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To the State Secretary for Youth, Prevention and Sport, and the Inspector General of the Netherlands Food and Consumer Product Safety Authority

Advice of the Director of the Office for Risk Assessment & Research

on the risk assessment of biocidal residues in food

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Advice from BuRO

The use of biocidal products in food production chains may leave residues of the active substances and other components of biocidal products in food. As a result, the consumer can be exposed to these substances. There is currently no clear picture of the risks to consumers from these residues. The Office for Risk Assessment & Research (BuRO) of the Netherlands Food and Consumer Product Safety Authority (NVWA) sees reason to investigate this further.

BuRO has investigated, on its own initiative, what information is missing for carrying out a risk assessment of biocidal residues in food. BuRO also investigated what the first step for the NVWA could be to obtain this information, so that it can guarantee food safety. BuRO has issued the following advice:

To the Inspector General of the NVWA:

- Start a survey on biocide residues in meat (products) and dairy (products) using the list of substances prioritised by RIVM.
- Use RIVM's method for prioritising substances for other widely consumed foods, prioritising processed products.
- Pay attention to the development of analytical methods for biocidal residues in food.

To the State Secretary for Youth, Prevention and Sport:

- Draw attention to the outcome of the recommended survey in a European context, so that it can be used in the prioritisation for setting Maximum Residue Limits (MRLs).
- Bring this advice to the attention of your colleague from the Ministry of Infrastructure and Water Management.

Yours sincerely,

Prof. Dr. Dick T.H.M. Sijm
Director of the Office for Risk Assessment & Research

Background

The use of biocidal products in food production chains may leave residues of the active substances and other components of biocidal products in food, to which the consumer is subsequently exposed. Recent research has shown that much information on use is lacking and has indicated that biocidal products are incorrectly applied in food production chains.

In addition, BuRO concluded that there may be potential risks to food safety in two previous events. However, it is currently not possible for the majority of biocidal products to carry out a risk assessment of residues in food. Therefore, the food safety cannot be guaranteed.

Research question and answer

Following the above findings, the Office for Risk Assessment & Research (BuRO) of the NVWA has formulated the following research question on its own initiative:

What is required for a risk assessment of biocidal residues in food?

Answer to the question:

Toxicity data and exposure data are necessary for a risk assessment of biocidal residues in food. Toxicity data are often available. However, data on residue levels in food are lacking for a large number of substances. In addition, maximum residue limits (MRLs) have only been set for a limited number of active substances from biocidal products. This leads to a vicious cycle in which monitoring (enforcement) and regulatory limits (MRLs) are waiting for one another. This circle can be broken by starting a survey of a prioritised group of biocidal active substances in widely consumed foods. In a subsequent phase, monitoring could be extended to include other substances (including transformation products, co-formulants, isomers, disinfection by-products (DBPs)) and a wider group of foods. The data obtained can then be used for setting regulatory limits. This can contribute to a unambiguous approach for enforcement, to ensure food safety.

Approach

BuRO has asked the National Institute for Public Health and the Environment (RIVM) to indicate which active substances in biocidal products have priority for monitoring in meat and dairy production chains, focusing on the situation in the Netherlands.

BuRO also sought additional information on legislation, authorisation, availability of toxicological data and information on residue measurements and prioritisation from other Member States.

Scope

This BuRO advice focuses on European approved active substances or active substances that are under evaluation. Other relevant substances from biocidal products, such as co-formulants (co-formulants) and DBPs, shall be included where possible. Non-approved substances and substances from unauthorised biocidal products are not included.

This advice focuses only on chemical risks to food safety. The microbiological risks to food safety or other risks arising from the use of biocidal products have not been considered.

Findings

In particular, data on residue levels in food are missing to carry out these risk assessments. The NVWA carries out monitoring for a limited number of biocidal residues and there are no analytical methods for many of these substances in food. In addition, there is no maximum residue limit (MRL) for a large number of active substances in biocidal products. As a consequence, supervision and policy end up in a vicious circle:

- Without MRL's, supervision cannot easily interpret the findings of residue measurements and has no unambiguous basis for enforcement;
- Policy cannot sufficiently substantiate the need for setting MRLs without monitoring results. Moreover, policy makers receive few indications that MRLs are missing.

A first step that can be taken for a proper risk assessment of biocidal residues in food is to start a survey of residue levels in food.

Possibilities for prioritising the substances for this survey are further discussed in the substantiation.

Processed foods deserve priority in the survey because of the application of disinfectants in the processing industry. It is best to start with widely consumed products, such as dairy and meat products.

Within the currently available analysis packages at Wageningen Food Safety Research (WFSR), a limited number of biocide residues can be measured, in a limited number of foods. This requires extra attention.

In addition to the active substances, it is important to obtain more information on degradation products, transformation products, DBPs and co-formulants. However, the data position for these substances is even more limited, and therefore, they should be included in follow-up research.

Substantiation

Office for risk assessment & Research

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1 Introduction

Biocidal products are means of repelling, rendering harmless or destroying harmful or unwanted organisms. Biocidal products can also be used to prevent certain effects of these organisms (NVWA, 2025a). An example of a group of biocides is the disinfectants. Disinfectants are used in all links of food production chains (primary business, transport, storage, trade and during processing). These products are used to disinfect work surfaces and spaces (such as equipment, machinery, floors and vehicles used for animal transport), thereby increasing microbiological safety. An important assumption in national and European policy was that biocidal products are not directly added to food or feed and that therefore no measurable residues in food would have to be left behind (DG-SANTE, 2017; Wezenbeek et al., 2025). However, the European Commission recognises that the use of biocidal products in the various process steps of food production can indeed lead to residues (DG-SANTE, 2017).

Chain risk assessments by the Office for Risk Assessment & Research (BuRO) of the Netherlands Food and Consumer Product Safety Authority (NVWA) showed that a risk assessment of residues of disinfectants for food safety is often not possible (BuRO, 2017;2018;2024a;2025). This was due to a lack of understanding of which products are used in which process and how they are applied in practice, as well as the lack of data on the presence of residues in food. In addition, on behalf of the Ministry of Infrastructure and Water Management (IenW), the National Institute for Public Health and the Environment (RIVM) carried out an extensive study on risk factors in the use of biocidal products, which concluded that risks from the use of biocidal products cannot be properly estimated (Wezenbeek & Komen, 2023).

