77-7							x
Salicylic acid	69-72-7	x	x					
Sec-butyl 2-(2-hydroxyethyl)piperidine-1- carboxylate/Icaridine (Icaridine)	119515-38-7						x	
Silicic acid, aluminium magnesium sodium salt	12040-43-6					x		
Silicium dioxide (Silicium dioxide/Kieselguhr)	61790-53-2					x		
Silver	7440-22-4		x	x				
Silver borophosphate glass	-		x					
Silver chloride	7783-90-6		x					
Silver nitrate	7761-88-8	x	x	x				
Silver phosphate glass	308069-39-8		x					
Silver phosphoborate glass	-		x					
S-Methoprene	65733-16-6					x		
Sodium acetate	127-09-3							x
Sodium benzoate	532-32-1							x
Sodium dichloroisocyanurate dihydrate	51580-86-0	x	x	x				
Sodium dimethylarsinate (Sodium Cacodylate)	124-65-2					x		
Spinosad	168316-95-8					x		
Sulfur dioxide generated from sulfur by combustion	-		x					

Active substance name from ECHA database	CAS no.	Product type						Annex I
		03	04	05	14	18	19	
Sulfuryl fluoride	2699-79-8					x		
Symclosene	87-90-1	x	x	x				
Synthetic amorphous silicon dioxide (nano)	112926-00-8					x		
Tetramethrin	7696-12-0					x		
Thiamethoxam	153719-23-4					x		
Tosylchloramide sodium (Tosylchloramide sodium - Chloramin T)	127-65-1	x	x	x				
Transfluthrin	118712-89-3					x		
Trisodium orthophosphate	7601-54-9							x
Troclosene sodium	2893-78-9	x	x	x				
Vinegar	8028-52-2							x
Warfarin	81-81-2				x			
Webbing clothes moths pheromone (Mixture)	-							x
Wolbachia pipientis strain wPip	-							x
α-cyano-3-phenoxybenzyl2,2-dimethyl-3-(2-methylprop-1-enyl)cyclopropanecarboxylate (Cyphenothrin)	39515-40-7					x		
α-cyano-4-fluoro-3-phenoxybenzyl3-(2,2-dichlorovinyl)-2,2-dimethylcyclo-propanecarboxylate (Cyfluthrin)	68359-37-5					x		

Substances listed in Annex I of the BPR are allowed in all PTs.
1) DBNPA is not allowed anymore (not approved for PT04 per 2 March 2023).
2) Methyl nonyl ketone is not allowed anymore (expired for PT19 per 30 April 2024).
3) Glucoprotamin is not allowed anymore (no longer supported for PT04 per 22 March 2024).
4) At the beginning of 2024 ‘Metofluthrin; epsilon-Metofluthrin’ was one active substance with CAS number 240494-71-7 for PT18 and PT19. At the beginning of 2025 this had changed. The active substance ‘2,3,5,6-tetrafluoro-4-(methoxymethyl) benzyl (EZ)-(1RS,3RS; 1SR,3SR)- 2,2-dimethyl-3-prop-1-enylcyclopropanecarboxylate (metofluthrin)’ without a CAS number is approved for PT18 (renewal in progress) and epsilon-Metofluthrin with CAS number 240494-71-7 is separately included in the review programme for PT19.
5) It is not clear whether the ECHA entry refers to egg powder or eggshell powder. We assume eggshell powder is meant.

Table A2.2 New active substance PT combinations that have to pass the assessment process to be allowed in biocides (situation January 2024).

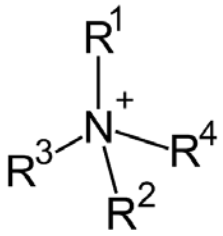
ECHA substance name	CAS no.	Product type					
		03	04	05	14	18	19
Alpha-bromadiolone	-				x		
Copper	7440-50-8			x			
Epsilon-Metofluthrin	240494-71-7						x
Free radicals generated in situ from ambient air or water	-	x	x	x			
Monochloramine generated from ammonia and a chlorine source	-			x			
Monochloramine generated from ammonium hydroxide and a chlorine source	-			x			
Monochloramine generated from sodium hypochlorite and an ammonium source	-			x			
Silicic acid, aluminium magnesium sodium salt	12040-43-6					x	
Silver borophosphate glass	-		x				
Silver chloride	7783-90-6		x				
Silver nitrate	7761-88-8	x	x	x			
Silver phosphate glass	308069-39-8		x				
Silver phosphoborate glass	-		x				

Annex 3 Details on active substances and MRLs for disinfectants: PT03, PT04, and PT05

This annex provides details on some active substances and the available MRLs for a number of disinfectants.

Quaternary ammonium compounds

Quaternary ammonium cations, also known as quats, are positively-charged polyatomic ions of the structure $[NR_4]^+$, where usually, two R-groups are a methyl group, one R-group is an alkyl group (C2 or C8-18), and the last R-group is a long-chain alkyl group (C8-18) or an aryl group (e.g. benzyl or ethylbenzyl). Quaternary ammonium salts or quaternary ammonium compounds are salts of quaternary ammonium cations, the most common being quaternary ammonium chloride.



The quats included in the ECHA database of active substances in biocides are:

- Alkyl (C12-C14) dimethylbenzylammonium chloride (ADBAC (C12-C14)).
- Alkyl (C12-16) dimethylbenzylammonium chloride (ADBAC/BKC (C12-16)).
- Alkyl (C12-18) dimethylbenzylammonium chloride (ADBAC (C12-18)).
- Alkyl (C12-C14) dimethyl(ethylbenzyl)ammonium chloride (ADEBAC (C12-C14)).
- Didecyldimethylammonium chloride (DDAC (C8-10)).
- Didecyldimethylammonium chloride (DDAC).
- Quaternary ammonium compounds, benzyl-C12-18-alkyldimethyl, salts with 1,2-benzisothiazol-3(2H)-one 1,1-dioxide.

For ADBAC (with unspecified alkyl carbon chain length), the name benzalkonium chloride (BAC) is also used. Other used abbreviations are BZK, BKC and BAK. The KAP database includes monitoring data on ‘Benzalkonium chloride (mixture of alkylbenzyldimethylammonium chlorides with alkyl chain lengths of C8, C10, C12, C14, C16 and C18)’ as well as monitoring data on the individual compounds BAC 8, BAC 10, BAC 12, BAC 14, BAC 16, BAC 18, and BACS (SOM). It is not clear whether BACS (SOM) is based on a common moiety method analysing all BACs present in the sample or whether this is the sum of all individually analysed BACs).

The name ‘didecyldimethylammonium chloride (DDAC)’ refers to DDAC-10. The name ‘didecyldimethylammonium chloride (DDAC (C8-10))’ used in the ECHA database is chemically incorrect, because ‘didecyl’ should only be used if both alkyl groups are C10. The KAP database includes monitoring data on ‘didecyldimethylammonium chloride (mixture of alkyl-quaternary ammonium salts with alkyl chain lengths of C8, C10 and C12)’. For this mixture, the term ‘didecyl’ should not be used either. There is monitoring data on dioctyldimonium chloride as well. This quat is also known as dioctyldimethylammonium chloride or DDAC-8. Furthermore, there is monitoring data on dilauryldimonium chloride. This quat is also known as dilauryldimethylammonium chloride or as didodecyldimethylammonium chloride or DDAC-12.

In the past, BAC (benzalkonium chloride) and DDAC (didecyldimethylammonium chloride) were approved for use in plant protection products. Because this is no longer allowed, the MRLs were set at the default value of 0.01* mg/kg. However, food business operators showed that residues of those substances are present in food products at levels that frequently exceed the default MRL of 0.01 mg/kg due to the use of biocides. In 2014, temporary MRLs of 0.1 mg/kg were set for BAC and DDAC in all products on the basis of monitoring data (EC, 2014). These MRLs are relevant for all BAC carbon chain lengths and all DDAC carbon chain lengths. They should have been reviewed within five years. EFSA did not identify potential consumer health risks for these proposed MRLs (EFSA, 2014). Thus, the proposed MRLs are considered to be sufficiently protective. However, due to the limited data available, the risk assessments are affected by a high degree of uncertainty.

In 2023, EFSA has again set biocide-specific temporary MRLs for these quats (EC, 2023a) in accordance with the interim approach of the EC (EC, 2017). These are, again, 0.1 mg/kg in meat products and milk for BAC and DDAC. For DDAC, the MRLs for products of plant origin were adjusted to 0.05 mg/kg. These MRLs are, again, based on monitoring data and should be reviewed within seven years.

BAC is a collective name for mixtures of alkyldimethylbenzylammonium chloride substances with a C8, C10, C12, C14, C16, or C18 alkyl group and the full name is: mixture of alkyl(C8-18) benzyldimethylammonium chloride (=ammonium compounds, benzyl-C8-18-alkyldimethyl, chlorides). The EU Pesticides Database contains an MRL for Benzalkonium chloride of 0.1 mg/kg according to EC 2023/377. The above-mentioned active substances in the biocides ADBAC (C12-C14), ADBAC/BKC (C12-16) and ADBAC (C12-18) are forms of alkyldimethylbenzylammonium chloride to which the MRL of 0.1 mg/kg applies. The EU Pesticides Database also lists a default MRL of 0.01 mg/kg for the substance ‘alkyldimethylbenzylammonium chloride’ according to article 18. This is considered an error in the EU Pesticides Database, as alkyldimethylbenzylammonium chloride and benzalkonium chloride are synonyms for the same substances, also abbreviated as BAC or ADBAC, and this should be corrected in the EU Pesticides Database. BAC is often spelled differently: alkyl benzyldimethylammonium

chloride, alkyldimethylbenzylammonium chloride and benzylalkyldimethylammonium chloride. This concerns the same substances, but the side chains of the molecule are mentioned in a different order.

In addition to BAC and DDAC, the substances alkyltrimethylammonium chloride and alkyltrimethylbenzylammonium chloride are listed separately in the MRL regulations for PPP with a default MRL of 0.01* mg/kg. The listing of alkyltrimethylbenzylammonium chloride must be an error, as this molecule is chemically impossible (five-side chains instead of the maximum of four). Furthermore, the MRL regulations for PPP include 'quaternary ammonium compounds' with a default MRL of 0.01* mg/kg, which is impossible to enforce if higher MRLs have been derived for specific quats. The Dutch Commodities Act (2008) still refers to quaternary ammonium compounds (expressed as cetryltrimethylammonium chloride) with an MRL of 0.5* mg/kg, the then LOQ of the common analysis method (see Annex 8). The MRL regulation for quats is quite confusing, as several MRLs could apply to the same substance. Both the MRL regulation and the Commodities Act could be improved on this point.

Active chlorine and chlorine dioxide

In the ECHA-database on active substances in biocides there are several active substances based on active chlorine, chlorine dioxide or chloramine:

- active chlorine generated from sodium chloride and pentapotassium bis(peroxymonosulphate) bis(sulphate);
- active chlorine generated from sodium chloride by electrolysis;
- active chlorine generated from sodium N-chlorosulfamate;
- active chlorine released from calcium hypochlorite;
- active chlorine released from chlorine;
- active chlorine released from hypochlorous acid;
- active chlorine released from sodium hypochlorite;
- chlorine dioxide;
- chlorine dioxide generated from sodium chlorate and hydrogen peroxide in the presence of a strong acid;
- chlorine dioxide generated from sodium chlorite by acidification;
- chlorine dioxide generated from sodium chlorite by electrolysis;
- chlorine dioxide generated from sodium chlorite by oxidation;
- chlorine dioxide generated from tetrachlorodecaoxide complex (TCDO) by acidification;
- monochloramine generated from ammonia and a chlorine source;
- monochloramine generated from ammonium hydroxide and a chlorine source;
- monochloramine generated from sodium hypochlorite and an ammonium source;
- tosylchloramide sodium.

These substances are used for disinfection purposes in PT03, PT04 and/or PT05, except for the substances generating monochloramine, because these are new active substances under review.
Chlorine residues are difficult to link to specific uses, because the end products chloride and chlorate can result from various uses and some compounds also occur in nature. Under the RRPPP, there are MRLs for various chlorine compounds. There are MRLs of 0.05-0.7 mg/kg for (Mg, Na, K) chlorate (EC, 2020b). The MRLs for chlorate for muscle, liver, kidney, and other edible offals (e.g. blood, tongue, heart, stomach, marrowbone, tail, trotters, pigs head, poultry skin, poultry feet) is 0.05 mg/kg, for fat tissue 0.1(*) mg/kg and for milk 0.1 mg/kg. There are also default MRLs of 0.01* mg/kg for sodium hypochlorite for meat and milk (Reg. (EU) 2024/352). The MRLs for chlorate and sodium hypochlorite can be found in the EU Pesticides Database on Pesticides residues29. For active chlorine generated from sodium chloride by electrolysis, chlorine dioxide, and calcium chloride, no MRLs are available in this database, because active substances with only default MRLs are not included here. When searching in the EU Pesticides Database on Active substances30 for these substances, it states ‘Default MRL of 0.01 mg/kg according to Art 18(1)(b) Reg 396/2005’.

In 2022, BuRO published an advice concerning the risks of chlorate in food for infants and toddlers (NVWA, 2022). According to the Commission Delegated Regulation (EU) 2016/127 (EC, 2015a) infant formulae and follow-on formulae shall not contain residues at levels exceeding 0.01 mg/kg per active substance. BuRO indicates that the applicable MRL of 0.01 mg/kg is sufficiently protective. With long-term consumption of (follow-on) infant formulae and ready-to-use commercially available foods for the specific target groups, negative effects on health cannot be excluded at levels above 0.04 mg/kg in ready-to-eat meals or milk powder. The NVWA's market surveillance shows that some of the food products contain these higher chlorate levels. BuRO recommends reducing their content in the foods concerned.

Perchlorate, like chlorate, can also be a degradation product or metabolite of chlorine dioxide and hypochlorite. Perchlorate in agricultural products, however, mainly comes from fertilisers (EFSA CONTAM, 2014). EFSA (2017) reported: ‘*Therefore, the use of these fertilisers is likely to be a main source of contamination in water and food, in particular in vegetables. The formation of perchlorate from the degradation of chlorinated products used for water potabilisation could be another notable source of exposure. Finally, minor or negligible routes of contamination could include the photochemical formation of perchlorate in the atmosphere or the use of chlorinated biocides or plant protection products*.’ However, the underpinning of these remarks is not clear to us. Maximum Levels (MLs) have been set for perchlorate (Annex I of EC, 2023b). For most products, these MLs range between 0.05 mg/kg and 0.75 mg/kg, depending on the product. For leafy vegetables, for example, an ML of 0.5 mg/kg

[29] See: https://ec.europa.eu/food/plant/pesticides/eu-pesticides-database/start/screen/mrls
[30] See: https://ec.europa.eu/food/plant/pesticides/eu-pesticides-database/start/screen/active-substances

applies. No MLs have been established for meat or milk. For baby and toddler food (ready-to-eat meals), the value is 0.02 mg/kg, while for infant and follow-on formulae (special food for infants and toddlers), the ML is 0.01 mg/kg. Infant and follow-on formulae '*are milk-based drinks or powders and similar protein-based products intended for young children.*'

Iodine

Iodine and polyvinylpyrrolidone iodine form iodide in solution. Iodine naturally occurs in high concentrations in marine products (seaweed, sea fish). In addition, iodine (element I) is added to baker's salt or cereal products in many countries to prevent iodine deficiency. Under the RRPPP and the RRVMP, an MRL for iodine is not considered necessary. But in the Dutch Commodities Act, there is an MRL of 0.3 mg/kg for milk.

Per-compounds

Active substances in the ECHA database that can be referred to as per-compounds are disodium peroxodisulphate/sodium persulphate, hydrogen peroxide, hydrogen peroxide released from sodium percarbonate, pentapotassium bis(peroxymonosulphate) bis(sulphate), peracetic acid, peracetic acid generated from tetra-acetylethylenediamine (TAED) and sodium percarbonate, performic acid generated from formic acid and hydrogen peroxide and reaction mass of peracetic acid and peroxyoctanoic acid. Per-compounds are reactive radical-forming substances that will quickly react to form water (from hydrogen peroxide), acetic acid (from peracetic acid), potassium hydrogen sulphate, sodium hydrogen sulphate, or sodium carbonate. Domínguez Henao et al. (2018) report that peracetic acid results in the formation of mainly carboxylic acids and aldehydes as DBPs. Lee and Huang (2019) show that peracetic acid formed much fewer chlorinated DBPs and slightly fewer aldehyde DBPs than sodium hypochlorite in wash water of lettuce.

Some of these substances have a default MRL under the RRPPP of 0.01 mg/kg. Nevertheless, a biocide-specific MRL of 1* mg/kg has been established in the Dutch Commodities Act for hydrogen peroxide, the LOQ of the analytical method at the time.

Annex 4 Monitoring data from the KAP database for the years 2018 to 2022 for active substances in PT03, PT04, PT05, PT14, PT18, and PT19

Note

The information in this annex should be used as an indication for available monitoring data. Currently there will be extra new data and there are also monitoring data in the EFSA databases on residues from PPP and from VMP.

This annex gives the available measurements from the KAP database for the years 2018 to 2022 for active substances in PT03, PT04, PT05, PT14, PT18 and PT19. The substance name behind 'E:' is used in the ECHA database on active substances of biocides. The substance name behind 'K:' is used in the KAP database. The substance name behind 'R:' is a name used in this report: a common name in literature or a name used in the C&L Inventory. Also measurement results of substances that may have a relation to the use of biocidal active substances are included. Then there is no name in the ECHA database on active substances (E: N/A = Not Applicable). Table A4.1 shows the results of measurements in meat, Table A4.2 in dairy products and Table A4.3 in infant/toddler food.

Table A4.1 PTs and measurement results per LOQ (mg/kg) for the active substances of the selected PTs in biocides in meat.

Substance name **E: from ECHA database** **K: from KAP database** **R: common name used in this report**	**CAS no.**	**Biocidal a.s.? [1]**	**PT(s)**	**LOQ**	**No. per LOQ [2]**	**No. ≥ LOQ**	**Product(s) ≥ LOQ**	**Average [3]**	**Maximum**
E: Biphenyl-2-ol K: 2-phenylphenol	90-43-7	Yes	03 04	0.005	51	0	-		
				0.01	26	1	Kidney fat of sheep	0.011	0.011
E: S-[(6-chloro-2-oxooxazolo[4,5-b]pyridin-3(2H)-yl)methyl] O,O-dimethylthiophosphate (Azamethiphos) K: Azamethiphos	35575-96-3	Yes	18	0.005	51	0	-		
				0.01	127	0	-		

Substance name **E: from ECHA database** **K: from KAP database** **R: common name used in this report**	**CAS no.**	**Biocidal a.s.? [1]**	**PT(s)**	**LOQ**	**No. per LOQ [2]**	**No. ≥ LOQ**	**Product(s) ≥ LOQ**	**Average [3]**	**Maximum**
E: N/A K: BAC 10 R: Benzyl(decyl)dimethyl ammonium chloride	965-32-2	No	N/A	0.01	1141	0	-		
E: N/A K: BAC 12 R: Benzododecinium chloride	139-07-1	No	N/A	0.001	60	0	-		
				0.05	1125	1	Meat of horse	0.018	0.018
						1	Meat of pig	0.089	0.089
E: N/A K: BAC 14 R: Miristalkonium chloride	139-08-2	No	N/A	0.001	60	0	-		
				0.01	3	0	-		
				0.05	1123	0	-		
E: N/A K: BAC 16 R: Cetalkonium chloride	122-18-9	No	N/A	0.01	1123	0	-		
				0.05	6	0	-		
E: N/A K: BAC 18	-	No	N/A	0.01	1117	0	-		
E: N/A K: BAC 8	-	No	N/A	0.01	1141	0	-		
E: N/A K: Benzalkonium chloride (mixture of alkylbenzyldimethylammonium chlorides with alkyl chain lengths of C8, C10, C12, C14, C16 and C18) R: BAC C8-18	-	No	N/A	0.001	60	1	Minced beef	0.069	0.069
						1	Bacon	0.034	0.034
				0.01	372	0	-		
E: Brodifacoum K: Brodifacoum	56073-10-0	Yes	14	0.01	2	1	Liver of pig	0.084	0.084

Substance name **E: from ECHA database** **K: from KAP database** **R: common name used in this report**	**CAS no.**	**Biocidal a.s.? [1]**	**PT(s)**	**LOQ**	**No. per LOQ [2]**	**No. ≥ LOQ**	**Product(s) ≥ LOQ**	**Average [3]**	**Maximum**
E: N/A K: Chlorates	-	No	N/A	0.001	47	1	Meat products	0.032	0.032
				0.01	85	3	Chicken fillet	0.27	0.68
						1	Minced beef	0.018	0.018
						2	Meat of pig	0.014	0.014
E: 4-bromo-2-(4-chlorophenyl)-1-ethoxy- methyl-5-trifluoromethylpyrrole-3-carbonitrile (Chlorfenapyr) K: Chlorfenapyr	122453-73-0	Yes	18	0.01	200	0	-		
				0.02	51	0	-		
E: (E)-1-(2-Chloro-1,3-thiazol-5-ylmethyl)-3- methyl-2-nitroguanidine (Clothianidin) K: Clothianidin	210880-92-5	Yes	18	0.005	51	0	-		
				0.01	127	0	-		

Substance name **E: from ECHA database** **K: from KAP database** **R: common name used in this report**	**CAS no.**	**Biocidal a.s.? [1]**	**PT(s)**	**LOQ**	**No. per LOQ [2]**	**No. ≥ LOQ**	**Product(s) ≥ LOQ**	**Average [3]**	**Maximum**
E: Copper K: Copper (Cu)	7440-50-8	Yes	05	0.13	1364	4	Import game meat	1.5	2.1
						12	Liver of duck	50	65
						12	Liver of chicken	3.9	4.6
						241	Liver of broiler	3.0	4.2
						350	Kidney of beef	3.9	9.1
						21	Kidney of sheep	3.6	5.8
						477	Kidney of pig	6.9	50
						26	Meat of pigeon game	3.6	4.2
						3	Meat of farmed deer	1.1	1.2
						32	Meat of deer game	1.6	2.3
						5	Meat of horse	2.1	2.8
						54	Meat of pig	0.55	0.76
						22	Meat of wild hare	2.6	4.2
						31	Meat of wild roe	1.5	1.9
						30	Meat of wild boar	1.3	1.8
						39	Meat of wild duck	4.6	6.5
				0.4	1	1	Liver of other poultry	3.8	3.8
E: α-cyano-4-fluoro-3-phenoxybenzyl3-(2,2-dichlorovinyl)-2,2-dimethylcyclo-propanecarboxylate (Cyfluthrin) K: Cyfluthrin	68359-37-5	Yes	18	0.01	265	0	-		
E: N/A K: Cyhalothrin [4]	68085-85-8	No	N/A	0.01	697	1	Fat of beef	0.016	0.016
E: Lambda-cyhalothrin K: Cyhalothrin, lambda- [4]	91465-08-6	Yes	18	0.01	73	0	-		

Substance name **E: from ECHA database** **K: from KAP database** **R: common name used in this report**	**CAS no.**	**Biocidal a.s.? [1]**	**PT(s)**	**LOQ**	**No. per LOQ [2]**	**No. ≥ LOQ**	**Product(s) ≥ LOQ**	**Average [3]**	**Maximum**
E: Lambda-cyhalothrin K: Lambda-cyhalothrin (includes gamma-cyhalothrin) (sum of R,S and S,R isomers)) [4]	91465-08-6	Yes	18	0.005	51	0	-		
				0.01	127	0	-		
E: (RS)-α-cyano-3-phenoxybenzyl-(1RS)-cis, trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate (Cypermethrin) K: Cypermethrin [5]	52315-07-8	Yes	18	0.01	217	3	Fat of pig	0.023	0.031
						1	Fat of broiler	0.011	0.011
				0.05	180	0	-		
E: (RS)-α-cyano-3-phenoxybenzyl-(1RS)-cis, trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate (Cypermethrin) K: Cypermethrin (Cypermethrin including other mixtures of constituent isomers (sum of isomers)) [5]	52315-07-8	Yes	18	0.005	51	0	-		
				0.01	1507	2	Fat of beef	0.017	0.021
						5	Fat of pig	0.017	0.026
				0.05	200	0	-		
E: α-cyano-3-phenoxybenzyl2,2-dimethyl-3-(2-methylprop-1-enyl)cyclopropanecarboxylate (Cyphenothrin) K: Cyphenothrin	39515-40-7	Yes	18	0.01	25	0	-		
				0.02	226	0	-		
E: N-cyclopropyl-1,3,5-triazine-2,4,6-triamine (Cyromazine) K: Cyromazine	66215-27-8	Yes	18	0.01	1223	0	-		
				0.05	36	0	-		

Substance name **E: from ECHA database** **K: from KAP database** **R: common name used in this report**	**CAS no.**	**Biocidal a.s.? [1]**	**PT(s)**	**LOQ**	**No. per LOQ [2]**	**No. ≥ LOQ**	**Product(s) ≥ LOQ**	**Average [3]**	**Maximum**
E: Deltamethrin K: Deltamethrin (cis-deltamethrin)	52918-63-5	Yes	18	0.005	51	0	-		
				0.01	2066	1	Fat of beef	0.014	0.014
						4	Fat of pig	0.025	0.043
				0.05	24	0	-		
E: N/A K: Didecyldimethylammonium chloride (mixture of alkyl-quaternary ammonium salts with alkyl chain lengths of C8, C10 and C12)) R: DDAC C8-12	-	No	N/A	0.01	77	2	Liver of beef	0.050	0.061
						4	Liver of pig	0.15	0.41
						1	Kidney fat of goat	0.14	0.14
						4	Minced beef	0.046	0.076
						8	Bacon	0.057	0.099
						1	Meat of pig	0.061	0.061
						4	Meat of fattening calf	0.089	0.22
						2	Meat of beef	0.067	0.11
						1	Meat of pig	16	16
						3	Meat of broiler	0.053	0.08
				0.02	714	1	Liver of pig	0.023	0.023
						5	Meat of fattening calf	0.26	0.48
				0.05	3	0	-		
				0.1	1	0	-		
E: N,N-diethyl-m-toluamide K: Diethyl-m-toluamid, N,N- R: DEET	134-62-3	Yes	19	0.005	51	0	-		
				0.01	127	0	-		
E: Diflubenzuron K: Diflubenzuron	35367-38-5	Yes	18	0.01	780	0	-		
				0.05	34	0	-		
E: N/A K: Dilauryl dimonium chloride R: DDAC-12	3401-74-9	No	N/A	0.02	338	0	-		

Substance name **E: from ECHA database** **K: from KAP database** **R: common name used in this report**	**CAS no.**	**Biocidal a.s.? [1]**	**PT(s)**	**LOQ**	**No. per LOQ [2]**	**No. ≥ LOQ**	**Product(s) ≥ LOQ**	**Average [3]**	**Maximum**
E: Dinotefuran K: Dinotefuran	165252-70-0	Yes	18	0.005	51	0	-		
				0.01	127	0	-		
E: N/A K: Dioctyl dimonium chloride R: DDAC-8	5538-94-3	No	N/A	0.02	338	0	-		
E: Etofenprox K: Etofenprox	80844-07-1	Yes	18	0.005	51	0	-		
				0.01	127	0	-		
E: 1-(3,5-dichloro-4-(1,1,2,2-tetrafluoroethoxy)phenyl)-3-(2,6-difluorobenzoyl) urea (Hexaflumuron) K: Hexaflumuron	86479-06-3	Yes	18	0.01	1063	0	-		
				0.05	38	0	-		
E: Imidacloprid K: Imidacloprid	138261-41-3	Yes	18	0.005	51	0	-		
				0.01	1232	0	-		
E: Indoxacarb (enantiomeric reaction mass S:R 75:25) K: Indoxacarb (sum of indoxacarb and its R enantiomer)	144171-61-9	Yes	18	0.005	51	0	-		
				0.01	1509	0	-		
				0.05	5	0	-		
E: S-Methoprene K: Methoprene	65733-16-6	Yes	18	0.05	102	0	-		
E: N/A K: Perchlorate	14797-73-0	No	N/A	0.001	40	0	-		
				0.02	47	0	-		
E: Permethrin K: Permethrin (sum of isomers)	52645-53-1	Yes	18	0.01	1710	3	Fat of beef	0.043	0.07
						1	Fat of sheep	0.036	0.036
				0.05	440	0	-		

Substance name **E: from ECHA database** **K: from KAP database** **R: common name used in this report**	**CAS no.**	**Biocidal a.s.? [1]**	**PT(s)**	**LOQ**	**No. per LOQ [2]**	**No. ≥ LOQ**	**Product(s) ≥ LOQ**	**Average [3]**	**Maximum**
E: 2-(2-butoxyethoxy)ethyl 6-propylpiper-onyl ether (Piperonyl butoxide/PBO) K: Piperonyl Butoxide	51-03-6	Yes	18	0.005	51	0	-		
				0.01	275	1	Kidney fat of horse	0.027	0.027
						7	Fat of pig	0.010	0.016
E: Pyriproxyfen K: Pyriproxyfen	95737-68-1	Yes	18	0.005	51	0	-		
				0.01	1232	0	-		
E: Salicylic acid K: Salicylic acid	69-72-7	Yes	03 04	N/A	2803	10	Meat of fattening calf	1.2	4.8
						17	Meat of horse	0.12	0.517
						6	Meat of pig	0.095	0.159
						4	Meat of broiler	0.18	0.379
E: Spinosad K: Spinosad (spinosad, sum of spinosyn A and spinosyn D)	168316-95-8	Yes	18	0.01	710	1	Fat of pig	0.057	0.057
						1	Meat of fattening calf	0.024	0.024
E: Tetramethrin K: Tetramethrin	7696-12-0	Yes	18	0.005	51	0	-		
				0.01	200	0	-		
E: Thiamethoxam K: Thiamethoxam	153719-23-4	Yes	18	0.005	51	0	-		
				0.01	1227	0	-		
				0.05	5	0	-		
E: Transfluthrin K: Transfluthrin	118712-89-3	Yes	18	0.005	51	0	-		
				0.01	127	0	-		

N/A: Not Applicable

1) Biocidal a.s. 'Yes' means biocidal active substance in the ECHA database on biocides. Biocidal a.s. 'No' are degradation products, quats other than the active substances with quats in the ECHA database on biocides and possibly other isomers of insecticides.
2) No. per LOQ is the number of measurements performed with the mentioned LOQ.
3) The average is calculated based on the measurement results ≥ LOQ only.
4) In the KAP database the substances 'Cyhalothrin', 'Cyhalothrin, lambda-' and 'Lambda-cyhalothrin (includes gamma-cyhalothrin) (sum of R,S and S,R isomers)' are included. We linked 'Cyhalothrin' to the CAS number of cyhalothrin and the other two to the CAS number of lambda-cyhalothrin.

However, as far as we know, the different isomers from cyhalothrin and lambda-cyhalothrin cannot be discriminated by the analytical methods used.

5) In the KAP database the substances 'Cypermethrin' and 'Cypermethrin (Cypermethrin including other mixtures of constituent isomers (sum of isomers))' are included. In both cases the sum of isomers is analysed. We linked them to the same CAS number.

Table A4.2 PTs and measurement results per LOQ (mg/kg) for the active substances of the selected PTs in biocides in dairy products.

Substance name **E: from ECHA database** **K: from KAP database** **R: common name used in this report**	**CAS no.**	**Biocidal a.s.? [1]**	**PT(s)**	**LOQ**	**No. per LOQ [2]**	**No. ≥ LOQ**	**Product(s) ≥ LOQ**	**Average [3]**	**Maximum**
E: Biphenyl-2-ol K: 2-phenylphenol	90-43-7	Yes	03 04	0.005	47	0	-		
E: S-[(6-chloro-2-oxooxazolo[4,5-b]pyridin-3(2H)-yl)methyl] O,O-dimethylthiophosphate (Azamethiphos) K: Azamethiphos	35575-96-3	Yes	18	0.005	58	0	-		
				0.01	12	0	-		
E: N/A K: BAC 10 R: Benzyl(decyl)dimethyl ammonium chloride	965-32-2	No	N/A	0.01	45	0	-		
E: N/A K: BAC 12 R: Benzododecinium chloride	139-07-1	No	N/A	0.001	34	0	-		
				0.01	57	1	Milk products	0.137	0.137
				0.05	45	0	-		
E: N/A K: BAC 14 R: Miristalkonium chloride	139-08-2	No	N/A	0.001	34	0	-		
				0.01	57	1	Milk products	0.263	0.263
				0.05	45	0	-		
E: N/A K: BAC 16 R: Cetalkonium chloride	122-18-9	No	N/A	0.01	102	0	-		
E: N/A K: BAC 18	-	No	N/A	0.01	45	0	-		

Substance name **E: from ECHA database** **K: from KAP database** **R: common name used in this report**	**CAS no.**	**Biocidal a.s.? [1]**	**PT(s)**	**LOQ**	**No. per LOQ [2]**	**No. ≥ LOQ**	**Product(s) ≥ LOQ**	**Average [3]**	**Maximum**
E: N/A K: BAC 8	-	No	N/A	0.01	54	0	-		
E: N/A K: Benzalkonium chloride (mixture of alkylbenzyldimethylammonium chlorides with alkyl chain lengths of C8, C10, C12, C14, C16 and C18) R: BAC C8-18	-	No	N/A	0.001	34	0	-		
				0.01	59	0	-		
E: N/A K: Chlorates	-	No	N/A	0.001	20	4	Milk	0.016	0.022
				0.01	20	1	Milk	0.033	0.033
E: 4-bromo-2-(4-chlorophenyl)-1-ethoxy- methyl-5-trifluoromethylpyrrole-3-carbonitrile (Chlorfenapyr) K: Chlorfenapyr	122453-73-0	Yes	18	0.001	47	0	-		
				0.005	23	0	-		
				0.01	22	0	-		
E: (E)-1-(2-Chloro-1,3-thiazol-5-ylmethyl)-3- methyl-2-nitroguanidine (Clothianidin) K: Clothianidin	210880-92-5	Yes	18	0.005	47	0	-		
				0.01	12	0	-		
E: Copper K: Copper (Cu)	7440-50-8	Yes	05	0.0029	44	2	Raw milk (goat)	0.11	0.13
						42	Raw milk (beef)	0.054	0.084
E: Lambda-cyhalothrin K: Cyhalothrin, lambda- [4]	91465-08-6	Yes	18	0.01	22	0	-		
E: Lambda-cyhalothrin K: Lambda-cyhalothrin (includes gamma-cyhalothrin) (sum of R,S and S,R isomers)) [4]	91465-08-6	Yes	18	0.001	47	0	-		

Substance name E: from ECHA database K: from KAP database R: common name used in this report	CAS no.	Biocidal a.s.? [1]	PT(s)	LOQ	No. per LOQ [2]	No. ≥ LOQ	Product(s) ≥ LOQ	Average [3]	Maximum
E: (RS)-α-cyano-3-phenoxybenzyl-(1RS)-cis, trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate (Cypermethrin) K: Cypermethrin [5]	52315-07-8	Yes	18	0.01	7	0	-		
				0.05	2	0	-		
E: (RS)-α-cyano-3-phenoxybenzyl-(1RS)-cis, trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate (Cypermethrin) K: Cypermethrin (Cypermethrin including other mixtures of constituent isomers (sum of isomers)) [5]	52315-07-8	Yes	18	0.001	47	0	-		
				0.01	116	0	-		
E: α-cyano-3-phenoxybenzyl2,2-dimethyl-3-(2-methylprop-1-enyl)cyclopropanecarboxylate (Cyphenothrin) K: Cyphenothrin	39515-40-7	Yes	18	0.005	50	0	-		
				0.01	22	0	-		
E: N-cyclopropyl-1,3,5-triazine-2,4,6-triamine (Cyromazine) K: Cyromazine	66215-27-8	Yes	18	0.01	80	0	-		
E: Deltamethrin K: Deltamethrin (cis-deltamethrin)	52918-63-5	Yes	18	0.001	47	0	-		
				0.01	102	0	-		
				0.02	23	0	-		

Substance name E: from ECHA database K: from KAP database R: common name used in this report	CAS no.	Biocidal a.s.? [1]	PT(s)	LOQ	No. per LOQ [2]	No. ≥ LOQ	Product(s) ≥ LOQ	Average [3]	Maximum
E: N/A K: Didecyldimethylammonium chloride (mixture of alkyl-quaternary ammonium salts with alkyl chain lengths of C8, C10 and C12)) R: DDAC C8-12	-	No	N/A	0.01	91	1	Milk products	9.67	9.67
				0.02	48	0	-		
E: N,N-diethyl-m-toluamide K: Diethyl-m-toluamid, N,N- R: DEET	134-62-3	Yes	19	0.005	47	0	-		
				0.01	12	0	-		
E: Diflubenzuron K: Diflubenzuron	35367-38-5	Yes	18	0.01	106	0	-		
E: N/A K: Dilauryl dimonium chloride R: DDAC-12	3401-74-9	No	N/A	0.02	45	0	-		
E: Dinotefuran K: Dinotefuran	165252-70-0	Yes	18	0.005	47	0	-		
				0.01	12	0	-		
E: N/A K: Dioctyl dimonium chloride R: DDAC-8	5538-94-3	No	N/A	0.02	45	0	-		
E: Etofenprox K: Etofenprox	80844-07-1	Yes	18	0.005	47	0	-		
				0.01	12	0	-		
E: 1-(3,5-dichloro-4-(1,1,2,2-tetrafluoroethoxy)phenyl)-3-(2,6-difluorobenzoyl) urea (Hexaflumuron) K: Hexaflumuron	86479-06-3	Yes	18	0.01	136	0	-		
				0.05	20	0	-		

Substance name E: from ECHA database K: from KAP database R: common name used in this report	CAS no.	Biocidal a.s.? [1]	PT(s)	LOQ	No. per LOQ [2]	No. ≥ LOQ	Product(s) ≥ LOQ	Average [3]	Maximum
E: Imidacloprid	138261-41-3	Yes	18	0.005	47	0	-		
K: Imidacloprid				0.01	66	0	-		
E: Indoxacarb (enantiomeric reaction mass S:R 75:25)	144171-61-9	Yes	18	0.005	58	0	-		
K: Indoxacarb (sum of indoxacarb and its R enantiomer)				0.01	121	0	-		
E: S-Methoprene	65733-16-6	Yes	18	0.001	47	0	-		
K: Methoprene									
E: N/A	14797-73-0	No	N/A	0.001	20	0	-		
K: Perchlorate									
E: Permethrin	52645-53-1	Yes	18	0.005	70	0	-		
K: Permethrin (sum of isomers)				0.01	93	0	-		
E: 2-(2-butoxyethoxy)ethyl 6-propylpiper-onyl ether (Piperonyl butoxide/PBO)	51-03-6	Yes	18	0.005	38	0	-		
K: Piperonyl Butoxide				0.01	41	0	-		
E: Pyriproxyfen	95737-68-1	Yes	18	0.005	47	0	-		
K: Pyriproxyfen				0.01	57	0	-		
E: Salicylic acid	69-72-7	Yes	03	N/A	2708	1	Raw milk (goat)	0.0088	0.0088
K: Salicylic acid			04	N/A		53	Raw milk (beef)	0.011	0.052
E: Spinosad	168316-95-8	Yes	18	0.005	40	0	-		
K: Spinosad (spinosad, sum of spinosyn A and spinosyn D)				0.01	92	0	-		
E: Tetramethrin	7696-12-0	Yes	18	0.005	70	0	-		
K: Tetramethrin				0.01	22	0	-		
E: Thiamethoxam	153719-23-4	Yes	18	0.005	47	0	-		
K: Thiamethoxam				0.01	57	0	-		

Substance name **E: from ECHA database** **K: from KAP database** **R: common name used in this report**	**CAS no.**	**Biocidal a.s.? [1]**	**PT(s)**	**LOQ**	**No. per LOQ [2]**	**No. ≥ LOQ**	**Product(s) ≥ LOQ**	**Average [3]**	**Maximum**
E: Transfluthrin K: Transfluthrin	118712-89-3	Yes	18	0.005	27	0	-		

N/A: Not Applicable

1) Biocidal a.s. 'Yes' means biocidal active substance in the ECHA database on biocides. Biocidal a.s. 'No' are degradation products, quats other than the active substances with quats in the ECHA database on biocides and possibly other isomers of insecticides.
2) No. per LOQ is the number of measurements performed with the mentioned LOQ.
3) The average is calculated based on the measurement results ≥ LOQ only.
4) In the KAP database the substances 'Cyhalothrin', 'Cyhalothrin, lambda-' and 'Lambda-cyhalothrin (includes gamma-cyhalothrin) (sum of R,S and S,R isomers)' are included. We linked 'Cyhalothrin' to the CAS number of cyhalothrin and the other two to the CAS number of lambda-cyhalothrin. However, as far as we know, the different isomers from cyhalothrin and lambda-cyhalothrin cannot be discriminated by the analytical methods used.
5) In the KAP database the substances 'Cypermethrin' and 'Cypermethrin (Cypermethrin including other mixtures of constituent isomers (sum of isomers))' are included. In both cases the sum of isomers is analysed. We linked them to the same CAS number.

