REGULATION (EU) NO 528/2012 CONCERNING THE MAKING AVAILABLE ON THE MARKET AND USE OF BIOCIDAL PRODUCTS

Assessment of active substances

COMPETENT AUTHORITY REPORT

THERMALLY TREATED GARLIC JUICE

Product type 19

Repellents and attractants

EC Number: N/A

CAS Number: N/A

Index Number: N/A

Applicant: Ecospray Limited UK

Contact details of evaluating CA: Federal Ministry Republic of Austria for Climate Action, Environment, Energy, Mobility, Innovation and Technology, 1010 Vienna, Austria

Version number: 3 **Date:** 10/08/2023

Important note: This active substance is already approved under the PPPR with the name "GARLIC EXTRACT" and was also submitted to the BPR as "GARLIC EXTRACT". During the peer review process under BPR it was agreed to change the name to "THERMALLY TREATED GARLIC JUICE".

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STATEMENT OF SUBJECT MATTER AND PURPOSE OF THE CAR

This assessment report has been established as a result of the assessment of the active substance thermally treated garlic juice in product type 19 carried out in the context of Regulation (EU) No 528/2012, with a view to the possible approval of this substance.

On 17.09.2019 the Competent Authority Austria received a dossier from the applicant. The Evaluating Competent Authority accepted the dossier as complete for the purpose of the assessment on 29.04.2020.

On 23.09.2022, the Evaluating Competent Authority (eCA) submitted to ECHA a copy of the assessment report containing the conclusions of the assessment, hereafter referred to as the competent authority report (CAR). Based on the conclusions of the assessment, the eCA proposed the approval of thermally treated garlic juice as active substance for product type 19 under Regulation (EU) No 528/2012. Before submitting the CAR to ECHA, the applicant was given the opportunity to provide written comments in line with Article 8(1) of Regulation (EU) No 528/2012.

According to the biocides Review Program Regulation/Biocides working procedure:

- If the CMR-based exclusion criteria are met, the RAC opinion on CLH needs to be available at the time of submitting the CAR.

- If the substitution criteria are met because of CMR properties, it is highly preferable and therefore strongly recommended that the RAC opinion on harmonised classification and labelling is available at the time of submitting the CAR. In any case if the substitution criteria are met, a CLH dossier needs to be submitted by the time of submitting the CAR.

- Regarding substances not considered to meet the exclusion or substitution criteria, if changes are proposed to an already existing harmonised classification and labelling, or no harmonised classification and labelling is available for the active substance, it is strongly recommended that a CLH dossier is submitted by the time of submitting the CAR.

On 22.09.2022 the competent authority Austria submitted a CLH dossier to ECHA.

In order to review the CAR and the comments received on it, consultations of technical experts from all Member States (peer review) were organised by ECHA. Revisions agreed upon were presented at the Biocidal Products Committee and its Working Groups meetings and the competent authority report (CAR) was amended accordingly.

The aim of the assessment report is to support the opinion of the Biocidal Products Committee and a decision on the approval of thermally treated garlic juice for product-type 19 and, should it be approved, to facilitate the authorisation of individual biocidal products. In the assessment of applications for product authorisation, the provisions of Regulation (EU) No 528/2012 shall be applied, in particular the provisions of Chapter IV, as well as the common principles laid down in Annex VI.

For the implementation of the common principles of Annex VI, the content and conclusions of the assessment report, which is available from the web-site of ECHA shall be taken into account.

However, where conclusions of this assessment report are based on data protected under the provisions of Regulation (EU) No 528/2012, such conclusions may not be used to the benefit of another applicant, unless access to these data for that purpose has been granted to that applicant.

BPC OPINION

Please see the BPC opinion on the application for approval of the active substance thermally treated garlic juice in product-type 19 (ECHA/BPC/47/2023), adopted on 05/06/2023.