In order to gain more insight into the use of disinfectants in food production chains, BuRO has carried out a number of studies in recent years, including research of the practical situation (Banach et al., 2020; Hoffmans et al., 2020; Tao et al., 2023; van Asselt et al., 2024; De Jonge et al., 2024). These studies show that disinfectants can be used incorrectly in all links of food production chains. How a product is to be used is described in the instructions given at the time of authorisation. This is determined by the Board for the Authorisation of Plant Protection Products and Biocidal Products (Ctgb). Failure to comply with these instructions for use (incorrect application) may result, among other things, from insufficient knowledge and/or time with the user. The studies show that the necessary cleaning step prior to disinfection is regularly skipped and that the required rinsing after disinfection is not always sufficient. In addition, higher concentrations of the disinfectant are sometimes applied than the instructions for use prescribe. During NVWA inspections such incorrect dosing methods and concentrations are also observed (NVWA, 2019; VMT, 2022). Furthermore, the studies show that disinfectants are also used for applications for which they are not authorised (improper application), and that unauthorised disinfectants are used (illegal application). These deviations from the instructions can lead to a (higher) presence of residues in food.

In two previous events, BuRO concluded that the presence of biocidal residues in food may lead to food safety risks (BuRO, 2021;2024b). However, for the vast majority of disinfectants used in food production, there is no understanding of the residues in food. As a result, there is also no insight into the potential risks for consumers.

2 Approach

BuRO asked RIVM to indicate which active substances in biocidal products have priority for monitoring in food and why. (Wezenbeek et al., 2025). This has been requested to be elaborated for the meat and dairy production chains (including infant formulae), as the use of disinfectants has already been better understood for these production chains from previous studies (Hoffmans et al., 2020). BuRO specifically asked RIVM to focus on the situation in the Netherlands. RIVM then concentrated on European approved active substances in biocidal products or active substances under evaluation. The RIVM study did not include illegal use or 'alternative' substances (substances that have not been assessed as regular biocidal products).

BuRO also sought additional information on legislation, authorisations, availability of toxicological data, and information on residue measurements and prioritisation from other Member States. BuRO has also taken note of European policy developments. No systematic literature review has been carried out but BuRO relied upon the previous studies by RIVM and WFSR. Refer to Annex 7.1 for a further explanation of the literature collection.

Very recently, the French food safety authority ANSES published a scientific article on the prioritisation of active substances for monitoring biocidal products in food of animal origin (Touchais et al., 2026). As this ANSES research is in line with the RIVM research, this research has also been taken into account by BuRO in the current advice.

2.1 Scope

This BuRO advice is limited to European approved active substances or active substances that are under evaluation. These substances may be present in authorised biocidal products and may be placed on the market in the Netherlands. The assessment of food safety risks not only concerns the active substances themselves, but also other relevant substances from these products, such as co-formulants (co-formulants) and disinfection by-products (DBPs), which are formed as a result of biocidal applications in all links of food production chains in the Netherlands. Substances in biocidal products that are not authorised in the European Union may be present as residues in imported products. Because it is unknown what these substances are, these residues are not included in this advice. Also, residues that may be introduced due to use of unauthorised substances/products or through the use of 'alternative' substances are not included in this advice.

The research focuses in particular on the applications of biocidal products in the production of meat and dairy products (including infant formula).

Finally, this advice focuses only on the chemical risks to food safety. Microbiological risks to food safety, which are controlled through the use of biocidal products, have not been considered. Other risks arising from the use of biocidal products, such as resistance development and risks to users and the environment, are also excluded from the scope of this advice.

2.2 Reading guide

Chapter 3 presents the context of the research question. To this end, this chapter briefly describes the legal framework, supervision and the information regarding regulatory limit values.

Chapter 4 details the selection and prioritisation of biocidal residues in relation to food safety. This chapter first describes the relevance of different biocide

applications in relation to food safety. The toxicity of the substances in biocidal products is then addressed, complemented by the availability of and the possibilities for setting legal limit values for biocidal residues. Thereafter, the monitoring and availability of residue levels of biocidal products shall be discussed.

The chapter concludes with an analysis of the interaction between setting regulatory limits and monitoring, the stalemate that has arisen and the consequences for the data position. The possible considerations to improve the data position are also discussed.

Chapters 5 describes the conclusions.

3 Background

3.1 Biocidal products

The European Biocidal Products Regulation (528/2012[1]) describes biocidal products as 'any substance or mixture, in the form in which it is supplied to the user, 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, any harmful organism by any means other than mere physical or mechanical action'.

Products intended to protect crops or plant-based products are covered by the Regulation for plant protection products[2] and not by the Regulation for biocidal products. Biocidal products are divided into four main groups: disinfectants, preservatives, pest control products and a residual group of 'other' biocidal products (Ctgb, 2025a). Within the four main groups, a further subdivision has been made based on different applications, the so-called product types (see Annex 7.2).

3.2 Authorisation and legislation

Biocidal products are covered by the Biocidal Products Regulation ((EU) 528/2012). This European Regulation has been in force since 2013 and aims to provide a high level of protection for humans, animals and the environment. According to this Regulation, evaluations shall be carried out for active substance–product type (PT) combination. After approval of such a combination at European level, biocidal products may be authorised with that active substance and for uses within those PT(s). Biocidal products may only be marketed and applied following an authorisation at national level or for the European Union as a whole. In the Netherlands, the competent authority is the Ctgb. Union authorisations can be granted by means of a regulation or decision by the European Commission (Ctgb, 2025b; ECHA, 2025a; NVWA, 2025b). The Ctgb evaluates whether the products are sufficiently effective and whether the risk to humans, animals and the environment is acceptable. The instructions for use laid down in the authorisation of the products must be followed when applied.

[1] Regulation (EU) No 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products

[2] Regulation (EC) No 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market

Authorisations of products for which an active substance has not yet been evaluated under the Biocidal Products Regulation (or under the former Biocidal Products Directive[3]) are subject to Dutch transitional law (Plant Protection Products and Biocidal Products Act). Harmonised evaluations of these substances and products have not yet been carried out.