Table A4.3 PTs and measurement results per LOQ (mg/kg) for the active substances of the selected PTs in biocides in infant/toddler food.

Substance name **E: from ECHA database** **K: from KAP database** **R: common name used in this report**	**CAS no.**	**Biocidal a.s.? [1]**	**PT(s)**	**LOQ**	**No. per LOQ [2]**	**No. ≥ LOQ**	**Product(s) ≥ LOQ**	**Average [3]**	**Maximum**
E: Biphenyl-2-ol K: 2-phenylphenol	90-43-7	Yes	03 04	0.005	109	0	-		
E: Acetamiprid K: Acetamiprid	135410-20-7	Yes	18	0.005	204	0	-		
				0.01	54	0	-		
E: S-[(6-chloro-2-oxooxazolo[4,5-b]pyridin-3(2H)-yl)methyl] O,O-dimethylthiophosphate (Azamethiphos) K: Azamethiphos	35575-96-3	Yes	18	0.005	204	0	-		
				0.01	54	0	-		
E: N/A K: BAC 12 R: Benzododecinium chloride	139-07-1	No	N/A	0.0005	35	0	-		
				0.001	17	3	Baby and toddler food	0.0030	0.0054
				0.002	1	1	Baby and toddler food	0.002	0.002
				0.0034	1	1	Follow-on formula	0.0034	0.0034
				0.01	21	0	-		
E: N/A K: BAC 14 R: Miristalkonium chloride	139-08-2	No	N/A	0.0005	35	0	-		
				0.001	17	1	Baby and toddler food	0.0036	0.0036
				0.0027	1	1	Follow-on formula	0.0027	0.0027
				0.01	21	0	-		
E: N/A K: BAC 16 R: Cetalkonium chloride	122-18-9	No	N/A	0.0005	35	0	-		
				0.01	21	0	-		

Substance name **E: from ECHA database** **K: from KAP database** **R: common name used in this report**	**CAS no.**	**Biocidal a.s.? [1]**	**PT(s)**	**LOQ**	**No. per LOQ [2]**	**No. ≥ LOQ**	**Product(s) ≥ LOQ**	**Average [3]**	**Maximum**
E: N/A K: Benzalkonium chloride (mixture of alkylbenzyldimethylammonium chlorides with alkyl chain lengths of C8, C10, C12, C14, C16 and C18) R: BAC C8-18	-	No	N/A	0.0005	35	4	Baby and toddler food	0.0070	0.012
				0.001	65	4	Baby and toddler food	0.0047	0.0090
						7	Follow-on formula	0.0031	0.0066
						4	Infant formula	0.0063	0.0099
				0.0061	1	1	Follow-on formula	0.0061	0.0061
				0.01	21	0	-		
E: N/A K: Chlorates	-	No	N/A	0.01	169	19	Baby and toddler food	0.078	0.3
						13	Follow-on formula	0.018	0.03
						5	Infant formula	0.043	0.16
E: 4-bromo-2-(4-chlorophenyl)-1-ethoxy- methyl-5-trifluoromethylpyrrole-3-carbonitrile (Chlorfenapyr) K: Chlorfenapyr	122453-73-0	Yes	18	0.001	66	0	-		
				0.005	54	0	-		
				0.01	55	0	-		
				0.02	83	0	-		
E: (E)-1-(2-Chloro-1,3-thiazol-5-ylmethyl)-3- methyl-2-nitroguanidine (Clothianidin) K: Clothianidin	210880-92-5	Yes	18	0.005	204	0	-		
				0.01	54	0	-		
E: N/A K: Cyhalothrin [4]	68085-85-8	No	N/A	0.005	109	0	-		
E: Lambda-cyhalothrin K: Cyhalothrin, lambda- [4]	91465-08-6	Yes	18	0.005	54	0	-		
E: Lambda-cyhalothrin K: Lambda-cyhalothrin (includes gamma-cyhalothrin) (sum of R,S and S,R isomers)) [4]	91465-08-6	Yes	18	0.001	66	0	-		
				0.005	138	0	-		

Substance name **E: from ECHA database** **K: from KAP database** **R: common name used in this report**	**CAS no.**	**Biocidal a.s.? [1]**	**PT(s)**	**LOQ**	**No. per LOQ [2]**	**No. ≥ LOQ**	**Product(s) ≥ LOQ**	**Average [3]**	**Maximum**
E: (RS)-α-cyano-3-phenoxybenzyl-(1RS)-cis, trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate (Cypermethrin) K: Cypermethrin (Cypermethrin including other mixtures of constituent isomers (sum of isomers)) [5]	52315-07-8	Yes	18	0.001	66	0	-		
				0.005	192	0	-		
E: α-cyano-3-phenoxybenzyl2,2-dimethyl-3-(2-methylprop-1-enyl)cyclopropanecarboxylate (Cyphenothrin) K: Cyphenothrin	39515-40-7	Yes	18	0.005	66	0	-		
				0.01	109	0	-		
				0.02	83	0	-		
E: Deltamethrin K: Deltamethrin (cis-deltamethrin)	52918-63-5	Yes	18	0.001	66	0	-		
				0.005	192	0	-		
E: N/A K: Didecyldimethylammonium chloride (mixture of alkyl-quaternary ammonium salts with alkyl chain lengths of C8, C10 and C12)) R: DDAC C8-12	-	No	N/A	0.0005	35	4	Baby and toddler food	0.003	0.004
				0.01	38	0	-		
E: N,N-diethyl-m-toluamide K: Diethyl-m-toluamid, N,N- R: DEET	134-62-3	Yes	19	0.005	204	0	-		
				0.01	54	0	-		
E: Diflubenzuron K: Diflubenzuron	35367-38-5	Yes	18	0.01	258	0	-		

Substance name E: from ECHA database K: from KAP database R: common name used in this report	CAS no.	Biocidal a.s.? [1]	PT(s)	LOQ	No. per LOQ [2]	No. ≥ LOQ	Product(s) ≥ LOQ	Average [3]	Maximum
E: Dinotefuran K: Dinotefuran	165252-70-0	Yes	18	0.005	204	0	-		
				0.01	54	0	-		
E: Etofenprox K: Etofenprox	80844-07-1	Yes	18	0.005	258	0	-		
E: 1-(3,5-dichloro-4-(1,1,2,2-tetrafluoroethoxy)phenyl)-3-(2,6-difluorobenzoyl) urea (Hexaflumuron) K: Hexaflumuron	86479-06-3	Yes	18	0.01	258	0	-		
E: Imidacloprid K: Imidacloprid	138261-41-3	Yes	18	0.005	204	0	-		
				0.01	54	0	-		
E: Indoxacarb (enantiomeric reaction mass S:R 75:25) K: Indoxacarb (sum of indoxacarb and its R enantiomer)	144171-61-9	Yes	18	0.005	258	0	-		
E: S-Methoprene K: Methoprene	65733-16-6	Yes	18	0.001	66	0	-		
				0.01	54	0	-		
				0.02	55	0	-		
E: N/A K: Perchlorate	14797-73-0	No	N/A	0.001	48	0	-		
				0.01	1	1	Baby and toddler food	0.01	0.01
				0.013	1	1	Baby and toddler food	0.013	0.013
E: Permethrin K: Permethrin (sum of isomers)	52645-53-1	Yes	18	0.005	175	0	-		
				0.01	83	0	-		
E: 2-(2-butoxyethoxy)ethyl 6-propylpiper-onyl ether (Piperonyl butoxide/PBO) K: Piperonyl Butoxide	51-03-6	Yes	18	0.005	258	1	Baby and toddler food	0.042	0.042

Substance name E: from ECHA database K: from KAP database R: common name used in this report	CAS no.	Biocidal a.s.? [1]	PT(s)	LOQ	No. per LOQ [2]	No. ≥ LOQ	Product(s) ≥ LOQ	Average [3]	Maximum
E: Pyriproxyfen K: Pyriproxyfen	95737-68-1		18	0.005	258	0	-		
E: Spinosad	168316-95-8	Yes	18	0.005	66	0	-		
K: Spinosad (spinosad, sum of spinosyn A and spinosyn D)				0.01	192	0	-		
E: Tetramethrin	7696-12-0	Yes	18	0.005	204	0	-		
K: Tetramethrin				0.02	54	0	-		
E: Thiamethoxam	153719-23-4	Yes	18	0.005	204	0	-		
K: Thiamethoxam				0.01	54	0	-		
E: Transfluthrin K: Transfluthrin	118712-89-3	Yes	18	0.005	258	0	-		

N/A: Not Applicable

1) Biocidal a.s. 'Yes' means biocidal active substance in the ECHA database on biocides. Biocidal a.s. 'No' are degradation products, quats other than the active substances with quats in the ECHA database on biocides and possibly other isomers of insecticides.
2) No. per LOQ is the number of measurements performed with the mentioned LOQ.
3) The average is calculated based on the measurement results ≥ LOQ only.
4) In the KAP database the substances 'Cyhalothrin', 'Cyhalothrin, lambda-' and 'Lambda-cyhalothrin (includes gamma-cyhalothrin) (sum of R,S and S,R isomers)' are included. We linked 'Cyhalothrin' to the CAS number of cyhalothrin and the other two to the CAS number of lambda-cyhalothrin. However, as far as we know, the different isomers from cyhalothrin and lambda-cyhalothrin cannot be discriminated by the analytical methods used.
5) In the KAP database the substance 'Cypermethrin (Cypermethrin including other mixtures of constituent isomers (sum of isomers))' is included. We linked this to the CAS number of cypermethrin.

Annex 5 Monitoring data in public literature

This annex provides results of monitoring data on residues in meat and dairy from literature available at RIVM. In the context of this research, we did not perform a literature search for this type of information. The text below sometimes mentions ‘Dutch MRLs’. See Section 6.2 and Annex 8 for more information on this subject.

Perchlorate

In the scientific opinion by the EFSA CONTAM panel, monitoring data on perchlorate in milk and infant formulae was collected. In samples of milk from China, Japan, and the USA, the weighted mean concentration of perchlorate was 6.8 µg/L, based on 221 samples, and in infant formulae (powder), it was 10 µg/kg, based on 20 samples (EFSA CONTAM, 2014). In 2017, EFSA performed an exposure assessment for perchlorate in food (EFSA, 2017). They used a dataset containing 18,217 analytical results on perchlorate, including results for ‘milk and dairy products’ (287 samples), liquid milk (166 samples), concentrated milk (2 samples), whey and whey products (13 samples), cream and cream products (2 samples), fermented milk products (46 samples), cheese (39 samples), infant formulae, powder (46 samples), and follow-on formulae (9 samples). The collected data dates from between 1 September 2013 and 6 April 2017. For some products, there have been very few analyses of perchlorate in more than three years. The category ‘milk and dairy products’ was found to be an important contributor to the exposure across all population groups. For milk and dairy, they reported that 22% of the values were above the LOQ, with a P95 of 0.014 mg/kg (95% of the measured values are below 0.014 mg/kg).

BuRO advice about the dairy chain

In 2017, BuRO published an advice about the risks of the dairy chain for animal welfare, public health, and animal health. The appendices to this BuRO advice (NVWA, 2017) report three notifications of high concentrations of hydrogen peroxide in butter and milk, and of quats in cream and ice cream (up to 16 mg/kg). It is not clear whether they are the results of monitoring data following an incident, or whether they are random monitoring results. Chlorate, perchlorate and chloroform could be present in dairy as DBPs (see Section 3.3). In Regulation EU 37/2010 (EC, 2009), chloroform is on the list of 'prohibited substances' and therefore, it should not be present in foods at all. It is not known whether chloroform occurs in dairy products in the Netherlands. There is data about chloroform in cheese brine, the bath in which cheese is immersed during preparation. This data originates from the COKZ (Stichting Controle Orgaan Kwaliteits Zaken), the Dutch supervisory authority in the field of dairy, poultry, and eggs. During inspections by the COKZ in 2013 and 2014, the standard of 0.002 mg/kg for chloroform was exceeded in the cheese brine several times (1.5% of more than 350 samples). This involved multiple samples at one company. It is not known whether chloroform from cheese brine is absorbed into cheese as well. COKZ also reported 'exceedance of the

action limit' for cyanuric acid in a ‘powdery end product’. For milk, EFSA reported an ‘exceedance of the standard’ of the prohibited substance chloroform ‘in a single sample’. Chlorate and perchlorate were found in six dairy samples (cheese, cream, milk powder, and ice cream) in 2014-2015, in concentrations ranging between 0.01 and 0.1 mg/kg. EFSA reports chlorate concentrations in dairy and dairy products ranging between ‘0 and 0.5 mg/kg’. Some results of the BuRO advice come from a RIKILT report (RIKILT, 2016). In this report, too, high levels of hydrogen peroxide are mentioned in butter and desserts. The dairy products originate from France, Germany, and the Czech Republic. The measured concentrations are not available.

RIVM study on food safety

An extensive RIVM study on food safety (Mengelers et al., 2017) states the following about biocides: ‘Disinfectants such as quaternary ammonium compounds (QACs or quats) and p-toluenesulfonamide (chloramine-T) are found at levels above the Dutch MRL in mixed products like soft ice-cream, milkshakes, whipped cream, cream cakes, minced meat, minced beef, minced steak and sausages. Chlorate resulting from the chemical reaction and/or degradation of the disinfectants perchlorate or hypochlorite is found in dairy products, fruits, vegetables and drinking water at levels above the default MRL of 0.01 mg/kg as used in the PPP (Plant Protection Products) framework. These results indicate that the occurrence of biocide residues in food is not theoretical or imaginary, but needs special attention from risk assessors and risk managers.’

Iodine in milk

A recent RIVM study (Wezenbeek and Komen, 2023) pays attention to iodine in milk: ‘*In the Dutch Nutrient database (NEVO[31]), there appears to be evidence of iodine in raw milk. The iodine content in raw milk is 14.9 µg/100 g milk (NEVO code 270). This is therefore 149 µg/kg or 0.149 mg/kg. This is an average of analyses of Friesland Campina from 2013 and analyses of the Dutch Dairy Organisation (NZO) from 2014 (RIVM communication). This content is therefore well below the Dutch MRL. Inquiry by the Dutch Ministry of Health, Welfare and Sport (VWS) (communication, VWS) shows that the COKZ (Stichting Controle Orgaan Kwaliteits Zaken; Central Body for Quality Affairs), the NZO (Nederlandse Zuivel Organisatie; Dutch Dairy Organisation) and the NGZO (Nederlandse Geiten Zuivel Organisatie; Dutch Goat Dairy Organisation) does not have iodine included in their monitoring programs. The NZO does additional research into iodine in milk. Via the COKZ information from the NZO from 2020 is available. The NZO keeps iodine monitored annually through an additional program. In 2020 the results in mixed samples of farm milk are as follows: median 169 µg/kg, minimum 138 µg/kg and maximum 214 µg/kg. The median values have been quite stable in recent years. The NZO covers the sources (and causes of variability) of iodine quite well, so that they can anticipate changing trends. For now, according to the NZO, there is no reason to do so. The data from 2020 are well below the Dutch MRL.*’

[31] See: https://nevo-online.rivm.nl/

Insecticides in poultry muscle and fat

In 2017, EFSA asked the EU Member States to test for residues of fipronil and other acaricides or insecticides in chicken eggs, meat, and fat (EFSA, 2018). The results included a relatively large number of samples from Dutch companies that had used an illegal anti-red mite agent (biocide or veterinary medicinal product) that was based on fipronil. Most samples were analysed for fipronil alone, a small portion were also tested for other acaricides or insecticides. Exceedances of the LOQ in muscle and fat have exclusively been found for fipronil. Fipronil was found above the MRL in 133 suspect samples of poultry fat and in 5 suspect samples of poultry muscle as a result of the use of the illegal product. The MRL is 0.006 mg/kg for poultry fat and 0.005* for other poultry tissues. Only one of the random samples of poultry fat had a concentration of fipronil above the LOQ and this also exceeded the MRL. This case shows that illegal use of biocides or veterinary medicinal products can result in large-scale exceedances of MRLs. The approval of fipronil for use in other authorised PT18 biocides expired in September 2023, so biocides containing this substance will disappear from the market.

DBPs in meat

An EFSA study (Gadelha et al., 2019; see also Section 3.3) states that chlorate, THMs, and HAAs are the DBP classes formed at the highest concentrations following chlorination of water. Cardador and Gallego (2017) analysed several DBPs in frozen meat, among other foods purchased at local markets in Spain. They reported concentrations of THMs: 1.2–3.6 µg/kg in canned meat (60% positive samples) and 1.5-6.4 µg/kg in frozen meat (36% positive samples). And concentrations of HAAs: 0.5–2.3 µg/kg in frozen meat (20% positive samples). The percentage of positive samples shows that DBPs will regularly be present in meat. The DBPs found in meat were TCM (trichloromethane; chloroform), maximum 0.0042 mg/kg, BDCM (bromodichloromethane), maximum 0.0022 mg/kg, DCAA (dichloroacetic acid), maximum 0.0011 mg/kg and TCNM (trichloronitromethane) maximum 0.0021 mg/kg.

Salicylic acid in milk

In 2023, a Dutch student who was supervised by the NVWA investigated the factors contributing to concentrations of salicylic acid found in milk (Jongerman, 2023). This substance is used in human and veterinary medicinal products, in teat dip biocides (PT03) and it is present in natural sources such as willow bark. The study mentions salicylic acid concentrations in milk higher than the MRL of 9 µg/kg.
The factors identified did not have a significant association with whether or not salicylic acid was found in milk on the farms visited. Even though they were not significant, there was a trend for the factors ‘biological management’, ‘use of teat dip with salicylic acid’, ‘use of hoof products containing salicylic acid’, and ‘use of non-prescription only medicine or feed additives’ to be positively associated with salicylic acid being found in samples from a given farm.

Annex 6 Measurable substances by WFSR in meat and/or dairy products

Note

The information in this annex was provided by WFSR at the beginning of 2025. The information changes over time. If this information is used for decision-making, please ensure that the information is still up to date and correct.

Table A6.1 Measurability of active substances in meat and/or dairy products by WFSR.

Active substance name from ECHA database	CAS no.	PT	Method A (quant/ PPP routine)	Method B (qual/ PPP routine)	Method C (quant/ biocide) [5]	Method D (SRM)	WFSR name
(E)-1-(2-Chloro-1,3-thiazol-5-ylmethyl)-3- methyl-2-nitroguanidine (Clothianidin)	210880-92-5	18		x	x		Clothianidin
(RS)-α-cyano-3-phenoxybenzyl-(1RS)-cis, trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate (Cypermethrin)	52315-07-8	18	x	x	x		Cypermethrin (all isomers) [2]
[2,4-Dioxo-(2-propyn-1-yl)imidazolidin-3-yl]methyl(1R)-cis-chrysanthemate;[2,4- Dioxo-(2-propyn-1-yl)imidazolidin-3-yl] methyl(1R)-trans-chrysanthemate (Imiprothrin)	72963-72-5	18			x		Imiprothrin
1-(3,5-dichloro-4-(1,1,2,2-tetrafluoroethoxy)phenyl)-3-(2,6-difluorobenzoyl) urea (Hexaflumuron)	86479-06-3	18	x	x	x		Hexaflumuron
1R-trans phenothrin	26046-85-5	18		x			Phenothrin
2-(2-butoxyethoxy)ethyl 6-propylpiper-onyl ether (Piperonyl butoxide/PBO)	51-03-6	18		x	x		Piperonyl butoxide/PBO [3]

Active substance name from ECHA database	CAS no.	PT	Method A (quant/ PPP routine)	Method B (qual/ PPP routine)	Method C (quant/ biocide) [5]	Method D (SRM)	WFSR name
2-methyl-4-oxo-3-(prop-2-ynyl)cyclopent-2-en-1-yl 2,2-dimethyl-3-(2-methylprop-1-enyl)cyclopropanecarboxylate (Prallethrin)	23031-36-9	18		x	x		Prallethrin
4-bromo-2-(4-chlorophenyl)-1-ethoxy- methyl-5-trifluoromethylpyrrole-3-carbonitrile (Chlorfenapyr)	122453-73-0	18		x			Chlorfenapyr
5-chloro-2-(4-chlorphenoxy)phenol (DCPP)	3380-30-1	04			x		5-chloro-2-(4-chlorphenoxy)phenol, Diclosan)
Acetamiprid	135410-20-7	18	x	x	x		Acetamiprid
Alkyl (C12-18) dimethylbenzyl ammonium chloride (ADBAC (C12-18))	68391-01-5	03 04	x	x	x		BAC (8-18) [8]
Alkyl (C12-C14) dimethyl(ethylbenzyl)ammonium chloride (ADEBAC (C12-C14))	85409-23-0	03 04			x		C12-Alkyl(ethylbenzyl) dimethylammonium Cl
Alkyl (C12-C14) dimethyl(ethylbenzyl)ammonium chloride (ADEBAC (C12-C14))	85409-23-0	03 04			x		C14-Alkyl(ethylbenzyl) dimethylammonium Cl
Alpha-bromadiolone	-	14		x	x		Bromadiolone
Alphachloralose	15879-93-3	14		x			Alpha-chloralose
Biphenyl-2-ol	90-43-7	03 04	x				Ortho-phenylphenol
Brodifacoum	56073-10-0	14	x	x	x		Brodifacoum
Bromadiolone	28772-56-7	14			x		Bromadiolone

Active substance name from ECHA database	CAS no.	PT	Method A (quant/ PPP routine)	Method B (qual/ PPP routine)	Method C (quant/ biocide) [5]	Method D (SRM)	WFSR name
Chlorine dioxide generated from sodium chlorate and hydrogen peroxide in the presence of a strong acid	7775-09-9	05				x	Chlorate [6]
Chlorocresol	59-50-7	03			x		4-chloro-3-methylphenol (PCMP)
Chlorophacinone	3691-35-8	14		x			Chlorophacinone
Copper	7440-50-8	05				x	Copper
Coumatetralyl	5836-29-3	14	x	x			Coumatetralyl
Deltamethrin	52918-63-5	18	x	x	x		Deltamethrin
Didecyldimethylammonium chloride (DDAC (C8-10))	68424-95-3	03 04	x	x	x		DDAC (C8-C12)
Didecyldimethylammonium chloride (DDAC)	7173-51-5	03 04	x	x	x		DDAC-C10
Difenacoum	56073-07-5	14	x	X	x		Difenacoum
Difethialone	104653-34-1	14		X	x		Difethialone
Diflubenzuron	35367-38-5	18	x	X	x		Diflubenzuron
Dimethyldioctylammonium chloride [1] Dioctyldimethylammonium chloride (DDAC-8)	5538-94-3	03 04	x	x	x		DDAC-C8
Dinotefuran	165252-70-0	18		x			Dinotefuran
Epsilon-Momfluorothrin	1065124-65-3	18			x		Epsilon-Momfluorothrin
Etofenprox	80844-07-1	18		x			Etofenprox
Flocoumafen	90035-08-8	14		x	x		Flocoumafen
Formaldehyde	50-00-0	03				x	Formaldehyde
Hydogen cyanide	74-90-8	141 8				x	Hydrogen cyanide
Imidacloprid	138261-41-3	18	x	x	x		Imidacloprid

Active substance name from ECHA database	CAS no.	PT	Method A (quant/ PPP routine)	Method B (qual/ PPP routine)	Method C (quant/ biocide) [5]	Method D (SRM)	WFSR name
Indoxacarb (enantiomeric reaction mass S:R 75:25)	144171-61-9	18	x	x	x		Indoxacarb
Lambda-cyhalothrin	91465-08-6	18	x		x		Lambda-cyhalothrin
Metofluthrin; epsilon-Metofluthrin	240494-71-7	18 19			x		Metofluthrin
Mixture of 5-chloro-2-methyl-2H-isothiazol-3-one (EINECS 247-500-7) and 2-methyl-2H-isothiazol-3-one (EINECS 220-239-6) (Mixture of CMIT/MIT)	55965-84-9	04			x		5-chloro-2-methyl-3-isothiazolinone (CMI) and 2-methyl-3-isothiazolinone (MIT)
N,N-diethyl-meta-toluamide	134-62-3	19		x	x		DEET
N-cyclopropyl-1,3,5-triazine-2,4,6-triamine (Cyromazine)	66215-27-8	18	x	x			Cyromazine
Perchlorate [7]	14797-73-0					x	Perchlorate
Permethrin	52645-53-1	18	x	x	x		Permethrin
Phosphine	12057-74-8	18				(x) [4]	Phosphine
Pyriproxyfen	95737-68-1	18	x		x		Pyriproxyfen
S-[(6-chloro-2-oxooxazolo[4,5-b]pyridin-3(2H)-yl)methyl] O,O-dimethylthiophosphate (Azamethiphos)	35575-96-3	18		x			Azamethiphos
Salicylic acid	69-72-7	03 04				Via NSAIDs	Salicylic acid
Sec-butyl 2-(2-hydroxyethyl)piperidine-1-carboxylate/Icaridine (Icaridine)	119515-38-7	19			x		Icaridine (picaridin)
Silver	7440-22-4	04 05				x	Silver
S-Methoprene	65733-16-6	18		x			Methoprene

Active substance name from ECHA database	CAS no.	PT	Method A (quant/ PPP routine)	Method B (qual/ PPP routine)	Method C (quant/ biocide) [5]	Method D (SRM)	WFSR name
Sodium dimethylarsinate (Sodium Cacodylate)	124-65-2	18				x	Dimethylarsinic acid (DMA)
Spinosad	168316-95-8	18	x	x			Spinosad (spinosyn A & D)
Tetramethrin	7696-12-0	18		x	x		Tetramethrin
Thiamethoxam	153719-23-4	18	x	x	x		Thiamethoxam
Warfarin	81-81-2	14		x			Warfarin
α-cyano-3-phenoxybenzyl2,2-dimethyl-3-(2-methylprop-1-enyl)cyclopropanecarboxylate (Cyphenothrin)	39515-40-7	18		x	x		Cyphenothrin
α-cyano-4-fluoro-3-phenoxybenzyl3-(2,2-dichlorovinyl)-2,2-dimethylcyclo-propanecarboxylate (Cyfluthrin)	68359-37-5	18	x				Cyfluthrin

See Chapter 5 for the explanation of the different methods.

1) This is not an active substance itself, but an individual substance of the mixture didecyldimethylammonium chloride (DDAC (C8-10)) that is an active substance.
2) EFSA/COM intends to set a separate MRL for alpha-cypermethrin (the most bioactive isomer), besides the existing MRL for cypermethrin (sum of isomers). Technical possibilities for separate determination of alpha-cypermethrin in the EURL/NRL/OL network are currently under investigation.
3) PBO is not an active substance as such, but a synergist which may be added as co-formulant in biocides containing pyrethroids as active substance.
4) Method for phosphine is being developed (2025), this applies to aluminium phosphide releasing phosphine (CAS no. 20859-73-8) and magnesium phospide releasing phosphine (CAS no. 12057-74-8).
5) Method C includes more (active) substances reported to be present in biocides but not covered in the inventory in this report. These are mentioned in the list below.
6) For this substance chlorate is one of the precursors. For some other biocidal active substances chlorate is a possible degradation product.
7) Perchlorate is not an active substance, but a possible degradation product of some biocidal active substances.
8) WFSR measures and reports the individual compounds and the sum according to the residue definition of CR 396/2005: BAC: Benzalkonium chloride (mixture of alkylbenzyldimethylammonium chlorides with alkyl chain lengths of C8, C10, C12, C14, C16 and C18). Sum = summation of mg/kg values of each BAC quantified (>LOQ), and using 0 for the ones <LOQ.

Method C: other compounds included in this method (for information):

- 1,2-benzisothiazolinone (BIT)
- 2-(Thiocyanomethylthio)benzothiazole (TCMTB)
- 2-octyl-3-isothiazolinone (OIT)

- 3-iodo-2-propylbutylcarbamate (IPBC)
- 4,5-dichloro-2-octyl-2H-isothiozol-3-one DCOIT
- Abamectin B1
- Allethrin
- Azadirachtin
- Bendiocarb
- Benzalkonium bromide (BAB)
- Benzethonium chloride (BEC)
- Bromochlorophen (BCP)
- Bromuconazole
- C12 lauryldimethylamine oxide
- C14 myristamine oxide
- Carbendazim
- Chlorophene
- Cloflucarban (CFC)
- Cyproconazole
- Dichlofluanid
- Dichlofluanid metaboilte (DMSA)
- Difenoconazole
- Diuron
- Ecamsule
- Epoxiconazole
- Fenbuconazole
- Fipronil
- Fipronil sulfone
- Flubendazole
- Fluquinconazole
- Flusilazole
- Flutriafol
- Griseofulvin
- Hexachlorophene (HCP)
- Hexaconazole
- Imazalil
- Irgarol
- Metalaxyl
- Metconazole
- Monolinuron
- Myclobutanil
- N,N,N′,N′-Tetraacetylethylenediamine (TAED)
- n-butyl-1,2-benzisothiazolin-3-on (BBIT)
- Paclobutrazol
- Penconazole

- Penflufen
- Prochloraz
- Propiconazole
- Prothioconazole desthio
- Pyrethrin I
- Pyrethrin II
- Pyriproxyphen
- Rotenone
- Tebuconazole
- Thiabendazole
- Thiacloprid
- Tolylfluanid
- Tralopyril
- Triclocarban (TCC)
- Triclosan (TCS)
- Triflumuron
- Triticonazole

Annex 7 Deriving MRLs for biocides

MRLs according to the BPR

The Biocidal Products Regulation (EC 528/2012; BPR) is the legal framework for the authorisation of biocides (active substances and products). Article 19.1(e) of the BPR indicates that MRLs for biocides only need to be derived 'where appropriate' in accordance with the legal frameworks below:

- Regulation on Residues of Plant Protection Products (EC 396/2005; RRPPP);
- Regulation on Residues of Veterinary Medicinal Products (EC 470/2009; RRVMP). The maximum residue levels are laid down in Commission Regulation (EU) No 37/2010 (EC, 2009);
- Regulation on contaminants in food (EEC 315/93). The standards are called Maximum Levels (ML) instead of MRLs and laid down in EC Regulation (EC, 2023b);
- Directive on undesirable substances in animal feed (2002/32/EC). The standards are called Maximum Levels (ML) instead of MRLs;
- Regulation on Food Contact Materials (EC 1935/2004; RFCM). The standards are called Specific Migration Limits (SMLs) instead of MRLs.

Because of the above-mentioned equivocal text about MRLs in the BPR, the 'EU Conference on MRL setting for biocides' was organised in Berlin in March 2014. Following this conference, the EC proposed an interim approach in 2017 (EC, 2017) indicating when MRLs for biocides should be set and within which legal framework.

The EU-interim approach from 2017 onwards

Key points of the EU-interim approach from 2017 onwards are:

- Biocides of PT03, PT04, PT05, PT18, PT19, and PT21 are more prone to leave residues in food or feed. Therefore, a risk-based approach should concentrate on these products. The remaining PTs are not expected to be able to leave presence of residues in food or feed.
- From a use perspective, biocide residues will not only be found in raw (unprocessed) agricultural products, but also in compound foods or processed agricultural products. The existing MRL regulations for PPP and VMP only focus on raw agricultural products (such as fruit, vegetables, cereals, oilseeds, muscle, fat tissue, kidney, liver, eggs, milk).
- If an MRL already exists for the biocidal active substance under the RRPPP or RRVMP, the biocide residues must be lower than the MRL currently established in the other frameworks.
- Specific biocide MRLs are required if measurable residues can be found in foods as a result of biocidal use, except when the active substances concern food or feed, approved food or feed additives, low risk substances (including Annex I BPR), or approved micro-organisms under the BPR or the Plant Protection Products Regulation (EC 1107/2009). If the applicant does not

provide monitoring data on residues, a default MRL of, for example, 0.01 mg/kg can be used.
- If the biocide is used on a surface that may come into contact with food, an SML is derived, if necessary, in accordance with the RFCM. The risk assessment is carried out by EFSA.
- If the biocide is used on or near farm animals, an MRL is derived, if necessary, in accordance with the RRVMP. The risk assessment is carried out by EMA.
- If the biocide is an active substance that was previously or is currently used as a PPP, a standard MRL of 0.01* mg/kg is used for foods for which no biocide monitoring data on residues is available. If this MRL proves to be too low, more specific MRLs can be derived, provided that a higher MRL does not pose a risk to the consumer. This higher MRL is derived on the basis of the ALARA principle (As Low As Reasonably Achievable). This means that the biocide monitoring data on residues must be based on biocidal use in accordance with the use instructions. The risk assessment is carried out by EFSA.
- For biocidal active substances for which an MRL is considered necessary, and which cannot be classified as FCM, PPP or VMP, an ML can be derived in accordance with the legislation for contaminants or feed. To this end, as much monitoring data as possible needs to be collected for the foodstuffs and/or feeds in which biocides are expected to occur. On the basis of this data, the EU Commission will decide on a possible ML.