ASSESSMENT REPORT

SUMMARY

1. PRESENTATION OF THE ACTIVE SUBSTANCE

1.1 IDENTITY OF THE ACTIVE SUBSTANCE

Table 1.1 Main constituents

Main constituent(s)	
ISO name	Thermally treated garlic juice
IUPAC or EC name	Thermally treated garlic juice
EC number	N/A
CAS number	---
Index number in Annex VI of CLP	N/A
Minimum purity / content	100% (1000 g/kg)
Structural formula	Marker compounds responsible for efficacy: 1. $C_6H_{10}S$ (Diallyl monosulfide, DAS1) 2. $C_6H_{10}S_2$ (Diallyl disulfide, DAS2) 3. $C_6H_{10}S_3$ (Diallyl trisulfide, DAS3) 4. $C_6H_{10}S_4$ (Diallyl tetrasulfide, DAS4) The content of the sum of this four marker compounds ("[redacted]") is [redacted].

The active substance is of food grade quality and complies with Commission Regulation (EC) No 1881/2006 of 19 December 2006 setting maximum levels for certain contaminants in foodstuffs and its amendments as well as with Regulation (EC) No 396/2005 of the European Parliament and of the Council of 23 February 2005 on maximum residue levels of pesticides in or on food and feed of plant and animal origin and its amendments.
Please note that the active substance has been approved as "*Garlic extract*" under Plant Protection Products (PPP) Directive 91/414/EEC and this approval has been renewed under PPP Regulation (EC) No 1107/2009 (PPPR) on 01.03.2021 (Commission Implementing Regulation (EU) 2021/129). The name of the active substance under PPPR currently differs from the one under the biocides regime. Under PPPR, the active substance "*Garlic extract*" is associated to the CAS-numbers 8008-99-9 and 8000-78-0. Under the Biocidal Products Regulation (BPR, Regulation (EU) 528/2012) no CAS-number will be associated to this UVCB substance. However, it is the same active substance approved under PPPR as in the present dossier. In both dossiers, the applicant, the manufacturing site as well as the manufacturing process are identical.

Table 1.2 Relevant impurities and additives

Relevant impurities and additives		
IUPAC name or chemical name or EC name	Maximum concentration in % (w/w)	**Index number in Annex VI of CLP**
N/A – thermally treated garlic juice is a UVCB active substance. It is derived from garlic juice that is thermally treated and has food grade quality. The term 'impurity' is not relevant. The purity is 100%. Cf. to Appendix VI for detailed information.		

1.2 INTENDED USES AND EFFECTIVENESS

Table 1.3 Use of the active substance

Product type	
Intended use pattern(s)	Repellent; avoids the excretion of cats at treated places/objects.
Users	Non-professional

Table 1.4 Effectiveness of the active substance

Function	
Organisms to be controlled	Mammals (cats, of all ages)
Limitation of efficacy including resistance	Efficacious for up to 10 days under dry weather conditions. Re-application after rainfall is necessary to ensure the efficacy. There is no selection pressure from a repellent.
Mode of action	Olfactory repellent

2. PROPOSED HARMONISED CLASSIFICATION AND LABELLING OF THE ACTIVE SUBSTANCE ACCORDING TO THE CLP CRITERIA

2.1 PROPOSED HARMONISED CLASSIFICATION AND LABELLING FOR THE ACTIVE SUBSTANCE

Table 2.1 Proposed harmonised classification and labelling of the substance

	Index No	International Chemical Identification	EC No	CAS No	Classification		Labelling			Specific Conc. Limits, M-factors, ATEs	Notes
					Hazard Class and Category Code(s)	Hazard statement Code(s)	Pictogram, Signal Word Code(s)	Hazard statement Code(s)	Suppl. Hazard statement Code(s)		
Current Annex VI entry											
Dossier submitters proposal	TBD	Thermally treated garlic juice	N/A	N/A	Skin Sens. 1B	H317	Warning GHS07	H317	--	--	--
Resulting entry in Annex VI if adopted by RAC and agreed by Commission	TBD	Thermally treated garlic juice	N/A	N/A	Skin Sens. 1B	H317	Warning GHS07	H317	--	--	--

Table 2.2 Reason for not proposing harmonised classification and labelling and the status under CLH public consultation