The European Commission has launched the evaluation of the Biocidal Products Regulation (DG-SANTE, 2025). This review is expected to be completed in the first half of 2027. The Commission defines this evaluation as an evidence-based assessment of the extent to which an intervention (in this case the Biocidal Products Regulation) is effective, efficient, relevant, coherent and has an added value for the European Union. In the Netherlands, biocides are the primary responsibility of the Ministry of Infrastructure and Water Management (IenW). IenW has indicated that it will actively contribute to the evaluation of the Biocidal Products Regulation.

3.3 Supervision

The Human Environment and Transport Inspectorate (ILT) is the national competent authority for the supervision and enforcement of biocide legislation and regulations (Biociden.nl, 2025). The supervision itself is divided between different authorities. ILT supervises the trade of professional biocidal products and the NVWA supervises the sale of biocidal products to consumers (NVWA, 2025a). The responsibility for food safety, including in the area of biocidal residues, lies with the food manufacturers (General Food Regulation (EC) No 178/2002)[4]. The NVWA supervises applications of biocidal products in the production of food, including the primary production of food and livestock farming. In addition, there are authorities that supervise specific topics in the field of biocides: the Netherlands Labour Authority, the Health and Youth Care Inspectorate, Water Boards and the State Supervision of Mines (ILT et al., 2025).

3.4 Regulatory limit values

Regulatory maximum limits for substances in food provide a clear legal basis for enforcement. A distinction is made between Maximum Limits (MLs) and Maximum Residue Limits (MRLs). MLs are set for substances that are not intentionally added to food and thus end up in food unintentionally, such as environmental or process contaminants. MLs are determined on the basis of measured levels in relevant foods and are based on the ALARA (As Low As Reasonably Achievable) principle. MRLs have been set for substances approved for use that may leave a residue in food, such as plant protection products and veterinary medicinal products. MRLs apply to unprocessed products. The maximum safe intake of a substance through food consumption shall be taken into account in the determination. For plant protection products, the MRLs also aim to keep the application as low as possible, based on Good Agricultural Practice (GAP). They can therefore also be below the maximum safe level. The MRLs for veterinary medicinal products, on the other hand, indicate the limit of the maximum safe level of residues in the food (according to worst case exposure).

[3] Directive 98/8/EC of the European Parliament and of the Council of 16 February 1998 concerning the placing of biocidal products on the market.

[4] Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety.

Both MLs and MRLs are regulatory maximum levels of a given substance in or on a given food product (substance-product combination). These regulatory limit values are set at European level.

For biocidal products, the setting of limit values is not included in legislation. Since 2014, there has been a dialogue at European level on whether and how MRLs or MLs for biocidal products in food should be set. (Wezenbeek et al., 2025). In 2024, the procedure for setting MRLs for biocidal products was agreed (DG-SANTE, 2024a) (also refer to Section 4.5.2).

An MRL is available for a number of active substances from biocidal products, because these active substances are also used in plant protection products and/or veterinary medicinal products or have been used in the past. These MRLs were set in accordance with the procedure for plant protection product or veterinary medicinal product.

4 Biocidal products and food safety

For a risk assessment of chemicals in food, BuRO follows the four steps based on the Codex Alimentarius methodology (FAO & WHO, 2019) and the working method of the European Food Safety Authority (EFSA). This is in line with the systematic risk assessment mentioned in the General Food Regulation. In order to assess the food safety risks of residues of biocidal products, the four steps are implemented as follows:

1. Hazard identification: identification of the (active) substances of biocidal products from which residues could end up in food.
2. Hazard characterisation: description of the potential human health effects of the active substances after ingestion.
3. Exposure assessment: the content of an active substance in a food is linked to the consumption of that food.
4. Risk characterisation: Conclusion of risk based on hazard characterisation and exposure assessment.

These four steps are further discussed in the following sections for biocidal products.

4.1 Which biocides are relevant in relation to food?

Biocidal products are divided into four main groups and subdivided into 22 product types (PTs, see Annex 7.2). Active substances may be approved for multiple uses (in multiple PTs) (see Annex 7.3). In the Netherlands, little is known about the quantities of biocides sold and used. Statistics Netherlands is in the process of setting up a sales register to gain more insight into the biocide market in the Netherlands. However, this is not yet available (CBS, 2024).

There are several sources that discuss which substances are most likely to end up in food (see also Table 1):

- Following a temporary approach from 2017 (DG-SANTE, 2017), the European Commission (DG-SANTE) published a compliance document on setting MRLs for active substances from biocidal products in 2024 (DG-SANTE, 2024a). Six PTs have been identified as most relevant for residues in food. These are three PTs from the disinfectant group: PT03, PT04 and PT05. In addition, two PTs from the pest control group have also been identified as relevant: PT18 and PT19. Finally, from the 'other biocidal products' group, PT21 was identified as a relevant PT.

- The ANSES study on active (organic) substances from biocidal products in products of animal origin (Touchais et al., 2026) identified PT3, PT4 and PT5 as most relevant for food. PT6, PT12 and PT18 are considered to be of average relevance and PT1, PT8, PT14 and PT19 are considered to be of low relevance.
- RIVM's research (Wezenbeek et al., 2025) results in approximately the same PTs as the European Commission. RIVM does not prioritise PT21 as relevant for dairy and meat production chains, because this product type contains antifouling agents. These products are relevant for fish production, for example. RIVM indicates that rodenticides (PT14) may be important for these production chains. In principle, rodenticides cannot end up in food when used correctly. In the Netherlands, however, there have recently been a number of incidents involving active substances from rodenticides in livestock farming (BuRO, 2024b; Wezenbeek et al., 2025). The active substances from rodenticides are very toxic to humans, so the possible presence of these residues is certainly important for a food safety risk assessment. RIVM's research results in a total of 186 unique active substances. Some active substances are used in different biocidal products and in different PTs.

Table 1 Classification of product-types (PTs) by main biocidal product group, with number of approved active substances plus the selection 'relevant for food'.