MRLs derived under the RRPPP

Under the RRPPP, for many substances a standard default value of 0.01* mg/kg is set as MRL. The addition of the '*' means that the concentration should be lower than the LOQ of the analytical method. In this report, we used a database with MRLs where the '*' is not included. Therefore, the '*' is not used in our texts and tables. The standard default value is not based on a risk assessment.

As mentioned above, specific MRLs derived in view of the use of PPP are based on the ALARA principle. Besides, the MRL may not result in lifelong exposure of consumers above the ADI (Acceptable Daily Intake), and short-term exposure may not exceed the ARfD (Acute Reference Dose).

Under the RRPPP (Art 5), active substances can also be listed as 'No MRL required'. The following should be taken into account:
- the use of the active substance;
- the scientific and technical knowledge available;
- the result of an assessment of any potential risks to consumers with a high intake and high vulnerability and, where appropriate, to animals;
- the results of any evaluations and decisions to modify the use of plant protection products.

The EC provided a guidance document (EC, 2015b) including criteria to assess whether an MRL is required for a PPP or not. In summary, these criteria are (see the guidance document for exact details):

1. The active substance is approved as a basic substance under Regulation (EC) No 1107/2009. Basic substances are, by definition, substances of no concern that do not have an inherent capacity to cause adverse effects on humans, such as endocrine disrupting, neurotoxic, or immunotoxic effects.
2. The compound is listed in Annex I of Regulation (EC) No 396/2005, Active substances that fulfil the criteria of a `foodstuff` are listed as a food or feed commodity in the afore-mentioned Annex I. This criterion only applies to the unprocessed food or feed or to food and feed items that were subject to simple mechanical processing or purification (i.e. milling and grinding).
3. The compound has no identified hazardous properties. This criterion can apply to micro-organisms, chemicals, and natural materials.
4. The consumer exposure to the compound linked to use as PPP is considered negligible compared to other uses in the food chain and/or natural background. The natural exposure is higher than the one linked to the use as PPP.
5. Alternatively, no consumer exposure is forecast linked to the mode of application of the PPP.
6. Case-by-case decisions.

MRLs derived under the RRVMP

The MRLs derived in view of the use of VMP are based on a food basket that represents worst-case consumer exposure by assuming the daily consumption of 0.5 kg of meat (muscle, liver, kidney and fat), 100 g of eggs, 1.5 litre of milk, and 20 g of honey by a 60 kg person. MRLs for VMP are in place to determine withdrawal periods. In a residue depletion study, the point in time at which the residues in all tissues are at or below the MRL must be examined. MRLs are also in place for monitoring, i.e. they are used to check whether the meat, milk or eggs are safe for human consumption.

For VMP use, in cases where no significant residues in animal products such as meat, milk, or eggs are expected, a ‘No MRL required’ status is given. In such cases, it is not necessary to have MRLs for monitoring, because it is expected that the consumer exposure to residues will always remain at safe levels (even if the animals are slaughtered immediately after administration of the VMP). Previously, this status was also given to substances that sometimes required a withdrawal period before slaughter, but obtained this status, for instance, because they were used on a limited number of animals, or because animals were not expected to be sent to slaughter immediately. Nowadays, a ‘No MRL required’ status is only obtained if no significant residues are expected upon immediate slaughter (no withdrawal period applies).

The current MRLs for salicylic acid show that this underpinning based on VMP use can bring about a confusing situation. When using a VMP with salicylic acid as active substance, no residues are expected (according to the EMA evaluation), so there is a ‘No MRL required’ status in Regulation No 37/2010 (EC, 2009). This applies ‘for topical use only’. However, when using, for example, aluminium salicylate as an active substance, it

is considered necessary to have MRLs for monitoring salicylic acid as the marker residue. These MRLs are set to control the amount of salicylic acid residues in meat or milk. Withdrawal periods will be set accordingly. The result is that salicylic acid has the status 'No MRL required' when used topically as an active substance, and at the same time has an MRL for milk of 0.009 mg/kg when administered as the active substance aluminium salicylate. All in all, when monitoring, the residues of the marker residue salicylic acid should be below the MRL for the respective species and commodity, irrespective of the form of the active substance and/or VMP used.

Guidance for MRLs for biocides

Biocides used in animal husbandry: EMA has drawn up a guidance for deriving MRLs for biocides (EMA, 2015). This document presents the approach taken for performing MRL evaluations for pharmacologically active substances included in biocidal products for use in animal husbandry. It provides guidance on the type of data required in relation to the dietary risk assessment and MRL evaluation.

Biocides previously or currently used as PPP: According to the interim approach from 2017, EFSA should carry out the risk assessment if the default MRL of 0.01 mg/kg is exceeded due to biocidal use for active substances that were previously or are currently used as PPP. EFSA has not drawn up a guideline for deriving MRLs for biocides yet.

Other biocides: For biocidal active substances for which an MRL is considered necessary and which cannot be classified as FCM, PPP or VMP, an ML can be derived in accordance with the legislation for contaminants or feed. If this is the case, the EU Commission will decide on a possible ML.

Developments from 2021

In 2021 the EC issued an update of the interim approach from 2017 (EC, 2021). It was decided to extend the interim approach by three more years. This document describes the developments since 2017, such as:

- Temporary MRLs for chlorate in food have been set.
- The Standing Committee on Plants, Animals, Food and Feed (SCoPAFF) agreed on 'reference values for intra EU trade' for the substances DEET and icaridine. These have been determined for various plant products where the biocides end up in the food during picking/harvesting. No values have been established for meat or dairy.
- '*Taking into account the experience and developments in the period of three years after the adoption of the interim MRL approach, it can be concluded that the interim approach is properly functioning in relation to the establishment of levels by legislation concerning veterinary medicinal products, plant protection products and contaminants. However, it is clear that there is a need to further align and improve the interaction between the legislation for food contact materials and biocides.*' (EC, 2021).

MRLs specific to biocidal use

The MRLs for chlorate were set in 2020 (EC, 2020b). Chlorate was found to be present in food at concentrations above the TDI (Tolerable Daily Intake) in certain subgroups of the population, such as infants and young children with mild to moderate iodine deficiency. The MRLs are based on the ALARA principle. For meat products, these MRLs range between 0.05 and 0.1 mg/kg and for milk they are 0.1 mg/kg. For food for infants and toddlers, it has been decided to leave the MRL for chlorate at the standard value of 0.01 mg/kg.

Not only attention has been paid to chlorate, DEET and icaridine from biocidal use in recent years, but also to quats. During routine checks, concentrations above 0.01 mg/kg were measured, while these substances are no longer permitted as PPP. Subsequently, MRLs were derived on the basis of monitoring data and set in 2023 (EC, 2023a). They relate to specific values for BAC (benzalkonium chloride; 0.1 mg/kg and DDAC (didecyldimethylammonium chloride; 0.05 mg/kg). For quats, there is confusion about the correct MRL, as the MRL regulations for PPP include broad groups with a default MRL of 0.01* mg/kg, while there are also specific higher MRLs for substances that also appear in this broad group (see Annex 3 for more details).

Developments from 2024

In September 2024, the EC presented a new document on the setting of MRLs for biocides, which was agreed in the CA meeting (EC, 2024). We discuss some parts of this document:

- Point (10) is about substances with specific MRLs. It states: *'When specific MRLs have been established for residues of the active substance(s) it can be assumed that there is no consumer risk if the residue levels resulting from the biocidal use remain below these MRLs. Compliance with these MRLs needs to be estimated and evaluated in the application and evaluation of the biocidal product authorisation. If an exceedance of those MRLs is expected from the use of the product, the product cannot be authorised as food commodities will be non-compliant with the relevant applicable legislation on MRLs and cannot be made available on the market. Further consideration is required to decide if such MRL needs to be modified to take into account the overall exposure by use as VMP and/or PPP and biocidal use before the authorisation may be granted'*. To us, this seems a logical approach. However, there is a bottleneck when the overall exposure to the active substance in question is higher than the ADI or the ARfD. If, for example, the exposure to a VMP cannot be changed, it is unclear whether the exposure to a PPP should be changed (e.g. by using an alternative label resulting in lower residues or by removing one or more uses from the label) to make residues resulting from the exposure to a biocide possible. Which part of the ADI or ARfD is available for exposure to residues of PPP, VMP and/or biocides?
- Point (12)b is about active substances for which no setting or revision of current MRLs seems necessary as they have been examined under relevant EU legislation. This applies to substances that have the status 'No MRL required' under the

RRPPP and/or the RRVMP (Categories II, III, and IV in the EC document). As explained above, substances assessed under the RRVMP can have the status ‘No MRL required’ if no significant residues are expected due to the specific use of the VMP. This does not tell us anything about any residues resulting from biocidal use. Substances assessed under the RRPPP can also have the status ‘No MRL required’. One reason can be that no consumer exposure is forecast in connection to the mode of application of the PPP. Because the status ‘No MRL required’ is assessed in connection to PPP or VMP use, this does not have to be the same for biocidal use.

- Point (12)c is about alignment between MRLs derived under the RRPPP and under the RRVMP, if there are differences. We agree that there should only be one MRL per type of food. But this MRL should take uses as PPP, VMP and biocide into account. However, biocidal use is not mentioned in this statement.
- In some instances, the document states that existing or default MRLs may need to be revised. However, a procedure to do so is lacking. Existing (default) MRLs are in force and biocides cannot be authorised if they leave residues below the ADI and the ARfD on the basis of worst-case consumer exposure, but above existing legally binding MRLs.
- Another element that appears to be missing is that some foodstuffs may be exposed to more than one biocide application. For example, a disinfectant may be used in drinking water for livestock, for disinfection of teats or stables, and in the food processing industry.

Annex 8 Dutch MRLs for biocides

Table A8.1 Dutch MRLs for residues of active substances from biocides (source: Warenwetregeling residuen van bestrijdingsmiddelen, 2024).

Pesticide, component thereof or transformation product	**Transformation products included in maximum permitted levels**	**Maximum residue levels expressed as**	**Maximum permitted residue levels (mg/kg)**	
Chloramine – T	p-toluene-sulfonamide	p-toluene-sulfonamide	see sodium-p-toluenesulfon-chloramide	
P-chloro-m-cresol	no	p-chloro-m-cresol	all	0.1*
Cloquintocete-mexyl	5-chloro-8-quino-linyloxy-acetic acid	cloquintocete-mexyl	all	0.1*
Cresols	no	cresol	all	0.1*
N,N-dialkyldichloro-acetamide	no	N,N-dialkyldichloro-acetamide	all	0.05*
Dichloro-isocyanuric acid	isocyanuric acid	isocyanuric acid	see isocyanuric acid	
Fenchlorazole-ethyl	no	fenchlorazole-ethyl	all	0.1*
Isocyanuric acid	no	isocyanuric acid	all	1*
Iodine	iodide	iodine	milk	0.3
Bromoacetic acid	no	bromoacetic acid	all	0.05*
Sodium-p-toluenesulfon-chloramide	p-toluenesulfon-amide	p-toluenesulfon-amide	all	0.1*[1]
Peracetic acid	no	peroxide	see peroxide	
Peroxide	no	peroxide	all	1*[1]
Piperonyl-butoxide	no	piperonyl-butoxide	others	0.05*[2]
Quaternary ammonium compounds	no	cetryltrimethyl-ammonium-chloride	all	0.5*[1]
Trichloro-isocyanuric acid	no	isocyanuric acid	see isocyanuric acid	
Hydrogen peroxide	no	peroxide	see peroxide	

1) Only applies to residues resulting from use as a biocide.
2) There are specific Dutch MRLs for nuts, other fruits, vegetables, grains, oilseeds, and tropical seeds, between 1 and 10 mg/kg.

The indication * after a permissible amount means that a pesticide may only be used without leaving a demonstrable residue in a food or drink. The specified value, which indicates the LOQ of the analysis method at the time, is considered to be the highest concentration at which this requirement is still considered to be met.

Annex 9 Available MRLs for active substances in PT03, PT04, PT05, PT14, PT18, and PT19

Information on MRLs was gathered from the following sources:

- A non-public EFSA database (the Legal Limits Data Base: LLDB; latest version, 2023, downloaded 7 October 2024).
- The public EU Pesticides Database, accessed via the active substances[32]. After selecting an active substance, there is either the text 'Default MRL of 0.01 mg/kg according to Art 18(1)(b) Reg 396/2005.' or a link to the available MRLs in the EU Pesticides Database on Pesticide residues[33].
- The Commission Regulation (EU) No 37/2010 (EC, 2009) for MRLs derived in view of the use of VMP.

Art 18(1)(b) of Regulation 396/2005 says that food products shall not contain any pesticide residue exceeding '0.01 mg/kg for those products for which no specific MRL is set out in Annexes II or III, or for active substances not listed in Annex IV…'. Annex II lists specific MRLs, Annex III lists temporary MRLs, and Annex IV lists substances for which no MRL is required. Art 3(2)(c) of Regulation 396/2005 defines 'pesticide residues' as residues, including active substances, metabolites, and/or breakdown or reaction products of active substances currently or formerly used in PPP.

In a first step, the information on MRLs for active substances in biocides was gathered from the LLDB. This database should include all available MRLs derived for PPP and VMP. The substance names used by EFSA and EMA are not always the same as the substance names used by ECHA for biocides, so substance names could not be used as identifiers to link both databases. The LLDB does not use CAS numbers to identify substances. Instead, this database uses ParamCodes to identify the active substances. We used the ParamCatalogue from EFSA[34] to link the ParamCodes to the corresponding CAS numbers and substance names in the ECHA database. The ParamCodes for animal products have been selected to find available MRLs for meat and dairy products.

When we looked at the results, we appeared to have overlooked MRLs. We linked CAS numbers to ParamCodes that were not included in the LLDB, so there seemed to be no MRLs for the active substance with that CAS number. But from other sources we knew that there are MRLs for some of these active substances. When searching by the name of the active substance in the LLDB, we could find MRLs linked to other ParamCodes than those we had found linked to our CAS numbers. For example:

- The CAS number for permethrin is linked to the ParamCode RF-00012330-PAR. But in the LLDB, the ParamCode linked to permethrin is RF-0842-001-PPP. This way, we overlooked the MRLs for permethrin.

[32] See: https://ec.europa.eu/food/plant/pesticides/eu-pesticides-database/start/screen/active-substances
[33] See: https://ec.europa.eu/food/plant/pesticides/eu-pesticides-database/start/screen/mrls/searchpr
[34] EFSA publishes all catalogues here: https://zenodo.org/records/344473

- The CAS number for cypermethrin is linked to the ParamCode RF-0112-004-PPP. The CAS number for alpha-cypermethrin is linked to the ParamCode RF-0000161-VET. In the LLDB, the ParamCode RF-0112-001-PPP was used for cypermethrin (cypermethrin including other mixtures of constituent isomers (sum of isomers)). Because of these different ParamCodes, we also overlooked these MRLs.

There were differences in the ParamCodes linked to the CAS numbers and the ParamCodes linked to the MRLs for the same substance. Besides, the LLDB does not appear to be fully complete and up to date. We noticed for example:

- For active chlorine generated from sodium chloride by electrolysis, the default MRL is not included in the LLDB. However, the EU Pesticides Database, accessed via the active substance states: 'Default MRL of 0.01 mg/kg according to Art 18(1)(b) Reg 396/2005'.
- For a number of active substances, the LLDB refers to Commission Directive (EC) No 141/2006 for an MRL of 0.01 mg/kg for infant formulae and food for infants and young children. However, this directive expired per 21 February 2022.
- For pyriproxyfen, the LLDB does not give the applicable MRLs from Regulation (EU) 2023/1753, but the previous ones from Regulation (EU) 2023/679 instead.
- For salicylic acid for several MRLs, the LLDB refers to the Commission Implementing Regulation (EU) 2015/1308, which has expired per 31 December 2016. For some MRLs, the correct reference to Commission Implementing Regulation (EU) 2016/2074 is given.
- The LLDB does not provide information on active substances that have the status 'No MRL required', which is relevant to our study.

Because we were not able to derive all available MRLs from the LLDB and because this information does not seem fully accurate, we decided to search for MRLs in the EU Pesticides Database, accessed via the active substances. This database cannot be searched by CAS numbers. We decided to check the MRLs in this database by searching for the active substances by name. This way, we may have overlooked some MRLs if the substance name used by EFSA differs from the substance name used by ECHA.

As there is no public database with MRLs derived in view of the use of VMP, we consulted the latest version, dated April 2024, of Commission Regulation (EU) No 37/2010 (EC, 2009) for this information. The MRLs are set in Commission Implementing Regulations and they are subsequently included in the Commission Regulation (EU) No 37/2010. We checked the MRLs in this Regulation by searching for the active substances by name, because this is the only identifier it uses. As described above, we may have overlooked some MRLs due to differences in the substance names used by EMA and by ECHA.

As mentioned earlier, Commission Directive (EC) No 141/2006 which sets an MRL of 0.01 mg/kg for infant formulae and food for infants and young children has expired per 21 February 2022. The Commission

Delegated Regulation (EU) 2016/127 (version 17.03.2023) (EC, 2015a) includes requirements for pesticides in infant formulae and follow-on formulae. For pesticide residues (from PPP), this regulation refers to Regulation (EC) No 396/2005. Article 4(2) of Regulation (EU) 2016/127 states that 'Infant formulae and follow-on formulae shall not contain residues at levels exceeding 0.01 mg/kg per active substance'. For some specific active substances from PPP, an MRL of 0.003 mg/kg is applicable (Art. 4(4)), but none of them is also an active substance in the biocides we studied in this project.

In Table A9.1 below, we do not refer to Regulation 2016/127 as an MRL of 0.01 mg/kg for infant and follow-on formulae applies to all active substances currently or formerly used in PPP.

In September 2024, the EC provided a Note for agreement on the setting of MRLs for biocides for the CA meeting (meeting of the Competent Authorities for biocides of the EU Member States) (EC, 2024). This document refers to an Excel file containing a list developed by ECHA of biocidal active substances and their status regarding the setting of MRLs (document CA-Sept24-Doc.7.2.a[35]). We could not use this Excel file to check our results on MRLs for biocides, because:

- The name of the active substances used in the Excel file sometimes differs from the name used in the ECHA database on active substances in biocides. Adding CAS numbers would be very helpful. For example, DMPAP is mentioned, but this abbreviation cannot be found in the ECHA database. The ECHA database only contains the full name for DMPAP (reaction mass of N,N-didecyl-N-(2-hydroxyethyl)-N-methylammonium propionate and N-N-didecyl-N-(2-(2-hydroxyethoxy)ethyl)-N-methylammonium proprionate and N,N-didecyl-N-(2-(2-(2-hydroxyethoxy)ethoxy)ethyl)-N-methylammonium proprionate).
- The PTs are not always complete. For example, only PT11 and PT12 are mentioned for active chlorine released from sodium hypochlorite. However, this substance is also approved for PT01 to PT05. Only PT9 and PT10 are mentioned for biphenyl-2-ol. However, the substance is also approved for PT01 to PT04, PT06, and PT13.
- Some substances are missing, such as warfarin and (E)-1-(2-chloro-1,3-thiazol-5-ylmethyl)-3-methyl-2-nitroguanidine (clothianidin).
- The indicated MRLs for meat and milk are not always correct. For example, the MRLs for cypermethrin and alpha-cypermethrin are not specified per animal species, while different MRLs apply to chickens than to other animal species. For cyfluthrin, the Excel file contains different MRLs from those included in Regulation (EU) 2023/173, which is applicable according to the EU Pesticides Database. For cyromazine, some MRLs that are listed in Regulation (EU) 2023/147 are missing in the Excel file. For S-methoprene, there are differences per animal species, but this is not stated in the Excel file. The MRL for milk is also missing in the Excel file for this substance. For thiamethoxam, the MRL for

[35] See: https://circabc.europa.eu/ui/group/e947a950-8032-4df9-a3f0-f61eefd3d81b/library/121172fd-ef2e-4ca9-b5cc-c7b2bdfd2839/details

milk in the Excel file is 0.01 mg/kg, but Regulation (EU) 2017/671 states 0.05 mg/kg and this is applicable according to the EU Pesticides Database.
- Sometimes, MRLs may have been overlooked because EFSA uses a different name for the same substance. For example, the MRLs for biphenyl-2-ol were overlooked, because EFSA lists this substance under the name 2-phenylphenol. MRLs for this substance are available in Regulation (EU) 2018/78.
- Sometimes, there is a 'no' for MRLs for PPP, but then, the EU Pesticides Database states 0.01 mg/kg according to Regulation 396/2005. This applies to cholecalciferol and sodium hypochlorite (if this is the same as active chlorine released from sodium hypochlorite). For the various ADBAC variants, the MRL for BAC applies, but the Excel file, always states 'no' for MRLs.

The above observations clearly show that it is not easy to draw up a complete and correct list of MRLs for active substances in biocides. We cannot guarantee that our information is completely accurate and up to date either (see Section 1.4).

Table A9.1 gives an overview of the available MRLs for meat and milk for biocidal active substances allowed in the selected PTs for this study. If no MRLs were available for meat and/or milk, the active substances are not included in this table. As explained above, the MRL of 0.01 mg/kg for infant and follow-on formulae applies to all active substances currently or formerly used in PPP. This is not listed in Table A9.1 either. If the consulted sources say 'No MRL required', this is included in the table as 'not required' in the column on MRLs.

Note: the information in this annex was extracted from the above-mentioned sources in the course of 2024. The information changes over time. If this information is used for decision-making, please ensure that the information is still up to date and correct.

Table A9.1 Overview of the available MRLs for meat and milk for biocidal active substances allowed for PT03, PT04, PT05, PT14, PT18, and/or PT19 an active substances listed in Annex I of the BPR.

Active substance name from ECHA database	**CAS no.**	**PT or Annex I of BPR**	**Param Code**	**ProdName***	**MRL** (mg/kg)	**Regulation**
(+)-Tartaric acid [5]	87-69-4	Annex I	N/A	ALL	Not required (for use as excipient)	Commission Regulation (EU) No 37/2010 (08.04.2024) [5]
(13Z)-Hexadec-13-en-11-yn-1-yl acetate	78617-58-0	19	RF-00009593-PAR	ALL	0.01	Regulation (EC) No 396/2005 (amended)
(9Z,12E)-tetradeca-9,12-dien-1-yl acetate	30507-70-1	Annex I	N/A	ALL	Not required	Regulation (EU) 2023/1719
(E)-1-(2-Chloro-1,3-thiazol-5-ylmethyl)-3- methyl-2-nitroguanidine (Clothianidin)	210880-92-5	18	RF-0101-001-PPP	Fat, kidney, muscle (swine, bovine, sheep, goat, equine, other farm animals)	0.02	Reg. (EU) 2017/671
				Liver, edible offals (swine, bovine, sheep, goat, equine, other farm animals)	0.2	
				Other products (swine, bovine, sheep, goat, equine, other farm animals)	0.01	
				Fat, kidney, other products, muscle (poultry)	0.01	
				Liver, edible offals (poultry)	0.1	
				Milk (cattle, sheep, goat, horse, other species)	0.02	
				Terrestrial invertebrate animals	0.01	

Active substance name from ECHA database	**CAS no.**	**PT or Annex I of BPR**	**Param Code**	**ProdName***	**MRL** (mg/kg)	**Regulation**
(RS)-α-cyano-3-phenoxybenzyl-(1RS)-cis, trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate (Cypermethrin)	52315-07-8	18	RF-0112-001-PPP	Muscle, fat (swine, bovine, sheep, goat, equine)	2	Regulation (EU) 2017/626
				Liver, kidney, edible offals, others (swine, bovine, sheep, goat, equine, other farmed terrestrial animals)	0.2	
				Muscle, fat (poultry)	0.1	
				Liver, kidney, edible offals, others (poultry)	0.05	
				Muscle, fat (other farmed terrestrial animals)	0.2	
				Milk (cattle, sheep, goat, horse, others)	0.05	
				Muscle, liver, kidney, milk (all ruminants)	0.02	Commission Regulation (EU) No 37/2010 (08.04.2024)
				Fat (all ruminants)	0.2	

Active substance name from ECHA database	CAS no.	PT or Annex I of BPR	Param Code	ProdName*	MRL (mg/kg)	Regulation
[1.alpha.(S*),3.alpha.]-(.alpha.)-cyano-(3-phenoxyphenyl)methyl3-(2,2-dichlor-oethenyl)-2,2-dichlorovinyl)-2,2-dimethyl-cyclopropanecarboxylate (alpha-Cypermethrin); [1α(S*),3α]-(α)-cyano-(3-phenoxyphenyl)methyl3-(2,2-dichlor-oethenyl)-2,2-dichlorovinyl)-2,2-dimethyl-cyclopropanecarboxylate (αCypermethrin) [4]	67375-30-8	18	RF-0112-001-PPP	Muscle, fat (swine, bovine, sheep, goat, equine)	2	Regulation (EU) 2017/626
				Liver, kidney, edible offals, others (swine, bovine, sheep, goat, equine, other farmed terrestrial animals)	0.2	
				Muscle, fat (poultry)	0.1	
				Liver, kidney, edible offals, others (poultry)	0.05	
				Muscle, fat (other farmed terrestrial animals)	0.2	
				Milk (cattle, sheep, goat, horse, others)	0.05	
				Muscle, liver, kidney, milk (bovine, ovine)	0.02	Commission Regulation (EU) No 37/2010 (08.04.2024) [4]
				Fat (bovine, ovine)	0.2	
1-(3,5-dichloro-4-(1,1,2,2-tetrafluoroethoxy)phenyl)-3-(2,6-difluorobenzoyl) urea (Hexaflumuron)	86479-06-3	18	RF-0738-001-PPP	ALL	0.01	Regulation (EC) No 396/2005 (amended)
2-(2-butoxyethoxy)ethyl 6-propylpiper-onyl ether (Piperonyl butoxide/PBO)	51-03-6	18	N/A	Bovine, ovine, caprine, equidae	Not required (for topical use only)	Commission Regulation (EU) No 37/2010 (08.04.2024)
1R-trans phenothrin	26046-85-5	18	RF-0335-001-PPP	Muscle, fat, liver, kidney, edible offals, others (swine, bovine, sheep, goat, equine, poultry, other farmed terrestrial animals) and milk (cattle, sheep, goat, horse, others)	0.05	Regulation (EU) 2015/868

Active substance name from ECHA database	**CAS no.**	**PT or Annex I of BPR**	**Param Code**	**ProdName***	**MRL** (mg/kg)	**Regulation**
4-bromo-2-(4-chlorophenyl)-1-ethoxy- methyl-5-trifluoromethylpyrrole-3-carbonitrile (Chlorfenapyr)	122453-73-0	18	RF-0077-001-PPP	MRLs for plant commodities only MRLs for animal commodities not listed [17]	-	Regulation (EC) No 899/2012
Acetamiprid	135410-20-7	18	RF-0014-001-PPP, RF-00003326-PAR	Muscle (swine, bovine, sheep, goat, equine, other farmed terrestrial animals)	0.5	Regulation (EU) 2019/88
				Fat (swine, bovine, sheep, goat, equine, other farmed terrestrial animals)	0.3	
				Liver, kidney, edible offals (swine, bovine, sheep, goat, equine, other farmed terrestrial animals)	1	
				Others (swine, bovine, sheep, goat, equine, other farmed terrestrial animals) and muscle, fat, edible offals, others (poultry)	0.02	
				Liver, kidney (poultry)	0.1	
				Milk (cattle, sheep, goat, horse, others)	0.2	
Acetic acid	64-19-7	Annex I	RF-00000019-ADD	ALL	Not required	Regulation (EU) 2022/476

Active substance name from ECHA database	**CAS no.**	**PT or Annex I of BPR**	**Param Code**	**ProdName***	**MRL** (mg/kg)	**Regulation**
Active chlorine generated from sodium chloride by electrolysis	-	03 04 05	N/A	ALL	0.01	Regulation (EC) No 396/2005 (amended) for active chlorine
			RF-00000015-CHE	Muscle, liver, kidney, edible offals, others (swine, bovine, sheep, goat, equine, poultry, other farmed terrestrial animals)	0.05	Regulation (EC) No 2020/749 for chlorate [12]
				Fat (swine, bovine, sheep, goat, equine, poultry, other farmed terrestrial animals) and milk (cattle, sheep, goat, horse, others)	0.1	
Active chlorine released from sodium hypochlorite	7681-52-9	03 04 05	RF-00005775-PAR	ALL	0.01	Regulation (EC) No 396/2005 (amended) for active chlorine
			RF-00000015-CHE	Muscle, liver, kidney, edible offals, others (swine, bovine, sheep, goat, equine, poultry, other farmed terrestrial animals)	0.05	Regulation (EC) No 2020/749 for chlorate [12]
				Fat (swine, bovine, sheep, goat, equine, poultry, other farmed terrestrial animals) and milk (cattle, sheep, goat, horse, others)	0.1	

Active substance name from ECHA database	**CAS no.**	**PT or Annex I of BPR**	**Param Code**	**ProdName***	**MRL** (mg/kg)	**Regulation**
Alkyl (C12-16) dimethylbenzylammonium chloride (ADBAC/BKC (C12-16)) [9]	68424-85-1	03 04	RF-1078-004-PPP (BAC 12); RF-1078-005-PPP (BAC 14); RF-1078-006-PPP (BAC 16) RF-00012321-PAR (BAC)	ALL	0.1	Regulation EC 2023/377 for benzalkonium chloride
Alkyl (C12-18) dimethylbenzylammonium chloride (ADBAC (C12-18)) [9]	68391-01-5	03 04	RF-1078-004-PPP (BAC 12); RF-1078-005-PPP (BAC 14); RF-1078-006-PPP (BAC 16); RF-1078-007-PPP (BAC 18) RF-00012321-PAR (BAC)	ALL	0.1	Regulation EC 2023/377 for benzalkonium chloride
Alkyl (C12-C14) dimethylbenzylammonium chloride (ADBAC (C12-C14)) [9]	85409-22-9	03 04	RF-1078-004-PPP (BAC 12); RF-1078-005-PPP (BAC 14); RF-00012321-PAR (BAC)	ALL	0.1	Regulation EC 2023/377 for benzalkonium chloride
Alphachloralose	15879-93-3	14	N/A	ALL	0.01	Regulation (EC) No 396/2005 (amended)
Aluminium phosphide releasing phosphine	20859-73-8	14 18	N/A	ALL	0.01	Regulation (EU) 2016/1785
Arnica montana, ext.	68990-11-4	Annex I	N/A	ALL	Not required (for topical use only)	Commission Regulation (EU) No 37/2010 (08.04.2024)
Ascorbic acid	50-81-7	Annex I	RF-00000319-NTR	ALL	Not required	Regulation (EU) 588/2014

Active substance name from ECHA database	**CAS no.**	**PT or Annex I of BPR**	**Param Code**	**ProdName***	**MRL** (mg/kg)	**Regulation**
Bacillus amyloliquefaciens	-	03	RF-00012873-PAR	ALL	Not required	Regulation (EU) 2023/1030
Bacillus sphaericus 2362, strain ABTS-1743	143447-72-7	18	N/A	ALL	0.01	Regulation (EC) No 396/2005 (amended)
Bacillus thuringiensis subsp. israelensis Serotype H14, Strain AM65-52	-	18	N/A	ALL	0.01	Regulation (EC) No 396/2005 (amended)
Bacillus thuringiensis subsp. kurstaki, strain ABTS-351	-	18	N/A	ALL	0.01	Regulation (EC) No 396/2005 (amended)
Baculovirus	-	Annex I	N/A	ALL	0.01	Regulation (EC) No 396/2005 (amended)
Benzoic acid	65-85-0	03 04	RF-00000052-ADD	ALL	Not required	Regulation (EC) No 839/2008
Biphenyl-2-ol	90-43-7	03 04	RF-0823-001-PPP	Liver, kidney, edible offals, tissues, fat, muscle, other products (swine, bovine, sheep, goat, equine, poultry, other farm animals) and milk (cattle, sheep, goat, horse, other species)	0.01	Reg. (EU) 2018/78
Brodifacoum	56073-10-0	14	RF-0510-001-PPP	ALL	0.01	Regulation (EC) No 396/2005 (amended)
Bromadiolone	28772-56-7	14	RF-00002596-PAR	Liver, kidney, edible offals, tissues, fat, muscle, other products (swine, bovine, sheep, goat, equine, poultry, other farm animals) and milk (cattle, sheep, goat, horse, other species)	0.01	Reg. (EU) 2019/89

Active substance name from ECHA database	**CAS no.**	**PT or Annex I of BPR**	**Param Code**	**ProdName***	**MRL** (mg/kg)	**Regulation**
Calcium dihydroxide/calcium hydroxide/caustic lime/hydrated lime/slaked lime	1305-62-0	03	RF-00000079-ADD	ALL	Not required	Regulation (EU) 2016/143
				ALL	Not required	Commission Regulation (EU) No 37/2010 (08.04.2024)
Calcium oxide/lime/burnt lime/quicklime	1305-78-8	03	RF-00000010-CHE	ALL	0.01	Regulation (EC) No 396/2005 (amended)
				ALL	Not required	Commission Regulation (EU) No 37/2010 (08.04.2024)
Carbon dioxide	124-38-9	Annex I	RF-00000094-ADD	ALL	Not required	Regulation (EC) 839/2008
Chlorine dioxide	10049-04-4	03 04 05	RF-00010068-PAR	ALL	0.01	Regulation (EC) No 396/2005 (amended)
			RF-00000015-CHE	Muscle, liver, kidney, edible offals, others (swine, bovine, sheep, goat, equine, poultry, other farmed terrestrial animals)	0.05	Regulation (EC) No 2020/749 for chlorate [12]
				Fat (swine, bovine, sheep, goat, equine, poultry, other farmed terrestrial animals) and milk (cattle, sheep, goat, horse, others)	0.1	
Chlorocresol	59-50-7	03	RF-00000025-ORG	ALL	Not required	Commission Regulation (EU) No 37/2010 (08.04.2024)
Chlorophacinone	3691-35-8	14	N/A	ALL	0.01	Regulation (EC) No 396/2005 (amended)

Active substance name from ECHA database	**CAS no.**	**PT or Annex I of BPR**	**Param Code**	**ProdName***	**MRL** (mg/kg)	**Regulation**
Cholecalciferol [1]	67-97-0	14	RF-00000051-NTR	ALL	0.01	Regulation (EC) No 396/2005 (amended)
				ALL	Not required	Commission Regulation (EU) No 37/2010 (08.04.2024) [1]
Chrysanthemum cinerariaefolium extract from open and mature flowers of Tanacetum cinerariifolium obtained with supercritical carbon dioxide [8]	89997-63-7	18 19	N/A	ALL	Not required (for topical use only)	Commission Regulation (EU) No 37/2010 (08.04.2024) [8]
Cis-tricos-9-ene (Muscalure)	27519-02-4	19	N/A	ALL	0.01	Regulation (EC) No 396/2005 (amended)
Citronellal	106-23-0	Annex I	N/A	ALL	Not required	Regulation (EC) No 839/2008
Copper	7440-50-8	05	RF-0102-001-PPP	Muscle, fat, others (swine, bovine, sheep, goat, equine, poultry, other farmed terrestrial animals)	5	Regulation (EC) No 149/2008
				Liver, kidney, edible offals (swine, bovine, sheep, goat, equine, poultry, other farmed terrestrial animals)	30	
				Milk (cattle, sheep, goat, horse, others)	2	
Coumatetralyl	5836-29-3	14	RF-0572-001-PPP	ALL	0.01	Regulation (EC) No 396/2005 (amended)