Hazard class	Reason for not proposing classification and labelling	Within the scope of public consultation
Explosives	Data conclusive but not sufficient for classification	Yes
Flammable gases (including chemically unstable gases)	Hazard class not applicable	No
Oxidising gases	Hazard class not applicable	No
Gases under pressure	Hazard class not applicable	No
Flammable liquids	Data conclusive but not sufficient for classification	Yes
Flammable solids	Hazard class not applicable	No
Self-reactive substances and mixtures	Data conclusive but not sufficient for classification	Yes
Pyrophoric liquids	Data conclusive but not sufficient for classification	Yes
Pyrophoric solids	Hazard class not applicable	No
Self-heating substances and mixtures	Hazard class not applicable	No
Substances which in contact with water emit flammable gases	Data conclusive but not sufficient for classification	Yes
Oxidising liquids	Data conclusive but not sufficient for classification	Yes
Oxidising solids	Hazard class not applicable	No
Organic peroxides	Hazard class not applicable	No
Corrosive to metals	Hazard class not applicable	No
Acute toxicity via oral route	Data lacking	Yes
Acute toxicity via dermal route	Data lacking	Yes
Acute toxicity via inhalation route	Data lacking	Yes
Skin corrosion/irritation	Data conclusive but not sufficient for classification	Yes
Serious eye damage/eye irritation	Data conclusive but not sufficient for classification	Yes
Respiratory sensitisation	Data lacking	Yes
Skin sensitisation	Skin Sens. 1B, H317, harmonised classification proposed	Yes

Germ cell mutagenicity	Data lacking	Yes
Carcinogenicity	Data lacking	Yes
Reproductive toxicity	Data lacking	Yes
Specific target organ toxicity-single exposure	Data lacking	Yes
Specific target organ toxicity-repeated exposure	Data lacking	Yes
Aspiration hazard	Data conclusive but not sufficient for classification	Yes
Hazardous to the aquatic environment	Data conclusive but not sufficient for classification	Yes
Hazardous to the ozone layer	Data conclusive but not sufficient for classification	Yes

2.2.1 HISTORY OF THE PREVIOUS CLASSIFICATION AND LABELLING

The active substance thermally treated garlic juice, has been approved as "*garlic extract*" under the Plant Protection Products (PPP) Directive 91/414/EEC and this approval has been renewed under PPP Regulation (EC) No 1107/2009 on 01.03.2021 (Commission Implementing Regulation (EU) 2021/129). Under PPPR, the active substance "*garlic extract*" is associated to the CAS-numbers 8008-99-9 and 8000-78-0. Under BPR no CAS-number is associated to this UVCB substance. The only identified hazard of this active substance is skin sensitisation, proposed to be classified as Skin sens. 1B.

2.2 PROPOSED CLASSIFICATION AND LABELLING AND PACKAGING FOR THE REPRESENTATIVE PRODUCT(S)

Table 2.3 Proposed Classification and Labelling according to Regulation (EC) No 1272/2008

Classification			Labelling			
Hazard Class and Category	Hazard statements	Pictograms	Signal word	Hazard statements	Suppl. Hazard statements	Precautionary statements
Skin Sens. 1B	H317	GHS07 	Warning	H317	--	P101 P102 P103 P261 P302+P352 P333+P313 P362+P364 P501

Table 2.4 Packaging of the biocidal product

Type of packaging	Size/volume of the packaging	Material of the packaging	Type and material of closure(s)	Intended user (e.g. professional, non-professional)	Compatibility of the product with the proposed packaging materials (Yes/No)
Bottle	100-1000 g*	HDPE/Nylon	PE tamper proof screw cap	Non-professional	Yes

*[redacted] The definite packing size(s) for the biocidal product(s), has to be substantiated for every claimed packaging size later at product authorisation level.

2.3 DATA SOURCES

ECHA dissemination site: https://echa.europa.eu/en/substance-information/-/substanceinfo/100.029.426. The Draft Risk Assessment Report provided by the applicant in course of an application as active substance under the Biocidal Product Regulation (Regulation (EU) No 528/2012) including the original study reports served as information source. Moreover, scientific literature was used as data source as well as the public available documents referring to the renewal of garlic extract as active substance under the PPP Regulation (EC) No 1107/2009. Please see Appendix V: Overall reference list for details.