Main group	Product type (PT)	Description	Number of approved active substances *	Selection EC for food [1]	Selection ANSES for food of animal origin [2]	Selection RIVM for meat and dairy products [3]
Disinfectants	PT03	Veterinary hygiene	48	x	x	x
	PT04	Food and feed area	65	x	x	x
	PT05	Drinking water	27	x	x	x
Pest control	PT14	Rodenticides	14			x
	PT18	Insecticides, acaricides and products to control other arthropods	50	x		x
	PT19	Repellents and attractants	19	x		x
Other biocides	PT21	Anti-fouling products	13	x		

* off (Wezenbeek et al., 2025) (PT03, PT04, PT05, PT14, PT18, PT19) and (Ctgb, 2025c) (PT21)
[1] (DG-SANTE, 2024a)
[2](Touchais et al., 2026). PT 6, 12 and 18 are considered by ANSES as medium relevant and PT 1, 8, 14 and 19 as low relevant
[3] (Wezenbeek et al., 2025)

The potential risk of biocidal products to food safety arises if residues of biocidal products remain in food, and depends on toxicological properties and levels of these residues. In addition to the active substances, there are also other relevant substances that can be formed after application: (chemical) degradation products and DBPs (which arise as a result of biocidal application, in particular with reactive compounds) and metabolites (which can be formed after incorporation into an organism). Residues of co-formulants may also remain in food. Hence, regarding potential residues in food, this comprises a large and diverse group of substances. Not all these substances are equally relevant for food safety. Methods for prioritising the active substances are described in section 4.5.3.

4.2 What toxicological information is available on the different residues?

4.2.1 Toxicological information

For (approved) active substances, data on toxicological properties is available in the assessment report (authorisation assessment), which are regulatory data requirements (ECHA, 2025b). The European authorisation assessment is based on this data. This data is used to set acceptable exposure levels (AELs) for acute, short-term and chronic exposure for active substances. These levels are set in accordance with an ECHA guideline (ECHA, 2017a). An AEL is defined as a general (internal) health reference value that takes into account sensitive subgroups.

External health limits such as the Acceptable Daily Intake (ADI) and the Acute Reference Dose (ARfD) are used for food safety risk assessment. These health-based guidance values are derived from toxicological data similar to the AEL. ADIs and ARfDs are available for substances that have also been assessed in the context of plant protection products, namely in the EU Pesticide database(EC, 2025), or in the context of the authorisation assessments of veterinary medicinal products by the European Medicines Agency (EMA). (EMA, 2025)

Other substances (in addition to the active substances) in a biocidal product are part of the formulation and are covered by the evaluation under the product authorisation. For each co-formulant in a biocidal product, it is determined whether this substance may also pose a health risk (substance of concern). For this purpose, less toxicological data are available than for active substances. Whenever possible, data obtained at EU level (such as under REACH) will be taken into account (Ctgb, 2025d). However, the information on co-formulants (which co-formulants and at which concentrations) is confidential for biocidal products and is therefore not publicly available. Hence, co-formulants cannot be included in risk assessments by other authorities than the competent authorities.

For transformation products, (chemical) degradation products and DBPs that may occur in food, less toxicological information is available. Since 2019, an ECHA guidance document describing the risk assessment of DBPs has been in place (ECHA, 2017b). For the time being, this guideline focuses only on PT02, a product type that is not relevant in the context of the current advise.

4.2.2 Maximum residue limits (MRLs) for biocidal products

In its study, RIVM shows that for almost half of the active substances in biocidal products no MRLs have been set (85 out of 186 substances examined). The MRLs that are available result from (previous) use of the active substances within a different legal framework (see Figure 1).

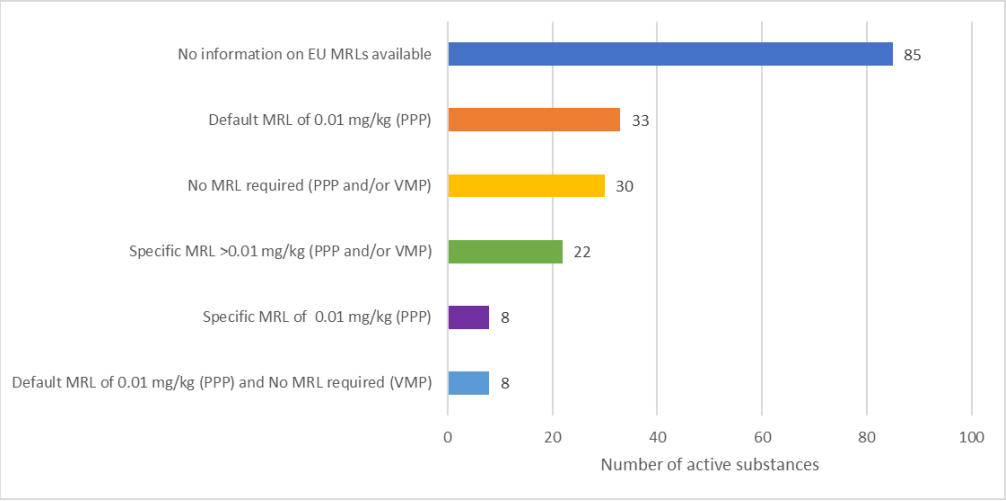

Figure 1 The availability of European maximum residue limits (MRLs) for the 186 active substances in biocidal products prioritised by RIVM. PPP=plant protection product; VMP= veterinary medicinal product) (reprinted from (Wezenbeek et al., 2025)).

The use of MRLs from other legal frameworks for a biocidal product application raises some important concerns:

- MRLs for plant protection products and veterinary medicinal products have been set for unprocessed food. However, biocidal products (especially disinfectants) are also used in an environment where food is processed, which means that residues in these products are to be expected (DG-SANTE, 2017).
- MRLs for the active substances from plant protection products and veterinary medicinal products are specific to active substance-food combinations. These products therefore have an authorisation issued for a specific crop or animal species, respectively. However, the same active substances may have a broader authorisation as biocidal products. Residues can therefore be present in a wider range of foods. Therefore, MRLs are not always available for the relevant foods.
- In case an MRL has been set for use as a plant protection product, the problem is that this MRL has been set on the basis of the lowest possible use based on good agricultural use (GAP) of the plant protection product. The effective use of a biocidal product may result in higher residues than the MRL for the plant protection product without this having to be a risk to food safety.
- Based on use as a plant protection product or veterinary medicinal product, a standard MRL may have been set or it may have been concluded that an MRL is not necessary. However, this does not have to be appropriate for the biocidal product application.