Active substance name from ECHA database	**CAS no.**	**PT or Annex I of BPR**	**Param Code**	**ProdName***	**MRL** (mg/kg)	**Regulation**
Deltamethrin	52918-63-5	18	RF-0120-001-PPP	Fat, edible offals (swine, bovine, sheep, goat, equine, other farm animals)	0.5	Reg. (EU) 2018/832
				Liver, kidney, muscle (swine, bovine, sheep, goat, equine, other farm animals)	0.03	
				Other products (swine, bovine, sheep, goat, equine, other farm animals)	0.02	
				Fat (poultry)	0.1	
				Liver, kidney, edible offals, other products, muscle (poultry)	0.02	
				Milk (cattle, sheep, goat, horse, other species)	0.05	
				Terrestrial invertebrate animals	0.02	
				Muscle, liver, kidney (ovine, caprine, bovine)	0.01	Commission Regulation (EU) No 37/2010 (08.04.2024)
				Fat (ovine, caprine, bovine)	0.05	
				Milk (ovine, caprine, bovine)	0.02	
D-Fructose	57-48-7	Annex I	N/A	ALL	Not required	Regulation (EU) 2016/143
Didecyldimethylammonium chloride (DDAC (C8-10))	68424-95-3	03 04	RF-1078-002-PPP (DDAC 8); RF-00007627-PAR (DDAC 10);	ALL	0.1	Regulation (EU) 2023/377 for didecyldimethylammonium chloride (DDAC)
Didecyldimethylammonium chloride (DDAC)	7173-51-5	03 04	RF-00007627-PAR (DDAC 10);	ALL	0.1	Regulation (EU) 2023/377 for didecyldimethylammonium chloride (DDAC)

Active substance name from ECHA database	**CAS no.**	**PT or Annex I of BPR**	**Param Code**	**ProdName***	**MRL** (mg/kg)	**Regulation**
Difenacoum	56073-07-5	14	RF-0617-001-PPP	ALL	0.01	Regulation (EC) No 2024/345
Difethialone	104653-34-1	14	N/A	ALL	0.01	Regulation (EC) No 396/2005 (amended)
Diflubenzuron	35367-38-5	18	RF-0134-001-PPP	ALL	0.01	Regulation (EU) 2019/91
Dinotefuran	165252-70-0	18	RF-0633-001-PPP	Liver, kidney, edible offals, muscle (swine, bovine, sheep, goat, equine, other farm animals)	0.1	Reg. (EU) No 491/2014
				Liver, kidney, edible offals, muscle (poultry)	0.02	
				Milk (cattle, sheep, goat, horse, other species)	0.1	
Ethanol	64-17-5	04	N/A	ALL	0.01	Regulation (EC) No 396/2005 (amended)
				ALL	Not required (for use as excipient)	Commission Regulation (EU) No 37/2010 (08.04.2024)

Active substance name from ECHA database	**CAS no.**	**PT or Annex I of BPR**	**Param Code**	**ProdName***	**MRL** (mg/kg)	**Regulation**
Etofenprox	80844-07-1	18	RF-0168-001-PPP	Fat, edible offals (swine, sheep, goat, other farm animals)	1.5	Regulation EU 2021/590
				Liver, kidney, meat, muscle (swine, sheep, goat, other farm animals)	0.05	
				Other products (swine, sheep, goat, other farm animals, bovine, equine)	0.01	
				Fat, edible offals (bovine, equine)	2	
				Liver, meat, muscle (bovine, equine)	0.06	
				Kidney (bovine, equine)	0.07	
				Fat, edible offals (poultry)	0.04	
				Liver, kidney, meat, muscle other products (poultry)	0.01	
				Milk (cattle, horse)	0.07	
				Milk (sheep, goat, other species)	0.04	
				Terrestrial invertebrate animals	0.01	
Eucalyptus citriodora oil, hydrated, cyclized	1245629-80-4	19	N/A	ALL	0.01	Regulation (EC) No 396/2005 (amended)
Flocoumafen	90035-08-8	14	RF-0696-001-PPP	ALL	0.01	Regulation (EC) No 396/2005 (amended)
Formaldehyde	50-00-0	03	RF-00004538-PAR	ALL	0.01	Regulation (EC) No 396/2005 (amended)
				ALL	Not required	Commission Regulation (EU) No 37/2010 (08.04.2024)

Active substance name from ECHA database	**CAS no.**	**PT or Annex I of BPR**	**Param Code**	**ProdName***	**MRL** (mg/kg)	**Regulation**
Formic acid	64-18-6	03 04 05	N/A	ALL	0.01	Regulation (EC) No 396/2005 (amended)
				ALL	Not required	Commission Regulation (EU) No 37/2010 (08.04.2024)
Garlic, ext.	8008-99-9	19	N/A	ALL	Not required	Regulation (EC) No 839/2008
Geraniol	106-24-1	18 19	N/A	ALL	Not required	Regulation (EU) 2015/896
Glutaral (Glutaraldehyde)	111-30-8	03 04	RF-00008184-PAR	ALL	0.01	Regulation (EC) No 396/2005 (amended)
				ALL	Not required	Commission Regulation (EU) No 37/2010 (08.04.2024)
Glyoxal	107-22-2	03 04	N/A	ALL	0.01	Regulation (EC) No 396/2005 (amended)
Hydrogen peroxide [14]	7722-84-1	03 04 05	N/A	ALL	Not required	Regulation (EU) 2017/1777
				ALL	Not required	Commission Regulation (EU) No 37/2010 (08.04.2024)
Imidacloprid	138261-41-3	18	RF-0250-001-PPP	Liver, kidney, edible offals, tissues, fat, muscle, other products (swine, bovine, sheep, goat, equine, poultry, other farm animals) and milk (cattle, sheep, goat, horse, other species)	0.01	Reg. (EU) 2021/1881
Indoxacarb (enantiomeric reaction mass S:R 75:25)	144171-61-9	18	RF-0251-001-PPP	ALL	0.01	Regulation (EU) 2024/376

Active substance name from ECHA database	**CAS no.**	**PT or Annex I of BPR**	**Param Code**	**ProdName***	**MRL** (mg/kg)	**Regulation**
Iodine	7553-56-2	03 04	N/A	ALL	Not required	Regulation (EU) 2016/439
				ALL	Not required	Commission Regulation (EU) No 37/2010 (08.04.2024)
Iron sulphate	7720-78-7	Annex I	N/A	ALL	Not required	Regulation (EU) 2015/896
				ALL	Not required	Commission Regulation (EU) No 37/2010 (08.04.2024)
Lactic acid [15]	50-21-5	Annex I	RF-00000167-ADD	ALL	Not required	Regulation (EU) 2015/165
				ALL	Not required	Commission Regulation (EU) No 37/2010 (08.04.2024)

Active substance name from ECHA database	CAS no.	PT or Annex I of BPR	Param Code	ProdName*	MRL (mg/kg)	Regulation
Lambda-cyhalothrin [2]	91465-08-6	18	RF-1004-001-PPP	Muscle (swine, goat)	0.15	Regulation (EU) 2021/590
				Fat, edible offals (swine, bovine, sheep, goat, equine, other farmed terrestrial animals)	3	
				Liver (swine, bovine, sheep, goat, equine, other farmed terrestrial animals)	0.05	
				Kidney (swine, bovine, sheep, goat, equine, other farmed terrestrial animals)	0.2	
				Others (swine, bovine, sheep, goat, equine, poultry, other farmed terrestrial animals), muscle, fat, liver, kidney, edible offals (poultry)	0.01	
				Muscle (bovine, sheep, equine, other farmed terrestrial animals) and milk (cattle, sheep, goat, horse, others)	0.02	
				Fat (bovine)	0.5	Commission Regulation (EU) No 37/2010 (08.04.2024) [2]
				Kidney, milk (bovine)	0.05	
Lauric acid	143-07-7	19	N/A	ALL	Not required	Regulation (EC) No 839/2008
Magnesium phosphide releasing phosphine	12057-74-8	18	N/A	ALL	0.01	Regulation (EU) 2016/1785
Margosa extract from cold-pressed oil of the kernels of Azadirachta Indica extracted with super-critical carbon dioxide	84696-25-3	18 19	N/A	ALL	0.01	Regulation (EC) No 149/2008

Active substance name from ECHA database	**CAS no.**	**PT or Annex I of BPR**	**Param Code**	**ProdName***	**MRL** (mg/kg)	**Regulation**
Methyl nonyl ketone [3]	112-12-9	19	RF-00003707-PAR	ALL	Not required	Regulation (EC) No 839/2008
N-cyclopropyl-1,3,5-triazine-2,4,6-triamine (Cyromazine)	66215-27-8	18	RF-0115-001-PPP	Muscle, fat, kidney, edible offals, others (swine, bovine, goat, equine, poultry, other farmed terrestrial animals)	0.01	Regulation (EU) No 2023/147
				Muscle, fat, liver, kidney, edible offals, others (sheep)	0.3	
				Milk (cattle, sheep, goat, horse, other species)	0.01	
				Terrestrial invertebrate animals	0.01	
				Liver (swine, bovine, goat, equine, poultry, other farmed terrestrial animals)	0.05	
				Muscle, fat, liver, kidney (ovine)	0.3	Commission Regulation (EU) No 37/2010 (08.04.2024)
Nitrogen	7727-37-9	Annex I	RF-00000081-CHE	ALL	0.01	Regulation (EC) No 396/2005 (amended)
Octanoic acid	124-07-2	04 18	RF-00000248-NTR	ALL	Not required	Regulation (EC) No 839/2008
Orange, sweet, ext.	8028-48-6	19	RF-00005784-PAR	ALL	Not required	Regulation (EU) No 588/2014
Ozone generated from oxygen	-	04 05	N/A	ALL	0.01	Regulation (EC) No 396/2005 (amended)
Pentapotassium bis(peroxymonosulphate) bis(sulphate)	70693-62-8	03 04 05	N/A	ALL	0.01	Regulation (EC) No 396/2005 (amended)

Active substance name from ECHA database	CAS no.	PT or Annex I of BPR	Param Code	ProdName*	MRL (mg/kg)	Regulation
Peracetic acid [16]	79-21-0	03 04 05	N/A	ALL	0.01	Regulation (EC) No 396/2005 (amended)
				ALL	Not required	Commission Regulation (EU) No 37/2010 (08.04.2024)
Permethrin	52645-53-1	18	RF-0842-001-PPP	Muscle, liver, kidney, edible offals others (swine, bovine, sheep, goat, poultry), fat (swine, sheep, goat, poultry) and milk (cattle, sheep, goat, horse, others)	0.05	Regulation (EU) No 2017/623
				Fat (bovine)	0.5	
				Muscle, liver, kidney, milk (bovine)	0.05	Commission Regulation (EU) No 37/2010 (08.04.2024)
				Fat (bovine)	0.5	
Polyvinylpyrrolidone iodine	25655-41-8	03 04	N/A	ALL	Not required	Commission Regulation (EU) No 37/2010 (08.04.2024)
Potassium (E,E)-hexa-2,4-dienoate (Potassium Sorbate)	24634-61-5	Annex I	RF-00000248-ADD	ALL	Not required	Regulation (EC) No 2025/581
Powdered egg [11]	-	Annex I	N/A	ALL	0.01	Regulation (EC) No 396/2005 (amended) for eggshell powder
Propan-2-ol [6]	67-63-0	04	RF-00004850-PAR	ALL	0.01	Regulation (EC) No 396/2005 (amended)
				ALL	Not required	Commission Regulation (EU) No 37/2010 (08.04.2024) [6]
Propionic acid	79-09-4	Annex I	RF-00000256-ADD	ALL	0.01	Regulation (EC) No 396/2005 (amended)

Active substance name from ECHA database	**CAS no.**	**PT or Annex I of BPR**	**Param Code**	**ProdName***	**MRL** (mg/kg)	**Regulation**
Pyriproxyfen	95737-68-1	18	RF-0378-001-PPP	ALL	0.01	Regulation (EU) 2023/1753
Quaternary ammonium compounds, benzyl-C12-18-alkyldimethyl, salts with 1,2-benzisothiazol-3(2H)-one 1,1-dioxide[10]	68989-01-5	04	RF-1078-001-PPP	ALL	0.01	Regulation (EC) No 396/2005 (amended) for quaternary ammonium compounds
S-[(6-chloro-2-oxooxazolo[4,5-b]pyridin-3(2H)-yl)methyl] O,O-dimethylthiophosphate (Azamethiphos)	35575-96-3	18	RF-0484-001-PPP	ALL	0.01	Regulation (EC) No 396/2005 (amended)
Saccharomyces cerevisiae (yeast)	68876-77-7	Annex I	N/A	ALL	Not required	Regulation (EU) No 2016/1726

Active substance name from ECHA database	**CAS no.**	**PT or Annex I of BPR**	**Param Code**	**ProdName***	**MRL** (mg/kg)	**Regulation**
Salicylic acid [7]	69-72-7	03 04	RF-00000241-VET	Muscle (rabbit, equidae, caprine, bovine)	0.2	Commission Regulation (EU) No 37/2010 (08.04.2024) [7]
				Fat (rabbit, equidae, caprine, bovine)	0.5	
				Liver, kidney (rabbit, equidae, caprine, bovine)	1.5	
				Muscle (turkey)	0.4	
				Skin and fat (turkey)	2.5	
				Liver (turkey)	0.2	
				Kidney (turkey)	0.15	
				Muscle (poultry other than turkey)	0.25	
				Skin and fat (poultry other than turkey)	0.25	
				Liver (poultry other than turkey)	0.5	
				Kidney (poultry other than turkey)	1.0	
				Milk (equidae, caprine, bovine)	0.009	
				ALL (salicylic acid) ALL (sodium salicylate) Poultry (aluminium salicylate)	Not required (for topical use only)	
				Bovine, porcine (sodium salicylate)	Not required for oral use	
Silver nitrate	7761-88-8	03 04 05	N/A	ALL	0.01	Regulation (EC) No 396/2005 (amended)

Active substance name from ECHA database	**CAS no.**	**PT or Annex I of BPR**	**Param Code**	**ProdName***	**MRL** (mg/kg)	**Regulation**
S-Methoprene	65733-16-6	18	RF-0294-001-PPP	Muscle, liver, kidney, others (swine, bovine, sheep, goat, equine, poultry, other farmed terrestrial animals), fat, edible offals (goat, equine, poultry, other farmed terrestrial animals) and milk (cattle, sheep, goat, horse, others)	0.05	Regulation (EU) No 899/2012
				Fat (swine, bovine, sheep)	0.2	
				Edible offals (swine, bovine, sheep)	0.1	
Sodium dichloroisocyanurate dihydrate	51580-86-0	03 04 05	N/A	Bovine, ovine, caprine	Not required (for topical use only)	Commission Regulation (EU) No 37/2010 (08.04.2024)
Sodium dimethylarsinate (Sodium Cacodylate)	124-65-2	18	N/A	ALL	0.01	Regulation (EC) No 396/2005 (amended)

Active substance name from ECHA database	CAS no.	PT or Annex I of BPR	Param Code	ProdName*	MRL (mg/kg)	Regulation
Spinosad	168316-95-8	18	RF-0393-001-PPP	Fat, edible offals (bovine, sheep, goat, equine, other farmed terrestrial animals)	3	Regulation (EU) No 2022/1406
				Fat, edible offals (swine), liver (bovine)	2	
				Liver (sheep, goat, equine, other farmed terrestrial animals)	1.5	
				Kidney (bovine), fat, edible offals (poultry)	1	
				Liver (swine)	0.7	
				Kidney (swine, sheep, goat, equine, other farmed terrestrial animals)	0.5	
				Muscle (bovine)	0.3	
				Muscle (sheep, goat, equine, poultry, other farmed terrestrial animals), liver (poultry) and milk (cattle, sheep, goat, horse, others)	0.2	
				Muscle (swine)	0.1	
				Others (swine, bovine, sheep, goat, equine, poultry, other farmed terrestrial animals), kidney (poultry)	0.02	
Sulfuryl fluoride	2699-79-8	18	RF-0400-001-PPP	ALL	0.01	Regulation (EU) 2022/1321
Tetramethrin [13]	7696-12-0	18	RF-0922-001-PPP	ALL	0.01	Regulation (EC) No 396/2005 (amended)

Active substance name from ECHA database	CAS no.	PT or Annex I of BPR	Param Code	ProdName*	MRL (mg/kg)	Regulation
Thiamethoxam	153719-23-4	18	RF-0418-001-PPP	Fat, liver, kidney, other products (swine, bovine, sheep, goat, equine, poultry, other farm animals)	0.01	Reg. (EU) 2017/671
				Edible offals, muscle (swine, bovine, sheep, goat, equine, other farm animals)	0.02	
				Tissues, edible offals, muscle (poultry)	0.01	
				Milk (cattle, sheep, goat, horse, other species)	0.05	
				Terrestrial invertebrate animals	0.01	
Tosylchloramide sodium (Tosylchloramide sodium - Chloramin T)	127-65-1	03 04 05	N/A	Bovine, equidae	Not required (for topical use only)	Commission Regulation (EU) No 37/2010 (08.04.2024)
			RF-00000015-CHE	Muscle, liver, kidney, edible offals, others (swine, bovine, sheep, goat, equine, poultry, other farmed terrestrial animals)	0.05	Regulation (EC) No 2020/749 for chlorate [12]
				Fat (swine, bovine, sheep, goat, equine, poultry, other farmed terrestrial animals) and milk (cattle, sheep, goat, horse, others)	0.1	
Transfluthrin	118712-89-3	18	N/A	ALL	0.01	Regulation (EC) No 396/2005 (amended)
Vinegar	8028-52-2	Annex I	N/A	ALL	Not required	Regulation (EU) No 2016/143
Warfarin	81-81-2	14	RF-1043-001-PPP	ALL	0.01	Reg. (EU) No 703/2014

Active substance name from ECHA database	CAS no.	PT or Annex I of BPR	Param Code	ProdName*	MRL (mg/kg)	Regulation
α-cyano-4-fluoro-3-phenoxybenzyl3-(2,2-dichlorovinyl)-2,2-dimethylcyclo-propanecarboxylate (Cyfluthrin)	68359-37-5	18	RF-0108-001-PPP	Muscle, others (swine, bovine, sheep, goat, equine, poultry, other farmed animals), fat, edible offals, liver, kidney (poultry) and milk (horse, others)	0.01	Regulation (EU) 2023/173
				Fat, edible offals (swine, bovine, sheep, goat, equine, other farmed animals)	0.2	
				Liver, kidney (swine, bovine, sheep, goat, equine, other farmed animals) and milk (cattle, sheep, goat)	0.02	
				Muscle, liver, kidney (bovine, caprine)	0.01	Commission Regulation (EU) No 37/2010 (08.04.2024)
				Fat (bovine, caprine)	0.05	
				Milk (bovine, caprine)	0.02	

N/A: Not Applicable
Active substances listed in Annex I of the BPR are allowed for use in all PTs. Chemical identifiers, such as a CAS number and ParamCode, are included as well. ProdName describes the product to which the set MRL applies. The available MRLs are set in various regulations. An MRL of 0.01 mg/kg for infant and follow-on formulae applies to all active substances currently or formerly used in PPP. This is not listed in this table.
* A ProdName 'ALL' implies that the MRL applies to tissues, muscle, meat, fat, liver, kidney, edible offals, other (meat) products and milk.
1) In Commission Regulation (EU) No 37/2010 cholecalciferol is mentioned vitamin D
2) In Commission Regulation (EU) No 37/2010 this substance is mentioned cyhalothrin. The marker residue is cyhalothrin (sum of isomers), which is the same as for lambda-cyhalothrin
3) Methyl nonyl ketone is not allowed anymore (expired per 30 April 2024)
4) In Commission Regulation (EU) No 37/2010 this substance is mentioned alpha-cypermethrin. The marker residue is cypermethrin (sum of isomers), which is the same as for cypermethrin
5) In Commission Regulation (EU) No 37/2010 (+)-Tartaric acid is mentioned as L-tartaric acid and its mono and di-basic salt of sodium, potassium and calcium
6) In Commission Regulation (EU) No 37/2010 propan-2-ol is mentioned isopropanol
7) No MRL required refers to the topical use of salicylic acid, (ALL), topical use of sodium salicylate (ALL), topical use of aluminium salicylate basic (poultry and oral use of sodium salicylate (bovine, porcine). The values for turkey and poultry other than turkey refer to the marker residue of sodium salicylate and the values for bovine, caprine, equidae and rabbit refer to the marker residue of aluminium salicylate, basic.

8) In Commission Regulation (EU) No 37/2010 this substance is mentioned *Chrysanthemi cinerariifolii flos*. The status 'No MRL required' might also apply to Chrysanthemum cinerariaefolium extract from open and mature flowers of Tanacetum cinerariifolium obtained with hydrocarbon solvents (this has no CAS number).
9) The mentioned MRL is for benzalkonium chloride of 0.1 mg/kg according to EC 2023/377 in the EU Pesticides Database. The EU Pesticides Database also lists a default MRL of 0.01 mg/kg for the substances 'alkyldimethylbenzylammonium chloride' according to article 18. This is an error in the EU Pesticides Database, as alkyldimethylbenzylammonium chloride and benzalkonium chloride are synonyms for the same substances, also abbreviated as BAC or ADBAC, and this should be corrected in the EU Pesticides Database.
10) See Annex 3 for more information on this MRL for quaternary ammonium compounds.
11) The mentioned default MRL of 0.01 mg/kg is for the substance 'eggshell powder' in the EU Pesticides Database. Powdered egg is a foodstuff, for which no MRL is required. It is not clear whether the ECHA entry refers to egg powder or eggshell powder.
12) The MRL for chlorate also applies to:
Active chlorine generated from sodium chloride and pentapotassium bis(peroxymonosulphate) bis(sulphate) (no CAS no.)
Active chlorine generated from sodium chloride by electrolysis (no CAS no.)
Active chlorine generated from sodium N-chlorosulfamate (no CAS no.)
Active chlorine released from calcium hypochlorite (CAS no. 7778-54-3)
Active chlorine released from chlorine (CAS no. 7782-50-5)
Active chlorine released from hypochlorous acid (no CAS no.)
Active chlorine released from sodium hypochlorite (CAS no. 7681-52-9)
Chlorine dioxide (CAS no. 10049-04-4)
Chlorine dioxide generated from sodium chlorate and hydrogen peroxide in the presence of a strong acid (no CAS no.)
Chlorine dioxide generated from sodium chlorite by acidification (no CAS no.)
Chlorine dioxide generated from sodium chlorite by electrolysis (no CAS no.)
Chlorine dioxide generated from sodium chlorite by oxidation (no CAS no.)
Chlorine dioxide generated from Tetrachlorodecaoxide complex (TCDO) by acidification (no CAS no.)
Monochloramine generated from ammonia and a chlorine source (no CAS no.)
Monochloramine generated from ammonium hydroxide and a chlorine source (no CAS no.)
Monochloramine generated from sodium hypochlorite and an ammonium source (no CAS no.)
Tosylchloramide sodium (CAS no. 127-65-1)
13) The MRL for tetramethrin could also apply to d-tetramethrin.
14) The MRL for hydrogen peroxide could also apply to hydrogen peroxide released from sodium percarbonate (no CAS no.)
15) The MRL for lactic acid could also apply to L-(+)-lactic acid (CAS no. 79-33-4)
16) The MRL for peracetic acid could also apply to peracetic acid generated from tetra-acetylethylenediamine (TAED) and sodium percarbonate (no CAS no.)
17) The MRL regulation for chlorfenapyr (EC 899/2012) does not list MRLs for animal commodities. On the basis of the EFSA opinion for chlorfenapyr (EFSA, 2023), the EU MRL could have been set at 0.01* mg/kg (fat-soluble) for all animal commodities. It is not clear why EFSA did not define any MRLs for animal commodities, as there is no livestock exposure in the EU and metabolism studies in livestock confirmed the residue definition for enforcement as being chlorfenapyr only.

Annex 10 Prioritisation results on the basis of hazard properties

Note

The information in this annex was gathered during 2024. The information changes over time. If this information is used for decision-making, please ensure that the information is still up to date and correct.

Contents

Table A10.1 of this annex gives a complete overview of the meaning of the hazard statement codes for physical, health and environmental hazards. Table 10.2 gives the hazard properties of the active substances of the selected PTs and the prioritisation category given in this study. Table 10.3 gives the same information on possible degradation products, metabolites or DBPs of some active substances in biocides and on substances reported in the KAP database that could be part of active substances that are mixtures.

Table A10.1 Explanatory list of the hazard statement codes for the physical hazards, health hazards, and environmental hazards, with their corresponding class and category code and hazard description (H-phrase) (EC, 2019).

Hazard statement code	Hazard class and category code	H-phrase	Prioritisation category
H224	Flam. Liq. 1	Extremely flammable liquid and vapour	N/A
H225	Flam. Liq. 2	Highly flammable liquid and vapour	N/A
H226	Flam. Liq. 3	Flammable liquid and vapour	N/A
H242	Org. Perox. D	Heating may cause a fire	N/A
H260	Water-react. 1	In contact with water releases flammable gases which may ignite spontaneously	N/A
H270	Ox. Gas 1	May cause or intensify fire: oxidizer	N/A
H271	Ox. Liq. 1	May cause fire or explosion: strong oxidizer	N/A
H272	Ox. Sol. 3	May intensify fire: OXIDISER	N/A
H280	Press. Gas (Comp. / Liq.)	Contains gas under pressure: may explode if heated	N/A

Hazard statement code	Hazard class and category code	H-phrase	Prioritisation category
H281	Press. Gas (Ref. Liq.)	Contains refrigerated gas: may cause cyrogenic burns or injury	N/A
H290	Met. Corr. 1	May be corrosive to metals	N/A
H300	Acute Tox. 1 or 2	Fatal if swallowed	1
H310	Acute Tox. 1 or 2	Fatal in contact with skin	1
H330	Acute Tox. 1 or 2	Fatal if inhaled	1
H334	Resp. Sens. 1	May cause allergy or asthma symptoms or breathing difficulties if inhaled	1
H340*	Muta. 1A or 1B	May cause genetic defects	1
H341*	Muta. 2	Suspected of causing genetic defects	1
H350*	Carc. 1A or 1B	May cause cancer	1
H351*	Carc. 2	Suspected of causing cancer	1
H360*	Repr. 1A or 1B	May damage fertility or the unborn child	1
H361*	Repr. 2	Suspected of damaging fertility or the unborn child	1
H362	Lact.	May cause harm to breast-fed children	1
H301	Acute Tox. 3	Toxic if swallowed	2
H311	Acute Tox. 3	Toxic in contact with skin	2
H314	Skin Corr. 1A, 1B or 1C	Causes severe skin burns and eye damage	2
H318	Eye Dam. 1	Causes serious eye damage	2
H331	Acute Tox. 3	Toxic if inhaled	2
H370*	STOT SE 1	Causes damage to organs	2
H372*	STOT RE 1	Causes damage to organs through prolonged or repeated exposure	2
H302	Acute Tox. 4	Harmful if swallowed	3
H304	Asp. Tox. 1	May be fatal if swallowed and enters airways	3
H312	Acute Tox. 4	Harmful in contact with skin	3

Hazard statement code	Hazard class and category code	H-phrase	Prioritisation category
H315	Skin Irrit. 2	Causes skin irritation	3
H317	Skin Sens. 1	May cause an allergic skin reaction	3
H319	Eye Irrit. 2	Causes serious eye irritation	3
H332	Acute Tox. 4	Harmful if inhaled	3
H335	STOT SE 3	May cause respiratory irritation	3
H336	STOT SE 3	May cause drowsiness or dizziness	3
H371*	STOT SE 2	May cause damage to organs	3
H373*	STOT RE 2	May cause damage to organs through prolonged or repeated exposure	3
H400	Aquatic Acute 1	Very toxic to aquatic life	N/A
H410	Aquatic Chronic 1	Very toxic to aquatic life with long lasting effects	N/A
H411	Aquatic Chronic 2	Toxic to aquatic life with long lasting effects	N/A
H412	Aquatic Chronic 3	Harmful to aquatic life with long lasting effects	N/A

The last column contains the prioritisation category given in this study. Since the prioritisation of active substances was based on health hazards (see Section 7.4.1), no prioritisation category is given to physical and environmental hazards.
N/A: Not Applicable
* These hazard codes may apply to specific exposure routes only, which needs to be stated if it is conclusively proven that no other routes of exposure cause the hazard. For some H-phrases, specific effects (e.g. may damage the unborn child (D), may damage fertility (F), suspected of damaging the unborn child (d), suspected of damaging fertility (f): applies to H360 and H361) or affected organs (H370, H371, H372, H373) need to be specified as well, if known.
** STOT RE/SE stands for Specific Target Organ Toxicity Repeated Exposure / Single Exposure.

Table A10.2 Overview of active substances in biocides allowed for PT03, PT04, PT05, PT14, PT18, and/or PT19, or active substances listed on Annex I of the BPR, with information on their hazard properties from the C&L Inventory.

Active substance name from ECHA database	CAS no.	PT / Annex I	CfS [1]	Source C&L	Hazard class and category code	Hazard Statement Code(s)	Cat.
(1,3,4,5,6,7-hexahydro-1,3-dioxo-2H-isoindol-2-yl)methyl (1R-trans)-2,2-dimethyl-3-(2-methylprop-1-enyl)cyclo-propanecarboxylate (d-Tetramethrin)	1166-46-7	18	Under assessment	Harmonised C&L	Carc. 2 Acute Tox. 4 STOT SE 2 Aquatic Acute 1 Aquatic Chronic 1	H351 H302 H371 (nervous system; inhalation) H400 H410	1
[2,4-Dioxo-(2-propyn-1-yl)imidazolidin-3-yl]methyl(1R)-cis-chrysanthemate;[2,4- Dioxo-(2-propyn-1-yl)imidazolidin-3-yl] methyl(1R)-trans-chrysanthemate (Imiprothrin)	72963-72-5	18	No	Harmonised C&L	Carc. 2 Acute Tox. 4 Acute Tox. 4 STOT SE 2 Aquatic Acute 1 Aquatic Chronic 1	H351 H332 H302 H371 (nervous system; oral, inhalation) H400 H410	1
2,2-dibromo-2-cyanoacetamide (DBNPA) [2]	10222-01-2	04	Yes	Harmonised C&L	Acute Tox. 2 Acute Tox. 3 STOT RE 1 Skin Irrit. 2 Eye Dam. 1 Skin Sens. 1 Aquatic Acute 1 Aquatic Chronic 1	H330 H301 H372 (respiratory tract; inhalation) H315 H318 H317 H400 H410	1
Acetamiprid	135410-20-7	18	Yes	Harmonised C&L	Acute Tox. 3 Aquatic Acute 1 Aquatic Chronic 1 Repr. 2	H301 H400 H410 H361d	1

Active substance name from ECHA database	CAS no.	PT / Annex I	CfS [1]	Source C&L	Hazard class and category code	Hazard Statement Code(s)	Cat.
Aluminium phosphide releasing phosphine	20859-73-8	14 18	No	Harmonised C&L	Water-react. 1 Acute Tox. 1 Acute Tox. 2 Acute Tox. 3 Aquatic Acute 1	H260 H330 H300 H311 H400	1
Bacillus thuringiensis subsp. israelensis Serotype H14, Strain AM65-52 [3]	- 68038-71-1	18	No	Notified C&L	Skin Sens. 1 Resp. Sens. 1 Eye Irrit. 2 STOT SE 3	H317 H334 H319 H335	1
Bacillus thuringiensis subsp. kurstaki, strain ABTS-351 [3]	- 68038-71-1	18	No	Notified C&L	Skin Sens. 1 Resp. Sens. 1 Eye Irrit. 2 STOT SE 3	H317 H334 H319 H335	1
Bacillus thuringiensis subsp. israelensis, strain SA3A [3]	- 68038-71-1	18	No	Notified C&L	Skin Sens. 1 Resp. Sens. 1 Eye Irrit. 2 STOT SE 3	H317 H334 H319 H335	1
Brodifacoum	56073-10-0	14	Yes	Harmonised C&L	Repr. 1A Acute Tox. 1 Acute Tox. 1 Acute Tox. 1 STOT RE 1 Aquatic Acute 1 Aquatic Chronic 1	H360D H330 H310 H300 H372 (blood) H400 H410	1
Bromadiolone	28772-56-7	14	Yes	Harmonised C&L	Repr. 1B Acute Tox. 1 Acute Tox. 1 Acute Tox. 1 STOT RE 1 Aquatic Acute 1 Aquatic Chronic 1	H360D H330 H310 H300 H372 (blood) H400 H410	1

Active substance name from ECHA database	CAS no.	PT / Annex I	CfS [1]	Source C&L	Hazard class and category code	Hazard Statement Code(s)	Cat.
Chlorophacinone	3691-35-8	14	Yes	Harmonised C&L	Repr. 1B Acute Tox. 1 Acute Tox. 1 Acute Tox. 1 STOT RE 1 Aquatic Acute 1 Aquatic Chronic 1	H360D H330 H310 H300 H372 (blood) H400 H410	1
Cholecalciferol	67-97-0	14	Yes	Harmonised C&L	Acute Tox. 2 Acute Tox. 2 Acute Tox. 2 STOT RE 1	H330 H310 H300 H372	1
Coumatetralyl	5836-29-3	14	Yes	Harmonised C&L	Repr. 1B Acute Tox. 2 Acute Tox. 2 Acute Tox. 3 STOT RE 1 Aquatic Chronic 1	H360D H330 H300 H311 H372 (blood) H410	1
Difenacoum	56073-07-5	14	Yes	Harmonised C&L	Repr. 1B Acute Tox. 1 Acute Tox. 1 Acute Tox. 1 STOT RE 1 Aquatic Acute 1 Aquatic Chronic 1	H360D H330 H310 H300 H372 (blood) H400 H410	1
Difethialone	104653-34-1	14	Yes	Harmonised C&L	Repr. 1B Acute Tox. 1 Acute Tox. 1 Acute Tox. 1 STOT RE 1 Aquatic Acute 1 Aquatic Chronic 1	H360D H330 H310 H300 H372 (blood) H400 H410	1

Active substance name from ECHA database	CAS no.	PT / Annex I	CfS [1]	Source C&L	Hazard class and category code	Hazard Statement Code(s)	Cat.
Disodium peroxodisulphate/Sodium persulphate	7775-27-1	04	Under assessment	Notified C&L	Acute Tox. 4 Skin Sens. 1 Resp. Sens. 1 STOT SE 3 Skin Irrit. 2 Eye Irrit. 2 Ox. Sol. 3	H302 H317 H334 H335 H315 H319 H272	1
Etofenprox	80844-07-1	18	Yes	Harmonised C&L	Lact. Aquatic Acute 1 Aquatic Chronic 1	H362 H400 H410	1
Flocoumafen	90035-08-8	14	Yes	Harmonised C&L	Repr. 1B Acute Tox. 1 Acute Tox. 1 Acute Tox. 1 STOT RE 1 Aquatic Acute 1 Aquatic Chronic 1	H360D H330 H310 H300 H372 (blood) H400 H410	1
Formaldehyde	50-00-0	03	Yes	Harmonised C&L	Carc. 1B Muta. 2 Acute Tox. 3 * Acute Tox. 3 * Acute Tox. 3 * Skin Corr. 1B Skin Sens. 1	H350 H341 H331 H311 H301 H314 H317	1

Active substance name from ECHA database	CAS no.	PT / Annex I	CfS [1]	Source C&L	Hazard class and category code	Hazard Statement Code(s)	Cat.
Glutaral (Glutaraldehyde)	111-30-8	03 04	Yes	Harmonised C&L	Acute Tox. 2 Acute Tox. 3 STOT SE 3 Skin Corr. 1B Resp. Sens. 1 Skin Sens. 1A Aquatic Acute 1 Aquatic Chronic 2	H330 H301 H335 H314 H334 H317 H400 H411	1
Glyoxal	107-22-2	03 04	No	Harmonised C&L	Muta. 2 Acute Tox. 4 * Skin Irrit. 2 Eye Irrit. 2 Skin Sens. 1	H341 H332 H315 H319 H317	1
Hydrogen cyanide [4]	74-90-8	14 18	Under assessment	Harmonised C&L	Acute Tox. 2 * Acute Tox. 1 Acute Tox. 2 Aquatic Acute 1 Aquatic Chronic 1	H300 H310 H330 H400 H410	1
Lambda-cyhalothrin	91465-08-6	18	Yes	Harmonised C&L	Acute Tox. 2 * Acute Tox. 3 * Acute Tox. 4 * Aquatic Acute 1 Aquatic Chronic 1	H330 H301 H312 H400 H410	1
Magnesium phosphide releasing phosphine	12057-74-8	18	No	Harmonised C&L	Water-react. 1 Acute Tox. 1 Acute Tox. 2 Acute Tox. 3 Aquatic Acute 1	H260 H330 H300 H311 H400	1