3. SUMMARY OF THE HUMAN HEALTH RISK ASSESSMENT

3.1 SUMMARY OF THE ASSESSMENT OF EFFECTS ON HUMAN HEALTH

Table 3.1 Summary of the assessment of effects on human health

Endpoint	Brief description
Toxicokinetics	The manufacturing process of thermally treated garlic juice covers processes similar to [redacted]. Rapid formation of the marker substances allyl polysulfides from thiosulfinates is reported, if garlic is exposed to hot water e.g. via cooking (Lawson and Hunsaker, 2018). Based on the similarity of these processes, it is reasonable to anticipate that dietary uptake of manufactured or kitchen prepared garlic food products cover the allyl polysulfides and other compounds of thermally treated garlic juice used in the biocidal product, qualitatively and quantitatively. Therefore waiving of the data requirement of Annex II 8.8 of Regulation (EU) No. 528/2012 is acceptable. Literature data indicate rapid uptake and metabolism of garlic compounds after oral uptake. Thus it can be concluded that allyl polysulfides present in thermally treated garlic juice are metabolized similarly to kitchen prepared garlic.
Acute toxicity	Garlic is listed as GRAS (Generally Recognized As Safe) by U.S. FDA. Dietary exposure is expected to exceed the systemic exposure by dermal (or inhalation) route. Waiving of the data requirement of Annex II 8.7 of Regulation (EU) No. 528/2012 is acceptable.
Corrosion and irritation	Thermally treated garlic juice is not considered to be corrosive or irritant to skin or eyes in experimental studies. In the GLP compliant skin irritation study slight irritating effects (not sufficient for classification) were observed.
Sensitisation	Skin sensitisation was detected in a mouse local lymph node assay (LLNA) and therefore classification for Skin Sens. 1B, H317 is justified. Some evidence in literature, mainly related to garlic powder and dust, reported the potential to cause adverse respiratory sensitising effects, but no studies or case reports for thermally treated garlic juice supported under Regulation (EU) No. 528/2012 is available.
Repeated dose toxicity	Waiving of the data requirement of Annex II 8.9 of Regulation (EU) No. 528/2012 is acceptable.
Genotoxicity	Waiving of the data requirement of Annex II 8.5 of Regulation (EU) No. 528/2012 is acceptable.
Carcinogenicity	Waiving of the data requirement of Annex II 8.11 of Regulation (EU) No. 528/2012 is acceptable.
Reproductive toxicity	Waiving of the data requirement of Annex II 8.10 of Regulation (EU) No. 528/2012 is acceptable.
Neurotoxicity	There is no data available on the neurotoxicity potential of the active substance.
Immunotoxicity	There is no additional data available on immunotoxicity of the active substance.

Disruption of the endocrine system	Some experimental data with garlic preparations and garlic components such as diallyl disulfide were available in public literature indicating effects on male fertility. However, no robust guideline conforming systemic or reproductive toxicity study including endpoints related to endocrine disruption was submitted. Thermally treated garlic juice is processed from [redacted]. Dietary exposure is expected to exceed the systemic exposure by dermal (or inhalation) route. Waiving of the data requirement of Annex II 8.13.3 of Regulation (EU) No. 528/2012 is acceptable, based on scientific reasons according to Annex IV of Regulation (EU) No. 528/2012.
Other effects	Traditional use for mild beneficial health effects concerning atherosclerosis and common cold were reported.

3.2 REFERENCE VALUES

No reference values were allocated for the active substance as a quantitative risk assessment was not performed. As the marker substances and other compounds of thermally treated garlic juice are considered to be part of the human diet assuming uptake of food processed garlic and the exposure levels via the biocidal use are below the potential diet levels, no human health reference values were necessary.

EFSA (2020) stated the dietary intake values of the European population to garlic from PRIMoV3.1[1]. The largest chronic consumption of garlic is 0.0833 g/kg bw/d (for the Romania general population, equal to an intake of 4.9 g/day). The 97.5th percentile consumption was 0.64 g/kg bw/d, corresponding to an intake of 42.7 g/day (for an UK vegetarian) representing largest acute consumption.