4.3 What information on residues is available, and what information is missing?

4.3.1 Monitoring data

A limited amount of data on residue levels of biocidal products in food is publicly available. For a small number of active substances, relatively large amounts of data are available for specific foods. However, for a large group of active substances, little or no data are available. In addition, it is unclear which active substances are most likely to be present and in which foods the most and highest residue levels may be present. BuRO has therefore asked RIVM to find out more about this for the two food production chains, meat and dairy.

RIVM has compiled an overview of available monitoring data for active substance-food combinations (RIVM; Wezenbeek et al., 2025). For 28% of active substances (53 out of 186 relevant active substances), monitoring data are publicly available. For example, there are data on quaternary ammonium compounds (quats) and chlorate (a DBP), related to the use of disinfectants. It appears that these substances can be measurably present in food. For other substances for which monitoring data are available, it is not always clear what the source of the residue is. This mostly concerns substances that (in addition to the biocidal product application) are also approved as veterinary medicinal products (such as salicylic acid) or plant protection products (such as insecticides) and are therefore included in monitoring programs.

4.3.1.1 Points of attention for monitoring biocide residues

A residue definition is not yet established for biocidal products, as it exists for plant protection products and veterinary medicinal products. A residue definition defines which other substances, in addition to the active substance, are relevant

for the risk assessment and/or for enforcement (monitoring). Due to the lack of a residue definition, it is also unclear which substances should be included for effective monitoring. The current Biocidal Products Regulation indicates that not only active substances should be included, because co-formulants, isomers, DBPs and transformation products may also be relevant.

Another point of attention is that other applications during food production can also lead to the introduction of the same residues, such as the use of plant protection products or veterinary medicinal products with the same (active) substances. This potential cumulative use should be taken into account when prioritising for monitoring.

Methods of analysis

In addition to monitoring data, the RIVM study also looked at the current possibilities of the analytical methods at the Wageningen Food Safety Research (WFSR) laboratory to analyse residues of biocidal products (Wezenbeek et al., 2025). RIVM distinguishes between: (i) substance-specific but time-intensive methods that require prioritisation of the relevance of the substances concerned (based on both the likelihood of finding the substances and the toxicological relevance) and (ii) multi-methods for broader screening (where a large number of substances are measured at the same time in one analysis). Within the currently available analysis packages at WFSR, 31% of the 186 biocidal residues considered by RIVM can be measured.

ANSES also considered the availability of analytical methods in its prioritisation of biocidal residues in food (Touchais et al., 2026). ANSES relied on the availability of analytical methods in the literature and the possibilities of measuring these substances also in food of animal origin. So this is more of a preview of what is achievable. It should not be taken for granted that these methods are available in one laboratory.

Both sources, RIVM and ANSES, do not specify the possibilities to perform the analyses on a specific food. Therefore, it is not yet possible to prioritise foods for the possibilities to be analysed.

4.4 Why is it not possible to assess the risks?

In order to assess the risks to consumers of biocidal residues in food and to be able to go through the four steps of the risk assessment, different types of information are needed. First, it must be possible to make an inventory of the relevant substances (see section 4.1). Subsequently, information on toxicity (see section 4.2) and on residue levels in food (see section 4.3) is needed. It has become clear in the previous sections that residue levels in particular are often lacking. As a result, the risks cannot be assessed, because additional data on residue levels of biocidal products in food are required.

4.5 A vicious circle

4.5.1 The interaction between regulatory limits and monitoring

As indicated, few data are available on residue levels of biocidal products in food and MRLs have been set for few active substances of biocidal products. These two observations are not separate from each other. If the NVWA (as supervisor) carries out measurements without availability of MRLs, it can only act on the basis of Article 14 of the General Food Regulation. However, this requires a case-by-case risk assessment and MRLs can be helpful for a unambiguous approach. Due to the absence of MRLs, a direct need for monitoring of biocidal residues is not recognised. And a lack of monitoring results does not provide sufficient

justification for the need to set MRLs (by policy makers). This creates a vicious circle. As a result, policy also receives few signals that MRLs are missing. Figure 2 shows this vicious circle graphically.

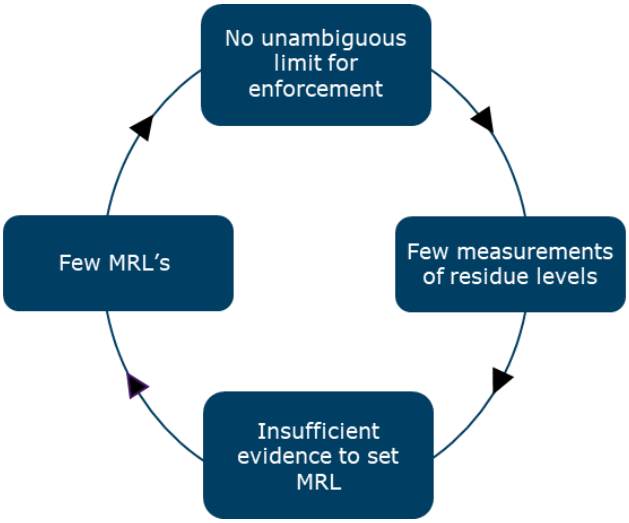

Figure 2 Schematic representation of the interaction between regulatory limits and monitoring, and the consequences for the data position. Concerns have been raised regarding the maximum residue limits (MRLs) currently available, from other legal frameworks (please refer to Section 4.2.2).

4.5.2 Initiatives for setting MRLs for biocidal products

Currently, biocidal products are authorised without MRLs being set for the active substances. An important assumption in the national and European approach was that biocidal products are not directly added to food or feed and therefore measurable residues in food were not expected (DG-SANTE, 2017; Wezenbeek et al., 2025). However, the European Commission recognises that the use of biocidal products in the various process steps of food production can indeed lead to residues (DG-SANTE, 2017). The Commission also indicates that this is difficult to prevent for some applications.