Active substance name from ECHA database	CAS no.	PT / Annex I	CfS [1]	Source C&L	Hazard class and category code	Hazard Statement Code(s)	Cat.
Mixture of 5-chloro-2-methyl-2H-isothiazol-3-one (EINECS 247-500-7) and 2-methyl-2H-isothiazol-3-one (EINECS 220-239-6) (Mixture of CMIT/MIT)	55965-84-9	04	No	Harmonised C&L	Acute Tox. 2 Acute Tox. 2 Acute Tox. 3 Skin Corr. 1C Eye Dam. 1 Skin Sens. 1A Aquatic Acute 1 Aquatic Chronic 1	H330 H310 H301 H314 H318 H317 H400 H410	1
Polyhexamethylene biguanide hydrochloride with a mean number-average molecular weight (Mn) of 1415 and a mean polydispersity (PDI) of 4.7 (PHMB(1415;4.7)) [5]	1802181-67-4	04	Yes	Harmonised C&L	Carc. 2 Acute Tox. 2 Acute Tox. 4 STOT RE 1 Eye Dam. 1 Skin Sens. 1B Aquatic Acute 1 Aquatic Chronic 1	H351 H330 H302 H372 (respiratory tract) (inhalation) H318 H317 H400 H410	1
Polyhexamethylene biguanide hydrochloride with a mean number-average molecular weight (Mn) of 1600 and a mean polydispersity (PDI) of 1.8 (PHMB(1600;1.8))	27083-27-8	03 04	Yes	Harmonised C&L	Carc. 2 Acute Tox. 2 Acute Tox. 4 STOT RE 1 Eye Dam. 1 Skin Sens. 1B Aquatic Acute 1 Aquatic Chronic 1	H351 H330 H302 H372 (respiratory tract) (inhalation) H318 H317 H400 H410	1
Reaction products of: glutamic acid and N-(C12-C14-alkyl)propylenediamine (Glucoprotamin) [6]	164907-72-6	04	Under assessment	Harmonised C&L	Skin Corr. 1B Acute Tox. 4 Aquatic Acute 1 Acute Tox. 2	H314 H302 H400 H330	1

Active substance name from ECHA database	CAS no.	PT / Annex I	CfS [1]	Source C&L	Hazard class and category code	Hazard Statement Code(s)	Cat.
S-[(6-chloro-2-oxooxazolo[4,5-b]pyridin-3(2H)-yl)methyl] O,O-dimethylthiophosphate (Azamethiphos)	35575-96-3	18	No	Harmonised C&L	Carc. 2 Acute Tox. 3 Acute Tox. 4 STOT SE 1 Skin Sens. 1 Aquatic Acute 1 Aquatic Chronic 1	H351 H331 H302 H370 (nervous system) H317 H400 H410	1
Salicylic acid	69-72-7	03 04	No	Harmonised C&L	Repr. 2 Acute Tox. 4 Eye Dam. 1	H361d H302 H318	1
Tetramethrin	7696-12-0	18	Under assessment	Harmonised C&L	Carc. 2 Acute Tox. 4 STOT SE 2 Aquatic Acute 1 Aquatic Chronic 1	H351 H302 H371 (nervous system) (Inhalation) H400 H410	1
Thiamethoxam	153719-23-4	18	Under assessment	Harmonised C&L	Repr. 2 Acute Tox. 4 Aquatic Acute 1 Aquatic Chronic 1	H361fd H302 H400 H410	1
Tosylchloramide sodium (Tosylchloramide sodium - Chloramin T)	127-65-1	03 04 05	Under assessment	Harmonised C&L	Acute Tox. 4 * Skin Corr. 1B Resp. Sens. 1	H302 H314 H334	1
Warfarin	81-81-2	14	Yes	Harmonised C&L	Repr. 1A Acute Tox. 1 Acute Tox. 1 Acute Tox. 2 STOT RE 1 Aquatic Chronic 2	H360D H330 H310 H300 H372 (blood) H411	1

Active substance name from ECHA database	CAS no.	PT / Annex I	CfS [1]	Source C&L	Hazard class and category code	Hazard Statement Code(s)	Cat.
α-cyano-4-fluoro-3-phenoxybenzyl3-(2,2-dichlorovinyl)-2,2-dimethylcyclo-propanecarboxylate (Cyfluthrin)	68359-37-5	18	No	Harmonised C&L	Lact. Acute Tox. 2 Acute Tox. 2 STOT SE 1 Aquatic Acute 1 Aquatic Chronic 1	H362 H330 H300 H370 (nervous system) H400 H410	1
(+)-Tartaric acid	87-69-4	Annex I	No	Notified C&L	Eye Irrit. 2 STOT SE 3 Skin Irrit. 2 Skin Sens. 1 Acute Tox. 4 Eye Dam. 1	H319 H335 H315 H317 H302 H318	2
(RS)-α-cyano-3-phenoxybenzyl-(1RS)-cis, trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate (Cypermethrin) [7]	52315-07-8	18	No	Notified C&L [7]	Aquatic Chronic 1 STOT SE 3 Aquatic Acute 1 Acute Tox. 4 Acute Tox. 4 STOT RE 2 Acute Tox. 3	H410 H335 H400 H302 H332 H373 H301	2
[1.alpha.(S*),3.alpha.]-(.alpha.)-cyano-(3-phenoxyphenyl)methyl3-(2,2-dichlor-oethenyl)-2,2-dichlorovinyl)-2,2-dimethyl-cyclopropanecarboxylate (alpha-Cypermethrin); [1α(S*),3α]-(α)-cyano-(3-phenoxyphenyl)methyl3-(2,2-dichlor-oethenyl)-2,2-dichlorovinyl)-2,2-dimethyl-cyclopropanecarboxylate (αCypermethrin)	67375-30-8	18	No	Harmonised C&L	Acute Tox. 3 * STOT SE 3 STOT RE 2 * Aquatic Acute 1 Aquatic Chronic 1	H301 H335 H373 ** H400 H410	2

Active substance name from ECHA database	CAS no.	PT / Annex I	CfS [1]	Source C&L	Hazard class and category code	Hazard Statement Code(s)	Cat.
2-Methyl-4-oxo-3-(prop-2-ynyl)cyclopent-2-en-1-yl 2,2-dimethyl-3-(2-methylprop-1-enyl)cyclopropanecarboxylate (Prallethrin)	23031-36-9	18	Under assessment	Harmonised C&L	Acute Tox. 3 * Acute Tox. 4 * Aquatic Acute 1 Aquatic Chronic 1	H331 H302 H400 H410	2
2-Phenoxyethanol	122-99-6	04	No	Harmonised C&L	Acute Tox. 4 STOT SE 3 Eye Dam. 1	H302 H335 H318	2
4-Bromo-2-(4-chlorophenyl)-1-ethoxy- methyl-5-trifluoromethylpyrrole-3-carbonitrile (Chlorfenapyr)	122453-73-0	18	Under assessment	Harmonised C&L	Acute Tox. 3 * Acute Tox. 4 * Aquatic Acute 1 Aquatic Chronic 1	H331 H302 H400 H410	2
5-Chloro-2-(4-chlorphenoxy)phenol (DCPP)	3380-30-1	04	Yes	Harmonised C&L	Eye Dam. 1 Aquatic Acute 1 Aquatic Chronic 1	H318 H400 H410	2
Acetic acid	64-19-7	Annex I	No	Harmonised C&L	Flam. Liq. 3 Skin Corr. 1A	H226 H314	2
Active chlorine released from calcium hypochlorite	7778-54-3	03 04 05	No	Harmonised C&L	Ox. Sol. 2 Acute Tox. 4 * Skin Corr. 1B Aquatic Acute 1	H272 H302 H314 H400	2
Active chlorine released from chlorine	7782-50-5	05	No	Harmonised C&L	Ox. Gas 1 Press. Gas Acute Tox. 3 * STOT SE 3 Skin Irrit. 2 Eye Irrit. 2 Aquatic Acute 1	H270 H331 H335 H315 H319 H400	2

Active substance name from ECHA database	CAS no.	PT / Annex I	CfS [1]	Source C&L	Hazard class and category code	Hazard Statement Code(s)	Cat.
Active chlorine released from sodium hypochlorite	7681-52-9	03 04 05	No	Harmonised C&L	Skin Corr. 1B Eye Dam. 1 Aquatic Acute 1 Aquatic Chronic 1	H314 H318 H400 H410	2
Alkyl (C12-16) dimethylbenzyl ammonium chloride (ADBAC/BKC (C12-16))	68424-85-1	03 04	Under assessment	Notified C&L	Skin Corr. 1B Acute Tox. 4 Aquatic Acute 1 Eye Dam. 1 Acute Tox. 3 Acute Tox. 3 Skin Corr. 1C Aquatic Chronic 1	H314 H302 H400 H318 H311 H301 H314 H410	2
Alkyl (C12-18) dimethylbenzyl ammonium chloride (ADBAC (C12-18))	68391-01-5	03 04	Under assessment	Notified C&L	Acute Tox. 4 Skin Corr. 1B Aquatic Acute 1 Eye Dam. 1 Aquatic Chronic 1 Acute Tox. 4	H302 H314 H400 H318 H410 H312	2
Alkyl (C12-C14) dimethyl(ethylbenzyl)ammonium chloride (ADEBAC (C12-C14))	85409-23-0	03 04	Under assessment	Notified C&L	Skin Corr. 1B Acute Tox. 4 Aquatic Acute 1 Eye Dam. 1 Aquatic Chronic 1 Acute Tox. 4 NOTCLASS	H314 H302 H400 H318 H410 H312	2
Alkyl (C12-C14) dimethylbenzylammonium chloride (ADBAC (C12-C14))	85409-22-9	03 04	Under assessment	Notified C&L	Acute Tox. 4 Skin Corr. 1B Aquatic Acute 1 Aquatic Chronic 1 Eye Dam. 1	H302 H314 H400 H410 H318	2

Active substance name from ECHA database	CAS no.	PT / Annex I	CfS [1]	Source C&L	Hazard class and category code	Hazard Statement Code(s)	Cat.
Alphachloralose	15879-93-3	14	No	Harmonised C&L	Acute Tox. 3 Acute Tox. 4 * STOT SE 3 Aquatic Acute 1 Aquatic Chronic 1	H301 H332 H336 H400 H410	2
Amines, N-C10-16-alkyltrimethylenedi-, reaction products with chloroacetic acid	139734-65-9	03 04	No	Notified C&L	Aquatic Acute 1 Acute Tox. 4 Skin Corr. 1C Eye Dam. 1 Met. Corr. 1 Aquatic Chronic 1	H400 H302 H314 H318 H290 H410	2
Benzoic acid	65-85-0	03 04	Under assessment	Harmonised C&L	STOT RE 1 Skin Irrit. 2 Eye Dam. 1	H372 (lungs) (Inhalation) H315 H318	2
Bromoacetic acid	79-08-3	04	No	Harmonised C&L	Acute Tox. 3 * Acute Tox. 3 * Acute Tox. 3 * Skin Corr. 1A Skin Sens. 1 Aquatic Acute 1	H331 H311 H301 H314 H317 H400	2
Calcium dihydroxide/calcium hydroxide/caustic lime/hydrated lime/slaked lime	1305-62-0	03	No	Notified C&L	Eye Dam. 1 Skin Irrit. 2 STOT SE 3 Skin Corr. 1B	H318 H315 H335 H314	2
Calcium magnesium oxide/dolomitic lime	37247-91-9	03	No	Notified C&L	Eye Dam. 1 Skin Irrit. 2 STOT SE 3	H318 H315 H335	2

Active substance name from ECHA database	CAS no.	PT / Annex I	CfS [1]	Source C&L	Hazard class and category code	Hazard Statement Code(s)	Cat.
Calcium magnesium tetrahydroxide/calcium magnesium hydroxide/hydrated dolomitic lime	39445-23-3	03	No	Notified C&L	Eye Dam. 1 STOT SE 3 Skin Irrit. 2 NOTCLASS	H318 H335 H315	2
Calcium oxide/lime/burnt lime/quicklime	1305-78-8	03	No	Notified C&L	Eye Dam. 1 Skin Irrit. 2 STOT SE 3 Skin Corr. 1C Acute Tox. 4	H318 H315 H335 H314 H302	2
Chlorine dioxide [4]	10049-04-4	03 04 05	Under assessment	Harmonised C&L	Acute Tox. 3 * Skin Corr. 1B Aquatic Acute 1	H301 H314 H400	2
Chlorocresol	59-50-7	03	No	Harmonised C&L	Acute Tox. 4 STOT SE 3 Skin Corr. 1C Eye Dam. 1 Skin Sens. 1B Aquatic Acute 1 Aquatic Chronic 3	H302 H335 H314 H318 H317 H400 H412	2
Cymbopogon winterianus oil, fractionated, hydrated, cyclized [8]	- [8]	19	Under assessment	Notified C&L	Eye Dam. 1 Skin Sens. 1 Aquatic Chronic 2 Asp. Tox. 1 Skin Irrit. 2 Acute Tox. 4	H318 H317 H411 H304 H315 H302	2
Deltamethrin	52918-63-5	18	No	Harmonised C&L	Acute Tox. 3 * Acute Tox. 3 * Aquatic Acute 1 Aquatic Chronic 1	H331 H301 H400 H410	2

Active substance name from ECHA database	CAS no.	PT / Annex I	CfS [1]	Source C&L	Hazard class and category code	Hazard Statement Code(s)	Cat.
D-gluconic acid, compound with N,N′′-bis(4-chlorophenyl)-3,12-diimino-2,4,11,13-tetraazatetradecanediamidine(2:1) (CHDG)	18472-51-0	03	Under assessment	Notified C&L	Aquatic Chronic 1 Aquatic Acute 1 Eye Dam. 1 Acute Tox. 4	H410 H400 H318 H302	2
Didecyldimethylammonium chloride (DDAC (C8-10))	68424-95-3	03 04	Under assessment	Notified C&L	Aquatic Acute 1 Skin Corr. 1B Acute Tox. 4 Eye Dam. 1 Aquatic Chronic 2 Acute Tox. 4 Acute Tox. 3 Skin Corr. 1C	H400 H314 H302 H318 H411 H312 H301 H314	2
Didecyldimethylammonium chloride (DDAC)	7173-51-5	03 04	Under assessment	Harmonised C&L	Acute Tox. 4 * Skin Corr. 1B	H302 H314	2
Epsilon-Metofluthrin	240494-71-7	19	Under assessment	Harmonised C&L	Acute Tox. 3 Acute Tox. 4 STOT SE 1 STOT RE 2 Aquatic Acute 1 Aquatic Chronic 1	H301 H332 H370 (nervous system) H373 H400 H410	2
Formic acid	64-18-6	03 04 05	Under assessment	Harmonised C&L	Skin Corr. 1A	H314	2
Garlic, ext.	8008-99-9	19	Under assessment	Notified C&L	Skin Sens. 1 Flam. Liq. 3 Skin Irrit. 2 Eye Irrit. 2 Acute Tox. 3	H317 H226 H315 H319 H301	2

Active substance name from ECHA database	CAS no.	PT / Annex I	CfS [1]	Source C&L	Hazard class and category code	Hazard Statement Code(s)	Cat.
Glycolic acid	79-14-1	03 04	Under assessment	Notified C&L	Skin Corr. 1B Acute Tox. 4 Acute Tox. 4 Eye Dam. 1	H314 H302 H332 H318	2
Hydrogen peroxide	7722-84-1	03 04 05	No	Harmonised C&L	Ox. Liq. 1 Acute Tox. 4 * Acute Tox. 4 * Skin Corr. 1A	H271 H332 H302 H314	2
Imidacloprid	138261-41-3	18	Yes	Harmonised C&L	Acute Tox. 3 Aquatic Acute 1 Aquatic Chronic 1	H301 H400 H410	2
Indoxacarb (enantiomeric reaction mass S:R 75:25)	144171-61-9	18	No	Harmonised C&L	Acute Tox. 3 Skin Sens. 1B Acute Tox. 4 STOT RE 1 Aquatic Acute 1 Aquatic Chronic 1	H301 H317 H332 H372 H400 H410	2
L-(+)-lactic acid	79-33-4	03 04	No	Harmonised C&L	Skin Corr. 1C Eye Dam. 1	H314 H318	2
Lactic acid	50-21-5	Annex I	No	Notified C&L	Eye Dam. 1 Skin Irrit. 2	H318 H315	2
Lauric acid	143-07-7	19	No	Notified C&L	Eye Dam. 1 Eye Irrit. 2 Skin Irrit. 2	H318 H319 H315	2
Metofluthrin(2,3,5,6-tetrafluoro-4-(methoxymethyl) benzyl (EZ)-(1RS,3RS; 1SR,3SR)- 2,2-dimethyl-3-prop-1-enylcyclopropanecarboxylate)	-	18	Under assessment	Harmonised C&L	Acute Tox. 3 Acute Tox. 4 STOT SE 1 STOT RE 2 Aquatic Acute 1 Aquatic Chronic 1	H301 H332 H370 (nervous system) H373 H400 H410	2

Active substance name from ECHA database	CAS no.	PT / Annex I	CfS [1]	Source C&L	Hazard class and category code	Hazard Statement Code(s)	Cat.
N-(3-aminopropyl)-N-dodecylpropane-1,3-diamine (Diamine)	2372-82-9	03 04	Under assessment	Notified C&L	Acute Tox. 3 Aquatic Acute 1 STOT RE 2 Aquatic Chronic 1 Eye Dam. 1 Skin Corr. 1C Skin Corr. 1B	H301 H400 H373 H410 H318 H314 H314	2
Octanoic acid	124-07-2	04 18	Under assessment	Harmonised C&L	Skin Corr. 1C Aquatic Chronic 3	H314 H412	2
Pentapotassium bis(peroxymonosulphate) bis(sulphate)	70693-62-8	03 04 05	No	Notified C&L	Acute Tox. 4 Skin Corr. 1B Eye Dam. 1 Aquatic Chronic 3 Skin Corr. 1A Ox. Sol. 1	H302 H314 H318 H412 H314 H271	2
Peracetic acid	79-21-0	03 04 05	No	Harmonised C&L	Flam. Liq. 3 Org. Perox. D **** Acute Tox. 4 * Acute Tox. 4 * Acute Tox. 4 * Skin Corr. 1A Aquatic Acute 1	H226 H242 H332 H312 H302 H314 H400	2
Poly(oxy-1,2-ethanediyl), α-[2-(didecylmethylammonio)ethyl]- .omega.-hydroxy-, propanoate (salt) (Bardap 26)	94667-33-1	04	Under assessment	Notified C&L	Aquatic Acute 1 Acute Tox. 4 Skin Corr. 1B Aquatic Chronic 1	H400 H302 H314 H410	2
Polyvinylpyrrolidone iodine	25655-41-8	03 04	Yes	Notified C&L	Skin Irrit. 2 Aquatic Chronic 2 Eye Dam. 1 NOTCLASS	H315 H411 H318	2

Active substance name from ECHA database	CAS no.	PT / Annex I	CfS [1]	Source C&L	Hazard class and category code	Hazard Statement Code(s)	Cat.
Propan-1-ol	71-23-8	04	No	Harmonised C&L	Flam. Liq. 2 STOT SE 3 Eye Dam. 1	H225 H336 H318	2
Propionic acid	79-09-4	Annex I	No	Harmonised C&L	Skin Corr. 1B	H314	2
Silver nitrate	7761-88-8	03 04 05	Under assessment	Harmonised C&L	Ox. Sol. 2 Skin Corr. 1B Aquatic Acute 1 Aquatic Chronic 1	H272 H314 H400 H410	2
Sodium dimethylarsinate (Sodium Cacodylate)	124-65-2	18	Under assessment	Notified C&L	Acute Tox. 3 Aquatic Acute 1 Aquatic Chronic 1 Acute Tox. 3	H301 H400 H410 H331	2
Sulfuryl fluoride	2699-79-8	18	No	Harmonised C&L	Press. Gas Acute Tox. 3 * STOT RE 2 * Aquatic Acute 1	 H331 H373 ** H400	2
Vinegar [9]	8028-52-2 [9]	Annex I	No	Notified C&L	Flam. Liq. 3 Eye Dam. 1 Skin Corr. 1C	H226 H318 H314	2
α-cyano-3-phenoxybenzyl2,2-dimethyl-3-(2-methylprop-1-enyl)cyclopropanecarboxylate (Cyphenothrin)	39515-40-7	18	Yes	Notified C&L	Acute Tox. 4 Aquatic Chronic 1 Aquatic Acute 1 Acute Tox. 4 STOT RE 1	H302 H410 H400 H332 H372	2
(13Z)-Hexadec-13-en-11-yn-1-yl acetate	78617-58-0	19	No	Notified C&L	Aquatic Acute 1 Aquatic Chronic 1	H400 H410	3
(9Z,12E)-tetradeca-9,12-dien-1-yl acetate	30507-70-1	Annex I	No	Notified C&L	Skin Irrit. 2	H315	3

Active substance name from ECHA database	CAS no.	PT / Annex I	CfS [1]	Source C&L	Hazard class and category code	Hazard Statement Code(s)	Cat.
(E)-1-(2-Chloro-1,3-thiazol-5-ylmethyl)-3- methyl-2-nitroguanidine (Clothianidin)	210880-92-5	18	Yes	Harmonised C&L	Acute Tox. 4 * Aquatic Acute 1 Aquatic Chronic 1	H302 H400 H410	3
1-(3,5-dichloro-4-(1,1,2,2-tetrafluoroethoxy)phenyl)-3-(2,6-difluorobenzoyl) urea (Hexaflumuron)	86479-06-3	18	Yes	Harmonised C&L	Aquatic Acute 1 Aquatic Chronic 1	H400 H410	3
1R-trans phenothrin	26046-85-5	18	Yes	Notified C&L	Aquatic Acute 1 Aquatic Chronic 1	H400 H410	3
2-(2-butoxyethoxy)ethyl 6-propylpiper-onyl ether (Piperonyl butoxide/PBO)	51-03-6	18	No	Harmonised C&L	STOT SE 3 Eye Irrit. 2 Aquatic Acute 1 Aquatic Chronic 1	H335 H319 H400 H410	3
Arnica montana, ext.	68990-11-4	Annex I	No	Notified C&L	NOTCLASS		3
Ascorbic acid	50-81-7	Annex I	No	Notified C&L	NOTCLASS		3
Bentonite	1302-78-9	Annex I	No	Notified C&L	NOTCLASS Eye Irrit. 2 Skin Irrit. 2 STOT SE 3	 H319 H315 H335	3
Biphenyl-2-ol	90-43-7	03 04	No	Harmonised C&L	STOT SE 3 Skin Irrit. 2 Eye Irrit. 2 Aquatic Acute 1	H335 H315 H319 H400	3
Carbon dioxide	124-38-9	Annex I	No	Notified C&L	Press. Gas (Comp.) Press. Gas (Liq.) Press. Gas (Ref. Liq.)	H280 H280 H281	3

Active substance name from ECHA database	CAS no.	PT / Annex I	CfS [1]	Source C&L	Hazard class and category code	Hazard Statement Code(s)	Cat.
Chrysanthemum cinerariaefolium extract from open and mature flowers of Tanacetum cinerariifolium obtained with supercritical carbon dioxide [10]	89997-63-7	18 19	No	Notified C&L	Aquatic Acute 1 Acute Tox. 4 Acute Tox. 4 Aquatic Chronic 1 Skin Sens. 1B Acute Tox. 4	H400 H332 H302 H410 H317 H312	3
Chrysanthemum cinerariaefolium, extract from open and mature flowers of Tanacetum cinerariifolium obtained with hydrocarbon solvents	-	18 19	No	Notified C&L	Aquatic Acute 1 Acute Tox. 4 Acute Tox. 4 Aquatic Chronic 1 Skin Sens. 1B Acute Tox. 4	H400 H332 H302 H410 H317 H312	3
Cis-tricos-9-ene (Muscalure)	27519-02-4	19	Under assessment	Harmonised C&L	Skin Sens. 1B	H317	3
Citric acid	77-92-9	Annex I	No	Harmonised C&L	STOT SE 3 Eye Irrit. 2	H335 H319	3
Citronellal	106-23-0	Annex I	No	Notified C&L	Skin Irrit. 2 Eye Irrit. 2 Skin Sens. 1 Aquatic Chronic 2	H315 H319 H317 H411	3
Copper	7440-50-8	05	Under assessment	Harmonised C&L	Aquatic Chronic 2	H411	3
Decanoic acid	334-48-5	04 18 19	Under assessment	Harmonised C&L	Skin Irrit. 2 Eye Irrit. 2 Aquatic Chronic 3	H315 H319 H412	3
D-Fructose	57-48-7	Annex I	No	Notified C&L	NOTCLASS		3
Diflubenzuron	35367-38-5	18	No	Notified C&L	Aquatic Acute 1 Aquatic Chronic 1 Acute Tox. 4 STOT RE 2	H400 H410 H312 H373	3

Active substance name from ECHA database	CAS no.	PT / Annex I	CfS [1]	Source C&L	Hazard class and category code	Hazard Statement Code(s)	Cat.
Dinotefuran	165252-70-0	18	Yes	Notified C&L	Acute Tox. 4 Aquatic Chronic 1 Aquatic Acute 1	H302 H410 H400	3
Epsilon-Momfluorothrin	1065124-65-3	18	No	Harmonised C&L	Acute Tox. 4 STOT SE 2 Aquatic Acute 1 Aquatic Chronic 1	H302 H371 (nervous system) H400 H410	3
Ethanol	64-17-5	04	Under assessment	Harmonised C&L	Flam. Liq. 2	H225	3
Ethyl butylacetylaminopropionate	52304-36-6	19	No	Notified C&L	Eye Irrit. 2	H319	3
Eucalyptus citriodora oil, hydrated, cyclized	1245629-80-4	19	Under assessment	Notified C&L	Eye Irrit. 2	H319	3
Geraniol	106-24-1	18 19	Under assessment	Harmonised C&L	Skin Sens. 1	H317	3
Honey	8028-66-8	Annex I	No	Notified C&L	NOTCLASS		3
Iodine	7553-56-2	03 04	Yes	Harmonised C&L	Acute Tox. 4 * Acute Tox. 4 * Aquatic Acute 1	H332 H312 H400	3
Iron sulphate	7720-78-7	Annex I	No	Harmonised C&L	Acute Tox. 4 * Skin Irrit. 2 Eye Irrit. 2	H302 H315 H319	3
Lavender oil (Natural oil)	8000-28-0	Annex I	No	Notified C&L	Skin Irrit. 2 Aquatic Chronic 3 Asp. Tox. 1 Skin Sens. 1 Eye Irrit. 2	H315 H412 H304 H317 H319	3

Active substance name from ECHA database	CAS no.	PT / Annex I	CfS [1]	Source C&L	Hazard class and category code	Hazard Statement Code(s)	Cat.
Lavender, Lavandula hybrida, ext./Lavandin oil	91722-69-9	19	Under assessment	Notified C&L	Skin Sens. 1 Skin Irrit. 2 Aquatic Chronic 2 Asp. Tox. 1 STOT RE 2 Aquatic Chronic 3 Eye Irrit. 2 Skin Sens. 1B	H317 H315 H411 H304 H373 H412 H319 H317	3
Linseed oil	8001-26-1	Annex I	No	Notified C&L	NOTCLASS Eye Irrit. 2 Skin Sens. 1	 H319 H317	3
Margosa extract from cold-pressed oil of the kernels of Azadirachta Indica extracted with super-critical carbon dioxide	84696-25-3	18 19	Under assessment	Notified C&L	Aquatic Chronic 3 NOTCLASS	H412	3
Methyl nonyl ketone [11]	112-12-9	19	No	Notified C&L	Aquatic Acute 1 NOTCLASS	H400	3
N,N-diethyl-meta-toluamide	134-62-3	19	No	Harmonised C&L	Acute Tox. 4 Skin Irrit. 2 Eye Irrit. 2	H302 H315 H319	3
N-cyclopropyl-1,3,5-triazine-2,4,6-triamine (Cyromazine)	66215-27-8	18	No	Notified C&L	Skin Irrit. 2 Eye Irrit. 2 STOT SE 3 Aquatic Chronic 1	H315 H319 H335 H410	3
Nitrogen	7727-37-9	Annex I	No	Notified C&L	Press. Gas (Comp.) Press. Gas (Ref. Liq.)	H280 H281	3

Active substance name from ECHA database	CAS no.	PT / Annex I	CfS [1]	Source C&L	Hazard class and category code	Hazard Statement Code(s)	Cat.
Oct-1-en-3-ol	3391-86-4	Annex I	No	Notified C&L	Eye Irrit. 2 Skin Irrit. 2 Acute Tox. 4 Acute Tox. 4 Aquatic Acute 1	H319 H315 H332 H302 H400	3
Orange, sweet, ext.	8028-48-6	19	Under assessment	Notified C&L	Skin Irrit. 2 Asp. Tox. 1 Skin Sens. 1 Flam. Liq. 3 Aquatic Chronic 1 Aquatic Acute 1 Flam. Liq. 2 Aquatic Chronic 2	H315 H304 H317 H226 H410 H400 H225 H411	3
Peppermint oil (Natural oil)	8006-90-4	Annex I	No	Notified C&L	Skin Irrit. 2 Skin Sens. 1 Aquatic Chronic 2 Eye Irrit 2. Aquatic Chronic 3	H315 H317 H411 H319 H412	3
Permethrin	52645-53-1	18	Yes	Harmonised C&L	Acute Tox. 4 * Acute Tox. 4 * Skin Sens. 1 Aquatic Acute 1 Aquatic Chronic 1	H332 H302 H317 H400 H410	3
Potassium (E,E)-hexa-2,4-dienoate (Potassium Sorbate)	24634-61-5	Annex I	No	Harmonised C&L	Eye Irrit. 2	H319	3
Propan-2-ol	67-63-0	04	No	Harmonised C&L	Flam. Liq. 2 STOT SE 3 Eye Irrit. 2	H225 H336 H319	3
Pyriproxyfen	95737-68-1	18	Under assessment	Harmonised C&L	Aquatic Acute 1 Aquatic Chronic 1	H400 H410	3

Active substance name from ECHA database	CAS no.	PT / Annex I	CfS [1]	Source C&L	Hazard class and category code	Hazard Statement Code(s)	Cat.
Pyrogenic, synthetic amorphous, nano, surface treated silicon dioxide	68909-20-6	18	No	Harmonised C&L	STOT RE 2	H373 (lungs, inhalation)	3
Saccharomyces cerevisiae (yeast)	68876-77-7	Annex I	No	Notified C&L	NOTCLASS		3
Sec-butyl 2-(2-hydroxyethyl)piperidine-1-carboxylate/Icaridine (Icaridine)	119515-38-7	19	No	Notified C&L	Eye Irrit. 2	H319	3
Silicic acid, aluminium magnesium sodium salt	12040-43-6	18	Under assessment	Notified C&L	NOTCLASS		3
Silicium dioxide (Silicium dioxide/Kieselguhr)	61790-53-2	18	No	Notified C&L	NOTCLASS STOT SE 3 Eye Irrit. 2 Acute Tox. 4	 H335 H319 H302	3
Silver	7440-22-4	04 05	Under assessment	Notified C&L	Aquatic Acute 1 Aquatic Chronic 1 NOTCLASS	H400 H410	3
Silver chloride	7783-90-6	04	Under assessment	Notified C&L	Aquatic Acute 1 Aquatic Chronic 1 Met. Corr. 1 NOTCLASS STOT SE 2	H400 H410 H290 H335	3
Silver phosphate glass	308069-39-8	04	Under assessment	Notified C&L	NOTCLASS Eye Irrit. 2	 H319	3
S-Methoprene	65733-16-6	18	No	Harmonised C&L	Aquatic Acute 1 Aquatic Chronic 1	H400 H410	3
Sodium acetate	127-09-3	Annex I	No	Notified C&L	NOTCLASS		3
Sodium benzoate	532-32-1	Annex I	No	Notified C&L	NOTCLASS Eye Irrit. 2	 H319	3

Active substance name from ECHA database	CAS no.	PT / Annex I	CfS [1]	Source C&L	Hazard class and category code	Hazard Statement Code(s)	Cat.
Sodium dichloroisocyanurate dihydrate	51580-86-0	03 04 05	Under assessment	Harmonised C&L	Acute Tox. 4 * STOT SE 3 Eye Irrit. 2 Aquatic Acute 1 Aquatic Chronic 1	H302 H335 H319 H400 H410	3
Spinosad	168316-95-8	18	Yes	Notified C&L	Aquatic Chronic 1 Aquatic Acute 1	H410 H400	3
Symclosene	87-90-1	03 04 05	Under assessment	Harmonised C&L	Ox. Sol. 2 Acute Tox. 4 * STOT SE 3 Eye Irrit. 2 Aquatic Acute 1 Aquatic Chronic 1	H272 H302 H335 H319 H400 H410	3
Synthetic amorphous silicon dioxide (nano)	112926-00-8	18	No	Notified C&L	NOTCLASS		3
Transfluthrin	118712-89-3	18	No	Harmonised C&L	Skin Irrit. 2 Aquatic Acute 1 Aquatic Chronic 1	H315 H400 H410	3
Trisodium orthophosphate	7601-54-9	Annex I	No	Notified C&L	Skin Irrit. 2 Eye Irrit. 2 STOT SE 3	H315 H319 H335	3
Troclosene sodium	2893-78-9	03 04 05	Under assessment	Harmonised C&L	Ox. Sol. 2 Acute Tox. 4 * STOT SE 3 Eye Irrit. 2 Aquatic Acute 1 Aquatic Chronic 1	H272 H302 H335 H319 H400 H410	3
Active chlorine generated from sodium chloride and pentapotassium bis(peroxymonosulphate) bis(sulphate)	-	03 04 05	No	Not available			Not (or 2) [12]

Active substance name from ECHA database	CAS no.	PT / Annex I	CfS [1]	Source C&L	Hazard class and category code	Hazard Statement Code(s)	Cat.
Active chlorine generated from sodium chloride by electrolysis	-	03 04 05	Under assessment	Not available			Not (or 2) [12]
Active chlorine generated from sodium N-chlorosulfamate	-	04	Under assessment	Not available			Not (or 2) [12]
Active chlorine released from hypochlorous acid	-	03 04 05	No	Not available			Not (or 2) [12]
Alpha-bromadiolone	-	14	Under assessment	Not available			Not (or 1) [13]
Bacillus amyloliquefaciens	-	03	No	Not available			Not
Bacillus sphaericus 2362, strain ABTS-1743	143447-72-7	18	No	Not available			Not
Baculovirus	-	Annex I	No	Not available			Not
Carbon dioxide generated from propane, butane or a mixture of both by combustion	-	Annex I	No	Not available			Not
Cheese	-	Annex I	No	Not available			Not
Chlorine dioxide generated from sodium chlorate and hydrogen peroxide in the presence of a strong acid	-	05	Under assessment	Not available			Not (or 2) [14]
Chlorine dioxide generated from sodium chlorite by acidification	-	03 04 05	Under assessment	Not available			Not (or 2) [14]
Chlorine dioxide generated from sodium chlorite by electrolysis	-	03 04 05	Under assessment	Not available			Not (or 2) [14]

Active substance name from ECHA database	CAS no.	PT / Annex I	CfS [1]	Source C&L	Hazard class and category code	Hazard Statement Code(s)	Cat.
Chlorine dioxide generated from sodium chlorite by oxidation	-	03 04 05	Under assessment	Not available			Not (or 2) [14]
Chlorine dioxide generated from Tetrachlorodecaoxide complex (TCDO) by acidification	-	04	Under assessment	Not available			Not (or 2) [14]
Concentrated apple juice	-	Annex I	No	Not available			Not
Free radicals generated in situ from ambient air or water	-	03 04 05	Under assessment	Not available			Not (or 2) [19]
Hydrogen peroxide released from sodium percarbonate	-	03	Under assessment	Not available			Not (or 2) [20]
Monochloramine generated from ammonia and a chlorine source	-	05	Under assessment	Not available			Not (or 2) [15]
Monochloramine generated from ammonium hydroxide and a chlorine source	-	05	Under assessment	Not available			Not (or 2) [15]
Monochloramine generated from sodium hypochlorite and an ammonium source	-	05	Under assessment	Not available			Not (or 2) [15]
Chloramide [16]	10599-90-3	N/A	N/A	Notified C&L	Met. Corr. 1 Skin Corr. 1A STOT SE 3 STOT RE 1 Aquatic Chronic 3 Skin Irrit. 2 Eye Irrit. 2	H290 H314 H335 H372 H412 H315 H319	2
Nitrogen generated from ambient air	-	Annex I	No	Not available			Not