3.3 RISK CHARACTERISATION

Table 3.3 Summary of exposure scenarios

Summary table: scenarios			
Scenario number	Scenario (e.g. mixing/ loading)	Primary or secondary exposure Brief description of scenario	**Exposed group (e.g. professionals, non-professionals, bystanders)**
1.	Outdoor application of the product	Primary exposure: An adult user applies the product "Katzenschreck" by pouring from the container.	Non-professional
2.	Exposure to the product from re-entry into treated areas	Secondary exposure: An adult and/or child re-enters an area treated with "Katzenschreck" following the application of the product.	Bystanders (general public)

[1]Available at https://www.efsa.europa.eu/en/applications/pesticides/tools 2022-12-19

Referring to the envisaged use of the biocidal product, the estimated exposure levels to the active substance thermally treated garlic juice are low. The calculated exposure levels are external levels and represent worst case estimates for systemic exposure levels.
Based on the similarity of the manufacturing process of thermally treated garlic juice and garlic food processes, it is reasonable to anticipate that dietary uptake of industrially manufactured and kitchen prepared garlic food products cover exposure to the allyl polysulfides and other compounds of thermally treated garlic juice. Exposure to the same compounds and lower exposure levels than via diet are assumed for the use of the biocidal product. Therefore, acceptable risk regarding systemic exposure is assumed.

The local risk assessments for non-professional users and the general public indicated acceptable risks due to low exposure, outdoor use and adequate labelling, safety and use instructions.

4. SUMMARY OF THE ENVIRONMENTAL RISK ASSESSMENT

4.1 FATE AND BEHAVIOUR IN THE ENVIRONMENT

Table 4.5 Summary table on compartments exposed and assessed

Summary table on compartments exposed and assessed		
Compartment	Exposed (Y/N)	Assessed (Y/N)
Soil	Y	Y
Water	N	N
Air	N	N

Table 4.6 Summary table on relevant metabolites/degradants

Summary table on relevant metabolites/ degradants		
Metabolite/ degradant/transformation- or reaction product	Compartment	% Active Substance
No metabolites	N/A	N/A

Table 4.7 Summary table on relevant physico-chemical and fate and behaviour parameter of the active substance

Summary table on relevant physico-chemical and fate and behaviour parameter of the active substance			
	Value	Unit	**Remarks**
Molecular weight	N/A		
Log Octanol/water partition coefficient (Log Kow)	-1.49	Log 10	
Organic carbon/water partition coefficient (Koc)	575.4 - 3981	L/kg	[redacted] OECD 121 HPLC Method.
Henry's Law Constant (20 °C)	0.354	Pa/m3/mol	[redacted]
Biodegradability	Readily biodegradable		
DT50 for biodegradation in surface water	15	d (at 12ºC)	Default value
DT50 for hydrolysis in surface water	16.3	h (at pH 7 and 12°C)	
DT50 for photolysis in surface water	Not determined		
DT50 for degradation in soil	6.86	d (at 12ºC)	
DT50 for degradation in air	5.591	h	Based on Atikson

Summary table on relevant physico-chemical and fate and behaviour parameter of the active substance			
			model (version 1.92)
DT50 for degradation in sediment	N/A		
Bioconcentration, aquatic	N/A		
Bioaccumulation, aquatic	N/A		
Bioconcentration, terrestrial	N/A		
Bioaccumulation, terrestrial	N/A		

Effects assessment

Table 4.8 Summary table on calculated PNEC values

Summary table on calculated PNEC values	
Compartment	**PNEC**
STP	2.5 mg/L
Freshwater	11.7 µg/L
Marine water	1.17 µg/L
Sediment (freshwater)	0.156 mg/kg sediment wwt
Sediment (marine water)	15.6 µg/kg sediment wwt
Soil	4.73 mg/kg soil dw 4.19 mg/kg soil wwt
Secondary poisoning	No potential for bioaccumulation
Air	No hazard identified

4.2 EXPOSURE ASSESSMENT

Available information on the active substance indicates that the substance is not classified as an acute or chronic environmental hazard under the CLP criteria, is not bioaccumulative and is expected to be rapidly degradable in the environment.
The applicant submitted a study (Anonymous 2021h) showing the effective concentrations released into the environment through agricultural activity and compared the emissions due to the maximum approved application levels proposed by application of the biocidal product. The study states that the values calculated from average garlic yield and minimum and maximum alliin equivalents are considered for emission estimates. The average estimated concentration of sulfoxides (as Polysulfide Alliin Equivalents (PAE)) range between 3.2 kg/ha and 64.7 kg/ha (Anonymous 2021h).