In the absence of established requirements, the European Commission drew up a temporary approach in 2017. This approach distinguished between biocidal products likely to result in residues in food and those unlikely to result in residues in food (DG-SANTE, 2017).The Commission notified that, where available, the existing MRLs from existing frameworks are sufficiently protective. Subsequently, the setting of MRLs for biocidal products was agreed in 2024 (DG-SANTE, 2024b). This European agreement builds on the use of regulatory limits (MRLs and MLs) from other legal frameworks, relating to plant protection products, veterinary medicinal products, food contact materials and contaminants in food (DG-SANTE, 2024a). RIVM concludes that the existing MRLs should be examined for relevance for biocidal product uses (Wezenbeek et al., 2025), also in view of the restrictions described in section 4.2.2.

The European Commission has determined that it is not appropriate to establish a specific procedure for setting MRLs for biocidal products (DG-SANTE, 2024b). The Commission is aiming for one MRL per substance-food combination, based on the 'one substance one assessment' approach. Therefore, the Commission is reluctant to establish a separate legal framework, for setting MRLs for biocidal products. The setting of MRLs will have to be approached case-by-case. For this purpose, the Commission considers that the legal frameworks setting MRLs for plant

protection products and/or veterinary medicinal products or MLs for food contact materials or contaminants should be used.

A draft guidance document on the risks of exposure to substances from biocidal products via food is available from the "ECHA Working Group on the Assessment of Residue Transfer to Food" (ARTFood) (ECHA, 2025c). ECHA indicates that this guideline has not yet been adopted, so it cannot yet be used to determine whether an MRL is needed. RIVM indicates that the process for the determination seems to have stalled (Wezenbeek et al., 2025).

4.5.3 Breaking the vicious circle

There are two ways to break the vicious circle described in section 4.5.1.:

1 Setting MRLs as an impetus to start monitoring.

2 Starting a monitoring program without MRLs. At this stage, monitoring focuses on understanding residue prevention and supporting future regulatory limits, not on direct enforcement.

Both options require a prioritisation of substances and food, given the large amount of substance-food combinations. In addition to the RIVM research requested by BuRO (Wezenbeek et al., 2025), two recent publications have been found that have investigated the prioritisation of substances. BuRO briefly names these studies. For the prioritisation of substances, BuRO relies on RIVM research, because the other publications are generic or not specific enough for the situation in the Netherlands. Food prioritisation has not been included in all studies.

- The study by ANSES prioritised 175 active substances as relevant in food of animal origin (Touchais et al., 2026). ANSES used the following criteria:
  - The potential risk of exposure of consumers, based on the likelihood of application resulting in the introduction of residues into the food.
  - Information resulting from laws and regulations on the potential application in one or more PTs.
  - Existing knowledge about the acute and chronic toxicological properties of the substance.
  - In addition, ANSES also looked at the availability of analytical methods (in the scientific literature).
- The German Institute for Occupational Safety and Health (BAuA) published a factsheet on the assessment of biocidal residues in food of animal origin in 2023 (BAuA, 2023). The proposed approach does not address specific substances but takes a generic approach (often with references to other sources, legislation and guidelines) to prioritise substances for which MRLs should be set. BAuA took the following into account:
  - The likelihood that the application will result in the introduction of biocidal residues in food.
  - Expected consumer exposure.
  - The possible risk that may arise from the exposure.

  BAuA refers (inter alia) to the draft ARTfood guideline on estimating biocidal residues in food through professional use (ARTfood, 2022) and

the guideline implemented by ECHA on estimating the exposure of livestock to active substances from biocidal products *(ECHA, 2017a)*.

- At the request of BuRO, RIVM specifically examined the possibilities for selection and prioritisation of biocidal residues in dairy, meat and infant formulae (Wezenbeek et al., 2025). Because this study looked at the situation relevant to the Netherlands, BuRO sees this as the most important source. For this purpose, RIVM first selected the relevant active substances on the basis of relevant PTs (see Section 4.1). This is based on substances that have a European approval (EU list of substances) and substances that are under evaluation for approval under the Biocidal Products Regulation. 'Low-risk substances' are not included (substances listed in Annex I of the Biocidal Products Regulation).

  These selected active substances (n=186) were then prioritised on the basis of the following three criteria groups:

  - I. Use in multiple PTs (see Annex 7.3). RIVM gives a number of points (0-5), depending on the number of PTs in which the active substance is used.
  - II. Information on monitoring, MRLs and transformation products. For this purpose, a number of points (0-10) are given to each active substance with combined information:
    - The availability and outcomes of monitoring data. When levels are above MRL (if available) a high number of points is given, and when levels are below the MRL a low number of points is given. When data are lacking, the number is in between.
    - The current analytical possibilities. The availability of an analytical method increases the number of points.
    - The availability of an MRL, also within a different legal framework. This affects the number of points associated with the presence or absence of monitoring data. The highest number of points is given to substances for which monitoring data and MRL or ML are lacking.
    - The relevance of and knowledge about degradation products such as DBPs. Active substances where (chlorinated) DBPs are expected receive the maximum number of points.
  - III. Hazardous properties. Classification into 3 categories based on hazard characteristics (see Annex 7.4), with the highest hazard category receiving the highest number of points (5, 3 and 1 points). Substances that could not be classified receive zero points.

  The points awarded per criteria group (I, II and III) are added up and give a total prioritisation score per active substance ranging from 0 to 20. For the 30 active substances with the highest prioritisation score (20 to 16 points), the distribution of the points among the three criteria groups can be found in Annex 7.5.

  For the proposed top 30 substances, the use in multiple PT species (criteria group I) is the most important criterion for disinfectants in particular. In addition, the expected DBPs (Group II criteria) determine the prioritisation score of chlorinated active substances, ozone and per-substances (which are reactive radical-forming substances such as

hydrogen peroxide, peracetic acid). And for chlorate, quats, salicylic acid and brodifacoum the most important criterion is to exceed the MRL (group II criteria). Furthermore, substances in the highest hazard category (criteria group III) score high in the absence of monitoring data (hydrogen cyanide, aluminium phosphide releasing phosphine and CMIT/MIT). There are no substances in the lowest hazard category among the 30 highest scoring active substances.