Active substance name from ECHA database	CAS no.	PT / Annex I	CfS [1]	Source C&L	Hazard class and category code	Hazard Statement Code(s)	Cat.
Ozone generated from oxygen	-	04 05	No	Not available			Not (or 1) [21]
Peanut butter	-	19	Under assessment	Not available			Not
Peracetic acid generated from tetra-acetylethylenediamine (TAED) and sodium percarbonate	-	03 04	No	Not available			Not (or 2) [22]
Performic acid generated from formic acid and hydrogen peroxide	-	04	Under assessment	Not available			Not (or 2) [23]
Powdered corn cob	-	14	No	Not available			Not
Powdered egg	-	Annex I	No	Not available			Not
Quaternary ammonium compounds, benzyl-C12-18-alkyldimethyl, salts with 1,2-benzisothiazol-3(2H)-one 1,1-dioxide	68989-01-5	04	Under assessment	Not available			Not (or 2) [24]
Reaction mass of N,N-didecyl-N-(2-hydroxyethyl)-N-methylammonium propionate and N,N-didecyl-N-(2-(2-hydroxyethoxy)ethyl)-N-methylammonium propionate and N,N-didecyl-N-(2-(2-(2-hydroxyethoxy)ethoxy)ethyl)-N-methylammonium propionate	-	04	No	Not available			Not (or 2) [25]
Reaction mass of peracetic acid and peroxyoctanoic acid	33734-57-5	03 04	No	Not available			Not (or 2) [26]
Silver borophosphate glass	-	04	Under assessment	Not available			Not

Active substance name from ECHA database	CAS no.	PT / Annex I	CfS [1]	Source C&L	Hazard class and category code	Hazard Statement Code(s)	Cat.
Silver phosphoborate glass	-	04	Under assessment	Not available			Not
Sulfur dioxide generated from sulfur by combustion	-	04	No	Not available			Not (or 2) [17]
Sulfur dioxide [18]	7446-09-5	N/A	N/A	Harmonised C&L	Acute Tox. 3 Skin Corr. 1B STOT SE 1	H331 H314 H370	2
Webbing clothes moths pheromone (Mixture)	-	Annex I	No	Not available			Not
Wolbachia pipientis strain wPip	-	Annex I	No	Not available			Not

N/A: Not Applicable
For notified classifications only classifications were included that were notified by >10% of the notifiers. Notifiers can also state that no classification applies (NOTCLASS in the table). Based on their classification of health hazards, substances are assigned to categories (cat.) 1, 2 or 3 (see Section 7.4.1). The table starts with the category 1 substances, followed by category 2, subsequently category 3 substances and finally the substances that could not be categorised because they were not included in the C&L Inventory. Whether a substance is candidate for substitution (CfS) is shown with 'yes', 'no', or 'under assessment'. This does not apply to substances listed on Annex I of the BPR. See Table A10.1 for an explanatory list of the hazard class and statement codes.
* The "*" indicates that manufacturers or importers must apply at least this minimum classification, but must classify in a more severe hazard category in the event that further information is available which shows that the hazard(s) meet the criteria for classification in the more severe category (see Annex VI, Section 1.2.1 of the CLP Regulation).
** "The classification under 67/548/EEC indicating the route of exposure has been translated into the corresponding class and category according to this Regulation, but with a general hazard statement not specifying the route of exposure as the necessary information is not available".
**** The entry might be assigned to a different (also higher) category or even another hazard class than indicated.
The indication *** does not apply for the substances in this table.
Ext. means extract
1) Substances listed on Annex I of the BPR can only be included there if, among other things, there is enough evidence that the substance does not give rise to concerns such as fulfilling any of the exclusion or substitution criteria set out in Article 10(1) or 5(1). Active substances listed on Annex I are therefore considered 'not CfS'.
2) DBNPA is not allowed anymore (not approved for PT04 per 2 March 2023).
3) "Bacillus thuringiensis subsp. israelensis Serotype H14, Strain AM65-52", "Bacillus thuringiensis subsp. israelensis, strain SA3A" and "Bacillus thuringiensis subsp. kurstaki, strain ABTS-351" have no CAS no. according to the ECHA database (information on biocidal active substances). There is a general CAS no. for *Bacillus thuringiensis*: 68038-71-1. The hazard classification information is based on this CAS no. in the C&L Inventory.
4) ECHA states that "Some substances (acids, bases, etc.) are placed on the market in aqueous solutions at various concentrations and, therefore, these solutions require different classification and labelling since the hazards vary at different concentrations. In part 3 entries with Note B have a general designation of the following type: "Nitric acid %". In this case the chemical supplier must state the percentage concentration of the solution on

the label. Unless otherwise stated, it is assumed that the percentage concentration is calculated on a weight/weight basis." This means that, depending on the concentration, additional or different hazard statements could apply to hydrogen cyanide and chlorine dioxide.
5) The hazard classification information is based on Polyhexamethylene biguanide hydrochloride (PHMB), CAS no. 32289-58-0.
6) Glucoprotamin is not allowed anymore (no longer supported for PT04 per 22 March 2024).
7) Cypermethrin will have a harmonised classification per February 2025 (ATP version 20). This will be: Acute Tox. 4 (H332), Acute Tox. 4 (H302), STOT SE 3 (H335), STOT RE 2 (H373) (nervous system), Aquatic Acute 1 (H400), Aquatic Chronic 1 (H410). Based on this, the category will become 3 instead of 2.
8) The hazard classification information is based on Cymbopogon winterianus, ext., CAS no. 91771-61-8.
9) The hazard classification information is based on Vinegar, ext., CAS no. 90132-02-8.
10) The hazard classification information for Chrysanthemum extract obtained with supercritical carbon dioxide is based on the Chrysanthemum extract obtained with hydrocarbon solvents (CAS 89997-63-7), because the same active substance is obtained.
11) Methyl nonyl ketone is not allowed anymore (expired per 30 April 2024).
12) These active chlorines could possibly be added to category 2, because of the categorisation of other substances releasing active chlorine, such as active chlorine released from calcium hypochlorite (CAS 7778-54-3) or from sodium hypochlorite (CAS 7681-52-9) or from chlorine (CAS 7782-50-5).
13) If alpha-bromadiolone has similar properties as bromadiolone (CAS no. 28772-56-7), this substance will also be categorised into category 1.
14) These chlorine dioxides could possibly be added to category 2, because of the categorisation of chlorine dioxide (CAS 10049-04-4).
15) These monochloramines could possibly be added to category 2, because of the categorisation of chloramide (=monochloramine, CAS 10599-90-3).
16) Chloramide (=monochloramine) is not a biocide, but was added in this table because the hazard classification might be relevant for in-situ generated monochloramines.
17) Sulfur dioxide generated from sulfur could possibly be added to category 2, because of the categorisation of sulfur dioxide (CAS 7446-09-5).
18) Sulfur dioxide is not a biocide, but was added in this table because the hazard classification might be relevant for in-situ generated sulfur dioxide.
19) In-situ generated radicals could possibly be added to category 2, as this substance is expected to form radicals similar to hydrogen peroxide (CAS 772-84-1).
20) In-situ generated hydrogen peroxide could possibly be added to category 2, as the active substance formed is hydrogen peroxide (CAS 7722-84-1; cat 2).
21) Ozone generated form oxygen could possibly be added to category 1, because of the potentially formation of carcinogenic DBPs.
22) In-situ generated peracetic acid could possibly be added to category 2, as the active substance formed is peracetic acid (CAS 79-21-0; cat 2).
23) In situ generated performic acid could possibly be added to category 2, as similar compounds such as hydrogen peroxide and peracetic acid were also classified in category 2.
24) Quaternary ammonium compounds, benzyl-C12-18-alkyldimethyl, salts with 1,2-benzisothiazol-3(2H)-one 1,1-dioxide could possibly be added to category 2, because of the classification of the other quats.
25) Reaction mass of these substances could possibly be added to category 2, as propionic acid and quaternary ammonium compounds were also categorised in category 2.
26) Reaction mass of peracetic acid and peroxyoctanoic acid could possibly be added to category 2, as similar per compounds such as peracetic acid were also categorised in category 2.

Table A10.3 Hazards classification information from the C&L Inventory for substances that could end up in food as degradation products, metabolites or DBPs of some active substances in biocides (see Section 7.4.2), also substances reported in the KAP database that could be part of active substances that are mixtures are included (see Section 4.2).

Substance name	**CAS no.**	**Source C&L**	**Hazard class and category code**	**Hazard Statement Code(s)**	**Cat.**
Bromodichloromethane	75-27-4	Notified C&L	Acute Tox. 4 STOT SE 3 Carc. 2 Skin Irrit. 2	H302 H335 H351 H315	1
Chloroform (trichloromethane)	67-66-3	Harmonised C&L	Carc. 2 Repr. 2 Acute Tox. 3 Acute Tox. 4 STOT RE 1 Skin Irrit. 2 Eye Irrit. 2	H351 H361d H331 H302 H372 H315 H319	1
Chlorohexidine	55-56-1	Notified C&L	Aquatic Chronic 1 Aquatic Acute 1 Eye Irrit. 2 Skin Irrit. 2 Eye Dam. 1 Resp. Sens. 1 STOT SE 3 Acute Tox. 4 STOT RE 2	H410 H400 H319 H315 H318 H334 H335 H302 H373	1

Substance name	CAS no.	Source C&L	Hazard class and category code	Hazard Statement Code(s)	Cat.
Dimethyldioctylammonium chloride (DDAC-8)	5538-94-3	Notified C&L	Skin Corr. 1B Aquatic Acute 1 Acute Tox. 3 Acute Tox. 2 Eye Dam. 1 Aquatic Chronic 1 Acute Tox. 4 Flam. Liq. 3	H314 H400 H301 H310 H318 H410 H302 H226	1
Sodium bromate	7789-38-0	Notified C&L	Acute Tox. 4 Eye Irrit. 2 Skin Irrit. 2 Carc. 1B Ox. Sol. 1 STOT SE 3 Ox. Sol. 2 Ox. Sol. 3 Muta. 2	H302 H319 H315 H350 H271 H335 H272 H272 H341	1
α-cyano-3-phenoxybenzyl 3-(2-chloro-3,3,3-trifluoroprop-1-enyl)-2,2-dimethylcyclopropanecarboxylate (Cyhalothrin)	68085-85-8	Notified C&L	Aquatic Chronic 1 Aquatic Acute 1 Acute Tox. 3 Acute Tox. 1 Skin Irrit. 2 Eye Irrit. 2 Skin Sens. 1 Skin Sens. 1B Acute Tox. 2 Acute Tox. 4	H410 H400 H301 H330 H315 H319 H317 H317 H330 H312	1

Substance name	CAS no.	Source C&L	Hazard class and category code	Hazard Statement Code(s)	Cat.
Benzododecinium chloride (BAC 12)	139-07-1	Notified C&L	Acute Tox. 4 Skin Corr. 1B Aquatic Acute 1 Acute Tox. 4 Eye Dam. 1 Aquatic Chronic 1	H302 H314 H400 H312 H318 H410	2
Bromoform (tribromomethane)	75-25-2	Harmonised C&L	Acute Tox. 4 Skin Irrit. 2 Eye Irrit. 2 Acute Tox. 3 Aquatic Chronic 2	H302 H315 H319 H331 H411	2
Cetalkonium chloride (BAC 16)	122-18-9	Notified C&L	Acute Tox. 4 Aquatic Acute 1 Skin Corr. 1B Acute Tox. 4 Eye Dam. 1 Aquatic Chronic 1	H302 H400 H314 H312 H318 H410	2
Dichloroacetic acid	79-43-6	Harmonised C&L	Skin Corr. 1A Aquatic Acute 1	H314 H400	2
Miristalkonium chloride (BAC 14)	139-08-2	Notified C&L	Acute Tox. 4 Skin Corr. 1B Aquatic Acute 1 Acute Tox. 4 Eye Dam. 1 Aquatic Chronic 1	H302 H314 H400 H312 H318 H410	2
Benzyl(decyl)dimethylammonium chloride (BAC 10)	965-32-2	Notified C&L	Eye Irrit. 2 STOT SE 3 Skin Irrit. 2	H319 H335 H315	3

Substance name	CAS no.	Source C&L	Hazard class and category code	Hazard Statement Code(s)	Cat.
Didodecyl dimethyl ammonium chloride Dilauryl dimethyl ammonium chloride (DDAC-12)	3401-74-9	Notified C&L	Eye Irrit. 2 Skin Irrit. 2 Acute Tox. 4	H319 H315 H302	3
Perchlorate	14797-73-0	Notified C&L	Acute Tox. 4 Ox. Sol. 1	H302 H271	3
Sodium chlorate	7775-09-9	Harmonised C&L	Ox. Sol. 1 Acute Tox. 4 * Aquatic Chronic 2	H271 H302 H411	3
BAC 8	-	Not available			Not
BAC 18	-	Not available			Not
Benzalkonium chloride (mixture of alkylbenzyldimethylammonium chlorides with alkyl chain lengths of C8, C10, C12, C14, C16 and C18)	-	Not available			Not
Didecyldimethylammonium chloride (mixture of alkyl-quaternary ammonium salts with alkyl chain lengths of C8, C10 and C12)	-	Not available			Not

For notified classifications only classifications were included that were notified by >10% of the notifiers. Based on their classification of health hazards, substances are assigned to categories (cat.) 1, 2 or 3 (see Section 7.4.1). The table starts with the category 1 substances, followed by category 2, subsequently category 3 substances and finally the substances which could not be catergorised because they were not included in the C&L Inventory. See Table A10.1 for an explanatory list of the hazard class and statement codes.

Annex 11 Suggested assignment of priority points and consolidated priority table

The complete consolidated priority table is provided electronically (in Excel https://www.rivm.nl/bibliotheek/rapporten/2025-0126-Annex-11.xlsx). In this digital version, the criteria and scaling of the priority points can be selected and amended as required. All gathered information and the explanation of the assignment of priority points is included in the Excel version.

In this annex, only the explanation for the suggested assignment of the priority points (Table A11.1) and the final results of the prioritisation (Table A11.2) are presented.

Note: the information in this annex was gathered in the course of 2024 and the first months of 2025. The information changes over time. If this information is used for decision-making, please ensure that the information is still up to date and correct.

Table A11.1 Explanation of the suggested assignment of priority points in the consolidated priority table.

Priority for No of PTs (5 is highest)	
Active substance allowed for use in 3 PTs	5
Active substance allowed for use in 2 PTs	3
Active substance allowed for use in 1 PT	1
Annex I low risk active substance allowed for use in all PTs	0
New active substances still under review	0

Priority for DBPs + Monitoring + MRL + Analytical Method (10 is highest)	
art 18 default PPP MRL; monitoring > MRL	10
chlorine DBPs expected; monitoring > MRL for chlorate	10
no monitoring data, no MRL legislation, anal. method available	10
non-chlorine DBPs expected	10
Quats: mismatch within PPP MRL regulation; monitoring > MRL	10
Salicylic acid: mismatch within VMP MRL regulations; monitoring > MRL;	10
specific PPP MRL, monitoring > MRL	10
VMP MRL not required; monitoring infant/toddler food > MRL	10
no monitoring data, no MRL legislation, no anal. method	9
no monitoring data, art 18 default PPP MRL, anal. method available	8
no monitoring data, specific PPP MRL, anal. method available	8
no monitoring data, art 18 default PPP MRL, no anal. method	7
no monitoring data, specific PPP MRL only, no anal. method	7
mismatch between PPP & VMP MRL; monitoring data but not for all 3 matrices (meat, dairy, infant/toddler food)	6
no mismatch between PPP & VMP MRL; monitoring data but not for all 3 matrices (meat, dairy, infant/toddler food)	5
specific PPP MRL only; monitoring data but not for all 3 matrices (meat, dairy, infant/toddler food)	5

Priority for DBPs + Monitoring + MRL + Analytical Method (10 is highest)	
no monitoring data, art 18 default PPP MRL, VMP MRL not required, anal. method available	4
no monitoring data, VMP MRL not required, anal. method available	4
no monitoring data, art 18 default PPP MRL, VMP MRL not required, no anal. method	3
no monitoring data, VMP MRL not required, no anal. method	3
art 18 default PPP MRL; monitoring (meat, dairy, infant/toddler food) <LOQ	2
no MRL legislation; monitoring (meat, dairy, infant/toddler food) < LOQ	2
mismatch between PPP & VMP MRL; monitoring (meat, dairy, infant/toddler food) < MRL	2
specific PPP & VMP MRL; monitoring (meat, dairy, infant/toddler food) < MRL	2
specific PPP MRL for plant commodities only, no MRL for animal commodities listed; monitoring (meat, dairy, infant/toddler food) < LOQ	2
no MRL legislation, substance = food, monitoring not relevant	1
no mismatch between PPP & VMP MRL; monitoring (meat, dairy, infant/toddler food) < MRL	1
specific PPP MRL only; monitoring (meat, dairy, infant/toddler food) < MRL	1
BPR Annex I, monitoring not relevant	0
new substance under review, monitoring not relevant yet	0
micro-organism: no monitoring possible	0
PPP MRL not required, monitoring not relevant	0
VMP & PPP MRL not required, monitoring not relevant	0

Priority for hazard category (5=highest)	
Category 1	5
Not (or 1)	5
Category 2	3
Not (or 2)	3
Category 3	1
not	0

Table A11.2 Results of prioritisation based on the suggested assignment of priority points.

Key Annex 11	Active substance name from ECHA database	Common name or abbreviation	CAS no.	Overall Priority	Annex I (all) or PTs	Priority for No of PTs (5 is highest)	Priority Comment for No of PTs	Priority for DBPs + Monitoring + MRL + Anal. Method (10 is highest)	Priority Comment for Monitoring + MRL + Anal. Method	Hazard Category	Priority for hazard category (5 is highest)
1	Tosylchloramide sodium (Tosylchloramide sodium - Chloramin T)	Chloramin T	127-65-1	20	03, 04, 05	5	3 PTs	10	chlorine DBPs expected; monitoring > MRL for chlorate	1	5
2	Active chlorine generated from sodium chloride and pentapotassium bis(peroxymono sulphate) bis(sulphate)	Active chlorine generated from sodium chloride and pentapotassium bis(peroxymono sulphate) bis(sulphate)	-	18	03, 04, 05	5	3 PTs	10	chlorine DBPs expected; monitoring > MRL for chlorate	Not (or 2)	3
3	Active chlorine generated from sodium chloride by electrolysis	Active chlorine generated from sodium chloride by electrolysis	-	18	03, 04, 05	5	3 PTs	10	chlorine DBPs expected; monitoring > MRL for chlorate	Not (or 2)	3
4	Active chlorine released from calcium hypochlorite	Active chlorine released from calcium hypochlorite	7778-54-3	18	03, 04, 05	5	3 PTs	10	chlorine DBPs expected; monitoring > MRL for chlorate	2	3

Key Annex 11	Active substance name from ECHA database	Common name or abbreviation	CAS no.	Overall Priority	Annex I (all) or PTs	Priority for No of PTs (5 is highest)	Priority Comment for No of PTs	Priority for DBPs + Monitoring + MRL + Anal. Method (10 is highest)	Priority Comment for Monitoring + MRL + Anal. Method	Hazard Category	Priority for hazard category (5 is highest)
5	Active chlorine released from hypochlorous acid	Active chlorine released from hypochlorous acid	-	18	03, 04, 05	5	3 PTs	10	chlorine DBPs expected; monitoring > MRL for chlorate	Not (or 2)	3
6	Active chlorine released from sodium hypochlorite	Active chlorine released from sodium hypochlorite	7681-52-9	18	03, 04, 05	5	3 PTs	10	chlorine DBPs expected; monitoring > MRL for chlorate	2	3
7	Chlorine dioxide	Chlorine dioxide	10049-04-4	18	03, 04, 05	5	3 PTs	10	chlorine DBPs expected; monitoring > MRL for chlorate	2	3
8	Chlorine dioxide generated from sodium chlorite by acidification	Chlorine dioxide generated from sodium chlorite by acidification	-	18	03, 04, 05	5	3 PTs	10	chlorine DBPs expected; monitoring > MRL for chlorate	Not (or 2)	3
9	Chlorine dioxide generated from sodium chlorite by electrolysis	Chlorine dioxide generated from sodium chlorite by electrolysis	-	18	03, 04, 05	5	3 PTs	10	chlorine DBPs expected; monitoring > MRL for chlorate	Not (or 2)	3

Key Annex 11	Active substance name from ECHA database	Common name or abbreviation	CAS no.	Overall Priority	Annex I (all) or PTs	Priority for No of PTs (5 is highest)	Priority Comment for No of PTs	Priority for DBPs + Monitoring + MRL + Anal. Method (10 is highest)	Priority Comment for Monitoring + MRL + Anal. Method	Hazard Category	Priority for hazard category (5 is highest)
10	Chlorine dioxide generated from sodium chlorite by oxidation	Chlorine dioxide generated from sodium chlorite by oxidation	-	18	03, 04, 05	5	3 PTs	10	chlorine DBPs expected; monitoring > MRL for chlorate	Not (or 2)	3
11	Hydrogen cyanide	Hydrogen cyanide	74-90-8	18	14, 18	3	2 PTs	10	no monitoring data, no MRL legislation, anal. method available	1	5
12	Hydrogen peroxide	Hydrogen peroxide	7722-84-1	18	03, 04, 05	5	3 PTs	10	non-chlorine DBPs expected	2	3
13	Ozone generated from oxygen	Ozone generated from oxygen	-	18	04, 05	3	2 PTs	10	non-chlorine DBPs expected	Not (or 1)	5
14	Pentapotassium bis(peroxymono sulphate) bis(sulphate)	Pentapotassium bis(peroxymono sulphate) bis(sulphate)	70693-62-8	18	03, 04, 05	5	3 PTs	10	non-chlorine DBPs expected	2	3
15	Peracetic acid	Peracetic acid	79-21-0	18	03, 04, 05	5	3 PTs	10	non-chlorine DBPs expected	2	3

Key Annex 11	Active substance name from ECHA database	Common name or abbreviation	CAS no.	Overall Priority	Annex I (all) or PTs	Priority for No of PTs (5 is highest)	Priority Comment for No of PTs	Priority for DBPs + Monitoring + MRL + Anal. Method (10 is highest)	Priority Comment for Monitoring + MRL + Anal. Method	Hazard Category	Priority for hazard category (5 is highest)
16	Salicylic acid	Salicylic acid	69-72-7	18	03, 04	3	2 PTs	10	Salicylic acid: mismatch within VMP MRL regulations; monitoring > MRL;	1	5
17	Polyhexamethylene biguanide hydrochloride with a mean number-average molecular weight (Mn) of 1600 and a mean polydispersity (PDI) of 1.8 (PHMB(1600;1.8))	PHMB(1600;1.8)	27083-27-8	17	03, 04	3	2 PTs	9	no monitoring data, no MRL legislation, no anal. method	1	5

Key Annex 11	Active substance name from ECHA database	Common name or abbreviation	CAS no.	Overall Priority	Annex I (all) or PTs	Priority for No of PTs (5 is highest)	Priority Comment for No of PTs	Priority for DBPs + Monitoring + MRL + Anal. Method (10 is highest)	Priority Comment for Monitoring + MRL + Anal. Method	Hazard Category	Priority for hazard category (5 is highest)
18	[2,4-Dioxo-(2-propyn-1-yl)imidazolidin-3-yl]methyl(1R)-cis-chrysanthemate;[2,4- Dioxo-(2-propyn-1-yl)imidazolidin-3-yl] methyl(1R)-trans-chrysanthemate (Imiprothrin)	Imiprothrin	72963-72-5	16	18	1	1 PT	10	no monitoring data, no MRL legislation, anal. method available	1	5
19	Alkyl (C12-16) dimethylbenzyl ammonium chloride (ADBAC/BKC (C12-16))	ADBAC/BKC (C12-16)	68424-85-1	16	03, 04	3	2 PTs	10	Quats: mismatch within PPP MRL regulation; monitoring > MRL	2	3
20	Alkyl (C12-18) dimethylbenzyl ammonium chloride (ADBAC (C12-18))	ADBAC (C12-18)	68391-01-5	16	03, 04	3	2 PTs	10	Quats: mismatch within PPP MRL regulation; monitoring > MRL	2	3

Key Annex 11	Active substance name from ECHA database	Common name or abbreviation	CAS no.	Overall Priority	Annex I (all) or PTs	Priority for No of PTs (5 is highest)	Priority Comment for No of PTs	Priority for DBPs + Monitoring + MRL + Anal. Method (10 is highest)	Priority Comment for Monitoring + MRL + Anal. Method	Hazard Category	Priority for hazard category (5 is highest)
21	Alkyl (C12-C14) dimethyl(ethylbenzyl)ammonium chloride (ADEBAC (C12-C14))	ADEBAC (C12-C14)	85409-23-0	16	03, 04	3	2 PTs	10	Quats: mismatch within PPP MRL regulation; monitoring > MRL	2	3
22	Alkyl (C12-C14) dimethylbenzyl ammonium chloride (ADBAC (C12-C14))	ADBAC (C12-C14)	85409-22-9	16	03, 04	3	2 PTs	10	Quats: mismatch within PPP MRL regulation; monitoring > MRL	2	3
23	Aluminium phosphide releasing phosphine	Aluminium phosphide releasing phosphine	20859-73-8	16	14, 18	3	2 PTs	8	no monitoring data, specific PPP MRL, anal. method available	1	5
24	Brodifacoum	Brodifacoum	56073-10-0	16	14	1	1 PT	10	art 18 default PPP MRL; monitoring > MRL	1	5

Key Annex 11	Active substance name from ECHA database	Common name or abbreviation	CAS no.	Overall Priority	Annex I (all) or PTs	Priority for No of PTs (5 is highest)	Priority Comment for No of PTs	Priority for DBPs + Monitoring + MRL + Anal. Method (10 is highest)	Priority Comment for Monitoring + MRL + Anal. Method	Hazard Category	Priority for hazard category (5 is highest)
25	Didecyldimethyl ammonium chloride (DDAC (C8-10))	DDAC (C8-10)	68424-95-3	16	03, 04	3	2 PTs	10	Quats: mismatch within PPP MRL regulation; monitoring > MRL	2	3
26	Didecyldimethyl ammonium chloride (DDAC)	DDAC	7173-51-5	16	03, 04	3	2 PTs	10	Quats: mismatch within PPP MRL regulation; monitoring > MRL	2	3
27	Disodium peroxodisulphate/Sodium persulphate	Disodium peroxodisulphate /Sodium persulphate	7775-27-1	16	04	1	1 PT	10	non-chlorine DBPs expected	1	5

Key Annex 11	Active substance name from ECHA database	Common name or abbreviation	CAS no.	Overall Priority	Annex I (all) or PTs	Priority for No of PTs (5 is highest)	Priority Comment for No of PTs	Priority for DBPs + Monitoring + MRL + Anal. Method (10 is highest)	Priority Comment for Monitoring + MRL + Anal. Method	Hazard Category	Priority for hazard category (5 is highest)
28	Mixture of 5-chloro-2-methyl-2H-isothiazol-3-one (EINECS 247-500-7) and 2-methyl-2H-isothiazol-3-one (EINECS 220-239-6) (Mixture of CMIT/MIT)	Mixture of 5-chloro-2-methyl-2H- isothiazol-3-one (EINECS 247-500-7) and 2-methyl-2H-isothiazol-3-one (EINECS 220-239-6) (Mixture of CMIT/MIT)	55965-84-9	16	04	1	1 PT	10	no monitoring data, no MRL legislation, anal. method available	1	5
29	Peracetic acid generated from tetra-acetylethylene diamine (TAED) and sodium percarbonate	Peracetic acid generated from tetra-acetylethylenediamine (TAED) and sodium percarbonate	-	16	03, 04	3	2 PTs	10	non-chlorine DBPs expected	Not (or 2)	3
30	Reaction mass of peracetic acid and peroxyoctanoic acid	Reaction mass of peracetic acid and peroxyoctanoic acid	33734-57-5	16	03, 04	3	2 PTs	10	non-chlorine DBPs expected	Not (or 2)	3
31	2,2-dibromo-2-cyanoacetamide (DBNPA)	DBNPA	10222-01-2	15	04	1	1 PT	9	no monitoring data, no MRL legislation, no anal. method	1	5

Key Annex 11	Active substance name from ECHA database	Common name or abbreviation	CAS no.	Overall Priority	Annex I (all) or PTs	Priority for No of PTs (5 is highest)	Priority Comment for No of PTs	Priority for DBPs + Monitoring + MRL + Anal. Method (10 is highest)	Priority Comment for Monitoring + MRL + Anal. Method	Hazard Category	Priority for hazard category (5 is highest)
32	Amines, N-C10-16-alkyltrimethylene di-, reaction products with chloroacetic acid	Amines, N-C10-16-alkyltrimethylene di-, reaction products with chloroacetic acid	139734-65-9	15	03, 04	3	2 PTs	9	no monitoring data, no MRL legislation, no anal. method	2	3
33	Decanoic acid	Decanoic acid	334-48-5	15	04, 18, 19	5	3 PTs	9	no monitoring data, no MRL legislation, no anal. method	3	1
34	Glycolic acid	Glycolic acid	79-14-1	15	03, 04	3	2 PTs	9	no monitoring data, no MRL legislation, no anal. method	2	3
35	Glyoxal	Glyoxal	107-22-2	15	03, 04	3	2 PTs	7	no monitoring data, art 18 default PPP MRL, no anal. method	1	5
36	N-(3-aminopropyl)-N-dodecylpropane-1,3-diamine (Diamine)	N-(3-aminopropyl)-N-dodecylpropane-1,3-diamine (Diamine)	2372-82-9	15	03, 04	3	2 PTs	9	no monitoring data, no MRL legislation, no anal. method	2	3

Key Annex 11	Active substance name from ECHA database	Common name or abbreviation	CAS no.	Overall Priority	Annex I (all) or PTs	Priority for No of PTs (5 is highest)	Priority Comment for No of PTs	Priority for DBPs + Monitoring + MRL + Anal. Method (10 is highest)	Priority Comment for Monitoring + MRL + Anal. Method	Hazard Category	Priority for hazard category (5 is highest)
37	Polyhexamethylene biguanide hydrochloride with a mean number-average molecular weight (Mn) of 1415 and a mean polydispersity (PDI) of 4.7 (PHMB(1415;4.7))	PHMB(1415;4.7)	180218 1-67-4	15	04	1	1 PT	9	no monitoring data, no MRL legislation, no anal. method	1	5
38	Reaction products of: glutamic acid and N-(C12-C14-alkyl)propylene diamine (Glucoprotamin)	Reaction products of: glutamic acid and N-(C12-C14-alkyl)propylene diamine (Glucoprotamin)	164907-72-6	15	04	1	1 PT	9	no monitoring data, no MRL legislation, no anal. method	1	5
39	Symclosene	Symclosene	87-90-1	15	03, 04, 05	5	3 PTs	9	no monitoring data, no MRL legislation, no anal. method	3	1
40	Troclosene sodium	Troclosene sodium	2893-78-9	15	03, 04, 05	5	3 PTs	9	no monitoring data, no MRL legislation, no anal. method	3	1

Key Annex 11	Active substance name from ECHA database	Common name or abbreviation	CAS no.	Overall Priority	Annex I (all) or PTs	Priority for No of PTs (5 is highest)	Priority Comment for No of PTs	Priority for DBPs + Monitoring + MRL + Anal. Method (10 is highest)	Priority Comment for Monitoring + MRL + Anal. Method	Hazard Category	Priority for hazard category (5 is highest)
41	2-methyl-4-oxo-3-(prop-2-ynyl)cyclopent-2-en-1-yl 2,2-dimethyl-3-(2-methylprop-1-enyl)cyclopropanecarboxylate (Prallethrin)	Prallethrin	23031-36-9	14	18	1	1 PT	10	no monitoring data, no MRL legislation, anal. method available	2	3
42	5-chloro-2-(4-chlorphenoxy)phenol (DCPP)	DCPP	3380-30-1	14	04	1	1 PT	10	no monitoring data, no MRL legislation, anal. method available	2	3
43	Active chlorine generated from sodium N-chlorosulfamate	Active chlorine generated from sodium N-chlorosulfamate	-	14	04	1	1 PT	10	chlorine DBPs expected; monitoring > MRL for chlorate	Not (or 2)	3
44	Active chlorine released from chlorine	Active chlorine released from chlorine	7782-50-5	14	05	1	1 PT	10	chlorine DBPs expected; monitoring > MRL for chlorate	2	3

Key Annex 11	Active substance name from ECHA database	Common name or abbreviation	CAS no.	Overall Priority	Annex I (all) or PTs	Priority for No of PTs (5 is highest)	Priority Comment for No of PTs	Priority for DBPs + Monitoring + MRL + Anal. Method (10 is highest)	Priority Comment for Monitoring + MRL + Anal. Method	Hazard Category	Priority for hazard category (5 is highest)
45	Biphenyl-2-ol	Biphenyl-2-ol 2-phenylphenol	90-43-7	14	03, 04	3	2 PTs	10	specific PPP MRL, monitoring > MRL	3	1
46	Bromadiolone	Bromadiolone	28772-56-7	14	14	1	1 PT	8	no monitoring data, specific PPP MRL, anal. method available	1	5
47	Chlorine dioxide generated from sodium chlorate and hydrogen peroxide in the presence of a strong acid	Chlorine dioxide generated from sodium chlorate and hydrogen peroxide in the presence of a strong acid	-	14	05	1	1 PT	10	chlorine DBPs expected; monitoring > MRL for chlorate	Not (or 2)	3
48	Chlorine dioxide generated from Tetrachlorodecaoxide complex (TCDO) by acidification	Chlorine dioxide generated from Tetrachlorodecaoxide complex (TCDO) by acidification	-	14	04	1	1 PT	10	chlorine DBPs expected; monitoring > MRL for chlorate	Not (or 2)	3

Key Annex 11	Active substance name from ECHA database	Common name or abbreviation	CAS no.	Overall Priority	Annex I (all) or PTs	Priority for No of PTs (5 is highest)	Priority Comment for No of PTs	Priority for DBPs + Monitoring + MRL + Anal. Method (10 is highest)	Priority Comment for Monitoring + MRL + Anal. Method	Hazard Category	Priority for hazard category (5 is highest)
49	Chlorophacinone	Chlorophacinone	3691-35-8	14	14	1	1 PT	8	no monitoring data, art 18 default PPP MRL, anal. method available	1	5
50	Coumatetralyl	Coumatetralyl	5836-29-3	14	14	1	1 PT	8	no monitoring data, art 18 default PPP MRL, anal. method available	1	5
51	Difenacoum	Difenacoum	56073-07-5	14	14	1	1 PT	8	no monitoring data, specific PPP MRL, anal. method available	1	5
52	Difethialone	Difethialone	104653-34-1	14	14	1	1 PT	8	no monitoring data, art 18 default PPP MRL, anal. method available	1	5

Key Annex 11	Active substance name from ECHA database	Common name or abbreviation	CAS no.	Overall Priority	Annex I (all) or PTs	Priority for No of PTs (5 is highest)	Priority Comment for No of PTs	Priority for DBPs + Monitoring + MRL + Anal. Method (10 is highest)	Priority Comment for Monitoring + MRL + Anal. Method	Hazard Category	Priority for hazard category (5 is highest)
53	Flocoumafen	Flocoumafen	90035-08-8	14	14	1	1 PT	8	no monitoring data, art 18 default PPP MRL, anal. method available	1	5
54	Hydrogen peroxide released from sodium percarbonate	Hydrogen peroxide released from sodium percarbonate	-	14	03	1	1 PT	10	non-chlorine DBPs expected	Not (or 2)	3
55	Magnesium phosphide releasing phosphine	Magnesium phosphide releasing phosphine	12057-74-8	14	18	1	1 PT	8	no monitoring data, specific PPP MRL, anal. method available	1	5
56	Metofluthrin	Metofluthrin	-	14	18	1	1 PT	10	no monitoring data, no MRL legislation, anal. method available	2	3
57	Performic acid generated from formic acid and hydrogen peroxide	Performic acid generated from formic acid and hydrogen peroxide	-	14	04	1	1 PT	10	non-chlorine DBPs expected	Not (or 2)	3