The emission calculation regarding the application of the biocidal product is based on the estimated maximum amount of polysulfide content in the active substance of 3.6% (Anonymous 2021h). [redacted]

The emission calculation regarding the application of the biocidal product will release a fraction [redacted]

[redacted]

[redacted]

[redacted]
environmental emissions:
[redacted]

Comparing emissions of the biocidal product application with the minimum and maximum residue values, agricultural activity leads to 44 and 899 times higher emissions.

5. ASSESSMENT OF EXCLUSION CRITERIA, SUBSTITUTION CRITERIA AND POP

Table 5.1 Assessment of exclusion criteria, substitution criteria and POP

Conclusion on exclusion criteria	
Conclusion on CMR	Thermally treated garlic juice is not expected to exhibit carcinogenic, mutagenic or reprotoxic properties.
Conclusion on ED assessment	Not identified as endocrine disruptor
Conclusion on PBT and vP/vB criteria	Not PBT or vP/vB. Thermally treated garlic juice is neither PBT or vP/vB
Conclusion on substitution criteria	None of the substitution criteria are fulfilled.
Conclusion on LRTAP/POP assessment	Thermally treated garlic juice does not have LRTAP and is not considered a POP.

A. Assessment of intrinsic properties and effects of the active substance

A.1. General substance information

A.1.1. Identity of the substance

Table A.1 Summary table on substance identity

Summary table on substance identity	
Common name (ISO name, synonyms)	Thermally treated garlic juice Synonyms: [redacted] garlic extract
Chemical name (EC name, CA name, IUPAC name)	Thermally treated garlic juice
EC number	N/A
CAS number	N/A
other CAS numbers (e.g. deleted, related, preferred, alternate)	N/A
Molecular formula	Marker compounds responsible for efficacy: 1. $C_6H_{10}S$ (Diallyl monosulfide, DAS1) 2. $C_6H_{10}S_2$ (Diallyl disulfide, DAS2) 3. $C_6H_{10}S_3$ (Diallyl trisulfide, DAS3) 4. $C_6H_{10}S_4$ (Diallyl tetrasulfide, DAS4)
Molecular weight or molecular weight range	N/A – thermally treated garlic juice is a UVCB substance. The molar masses of the marker compounds are given below: 1. DAS1: 114.05 g/mol 2. DAS2: 146.27 g/mol 3. DAS3: 178.34 g/mol 4. DAS4: 210.40 g/mol The content of the marker/total polysulfides is [redacted]
Information on optical activity and typical ratio of (stereo) isomers (if	Thermally treated garlic juice is a UVCB substance. Thermally treated garlic juice is characterised by four main marker compounds (DAS1-4). None of the marker compounds are optically active.

applicable and appropriate)	
Description of the manufacturing process and identity of the source (for UVCB substances only)	Please see IUCLID SECTION 1.2
Degree of purity (%)*	Thermally treated garlic juice is a UVCB substance. The purity is 100%.

Table A.2 Structural formula

Structural formula

N/A – thermally treated garlic juice is a UVCB. The structures of the marker molecules are however given below.

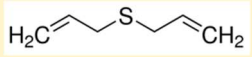
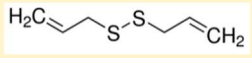
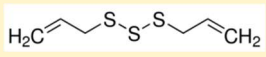
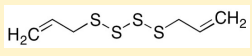
Marker molecule	Structural formula
Diallyl monosulfide (DAS1)	
Diallyl disulfide (DAS2)	
Diallyl trisulfide (DAS3)	
Diallyl tetrasulfide (DAS4)	

Table A.3 Origin of the natural active substance or precursor(s) of the active substance

Origin of the natural active substance or precursor(s) of the active substance
[redacted]

Table A.4 Method of manufacture

Method of manufacture
Details of the manufacturing process are reported in the confidential annex of the CAR

A.1.2. Composition of the substance (reference specifications)

Table A.5 Main constituents

Main constituent(s)					
Constituent (chemical name)	Typical concentration (%(w/w))	Concentration range (%(w/w))	Current CLH in Annex VI Table 3.1 (CLP)	Current self-classification and labelling (CLP)	**Remarks / Discussion**
Thermally treated garlic juice, UVCB*	**100**	**100**	**--**	**Skin Sens. 1B H 317**	
Total Polysulfides (DAS1-4) contained in the UVCB**		[redacted]		Please see table "Additional information on DAS 1-4" below.	