5 Conclusions

On the basis of the available information, there is a need to further investigate the risks posed by biocidal residues in food. Previous studies highlighted the possible situations when instructions for use are not followed during the application of biocidal products (no pre-cleaning, no or insufficient rinsing, overdosing, misuse or illegal use). This can lead to residues in food. Nevertheless, for a large group of substances, there is little measurement data on residues available in food. However, without information on residue levels, a food safety risk assessment is not possible. In addition, MRLs are missing for many (residues of) active substances in authorised biocidal products. Moreover, the MRLs available are not specific to the biocidal product application. This leads to a vicious circle in which a data question (for the purpose of setting MRLs and carrying out a risk assessment) and regulatory limits (MRLs as an unambiguous legal limit in enforcement checks) are waiting for each other. In order to ensure food safety, it is necessary to break this vicious circle, in order to improve the data position for risk assessment.

A study of residue levels of active substances may provide an initial picture of the presence of those substances in food. That seems to be the most obvious step. When designing such a survey, the following information is available:

- Selected PTs relevant for food (refer to Table 1).
- Prioritisation of active substances from relevant PT species (PT3, PT4, PT5, PT14, PT18 and PT19) for dairy, meat and infant formulae (refer to Annex 7.5).

No information was found on the prioritisation of foods to be measured. Processed food may deserve priority due to the use of disinfectants in the processing industry (DG-SANTE, 2017; Wezenbeek et al., 2025). It is best to start with widely consumed products, such as dairy and meat products, and other foods that are widely consumed according to the Food Consumption Survey (Voedselconsumptiepeiling (VCP)) of RIVM (RIVM, 2025).

Within the currently available analysis packages at WFSR, a limited number of biocidal residues can be measured, in a limited number of foods (Wezenbeek et al., 2025). This requires extra attention.

In addition to the active substances, it is important to obtain more information on breakdown products, transformation products, DBPs and co-formulants. However, the data position is even more limited for these substances, making it difficult to give direction for relevant monitoring. Therefore, these substances cannot be prioritised in an initial study, but should be included in follow-up studies.

Residues resulting from the illegal use of biocidal products, the use of biocidal products in countries outside the European Union (relevant for imported food products) and the use of ‘alternative’ products are not included in the above. The follow-up of these uses needs special attention at a later stage.

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7 Annexes

7.1 Targeted literature collection by BuRO

Information on biocidal products and MRLs was sought on the websites of the European authorities: European Chemicals Agency (ECHA), European Food Safety Authority (EFSA) and European Medicines Agency (EMA). Information was also sought from other EU Member States known to be active in the field of biocidal products: Bundesinstitut fűr Risikobewertung (BfR), Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail (ANSES) and Danish Environmental Protection Agency (Danish EPA).

No further systematic literature review was carried out. In the studies of WFSR and RIVM commissioned by BuRO, and used for the current advice, extensive literature research was carried out.

7.2 Biocidal products main groups and product types

Biocidal products are divided into four groups. These groups are further subdivided into product types (PTs).

Main group 1: Disinfectants
Product type 1: Human hygiene
Product-type 2: Disinfectants and algaecides not used directly on humans or animals
Product-type 3: Animal hygiene
Product-type 4: Food and feed
Product-type 5: Drinking water
Main group 2: Preservatives
Product-type 6: Preservatives for products during storage
Product-type 7: Film preservatives
Product-type 8: Wood preservatives
Product-type 9: Preservatives for fibres, leather, rubber and polymerised materials
Product-type 10: Preservatives for building materials
Product-type 11: Preservatives for liquid cooling and processing systems
Product-type 12: Glue control agents
Product-type 13: Liquid preservatives for processing and cutting
Main group 3: Pest control
Product-type 14: Rodenticides
Product-type 15: Avicids
Product-type 16: Molluscicides, vermicides and products to control other invertebrates
Product-type 17: Piscicides
Product-type 18: Insecticides, acaricides and products to control other arthropods
Product-type 19: Repellents and attractants
Product-type 20: Control of other vertebrate animals
Main group 4: Other biocides
Product-type 21: Anti-fouling products
Product-type 22: Fluids for embalming and mounting

7.3 Use of active substances of biocidal products in different PT types

Table 2 Number of active substances per Product Type (PT) (approved or under evaluation) plus overlap in use in different PTs (as at January 2024) (taken from (Wezenbeek et al., 2025)).

	PT03	PT04	PT05	PT14	PT18	PT19
Number of approved active substances	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	