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58	Quaternary ammonium compounds, benzyl-C12-18-alkyldimethyl, salts with 1,2-benzisothiazol-3(2H)-one 1,1-dioxide	Quaternary ammonium compounds, benzyl-C12-18-alkyldimethyl, salts with 1,2-benzisothiazol-3(2H)-one 1,1-dioxide	68989-01-5	14	04	1	1 PT	10	Quats: mismatch within PPP MRL regulation; monitoring > MRL	Not (or 2)	3
59	Silver	Silver	7440-22-4	14	04, 05	3	2 PTs	10	no monitoring data, no MRL legislation, anal. method available	3	1
60	Warfarin	Warfarin	81-81-2	14	14	1	1 PT	8	no monitoring data, specific PPP MRL, anal. method available	1	5
61	2-phenoxyethanol	2-phenoxyethanol	122-99-6	13	04	1	1 PT	9	no monitoring data, no MRL legislation, no anal. method	2	3

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62	Bromoacetic acid	Bromoacetic acid	79-08-3	13	04	1	1 PT	9	no monitoring data, no MRL legislation, no anal. method	2	3
63	Calcium magnesium oxide/dolomitic lime	Calcium magnesium oxide/dolomitic lime	37247-91-9	13	03	1	1 PT	9	no monitoring data, no MRL legislation, no anal. method	2	3
64	Calcium magnesium tetrahydroxide/ calcium magnesium hydroxide/hydrated dolomitic lime	Calcium magnesium tetrahydroxide/ calcium magnesium hydroxide/ hydrated dolomitic lime	39445-23-3	13	03	1	1 PT	9	no monitoring data, no MRL legislation, no anal. method	2	3
65	Cymbopogon winterianus oil, fractionated, hydrated, cyclized	Cymbopogon winterianus oil, fractionated, hydrated, cyclized	-	13	19	1	1 PT	9	no monitoring data, no MRL legislation, no anal. method	2	3

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66	D-gluconic acid, compound with N,N′′-bis(4-chlorophenyl)-3,12-diimino-2,4,11,13-tetraazatetradecane diamidine(2:1) (CHDG)	CHDG, Chlorohexidine digluconate	18472-51-0	13	03	1	1 PT	9	no monitoring data, no MRL legislation, no anal. method	2	3
67	Poly(oxy-1,2-ethanediyl), α-[2-(didecylmethylammonio) ethyl]- .omega.-hydroxy-, propanoate (salt) (Bardap 26)	Poly(oxy-1,2-ethanediyl), α-[2-(didecylmethyl ammonio)ethyl]-.omega.-hydroxy-, propanoate (salt) (Bardap 26)	94667-33-1	13	04	1	1 PT	9	no monitoring data, no MRL legislation, no anal. method	2	3
68	Propan-1-ol	Propan-1-ol	71-23-8	13	04	1	1 PT	9	no monitoring data, no MRL legislation, no anal. method	2	3

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69	Reaction mass of N,N-didecyl-N-(2-hydroxyethyl)-N-methylammonium propionate and N,N-didecyl-N-(2-(2-hydroxyethoxy) ethyl)-N-methylammonium propionate and N,N-didecyl-N-(2-(2-(2-hydroxyethoxy) ethoxy)ethyl)-N-methylammonium propionate	Reaction mass of N,N-didecyl-N-(2-hydroxyethyl)-N-methyl ammonium propionate and N,N-didecyl-N-(2-(2-hydroxyethoxy) ethyl)-N-methyl ammonium propionate and N,N-didecyl-N-(2-(2-(2-hydroxyethoxy) ethoxy)ethyl)-N-methyl ammonium propionate	-	13	04	1	1 PT	9	no monitoring data, no MRL legislation, no anal. method	Not (or 2)	3
70	Sulfur dioxide generated from sulfur by combustion	Sulfur dioxide generated from sulfur by combustion	-	13	04	1	1 PT	9	no monitoring data, no MRL legislation, no anal. method	Not (or 2)	3

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71	2-(2-butoxyethoxy)ethyl 6-propylpiper-onyl ether (Piperonyl butoxide/PBO)	Piperonyl butoxide/PBO	51-03-6	12	18	1	1 PT	10	VMP MRL not required; monitoring infant/toddler food > MRL	3	1
72	Alphachloralose	Alphachloralose	15879-93-3	12	14	1	1 PT	8	no monitoring data, art 18 default PPP MRL, anal. method available	2	3
73	Epsilon-Momfluorothrin	Epsilon-Momfluorothrin	1065124-65-3	12	18	1	1 PT	10	no monitoring data, no MRL legislation, anal. method available	3	1
74	Sec-butyl 2-(2-hydroxyethyl) piperidine-1-carboxylate/ Icaridine (Icaridine)	Icaridine	119515-38-7	12	19	1	1 PT	10	no monitoring data, no MRL legislation, anal. method available	3	1

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75	Sodium dimethylarsinate (Sodium Cacodylate)	Sodium dimethylarsinate (Sodium Cacodylate)	124-65-2	12	18	1	1 PT	8	no monitoring data, art 18 default PPP MRL, anal. method available	2	3
76	α-cyano-4-fluoro-3-phenoxybenzyl3-(2,2-dichlorovinyl)-2,2-dimethylcyclo-propanecarboxylate (Cyfluthrin)	Cyfluthrin	68359-37-5	12	18	1	1 PT	6	mismatch between PPP & VMP MRL; monitoring data but not for all 3 matrices (meat, dairy, infant/toddler food)	1	5
77	Acetamiprid	Acetamiprid	135410-20-7	11	18	1	1 PT	5	specific PPP MRL only; monitoring data but not for all 3 matrices (meat, dairy, infant/toddler food)	1	5

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78	Ethyl butylacetylaminopropionate	Ethyl butylacetylaminopropionate	52304-36-6	11	19	1	1 PT	9	no monitoring data, no MRL legislation, no anal. method	3	1
79	Formic acid	Formic acid	64-18-6	11	03, 04, 05	5	3 PTs	3	no monitoring data, art 18 default PPP MRL, VMP MRL not required, no anal. method	2	3
80	Glutaral (Glutaraldehyde)	Glutaral (Glutaraldehyde)	111-30-8	11	03, 04	3	2 PTs	3	no monitoring data, art 18 default PPP MRL, VMP MRL not required, no anal. method	1	5
81	Lavender, Lavandula hybrida, ext./Lavandin oil	Lavender, Lavandula hybrida, ext./Lavandin oil	91722-69-9	11	19	1	1 PT	9	no monitoring data, no MRL legislation, no anal. method	3	1

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82	Margosa extract from cold-pressed oil of the kernels of Azadirachta Indica extracted with super-critical carbon dioxide	Azadirachtin (Margosa extract)	84696-25-3	11	18, 19	3	2 PTs	7	no monitoring data, specific PPP MRL only, no anal. method	3	1
83	Pyrogenic, synthetic amorphous, nano, surface treated silicon dioxide	Pyrogenic, synthetic amorphous, nano, surface treated silicon dioxide	68909-20-6	11	18	1	1 PT	9	no monitoring data, no MRL legislation, no anal. method	3	1
84	Silicium dioxide (Silicium dioxide/Kieselguhr)	Silicium dioxide (Silicium dioxide/ Kieselguhr)	61790-53-2	11	18	1	1 PT	9	no monitoring data, no MRL legislation, no anal. method	3	1
85	Sulfuryl fluoride	Sulfuryl fluoride	2699-79-8	11	18	1	1 PT	7	no monitoring data, specific PPP MRL only, no anal. method	2	3
86	Synthetic amorphous silicon dioxide (nano)	Synthetic amorphous silicon dioxide (nano)	112926-00-8	11	18	1	1 PT	9	no monitoring data, no MRL legislation, no anal. method	3	1

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87	1R-trans phenothrin	1R-trans phenothrin	26046-85-5	10	18	1	1 PT	8	no monitoring data, specific PPP MRL, anal. method available	3	1
88	Formaldehyde	Formaldehyde	50-00-0	10	03	1	1 PT	4	no monitoring data, art 18 default PPP MRL, VMP MRL not required, anal. method available	1	5
89	(13Z)-Hexadec-13-en-11-yn-1-yl acetate	(13Z)-Hexadec-13-en-11-yn-1-yl acetate	78617-58-0	9	19	1	1 PT	7	no monitoring data, art 18 default PPP MRL, no anal. method	3	1
90	Cholecalciferol	Cholecalciferol	67-97-0	9	14	1	1 PT	3	no monitoring data, art 18 default PPP MRL, VMP MRL not required, no anal. method	1	5

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91	Cis-tricos-9-ene (Muscalure)	Muscalure (Z)-9-tricosene	27519-02-4	9	19	1	1 PT	7	no monitoring data, art 18 default PPP MRL, no anal. method	3	1
92	Eucalyptus citriodora oil, hydrated, cyclized	Eucalyptus citriodora oil, hydrated, cyclized	124562 9-80-4	9	19	1	1 PT	7	no monitoring data, art 18 default PPP MRL, no anal. method	3	1
93	Polyvinylpyrrolidone iodine	Polyvinyl pyrrolidone iodine	25655-41-8	9	03, 04	3	2 PTs	3	no monitoring data, VMP MRL not required, no anal. method	2	3
94	Sodium dichloroisocyanurate dihydrate	Sodium dichloroisocyanurate dihydrate	51580-86-0	9	03, 04, 05	5	3 PTs	3	no monitoring data, VMP MRL not required, no anal. method	3	1

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95	(1,3,4,5,6,7-hexahydro-1,3-dioxo-2H-isoindol-2-yl)methyl (1R-trans)-2,2-dimethyl-3-(2-methylprop-1-enyl)cyclo-propanecarboxylate (d-Tetramethrin)	D-Tetramethrin	1166-46-7	8	18	1	1 PT	2	art 18 default PPP MRL; monitoring (meat, dairy, infant/toddler food) <LOQ	1	5
96	Chlorocresol	Chlorocresol	59-50-7	8	03	1	1 PT	4	no monitoring data, VMP MRL not required, anal. method available	2	3
97	Lambda-cyhalothrin	Lambda-cyhalothrin	91465-08-6	8	18	1	1 PT	2	specific PPP & VMP MRL; monitoring (meat, dairy, infant/toddler food) < MRL	1	5

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98	S-[(6-chloro-2-oxooxazolo[4,5-b]pyridin-3(2H)-yl)methyl] O,O-dimethylthio phosphate (Azamethiphos)	Azamethiphos	35575-96-3	8	18	1	1 PT	2	art 18 default PPP MRL; monitoring (meat, dairy, infant/toddler food) <LOQ	1	5
99	Tetramethrin	Tetramethrin	7696-12-0	8	18	1	1 PT	2	art 18 default PPP MRL; monitoring (meat, dairy, infant/toddler food) <LOQ	1	5
100	Calcium oxide/lime/burnt lime/quicklime	Calcium oxide/lime/burnt lime/quicklime	1305-78-8	7	03	1	1 PT	3	no monitoring data, art 18 default PPP MRL, VMP MRL not required, no anal. method	2	3

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101	Chrysanthemum cinerariaefolium extract from open and mature flowers of Tanacetum cinerariifolium obtained with supercritical carbon dioxide	Chrysanthemum cinerariaefolium extract from open and mature flowers of Tanacetum cinerariifolium obtained with supercritical carbon dioxide	89997-63-7	7	18, 19	3	2 PTs	3	no monitoring data, VMP MRL not required, no anal. method	3	1
102	Chrysanthemum cinerariaefolium, extract from open and mature flowers of Tanacetum cinerariifolium obtained with hydrocarbon solvents	Chrysanthemum cinerariaefolium, extract from open and mature flowers of Tanacetum cinerariifolium obtained with hydrocarbon solvents	-	7	18, 19	3	2 PTs	3	no monitoring data, VMP MRL not required, no anal. method	3	1
103	Etofenprox	Etofenprox	80844-07-1	7	18	1	1 PT	1	specific PPP MRL only; monitoring (meat, dairy, infant/toddler food) < MRL	1	5

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104	N-cyclopropyl-1,3,5-triazine-2,4,6-triamine (Cyromazine)	Cyromazine	66215-27-8	7	18	1	1 PT	5	no mismatch between PPP & VMP MRL; monitoring data but not for all 3 matrices (meat, dairy, infant/toddler food)	3	1
105	Thiamethoxam	Thiamethoxam	153719-23-4	7	18	1	1 PT	1	specific PPP MRL only; monitoring (meat, dairy, infant/toddler food) < MRL	1	5
106	(RS)-α-cyano-3-phenoxybenzyl-(1RS)-cis, trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclo propanecarboxylate (Cypermethrin)	Cypermethrin	52315-07-8	6	18	1	1 PT	2	mismatch between PPP & VMP MRL; monitoring (meat, dairy, infant/toddler food) < MRL	2	3

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107	[1.alpha.(S*),3.alpha.]-(.alpha.)-cyano-(3-phenoxyphenyl) methyl3-(2,2-dichlor-oethenyl)-2,2-dichlorovinyl)-2,2-dimethyl-cyclopropane carboxylate (alpha-Cypermethrin); [1α(S*),3α]-(α)-cyano-(3-phenoxyphenyl) methyl3-(2,2-dichlor-oethenyl)-2,2-dichlorovinyl)-2,2-dimethyl-cyclopropane carboxylate (αCypermethrin)	Cypermethrin-alpha	67375-30-8	6	18	1	1 PT	2	mismatch between PPP & VMP MRL; monitoring (meat, dairy, infant/toddler food) < MRL	2	3

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108	4-bromo-2-(4-chlorophenyl)-1-ethoxy- methyl-5-trifluoromethylpyrrole-3-carbonitrile (Chlorfenapyr)	Chlorfenapyr	122 453-73-0	6	18	1	1 PT	2	specific PPP MRL for plant commodities only, no MRL for animal commodities listed; monitoring (meat, dairy, infant/toddler food) < LOQ	2	3
109	Bacillus thuringiensis subsp. israelensis Serotype H14, Strain AM65-52	Bacillus thuringiensis subsp. israelensis Serotype H14, Strain AM65-52	-	6	18	1	1 PT	0	micro-organism: no monitoring possible	1	5
110	Bacillus thuringiensis subsp. israelensis, strain SA3A	Bacillus thuringiensis subsp. israelensis, strain SA3A	-	6	18	1	1 PT	0	micro-organism: no monitoring possible	1	5
111	Bacillus thuringiensis subsp. kurstaki, strain ABTS-351	Bacillus thuringiensis subsp. kurstaki, strain ABTS-351	-	6	18	1	1 PT	0	micro-organism: no monitoring possible	1	5

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112	Benzoic acid	Benzoic acid	65-85-0	6	03, 04	3	2 PTs	0	PPP MRL not required, monitoring not relevant	2	3
113	Deltamethrin	Deltamethrin	52918-63-5	6	18	1	1 PT	2	mismatch between PPP & VMP MRL; monitoring (meat, dairy, infant/toddler food) < MRL	2	3
114	L-(+)-lactic acid	L-(+)-lactic acid	79-33-4	6	03, 04	3	2 PTs	0	VMP & PPP MRL not required, monitoring not relevant	2	3
115	Octanoic acid	Octanoic acid caprylic acid	124-07-2	6	04, 18	3	2 PTs	0	PPP MRL not required, monitoring not relevant	2	3

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116	α-cyano-3-phenoxybenzyl2,2-dimethyl-3-(2-methylprop-1-enyl)cyclopropanecarboxylate (Cyphenothrin)	Cyphenothrin	39515-40-7	6	18	1	1 PT	2	no MRL legislation; monitoring (meat, dairy, infant/toddler food) < LOQ	2	3
117	Alpha-bromadiolone	Alpha-bromadiolone	-	5	14	0	New under review	0	new substance under review, monitoring not relevant yet	Not (or 1)	5
118	Ethanol	Ethanol	64-17-5	5	04	1	1 PT	3	no monitoring data, art 18 default PPP MRL, VMP MRL not required, no anal. method	3	1
119	Imidacloprid	Imidacloprid	138261-41-3	5	18	1	1 PT	1	specific PPP MRL only; monitoring (meat, dairy, infant/toddler food) < MRL	2	3

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120	Indoxacarb (enantiomeric reaction mass S:R 75:25)	Indoxacarb	144 171-61-9	5	18	1	1 PT	1	specific PPP MRL only; monitoring (meat, dairy, infant/toddler food) < MRL	2	3
121	Propan-2-ol	Propan-2-ol isopropanol 2-propanol	67-63-0	5	04	1	1 PT	3	no monitoring data, art 18 default PPP MRL, VMP MRL not required, no anal. method	3	1
122	1-(3,5-dichloro-4-(1,1,2,2-tetrafluoroethoxy)phenyl)-3-(2,6-difluorobenzoyl) urea (Hexaflumuron)	Hexaflumuron	864 79-06-3	4	18	1	1 PT	2	art 18 default PPP MRL; monitoring (meat, dairy, infant/toddler food) <LOQ	3	1

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123	Calcium dihydroxide/calcium hydroxide/caustic lime/hydrated lime/slaked lime	Calcium dihydroxide/ calcium hydroxide/ caustic lime/hydrated lime/slaked lime	1305-62-0	4	03	1	1 PT	0	VMP & PPP MRL not required, monitoring not relevant	2	3
124	Garlic, ext.	Garlic, ext.	8008-99-9	4	19	1	1 PT	0	PPP MRL not required, monitoring not relevant	2	3
125	Geraniol	Geraniol	106-24-1	4	18, 19	3	2 PTs	0	PPP MRL not required, monitoring not relevant	3	1
126	Iodine	Iodine potassium iodide	7553-56-2	4	03, 04	3	2 PTs	0	VMP & PPP MRL not required, monitoring not relevant	3	1
127	Lauric acid	Lauric acid	143-07-7	4	19	1	1 PT	0	PPP MRL not required, monitoring not relevant	2	3

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128	N,N-diethyl-meta-toluamide	DEET	134-62-3	4	19	1	1 PT	2	no MRL legislation; monitoring (meat, dairy, infant/toddler food) < LOQ	3	1
129	Transfluthrin	Transfluthrin	118 712-89-3	4	18	1	1 PT	2	art 18 default PPP MRL; monitoring (meat, dairy, infant/toddler food) <LOQ	3	1
130	(+)-Tartaric acid	(+)-Tartaric acid	87-69-4	3	Annex I	0	Annex I low risk	0	BPR Annex I, monitoring not relevant	2	3
131	(E)-1-(2-Chloro-1,3-thiazol-5-ylmethyl)-3-methyl-2-nitroguanidine (Clothianidin)	Clothianidin	210 880-92-5	3	18	1	1 PT	1	specific PPP MRL only; monitoring (meat, dairy, infant/toddler food) < MRL	3	1
132	Acetic acid	Acetic acid	64-19-7	3	Annex I	0	Annex I low risk	0	BPR Annex I, monitoring not relevant	2	3

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133	Diflubenzuron	Diflubenzuron	35367-38-5	3	18	1	1 PT	1	specific PPP MRL only; monitoring (meat, dairy, infant/toddler food) < MRL	3	1
134	Dinotefuran	Dinotefuran	165252-70-0	3	18	1	1 PT	1	specific PPP MRL only; monitoring (meat, dairy, infant/toddler food) < MRL	3	1
135	epsilon-Metofluthrin	epsilon-Metofluthrin	240494-71-7	3	19	0	New under review	0	new substance under review, monitoring not relevant yet	2	3
136	Free radicals generated in situ from ambient air or water	Free radicals generated in situ from ambient air or water	-	3	03, 04, 05	0	New under review	0	new substance under review, monitoring not relevant yet	Not (or 2)	3

Key Annex 11	Active substance name from ECHA database	Common name or abbreviation	CAS no.	Overall Priority	Annex I (all) or PTs	Priority for No of PTs (5 is highest)	Priority Comment for No of PTs	Priority for DBPs + Monitoring + MRL + Anal. Method (10 is highest)	Priority Comment for Monitoring + MRL + Anal. Method	Hazard Category	Priority for hazard category (5 is highest)
137	Lactic acid	Lactic acid	50-21-5	3	Annex I	0	Annex I low risk	0	BPR Annex I, monitoring not relevant	2	3
138	Monochloramine generated from ammonia and a chlorine source	Monochloramine generated from ammonia and a chlorine source	-	3	05	0	New under review	0	new substance under review, monitoring not relevant yet	Not (or 2)	3
139	Monochloramine generated from ammonium hydroxide and a chlorine source	Monochloramine generated from ammonium hydroxide and a chlorine source	-	3	05	0	New under review	0	new substance under review, monitoring not relevant yet	Not (or 2)	3
140	Monochloramine generated from sodium hypochlorite and an ammonium source	Monochloramine generated from sodium hypochlorite and an ammonium source	-	3	05	0	New under review	0	new substance under review, monitoring not relevant yet	Not (or 2)	3

Key Annex 11	Active substance name from ECHA database	Common name or abbreviation	CAS no.	Overall Priority	Annex I (all) or PTs	Priority for No of PTs (5 is highest)	Priority Comment for No of PTs	Priority for DBPs + Monitoring + MRL + Anal. Method (10 is highest)	Priority Comment for Monitoring + MRL + Anal. Method	Hazard Category	Priority for hazard category (5 is highest)
141	Permethrin	Permethrin	52645-53-1	3	18	1	1 PT	1	no mismatch between PPP & VMP MRL; monitoring (meat, dairy, infant/toddler food) < MRL	3	1
142	Propionic acid	Propionic acid	79-09-4	3	Annex I	0	Annex I low risk	0	BPR Annex I, monitoring not relevant	2	3
143	Pyriproxyfen	Pyriproxyfen	95737-68-1	3	18	1	1 PT	1	specific PPP MRL only; monitoring (meat, dairy, infant/toddler food) < MRL	3	1
144	Silver nitrate	Silver nitrate	7761-88-8	3	03, 04, 05	0	New under review	0	new substance under review, monitoring not relevant yet	2	3

Key Annex 11	Active substance name from ECHA database	Common name or abbreviation	CAS no.	Overall Priority	Annex I (all) or PTs	Priority for No of PTs (5 is highest)	Priority Comment for No of PTs	Priority for DBPs + Monitoring + MRL + Anal. Method (10 is highest)	Priority Comment for Monitoring + MRL + Anal. Method	Hazard Category	Priority for hazard category (5 is highest)
145	S-Methoprene	S-Methoprene	65733-16-6	3	18	1	1 PT	1	specific PPP MRL only; monitoring (meat, dairy, infant/toddler food) < MRL	3	1
146	Spinosad	Spinosad	168316-95-8	3	18	1	1 PT	1	specific PPP MRL only; monitoring (meat, dairy, infant/toddler food) < MRL	3	1
147	Vinegar	Vinegar	8028-52-2	3	Annex I	0	Annex I low risk	0	BPR Annex I, monitoring not relevant	2	3
148	Methyl nonyl ketone	Methyl nonyl ketone	112-12-9	2	19	1	1 PT	0	PPP MRL not required, monitoring not relevant	3	1
149	Orange, sweet, ext.	Orange, sweet, ext.	8028-48-6	2	19	1	1 PT	0	PPP MRL not required, monitoring not relevant	3	1

Key Annex 11	Active substance name from ECHA database	Common name or abbreviation	CAS no.	Overall Priority	Annex I (all) or PTs	Priority for No of PTs (5 is highest)	Priority Comment for No of PTs	Priority for DBPs + Monitoring + MRL + Anal. Method (10 is highest)	Priority Comment for Monitoring + MRL + Anal. Method	Hazard Category	Priority for hazard category (5 is highest)
150	Peanut butter	Peanut butter	-	2	19	1	1 PT	1	no MRL legislation, substance = food, monitoring not relevant	Not	0
151	Powdered corn cob	Powdered corn cob	-	2	14	1	1 PT	1	no MRL legislation, substance = food, monitoring not relevant	Not	0
152	(9Z,12E)-tetradeca-9,12-dien-1-yl acetate	(9Z,12E)-tetradeca-9,12-dien-1-yl acetate	30507-70-1	1	Annex I	0	Annex I low risk	0	BPR Annex I, monitoring not relevant	3	1
153	Arnica montana, ext.	Arnica montana, ext.	68990-11-4	1	Annex I	0	Annex I low risk	0	BPR Annex I, monitoring not relevant	3	1
154	Ascorbic acid	Ascorbic acid	50-81-7	1	Annex I	0	Annex I low risk	0	BPR Annex I, monitoring not relevant	3	1

Key Annex 11	Active substance name from ECHA database	Common name or abbreviation	CAS no.	Overall Priority	Annex I (all) or PTs	Priority for No of PTs (5 is highest)	Priority Comment for No of PTs	Priority for DBPs + Monitoring + MRL + Anal. Method (10 is highest)	Priority Comment for Monitoring + MRL + Anal. Method	Hazard Category	Priority for hazard category (5 is highest)
155	Bacillus amyloliquefaciens	Bacillus amyloliquefaciens	-	1	03	1	1 PT	0	micro-organism: no monitoring possible	Not	0
156	Bacillus sphaericus 2362, strain ABTS-1743	Bacillus sphaericus 2362, strain ABTS-1743	143447-72-7	1	18	1	1 PT	0	micro-organism: no monitoring possible	Not	0
157	Bentonite	Bentonite	1302-78-9	1	Annex I	0	Annex I low risk	0	BPR Annex I, monitoring not relevant	3	1
158	Carbon dioxide	Carbon dioxide	124-38-9	1	Annex I	0	Annex I low risk	0	BPR Annex I, monitoring not relevant	3	1
159	Citric acid	Citric acid	77-92-9	1	Annex I	0	Annex I low risk	0	BPR Annex I, monitoring not relevant	3	1
160	Citronellal	Citronellal	106-23-0	1	Annex I	0	Annex I low risk	0	BPR Annex I, monitoring not relevant	3	1

Key Annex 11	Active substance name from ECHA database	Common name or abbreviation	CAS no.	Overall Priority	Annex I (all) or PTs	Priority for No of PTs (5 is highest)	Priority Comment for No of PTs	Priority for DBPs + Monitoring + MRL + Anal. Method (10 is highest)	Priority Comment for Monitoring + MRL + Anal. Method	Hazard Category	Priority for hazard category (5 is highest)
161	Copper	Copper	7440-50-8	1	05	0	New under review	0	new substance under review, monitoring not relevant yet	3	1
162	D-Fructose	D-Fructose	57-48-7	1	Annex I	0	Annex I low risk	0	BPR Annex I, monitoring not relevant	3	1
163	Honey	Honey	8028-66-8	1	Annex I	0	Annex I low risk	0	BPR Annex I, monitoring not relevant	3	1
164	Iron sulphate	Iron sulphate	7720-78-7	1	Annex I	0	Annex I low risk	0	BPR Annex I, monitoring not relevant	3	1
165	Lavender oil (Natural oil)	Lavender oil (Natural oil)	8000-28-0	1	Annex I	0	Annex I low risk	0	BPR Annex I, monitoring not relevant	3	1
166	Linseed oil	Linseed oil	8001-26-1	1	Annex I	0	Annex I low risk	0	BPR Annex I, monitoring not relevant	3	1

Key Annex 11	Active substance name from ECHA database	Common name or abbreviation	CAS no.	Overall Priority	Annex I (all) or PTs	Priority for No of PTs (5 is highest)	Priority Comment for No of PTs	Priority for DBPs + Monitoring + MRL + Anal. Method (10 is highest)	Priority Comment for Monitoring + MRL + Anal. Method	Hazard Category	Priority for hazard category (5 is highest)
167	Nitrogen	Nitrogen	7727-37-9	1	Annex I	0	Annex I low risk	0	BPR Annex I, monitoring not relevant	3	1
168	Oct-1-en-3-ol	Oct-1-en-3-ol	3391-86-4	1	Annex I	0	Annex I low risk	0	BPR Annex I, monitoring not relevant	3	1
169	Peppermint oil (Natural oil)	Peppermint oil (Natural oil)	8006-90-4	1	Annex I	0	Annex I low risk	0	BPR Annex I, monitoring not relevant	3	1
170	Potassium (E,E)-hexa-2,4-dienoate (Potassium Sorbate)	Potassium sorbate	24634-61-5	1	Annex I	0	Annex I low risk	0	BPR Annex I, monitoring not relevant	3	1
171	Saccharomyces cerevisiae (yeast)	Saccharomyces cerevisiae (yeast)	68876-77-7	1	Annex I	0	Annex I low risk	0	BPR Annex I, monitoring not relevant	3	1
172	Silicic acid, aluminium magnesium sodium salt	Silicic acid, aluminium magnesium sodium salt	12040-43-6	1	18	0	New under review	0	new substance under review, monitoring not relevant yet	3	1

Key Annex 11	Active substance name from ECHA database	Common name or abbreviation	CAS no.	Overall Priority	Annex I (all) or PTs	Priority for No of PTs (5 is highest)	Priority Comment for No of PTs	Priority for DBPs + Monitoring + MRL + Anal. Method (10 is highest)	Priority Comment for Monitoring + MRL + Anal. Method	Hazard Category	Priority for hazard category (5 is highest)
173	Silver chloride	Silver chloride	7783-90-6	1	04	0	New under review	0	new substance under review, monitoring not relevant yet	3	1
174	Silver phosphate glass	Silver phosphate glass	308069-39-8	1	04	0	New under review	0	new substance under review, monitoring not relevant yet	3	1
175	Sodium acetate	Sodium acetate	127-09-3	1	Annex I	0	Annex I low risk	0	BPR Annex I, monitoring not relevant	3	1
176	Sodium benzoate	Sodium benzoate	532-32-1	1	Annex I	0	Annex I low risk	0	BPR Annex I, monitoring not relevant	3	1
177	Trisodium orthophosphate	Trisodium orthophosphate	7601-54-9	1	Annex I	0	Annex I low risk	0	BPR Annex I, monitoring not relevant	3	1

Key Annex 11	Active substance name from ECHA database	Common name or abbreviation	CAS no.	Overall Priority	Annex I (all) or PTs	Priority for No of PTs (5 is highest)	Priority Comment for No of PTs	Priority for DBPs + Monitoring + MRL + Anal. Method (10 is highest)	Priority Comment for Monitoring + MRL + Anal. Method	Hazard Category	Priority for hazard category (5 is highest)
178	Baculovirus	Baculovirus	-	0	Annex I	0	Annex I low risk	0	BPR Annex I, monitoring not relevant	Not	0
179	Carbon dioxide generated from propane, butane or a mixture of both by combustion	Carbon dioxide generated from propane, butane or a mixture of both by combustion	-	0	Annex I	0	Annex I low risk	0	BPR Annex I, monitoring not relevant	Not	0
180	Cheese	Cheese	-	0	Annex I	0	Annex I low risk	0	BPR Annex I, monitoring not relevant	Not	0
181	Concentrated apple juice	Concentrated apple juice	-	0	Annex I	0	Annex I low risk	0	BPR Annex I, monitoring not relevant	Not	0
182	Nitrogen generated from ambient air	Nitrogen generated from ambient air	-	0	Annex I	0	Annex I low risk	0	BPR Annex I, monitoring not relevant	Not	0
183	Powdered egg	Powdered egg	-	0	Annex I	0	Annex I low risk	0	BPR Annex I, monitoring not relevant	Not	0

Key Annex 11	Active substance name from ECHA database	Common name or abbreviation	CAS no.	Overall Priority	Annex I (all) or PTs	Priority for No of PTs (5 is highest)	Priority Comment for No of PTs	Priority for DBPs + Monitoring + MRL + Anal. Method (10 is highest)	Priority Comment for Monitoring + MRL + Anal. Method	Hazard Category	Priority for hazard category (5 is highest)
184	Silver borophosphate glass	Silver borophosphate glass	-	0	04	0	New under review	0	new substance under review, monitoring not relevant yet	Not	0
185	Silver phosphoborate glass	Silver phosphoborate glass	-	0	04	0	New under review	0	new substance under review, monitoring not relevant yet	Not	0
186	Webbing clothes moths pheromone (Mixture)	Webbing clothes moths pheromone (Mixture)	-	0	Annex I	0	Annex I low risk	0	BPR Annex I, monitoring not relevant	Not	0
187	Wolbachia pipientis strain wPip	Wolbachia pipientis strain wPip	-	0	Annex I	0	Annex I low risk	0	BPR Annex I, monitoring not relevant	Not	0

At the beginning of 2024, 'Metofluthrin; epsilon-Metofluthrin' was one active substance with CAS number 240494-71-7 for PT18 and PT19. At the beginning of 2025, this had changed. The active substance '2,3,5,6-tetrafluoro-4-(methoxymethyl) benzyl (EZ)-(1RS,3RS; 1SR,3SR)- 2,2-dimethyl-3-prop-1-enylcyclopropanecarboxylate (metofluthrin)' without a CAS number is approved for PT18 (renewal in progress) and epsilon-Metofluthrin with CAS number 240494-71-7 is separately included the review programme for PT19. This is the reason why this table has 187 active substances instead of the 186 mentioned elsewhere in this report.

Annex 12 Evaluation of substances from hazard category 1

Evaluation of the category 1 active substances

In order to single out active substances to be prioritised for monitoring, with the aim of making decisions on the necessity of deriving or amending MRLs, we took a closer look at the category 1 substances (see Section 7.4.1). This evaluation is based on the information collected in the context of this study as well as on restricted, easily accessible additional information.

Table A12.1 shows the information available on the 35 category 1 substances. Almost all of these have a harmonised classification, except for 3 micro-organisms and 1 disinfectant. Out of the 11 disinfectants, only glutaral is mentioned by the NVZ (see Section 6.2.4) as a most commonly used active substance. This substance is also mentioned in the WFSR supply chain studies (see Section 7.2.5) as a used disinfectant, together with the category 1 substances formaldehyde and tosylchloramide sodium. Moreover, RIVM refers to 3 category 1 substances (see Section 7.3.2) as large molecules that are not easy to remove by rinsing. They are a mixture of CMIT/MIT and two types of PHMB. In our study, this kind of additional information was only collected for disinfectants, not for insecticides, rodenticides, or repellents.

For 26 out of the 35 substances in category 1, MRLs are currently available, while there is no information on MRLs for the other 9 substances. For the substances with MRLs, the question is whether the MRLs should be amended because of the use of biocides and whether there is a need for MRLs for other types of meat or dairy products. For 19 of these substances, the MRLs are set on the default value of 0.01 mg/kg; for 6 of them, there is a range of specific MRLs for meat and milk; and for 1 of them, there is only a Dutch MRL. Beside these MRLs, 5 substances also have the ‘No MRL required’ status for VMP use. This concerns 3 substances with a default MRL of 0.01 mg/kg, 1 substance with specific MRLs and the 1 substance with the Dutch MRL.

Below, we will consecutively evaluate the category 1 active substances with the default MRL of 0.01 mg/kg, the ones with specific MRLs, and the active substances without MRLs.

The results of the evaluation of the 19 category 1 active substances in biocides with a default EU MRL of 0.01 mg/kg are:

- For 3 disinfectants, formaldehyde, glutaral, and glyoxal, no monitoring data is available in the KAP database. Formaldehyde and glutaral are mentioned as used substances in the supply chain studies by WFSR. Glutaral is also mentioned by NVZ as one of the most commonly used active substances. This study provides no information on the necessity of amending these MRLs in view of the use of biocides. These two substances also have the ‘No MRL required’ status for VMP use. The Assessment Report of formaldehyde (Germany, 2019) states ‘*ADI and ARfD are not*

considered necessary based on the 2014 evaluation of the EFSA FEEDAP Panel (SCIENTIFIC REPORT OF EFSA, Endogenous formaldehyde turnover in humans compared with exogenous contribution from food sources. EFSA Journal 2014;12(2):3550). It concluded that the relative contribution of exogenous formaldehyde from consumption of animal products (milk, meat) from target animals exposed to formaldehyde-treated feed was negligible compared with formaldehyde turnover and the background levels of formaldehyde from food sources. This can also be assumed for animal products from animals exposed to formaldehyde-based biocidal products'. The Assessment Report of glutaraldehyde (Finland, 2014) states '*Glutaraldehyde is very reactive with for example proteins, as has been demonstrated in the metabolism studies and no residues remain. Therefore, glutaraldehyde is not expected to be present in food, and an ADI is not derived.*' The third disinfectant is glyoxal, an existing active substance which is still under review. We could not find authorised biocides containing glyoxal in the Ctgb database. Glyoxal is under review in the EU, so there are no authorised biocides in the ECHA database yet.