7.4 Classification of active substances by hazard properties

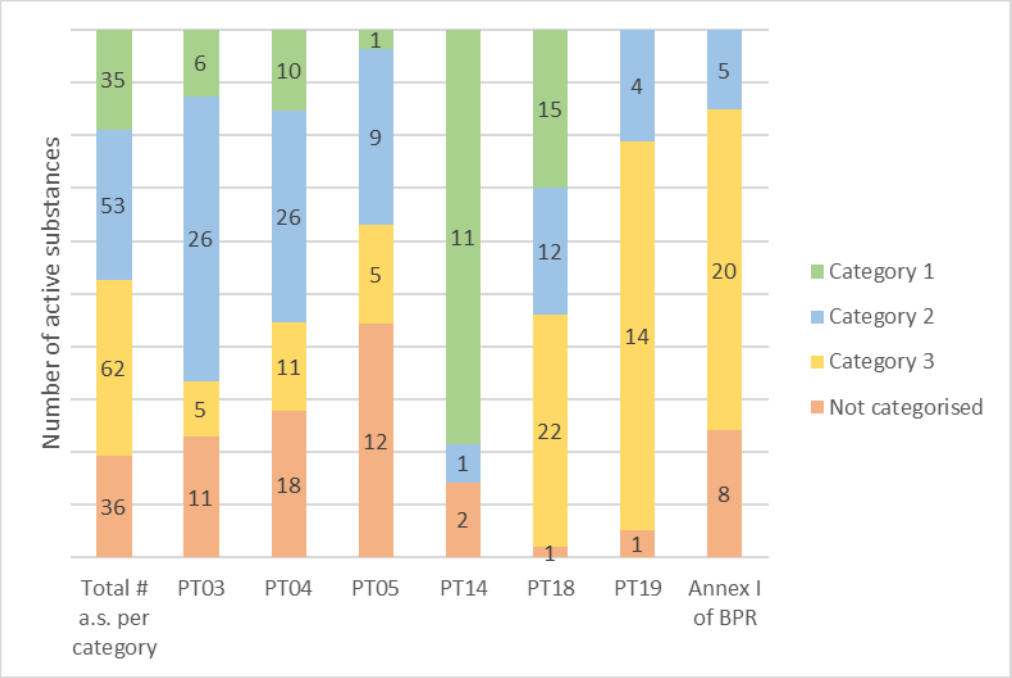

Figure 3 The number of approved active substances per Product Type (PT) and for all PTs together with the hazard category assigned by RIVM. Category 1 includes substances with the most important toxicological properties; Category 3 contains substances with the least significant toxicological properties. Category 2 is in between. Substances with 'No category' could not be assigned by RIVM for various reasons (taken from (Wezenbeek et al., 2025)).

7.5 The 30 highest-priority active ingredients for dairy and meat

Table 3 The 30 highest priority active substances for dairy and meat, with the awarded points per criteria group (I, II and III) plus the total prioritisation score (taken from (Wezenbeek et al., 2025)). See RIVM report (Wezenbeek et al., 2025) for the prioritisation of the other active substances. This list will change due to the inclusion or non-inclusion of certain criteria or a different choice for the points awarded.

	Name of active substance (English name from ECHA database)	General name or abbreviation (English)	CAS No.	Overall prioritisation score	Number of points from criteria group I (0-5 points)*	Number of points from Criteria Group II (0-10 points)**	Number of points from criteria group III (0-5 points)***
1	**Tosylchloramide sodium (Chloramin T)**	Chloramin T	127-65-1	20	5	10	5
2	**Active chlorine generated from sodium chloride and pentapotassium bis(peroxymonosulphate) bis(sulphate)**	Active chlorine generated from sodium chloride and pentapotassium bis(peroxymonosulphate) bis(sulphate)	-	18	5	10	3
3	**Active chlorine generated from sodium chloride by electrolysis**	Active chlorine generated from sodium chloride by electrolysis	-	18	5	10	3
4	**Active chlorine released from calcium hypochlorite**	Active chlorine released from calcium hypochlorite	7778-54-3	18	5	10	3
5	**Active chlorine released from hypochlorous acid**	Active chlorine released from hypochlorous acid	-	18	5	10	3
6	**Active chlorine released from sodium hypochlorite**	Active chlorine released from sodium hypochlorite	7681-52-9	18	5	10	3

7	**Chlorine dioxide**	Chlorine dioxide	10049-04-4	18	5	10	3
8	**Chlorine dioxide generated from sodium chlorite by acidification**	Chlorine dioxide generated from sodium chlorite by acidification	-	18	5	10	3
9	**Chlorine dioxide generated from sodium chlorite by electrolysis**	Chlorine dioxide generated from sodium chlorite by electrolysis	-	18	5	10	3
10	**Chlorine dioxide generated from sodium chlorite by oxidation**	Chlorine dioxide generated from sodium chlorite by oxidation	-	18	5	10	3
11	**Hydrogen cyanide**	Hydrogen cyanide	74-90-8	18	3	10	5
12	**Hydrogen peroxide**	Hydrogen peroxide	7722-84-1	18	5	10	3
13	**Ozone generated from oxygen**	Ozone generated from oxygen	-	18	3	10	5
14	**Pentapotassium bis(peroxymonosulphate) bis(sulphate)**	Pentapotassium bis(peroxymonosulphate) bis(sulphate)	70693-62-8	18	5	10	3
15	**Peracetic acid**	Peracetic acid	79-21-0	18	5	10	3
16	**Salicylic acid**	Salicylic acid	69-72-7	18	3	10	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	3	9	5

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	1	10	5
19	**Alkyl (C12-16) dimethylbenzyl ammonium chloride (ADBAC/BKC (C12-16))**	ADBAC/BKC (C12-16)	68424-85-1	16	3	10	3
20	**Alkyl (C12-18) dimethylbenzyl ammonium chloride (ADBAC (C12-18))**	ADBAC (C12-18)	68391-01-5	16	3	10	3
21	**Alkyl (C12-C14) dimethyl(ethylbenzyl)ammonium chloride (ADEBAC (C12-C14))**	ADEBAC (C12-C14)	85409-23-0	16	3	10	3
22	**Alkyl (C12-C14) dimethylbenzylammonium chloride (ADBAC (C12-C14))**	ADBAC (C12-C14)	85409-22-9	16	3	10	3
23	**Aluminium phosphide releasing phosphine**	Aluminium phosphide releasing phosphine	20859-73-8	16	3	8	5
24	**Brodifacoum**	Brodifacoum	56073-10-0	16	1	10	5
25	**Didecyldimethylammonium chloride (DDAC (C8-10))**	DDAC (C8-10)	68424-95-3	16	3	10	3

26	**Didecyldimethylammonium chloride (DDAC)**	DDAC	7173-51-5	16	3	10	3
27	**Disodium peroxodisulphate/Sodium persulphate**	Disodium peroxodisulphate/Sodium persulphate	7775-27-1	16	1	10	5
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	1	10	5
29	**Peracetic acid generated from tetra-acetylethylenediamine (TAED) and sodium percarbonate**	Peracetic acid generated from tetra-acetylethylenediamine (TAED) and sodium percarbonate	-	16	3	10	3
30	**Reaction mass of peracetic acid and peroxyoctanoic acid**	Reaction mass of peracetic acid and peroxyoctanoic acid	33734-57-5	16	3	10	3

*Criteria group I: Use in multiple PTs (see Annex 3)
**Criteria Group II: Information on monitoring, MRLs and transformation products.
***Criteria Group III: Hazardous properties