- For 2 insecticides, there is monitoring data, but it is all below the LOQ. They are azamethiphos and tetramethrin. For tetramethrin, there are 33 authorised biocides in the Ctgb database. Judging by the names, they are insecticides against wasps, ants, silverfish, fleas and crawling insects. For azamethiphos, there are 3 authorised biocides in the Ctgb database. These are all against flies in animal housing. On the basis of the information in this study, amending the MRLs for these 2 substances in view of the use of biocides seems unnecessary.
- For 7 rodenticides, no monitoring data is available. They are bromadiolone, chlorophacinone, cholecalciferol, difenacoum, difethialone, flocoumafen, and warfarin. Cholecalciferol is the same as vitamin D3, a substance that is formed in the skin of humans and animals. Therefore, it occurs naturally in animal products. It has the 'No MRL required' status for VMP use.
- For 2 rodenticides monitoring data is available above the LOQ. They are brodifacoum (1 measured value above the MRL) and coumatetralyl (measured value unknown). For rodenticides, exposure of animals for food production appears to be the result of improper use of these types of biocides. For this reason, amending the MRLs of 0.01 mg/kg for rodenticides is not appropriate. However, extra monitoring data on rodenticides in meat could demonstrate improper use. The current measured values are derived from liver.
- 2 substances are releasing phosphine. They may be used as insecticides, and one of them may also be used as a rodenticide. As far as we know, substances releasing phosphine are used for fumigation to protect unpacked products during transport or storage. We assume this is not applicable to cooled products such as meat and dairy products. For that reason, no residues in meat or dairy products are expected.
- Finally 3 substances are Bacillus subspecies that are used as insecticides. They might have a specific target. The first step is to collect information on the type of biocidal uses of these

insecticides. Information on the survival of these micro-organisms is also relevant. According to the EU interim approach from 2017, no MRLs for biocidal use of approved micro-organisms are necessary (see Annex 7).

The results of the evaluation of the 6 category 1 active substances in biocides with specific EU MRLs are:

- There are 5 insecticides with specific MRLs for meat products and milk. They are acetamiprid, etofenprox, lambda-cyhalothrin, thiamethoxam, and cyfluthrin. For all of them there is monitoring data in the KAP database, but it is all below the LOQ. On the basis of the information in this study, amending the MRLs for meat or dairy for these 5 substances in view of their use as biocides seems not to be necessary. There is only one measurement in meat of 0.016 mg/kg (so, above the LOQ) for 'cyhalothrin', which may refer to residues of lambda-cyhalothrin and/or gamma-cyhalothrin (both approved active substances for PPP) and/or cyhalothrin (approved as VMP). Cyhalothrin has 16 isomers and the residue is defined as a 'sum of isomers' because analytical methods cannot discriminate between the various isomers. The KAP database also contains separate monitoring data on 'lambda-cyhalothrin including gamma-cyhalothrin'. All monitoring data is based on the sum of isomers, but only reported differently.
- The other substance with specific MRLs is salicylic acid. As described in Section 6.3, the MRLs for salicylic acid in milk and meat are linked to the use of aluminium and sodium salicylate as VMP. For topical use of salicylic acid as VMP, the status 'No MRL required' applies. Salicylic acid has authorised biocides for udder disinfection and for Cleaning in Place (CIP) in breweries and the (soft) drinks industry. In raw milk, 0.77% of the monitoring data is above the MRL. In meat (muscle) 0.29% of the monitoring data is above the MRL. For milk, there is a (not significant) trend that the use of teat dip with salicylic acid is positively associated with finding this substance in milk samples (Jongerman, 2023). Another potential source could be the improper use of CIP biocides containing salicylic acid in milking machines, although we have no indications for this kind of improper use. In Belgium, research has been done on the cause of salicylic acid residues in milk and muscle (SciCom, 2023). Exceedances of MRLs due to proper use of VMP or biocides cannot be excluded, but it is more likely to be the result of improper use of VMP (incorrect dose administered, non-compliance with the waiting period or target species, etcetera) or of biocides (no or incomplete rinsing, use of unauthorised biocides for milking installations, accumulation of residues resulting from simultaneous use of several biocides containing salicylic acid in the same period, etcetera). On the basis of the current limited knowledge, it is unlikely that salicylic acid residues in milk are the result of consumption of plants with a high salicylic acid content by the animals.

For 1 out of the 35 active substances in category 1, only a Dutch MRL is available:

- This substance is tosylchloramide sodium (more generally known as chloramine-T). This substance also has the status 'No MRL required' for VMP for topical use only. In the Ctgb database, three authorised biocides are based on this substance ('natrium-p-tolueensulfonchloramide'). Two may be used in animal housing, one of which may also be used in transportation vehicles for animals. The third may be used for surfaces that are in contact with food, but not for milking machines. This substance is mentioned in the WFSR supply chain studies for red meat and for poultry. In literature, p-toluenesulfonamide was reported in measured values higher than 0.1 mg/kg in mixed dairy and meat products. This is a degradation product of tosylchloramide sodium (sodium p-toluenesulfonchloramide). It might be relevant to set EU MRLs for this substance for biocidal use.

For 9 out of the 35 active substances in category 1, no European or Dutch MRLs are available. For these substances, no monitoring data is available in the KAP database either. The results of the evaluation of these substances are:

- 6 of these substances are disinfectants. We collected some easily accessible additional information that helps to decide on monitoring:
  - From the selected PTs, the only PT for DBNPA is PT04 (see Annex 2). DBNPA is not approved for PT04 as per March 2023, so it should not be used in PT04 biocides anymore.
  - Glucoprotamin is no longer supported for PT04 or other PTs as per March 2024, so this active substance may not be used anymore
  - Sodium persulphate is the active substance in only one authorised biocide in the Netherlands, which may be used on surfaces in contact with food and in drinking water systems for cattle. This substance belongs to the per-compounds, which are reactive radical-forming substances. These kinds of substances can result in the formation of DBPs (see Annex 3 and Annex 13).
  - From the selected PTs, the only PT for CMIT/MIT is PT04 (see Annex 2). For the mixture of CMIT/MIT, there are 12 union authorisations, including PT04 uses, in the ECHA database. They could be studied to find more details on the use of this mixture. These substances have large molecules, which makes them harder to rinse off surfaces, potentially increasing residues in food.
  - PHMB has only one authorised biocide in the Ctgb database. This may be used for disinfections of cow udders after milking. PHMB consists of large molecules which are hard to rinse off surfaces, potentially increasing residues in food.
- 2 are insecticides belonging to the group of the pyrethroids: d-tetramethrin and imiprothrin. There are no authorised biocides with these active substances in the Ctgb database. For d-tetramethrin, the same applies to the ECHA database. For imiprothrin, the ECHA database contains only one authorised biocide, which is only marketed in France.

- Hydrogen cyanide is used for fumigation. It may be used as a rodenticide and insecticide as well. There is only one authorised biocide with this substance in the Netherlands. This may be used in empty stables against rats and insects, but we do not know whether this happens in practice. The application is subject to strict regulations, and livestock is not supposed to be exposed to it.

This evaluation shows that looking closer at specific substances can give a better idea of which substances are likely to be best choices for monitoring in which types of food.

Table A12.1 Overview of active substances (a.s.) in biocides allowed for PT03, PT04, PT05, PT14, PT18 and/or PT19 that are classified into priority category 1 (see Section 7.4.1 and Table A10.2 in Annex 10).

Substance name **E: from ECHA database** **K: from KAP database** **R: common name used in this report**	**CAS no.**	**PT**	**Source C&L**	**MRLs (mg/kg)**	**Mentioned by NVZ and/or WFSR and/or RIVM [1]**	**Monitoring data in KAP database (mg/kg)**	**Measurable by WFSR**
E: (1,3,4,5,6,7-hexahydro-1,3-dioxo-2H-isoindol-2-yl)methyl (1R-trans)-2,2-dimethyl-3-(2-methylprop-1-enyl)cyclo-propanecarboxylate (d-Tetramethrin)	1166-46-7	18	Harmonised	No	N/A	No	No
E: [2,4-Dioxo-(2-propyn-1-yl)imidazolidin-3-yl]methyl(1R)-cis-chrysanthemate;[2,4- Dioxo-(2-propyn-1-yl)imidazolidin-3-yl] methyl(1R)-trans-chrysanthemate (Imiprothrin)	72963-72-5	18	Harmonised	No	N/A	No	Method C
E: 2,2-dibromo-2-cyanoacetamide (DBNPA) [2]	10222-01-2	04	Harmonised	No	No	No	No
E: Acetamiprid K: Acetamiprid	135410-20-7	18	Harmonised	Yes Meat (0.02 – 1), milk (0.2)	N/A	All < LOQ (=0.005 and 0.01)	Method A, B, C
E: Aluminium phosphide releasing phosphine	20859-73-8	14, 18	Harmonised	Yes ALL (0.01)	N/A	No	(Method D)
E: Bacillus thuringiensis subsp. israelensis Serotype H14, Strain AM65-52	- [6] 68038-71-1	18	Notified	Yes ALL (0.01)	N/A	No	No
E: Bacillus thuringiensis subsp. israelensis, strain SA3A	- [6] 68038-71-1	18	Notified	Yes ALL (0.01)	N/A	No	No
E: Bacillus thuringiensis subsp. kurstaki, strain ABTS-351	- [6] 68038-71-1	18	Notified	Yes ALL (0.01)	N/A	No	No

Substance name E: from ECHA database K: from KAP database R: common name used in this report	CAS no.	PT	Source C&L	MRLs (mg/kg)	Mentioned by NVZ and/or WFSR and/or RIVM [1]	Monitoring data in KAP database (mg/kg)	Measurable by WFSR
E: Brodifacoum K: Brodifacoum	56073-10-0	14	Harmonised	Yes ALL (0.01)	N/A	Yes Measured value = 0.084 (meat)	Method A, B, C
E: Bromadiolone	28772-56-7	14	Harmonised	Yes ALL (0.01)	N/A	No	Method C
E: Chlorophacinone	3691-35-8	14	Harmonised	Yes ALL (0.01)	N/A	No	Method B
E: Cholecalciferol	67-97-0	14	Harmonised	Yes ALL (0.01)/Not required (VMP)	N/A	No	No
E: Coumatetralyl	5836-29-3	14	Harmonised	Yes ALL (0.01)	N/A	No/Yes [3]	Method A, B
E: Difenacoum	56073-07-5	14	Harmonised	Yes ALL (0.01)	N/A	No	Method A, B, C
E: Difethialone	104653-34-1	14	Harmonised	Yes ALL (0.01)	N/A	No	Method B, C
E: Disodium peroxodisulphate/Sodium persulphate	7775-27-1	04	Notified	No	No	No	No
E: Etofenprox K: Etofenprox	80844-07-1	18	Harmonised	Yes Meat (0.01 – 2), milk (0.04-0.07)	N/A	All < LOQ (=0.005 and 0.01)	Method B
E: Flocoumafen	90035-08-8	14	Harmonised	Yes ALL (0.01)	N/A	No	Method B, C

Substance name E: from ECHA database K: from KAP database R: common name used in this report	CAS no.	PT	Source C&L	MRLs (mg/kg)	Mentioned by NVZ and/or WFSR and/or RIVM [1]	Monitoring data in KAP database (mg/kg)	Measurable by WFSR
E: Formaldehyde	50-00-0	03	Harmonised	Yes ALL (0.01)/ Not required (VMP)	WFSR	No	Method D
E: Glutaral (Glutaraldehyde)	111-30-8	03, 04	Harmonised	Yes ALL (0.01)/ Not required (VMP)	NVZ, WFSR	No	No
E: Glyoxal	107-22-2	03, 04	Harmonised	Yes ALL (0.01)	No	No	No
E: Hydrogen cyanide	74-90-8	14, 18	Harmonised	No	N/A	No	Method D
E: Lambda-cyhalothrin K: Lambda-cyhalothrin (includes gamma-cyhalothrin) (sum of R,S and S,R isomers)	91465-08-6	18	Harmonised	Yes Meat (0.01 – 3), milk (0.02-0.05)	N/A	All < LOQ (=0.001 and 0.005 and 0.01) [4]	Method A, C
E: Magnesium phosphide releasing phosphine	12057-74-8	18	Harmonised	Yes ALL (0.01)	N/A	No	(Method D)
E: Mixture of 5-chloro-2-methyl-2H-isothiazol-3-one (EINECS 247-500-7) and 2-methyl-2H-isothiazol-3-one (EINECS 220-239-6) (Mixture of CMIT/MIT)	55965-84-9	04	Harmonised	No	RIVM	No	Method C
E: Polyhexamethylene biguanide hydrochloride with a mean number-average molecular weight (Mn) of 1415 and a mean polydispersity (PDI) of 4.7 (PHMB(1415;4.7))	1802181-67-4	04	Harmonised	No	RIVM	No	No

Substance name **E: from ECHA database** **K: from KAP database** **R: common name used in this report**	**CAS no.**	**PT**	**Source C&L**	**MRLs (mg/kg)**	**Mentioned by NVZ and/or WFSR and/or RIVM [1]**	**Monitoring data in KAP database (mg/kg)**	**Measurable by WFSR**
E: Polyhexamethylene biguanide hydrochloride with a mean number-average molecular weight (Mn) of 1600 and a mean polydispersity (PDI) of 1.8 (PHMB(1600;1.8))	27083-27-8	03, 04	Harmonised	No	RIVM	No	No
E: Reaction products of: glutamic acid and N-(C12-C14-alkyl)propylenediamine (Glucoprotamin) [5]	164907-72-6	04	Harmonised	No	No	No	No
S-[(6-chloro-2-oxooxazolo[4,5-b]pyridin-3(2H)-yl)methyl] O,O-dimethylthiophosphate (Azamethiphos)	35575-96-3	18	Harmonised	Yes ALL (0.01)	N/A	All < LOQ (=0.005 and 0.01)	Method B
E: Salicylic acid K: Salicylic acid	69-72-7	03, 04	Harmonised	Yes Meat (0.15 – 2.5), milk (0.09)/Not required (VMP, for topical use only)	No	Yes Measured value = 0.005 – 0.05 (milk), 0.02 – 4.8 (meat)	Via NSAIDs
E: Tetramethrin K: Tetramethrin	7696-12-0	18	Harmonised	Yes ALL (0.01)	N/A	All < LOQ (=0.005 and 0.01 and 0.02)	Method B, C
E: Thiamethoxam K: Thiamethoxam	153719-23-4	18	Harmonised	Yes Meat (0.01 – 0.02), milk (0.05)	N/A	All < LOQ (=0.005 and 0.01 and 0.05)	Method A, B, C

Substance name **E: from ECHA database** **K: from KAP database** **R: common name used in this report**	**CAS no.**	**PT**	**Source C&L**	**MRLs (mg/kg)**	**Mentioned by NVZ and/or WFSR and/or RIVM [1]**	**Monitoring data in KAP database (mg/kg)**	**Measurable by WFSR**
E: Tosylchloramide sodium (Tosylchloramide sodium - Chloramin T)	127-65-1	03, 04, 05	Harmonised	Not required (VMP, for topical use only), Dutch MRL of 0.1	WFSR	No	No
E: Warfarin	81-81-2	14	Harmonised	Yes ALL (0.01)	N/A	No	Method B
E: α-cyano-4-fluoro-3-phenoxybenzyl3-(2,2-dichlorovinyl)-2,2-dimethylcyclo-propanecarboxylate (Cyfluthrin) K: Cyfluthrin	68359-37-5	18	Harmonised	Yes Meat (0.01-0.2), milk (0.02)	N/A	All < LOQ (=0.01)	Method A

Information is given on the type of C&L classification (see Section 7.4.1 and Table A10.2 in Annex 10), existing (European) MRLs (see Section 6.3 and Annex 9), (often) used substances and large molecules (see Sections 7.2.4, 7.2.5 and 7.3.2), available monitoring data in the KAP database (see Section 4.2 and Annex 4), and the measurability of the substance by WFSR (see Chapter 5and Annex 6).

N/A: Not Applicable, because NVZ and WFSR input is about the use of disinfectants only

1) Mentioned by NVZ as most commonly used active substance in disinfectants (see Section 7.2.4) and/or by WFSR in the supply chain studies (see Section 7.2.5) and/or by RIVM as large molecules (see Section 7.3.2).
2) DBNPA is not allowed anymore (not approved for PT04 as per 2 March 2023).
3) Coumatetralyl was measured in the liver of a calf in 2023, so not yet in the selected data.
4) The KAP database also includes monitoring data on cyhalothrin. This could concern lambda-cyhalothrin. Maximum in meat is 0.016 in 1 sample out of 697.
5) Glucoprotamin is not allowed anymore (no longer supported for PT04 per 22 March 2024).
6) '*Bacillus thuringiensis subsp. israelensis Serotype H14, Strain AM65-52*', '*Bacillus thuringiensis subsp. israelensis, strain SA3A*' and '*Bacillus thuringiensis subsp. kurstaki, strain ABTS-351*' have no CAS no. according to the ECHA database (information on biocidal active substances). There is a general CAS no. for *Bacillus thuringiensis*: 68038-71-1. The hazard classification information is based on this CAS no. in the C&L Inventory.

Evaluation of the category 1 substances related to the active substances

Table A12.2 shows the information available on 5 category 1 substances (see Section 7.4.2) that could be degradation products, metabolites, DBPs, or individual substances in mixtures when using chlorinated disinfectants, ozone, quats or chlorohexidine digluconate. An important question is whether these substances related to the active substances will actually be present as residues in food, and if so, under what conditions in which type of food. To single out degradation products, metabolites, DBPs, or individual substances in mixtures for monitoring, with the aim of making decisions on the necessity of deriving or amending MRLs, we took a closer look at these substances:

- Trichloromethane (chloroform) could potentially be a category 1 DBP of active substances generating or releasing active chlorine, chlorine dioxide, or monochloramine. DBPs containing bromine, such as the category 1 substances bromodichloromethane and bromate, may also be formed when using the mentioned chlorinated active substances in the presence of bromide. Active chlorine is said to be the most commonly used disinfectant worldwide (Gadelha et al., 2019). The current assessment of these disinfectants by Ctgb is based on the formation of the degradation products chlorate and chlorite. Since cleaning products can also be based on chlorinated substances, potential DBPs cannot be exclusively linked to biocidal use. Chlorinated disinfectants are mentioned by NVZ as one of the most commonly used active substances, and the WFSR supply chain studies also mention this type of disinfectants. There is an MRL for active chlorine released from sodium hypochlorite and for chlorine dioxide, both at the standard value of 0.01 mg/kg. Literature mentions a measured value of 0.0022 mg/kg in meat for bromodichloromethane, and measured values of 0.0042 mg/kg in meat and >0.002 mg/kg in cheese brine and milk for trichloromethane. These results show that the formation of these two substances is possible in meat and/or dairy. Searching more information on the mentioned DBPs and on other potential DBPs seems necessary. To learn more about the formation of these substances, DBPs in meat and dairy could be monitored.
- When using ozone, the category 1 DBPs bromate, trihalomethanes (bromodichloromethane and trichloromethane (chloroform)), and formaldehyde could potentially be DBPs. The formation of formaldehyde is mentioned in a study on DBPs in washing water of vegetables (see Section 3.3). The active substance ozone generated from oxygen is approved for PT04 and PT05 per 1 July 2024. There are no authorised biocides in the Ctgb and ECHA databases yet. There is a BPC opinion for the approval of ozone generated from oxygen (ECHA, 2022c). This states: '*Residues in food or feed from the intended uses of ozone in PT 4 biocidal products are not expected due to the rapid rate of degradation of ozone in air and water*'. But it also states: '*It is known that using ozone for disinfection can lead to the formation of potential health hazardous disinfection by-products (DBPs) e.g. bromate. However, it is recognised that the draft guidance on DBPs is only available for swimming pools scenarios in PT 2. Due*

to the complex nature of predicting the compounds formed as DBPs, where the available data are applicable to drinking and swimming pool water and the scenarios presented in the current assessment, it is considered that the application of inappropriate guidance to substances and scenarios that have not been adequately investigated or reviewed in the formal guidance would result in unreliable conclusions. Therefore, no further consideration of disinfectant by-products is required as a risk assessment cannot be performed. The assessment of DBPs can be performed at product authorisation on provision of suitable guidance.' The Assessment Report for ozone generated from oxygen (The Netherlands, 2022) mentions the DBPs bromate, chlorate, and trihalomethanes (chloroform, bromoform, dibromochloromethane, bromodichloromethane). It states that *'it was observed that ozone did increase the toxicity of effluents, indicating that DBPs formed from ozone use can be of concern'*. Bromate has an ML of 0.003 mg/L in natural mineral water and of 0.01 mg/L in drinking water. Bromoform has an ML of 0.0001 mg/L in natural mineral water. The Assessment Report also states that a further consideration of ozonation DBPs must be conducted at the product authorisation stage '*on provision of available guidance'*. However, the required guidance for risk assessment at product authorisation is not available yet. This is an important knowledge gap. Based on the information on the classification of ozone generated from oxygen in the mentioned BPC opinion and AR, this substance would be classified into category 1.

- The KAP database includes measurement results for the quat DDAC-8. All measurement results were below the LOQ. Quats are widely used active substances in biocides, which is also mentioned by NVZ and in the WFSR studies. Because of the hazard properties, we recommend searching for more information on this specific quat.
- Chlorohexidine will be a degradation product of the use of chlorohexidine digluconate. This substance is used in biocides, but also in cleaning products, VMP, and human medicines. The use of this substance was mentioned in both WFSR supply chain studies. Wezenbeek and Komen (2023) reported allergic reactions, probably caused by chlorohexidine in sliced meat by a butcher. This specific case will probably be caused by its use as a cleaning product, because there are only authorised biocides for udder disinfection containing this substance in the Netherlands. Because of the reported allergic reactions, more information on the use of this substance and on measured values appears to be necessary. Measured values (above the LOQ) in milk might be caused by biocidal use (udder disinfection).

This evaluation shows that there are several knowledge gaps, especially on degradation products, metabolites, DBPs, or individual substances in mixtures of active substances concerning the use of chlorinated disinfectants, ozone, quats, or chlorohexidine.

Table A12.2 Overview of degradation products, metabolites or DBPs that are classified into priority category 1 (see Section 7.4.2 and Table A10.3 in Annex 10) including the category of potentially relevant active substances (a.s.) in biocides allowed for PT03, PT04, PT05, PT14, PT18 and/or PT19 that could potentially lead to these degradation products, metabolites or DBPs.

Substance name degradation products, metabolite or DBP ((category of) potentially relevant a.s.)	**CAS no.**	**PT**	**Source C&L**	**MRL (mg/kg)**	**Mentioned by NVZ and/or WFSR and/or RIVM[1]**	**Monitoring data in KAP database (mg/kg)**	**Monitoring data in literature (mg/kg)**	**Measurable by WFSR**
Bromodichloromethane (a.s. generating or releasing active chlorine, chlorine dioxide or monochloramine and ozone generated from oxygen)	75-27-4	03, 04, 05	Notified	Yes ALL (0.01) for active chlorine released from sodium hypochlorite and for chlorine dioxide	NVZ (a.s.), WFSR (a.s.)	No	Maximum 0.0022 in meat	Could be developed, Method D
Chlorohexidine (chlorohexidine digluconate)	55-56-1	03	Notified	No	WFSR	No	No	Could potentially be added to Method A, B and/or C
Sodium bromate (a.s. generating or releasing active chlorine, chlorine dioxide or monochloramine and ozone generated from oxygen)	7789-38-0	03, 04, 05	Notified	Yes ALL (0.01) for active chlorine released from sodium hypochlorite and for chlorine dioxide	NVZ (a.s.), WFSR (a.s.)	No	No	Could potentially be added to an existing Method D

Substance name degradation products, metabolite or DBP ((category of) potentially relevant a.s.)	CAS no.	PT	Source C&L	MRL (mg/kg)	Mentioned by NVZ and/or WFSR and/or RIVM[1]	Monitoring data in KAP database (mg/kg)	Monitoring data in literature (mg/kg)	Measurable by WFSR
K: Dioctyl dimonium chloride R: DDAC-8 R: Dioctyldimethylammonium chloride (a.s. with quaternary ammonium compounds)	5538-94-3	03, 04	Notified	Yes (0.1 for BAC and for DDAC); (0.01 for quaternary ammonium compounds)	NVZ (a.s.), WFSR (a.s.), RIVM (a.s.)	All < LOQ (= 0.02) and several other quaternary ammonium compounds (maximum 0.012 in infant/toddler food, maximum 9.67 in dairy, maximum 16 in meat)	Quaternary ammonium compounds up to 16 mg/kg in dairy, and above 0.5 in dairy and meat.	Method A, B, C
Trichloromethane (chloroform) (a.s. generating or releasing active chlorine, chlorine dioxide or monochloramine and ozone generated from oxygen)	67-66-3	03, 04, 05	Harmonised	Yes ALL (0.01 mg/kg) for active chlorine released from sodium hypochlorite and for chlorine dioxide	NVZ (a.s.), WFSR (a.s.)	No	>0.002 in cheese brine and milk, maximum 0.0042 in meat	Could be developed, method D

Information is given on the type of C&L classification (see Section 7.4.2 and Table A10.3 in Annex 10), existing MRLs (see Section 6.3 and Annex 9), (often) used substances and large molecules (see Sections 7.2.4, 7.2.5 and 7.3.2), available monitoring data in the KAP database (see Section 4.2 and Annex 4), and the measurability of the substance by WFSR (see Chapter 5 and Annex 6).
1) Mentioned by NVZ as most commonly used active substance in disinfectants (see Section 7.2.4) and/or by WFSR in the supply chain studies (see Section 7.2.5) and/or by RIVM as large molecules (see Section 7.3.2).

Annex 13 Evaluation of substances with monitoring data above the LOQ not from hazard category 1

Prioritisation based on monitoring data above the LOQ

In this study, we collected monitoring data in the KAP database on meat, dairy products, and infant/toddler food as well as in literature that is available at RIVM. In Annex 12, we evaluated the substances from hazard category 1, with and without monitoring data above the LOQ. Beside those category 1 substances, yet other substances with monitoring data in meat, dairy products, and infant/toddler food above the LOQ could be given priority for monitoring. In this annex, we take a closer look at these substances, with the aim of making decisions on the priority for monitoring and the necessity of deriving or amending MRLs.

Not category 1 active substances above the LOQ in the KAP database
Active substances that are not part of category 1, but have measured values above the LOQ in the KAP database are:

- Insecticides: piperonyl butoxide (category 3, for PPP a synergist), cypermethrin (category 2), deltamethrin (category 2), permethrin (category 3), and spinosad (category 3). For these insecticides, the use instructions of the authorised biocides could be studied, to gain insight into whether they can leave residues in meat or dairy products:
  - Piperonyl butoxide is the active substance in 22 authorised biocides in the Netherlands evident in the Ctgb database. The ECHA database contains 31 biocides with this substance (there are bound to be overlaps). Within the PPP framework, piperonyl butoxide is ‘not yet assessed at EU level’, but here, this substance is an insecticide synergist. It is also an active substance in three Dutch VMP, two of which may be used on the skin of cattle. Piperonyl butoxide has a measured maximum concentration in kidney fat of 0.027 mg/kg and in infant/toddler food of 0.042 mg/kg. This substance has a Dutch MRL of 0.05 mg/kg and the status ‘No MRL required’ for topical use as VMP.
  - Cypermethrin is the active substance in 132 biocides for PT18 in the ECHA database. It also has two authorisations for use in PPP in the Ctgb database and one as VMP for sheep in the database of the Dutch Medicines Evaluation Board (CBG MEB). Cypermethrin has a measured maximum concentration in fat of 0.031 mg/kg. This falls below the specific MRLs that are available for this substance.
  - Deltamethrin is the active substance in 94 biocides for PT18 in the ECHA database. It has also 13 authorisations for use in PPP in the Ctgb database, and 17 for use as VMP in the CBG MEB database, including 3 VMP for sheep and bovine animals. Deltamethrin has MRLs for specific animal species that range from 0.02 to 0.5 mg/kg. Deltamethrin has a measured maximum concentration in meat (fat of pig from the Netherlands) of 0.043 mg/kg, which is not exceeding the MRL of 0.5 mg/kg for fat. Exposure through the use of a VMP

does not seem relevant here, as its use on pigs as VMP is not allowed in the Netherlands. For this substance, exposure that leaves residues in pig meat might take place via feed (treated with PPP) or via biocides.
    - Permethrin is the active substance in 83 authorised biocides in the Ctgb-database, and in 192 in the ECHA database. It is not approved for PPP and has 67 authorisations for use as VMP, including only 2 for cattle, for ear labels of bovine animals (cattle). Permethrin has a measured maximum concentration in fat of 0.07 mg/kg, which is not exceeding the applicable MRL. Permethrin has MRLs for the use as PPP and as VMP, but biocidal use seems more important than use as PPP and VMP.
    - Spinosad is the active substance in 7 biocides for PT18 in the Ctgb database and in 38 biocides in the ECHA database. It also has three authorisations for use in PPP in the Ctgb database and eight for use as VMP in the database of CBG MEB, but these are all for cats and dogs. Spinosad has a measured maximum concentration in fat of 0.057 mg/kg, which is not exceeding the applicable MRL.
- A disinfectant, biphenyl-2-ol (category 3), was found at a level of 0.011 mg/kg in meat (kidney of Dutch sheep). This substance is approved for PPP (under the name 2-phenylphenol) as a fungicide for citrus and pears, post-harvest. According to the OECD feeding table, citrus dried pulp may be consumed by sheep. However, judging by livestock studies, no residues >0.01 mg/kg are expected in meat from PPP use at the MRLs for citrus listed in Annex II of EC 396/2005 (latest amendment EC 2018/78). There are no authorised VMP with this substance in the Netherlands. It is used in three authorised biocides in the Netherlands, with applications in PT01, PT06, PT09, and/or PT13. There are no Dutch authorised biocides for PT03 or PT04, although the active substance is approved for PT03 and PT04. The ECHA database contains no authorised biocides for this substance (the substance is still under review for PT09 and PT10). Although citrus dried pulp can be fed to sheep, according to the OECD feeding table, this is only common practice in the United States of America and Canada. This makes it unclear how this substance could end up in the kidney of Dutch sheep in a concentration of 0.011 mg/kg. This is above the applicable MRL of 0.01 mg/kg.
- Quats, individual quats, and mixtures used as active substances: BAC 12, BAC 14, benzalkonium chloride (a mixture of alkylbenzyldimethylammonium chlorides with alkyl chain lengths of C8, C10, C12, C14, C16 and C18), and didecyldimethylammonium chloride (a mixture of alkyl-quaternary ammonium salts with alkyl chain lengths of C8, C10 and C12). There are more than 200 authorised biocides in PT03 and PT04 with quats in the Ctgb database. Quats are only approved, or under review, for biocides (not for PPP or VMP), and the active substances are mainly quat mixtures with different lengths of the alkyl chain. Cleaning products can also contain

quats[36]. The available monitoring data sometimes relates to individual quats and sometimes to groups of quats, but are not exactly the same as the active substances, which also mainly relate to groups of quats. It is not clear whether concentrations of individual quats should be summed up before testing them against an MRL. The available MRLs are also confusing, because there is a default value of 0.01 for quats as a group, but separate values of 0.1 mg/kg for BAC and DDAC. In the KAP database, quats were >LOQ in 2% of the meat samples, 1.1% of the milk samples, and 18% of the infant/toddler food samples. The concentrations can be high, values of 16 mg/kg are included in the KAP database for meat (muscle) and mentioned in literature for cream and ice cream.

Chlorate and perchlorate

The KAP database also contains several measured values in meat, dairy products, and infant/toddler food above the LOQ of chlorate and perchlorate that are not part of the priority category 1. These substances can be degradation products of chlorinated disinfectants or cleaning products. The presence of chlorate in food was discovered by coincidence in 2014[37]. As described in Annex 12, most commonly chlorinated disinfectants are used. Searching on active chlorine and hypochlorite in the Ctgb database yields 94 authorised biocides in the Netherlands and searching in the ECHA database on active chlorine yields 175 results for the EU (there are bound to be overlaps). According to the KAP database, chlorate was >LOQ in 5% of the analysed meat samples, in 12% of the analysed milk samples, and in 22% of the analysed infant/toddler food samples. In meat and in infant/toddler food, there are values above the MRLs. The availability of MRLs for chlorate is remarkable, because all other MRLs are set for specific active substances. Chlorate can be a degradation product of a number of active substances. Perchlorate was >LOQ in the 2 analysed samples of infant/toddler food that are available in the KAP database. It is not clear whether this originates from biocides or, for example, from fertilisers (EFSA, 2017; Wezenbeek and Komen, 2023). EFSA (2017) reported perchlorate in 22% of samples of milk and dairy with a 95-percentile of 0.014 mg/kg (95% of the measured values are below 0.014 mg/kg).

Monitoring data above the LOQ from literature

In literature, measured values above the LOQ of dichloroacetic acid and trichloronitromethane were found in meat, so these are DBPs also worth paying attention to. It is not clear what degradation products, metabolites, and/or DBPs can be expected from the use of chlorinated disinfectants or cleaning products in food and the question is which substances should be monitored in which types of food.

Degradation products and metabolites of quats can also be relevant. A Danish study (Mongelli et al., 2024) shows that quats can form dozens of degradation products. It is not clear which of these might be present as residues in food. More attention for residues of quats in food seems desirable: Which are the biocides that contain quats? Why are they often

[36] See: https://waarzitwatin.nl/stoffen/kationogene-oppervlakteactieve-stoffen (in Dutch)
[37] See: https://food.ec.europa.eu/plants/pesticides/maximum-residue-levels/chlorate_en

found in infant/toddler food? What degradation products can be expected in food? Which substances should be monitored in which type of food? How should these be verified for compliance with MRLs?

Hydrogen peroxide, other per-compounds and iodine

The monitoring data from literature we reported mainly concern the above-discussed substances and some substances discussed in the previous annex. Only hydrogen peroxide, other per-compounds, and iodine were not evaluated yet.

Hydrogen peroxide was reported in 'too high levels' in imported butter and desserts. Because this is a reactive substance, it seems an unexpected result. Hydrogen peroxide is mentioned as a most commonly used substance by NVZ and it is reported in both WFSR supply chain studies. Out of the selected PTs, the PTs for hydrogen peroxide are PT03, PT04, and PT05 (see Annex 2). For these PTs, there are 110 authorised biocides in the Ctgb database and 160 in the ECHA database (there are bound to be overlaps). Hydrogen peroxide is a widely used reactive radical-forming substance. This could result in the formation of DBPs. For this evaluation, we consulted the Assessment Report for hydrogen peroxide as an active substance (Finland, 2017). Regarding DBPs it states: '*The range of by-products is considered wide and not well characterised at detailed level. It would be very difficult to provide analytical methodology to cover the low level concentrations of the enormous variety of molecular structures including breakdown products. At a level of practical concentrations, no disinfection by-products (DBPs) with (eco)toxicological relevance have been identified. No methods for DBPs is required*'. Other per-compounds like peracetic acid and sodium persulphate are also reactive and could result in DBPs. Peracetic acid is mentioned by NVZ as one of the most commonly used active substances, and by WFSR as a substance used in the poultry supply chain.

Iodine was measured in milk in a maximum concentration of 0.214 mg/kg. This is below the Dutch MRL for iodine in milk of 0.3 mg/kg. According to the Dutch 'Voedingscentrum' 150 ml of milk contains 0.022 mg iodine[38]. This is 0.147 mg/L. Iodine is (mainly) used for udder disinfection, so linkage of the measured higher concentrations to biocidal use is possible. Under the BPR, iodine is listed as a Candidate for Substitution due to endocrine disruption. However iodine is also added to several types of salt to maintain adequate health.

Conclusion

This annex shows that the measured values of several insecticides above the LOQ may have been caused by biocidal use. To gain more insight, it will be relevant to check the instructions for use of biocides containing these active substances. In addition, it is striking that chlorate and quats are found in measurable quantities in approximately 20% of the samples of infant/toddler food. This may be related to the fact that this is processed food. For quats, these results may be caused or influenced by the lower LOQ that is used for infant/toddler food

[38] See: https://www.voedingscentrum.nl/encyclopedie/jodium.aspx#blokwaar-zit-jodium-in? (in Dutch)

compared to meat and dairy products, which means that more products will show residues above the LOQ. For chlorate, this is not the case. For reactive per-compounds such as hydrogen peroxide, it is clear that all kinds of DBPs are formed, but because little is known about this, it cannot be included into the assessment for the approval of active substances. The assessment of the risks of measured values of iodine is difficult, because this is both a endocrine disrupting substance and an essential nutritional element.

J.M. Wezenbeek | T. van der Velde-Koerts | C.M. Mahieu |
S. ten Voorde | G. van Donkersgoed | E.H.W. Huiberts

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