Diallyl trisulfide (DAS3) contained in the UVCB CAS-No.: 2050-87-5		[redacted]		Acute Tox. 4 H302	

*Please note that the active substance is a UVCB substance and therefore highly variable in composition. [redacted] The active substance is of food grade quality and complies with Commission Regulation (EC) No 1881/2006 of 19 December 2006 setting maximum levels for certain contaminants in foodstuffs and its amendments as well as with Regulation (EC) No 396/2005 of the European Parliament and of the Council of 23 February 2005 on maximum residue levels of pesticides in or on food and feed of plant and animal origin and its amendments.
In addition, the UVCB substance is defined by four marker compounds (DAS1, DAS2, DAS3, DAS4). Please note that in the original BPR submission, the substance name was "*garlic extract*". Furthermore, it is also an approved active substance under PPPR (COMMISSION IMPLEMENTING REGULATION (EU) 2021/129 of 3 February 2021 renewing the approval of the active substance "*garlic extract*" in accordance with Regulation (EC) No 1107/2009 of the European Parliament and of the Council concerning the placing of plant protection products on the market, and amending the Annex to Commission Implementing Regulation (EU) No 540/2011). To ensure both dossiers are aligned, the marker molecules in the present dossier are the same than in the approval under PPPR.
** Exact identity of DAS1-4: cf. to table below.

Additional information on DAS 1-4:					
Constituent (chemical name)	Typical concentration (%(w/w))	Concentration range (%(w/w))	Current CLH in Annex VI Table 3.1 (CLP)	Current self-classification and labelling (CLP)	**Remarks / Discussion**
Diallyl sulfide (DAS1)			--	Flam. liq 3 H226	Refer to the Appendix VI: Confidential Information for further details.

CAS-No.: 592-88-1					
Diallyl disulfide (DAS2) CAS-No.: 2179-57-9				Flam. Liq. 3 H226 Acute Tox. 3 H301 Skin Irrit. 2 H315 Skin Sens. 1 H317 Eye Irrit. 2 H319	Refer to the Appendix VI: Confidential Information for further details.
Diallyl trisulfide (DAS3) CAS-No.: 2050-87-5				Acute Tox. 4 H302	Refer to the Appendix VI: Confidential Information for further details.
Diallyl tetrasulfide (DAS4) CAS-No.: 2444-49-7				Acute Tox. 4 H302	Refer to the Appendix VI: Confidential Information for further details.

Table A.6 Impurities

Impurities					
Constituent	Typical	Concentration	Current	Current self-	**Remarks / Discussion**

(chemical name)	concentration (%(w/w))	range (%(w/w))	CLH in Annex VI Table 3.1 (CLP)	classification and labelling (CLP)	
N/A - thermally treated garlic juice is a UVCB substance. It is derived from garlic juice that is thermally treated and has food grade quality. The term 'impurity' is not relevant. The purity is 100%.Cf. to Appendix VI for detailed information.					

Table A.7 Additives

Additives						
Constituent (chemical name)	Function	Typical concentration (%(w/w))	Concentration range (%(w/w))	Current CLH in Annex VI Table 3.1 (CLP)	Current self-classification and labelling (CLP)	**Remarks / Discussion**
N/A – thermally treated garlic juice is a UVCB substance. It is derived from garlic juice that is thermally treated and has food grade quality. The purity is 100%. The active substance does not contain any additives.						

Table A.8 Concentration of constituents (main constituents, impurities, additives) in batches used for (eco)toxicity studies and proposed specification

Constit-uents	**Specifi-cation supported (yes/no)**	**Proposed Specification [% w/w]**	**Batches used for (eco) toxicity studies [% w/w]**			
			Batch No. Study type (Reference)	Batch No. Study type (Reference)	Batch No. Study type (Reference)	Batch No. Study type (Reference)
Active substance	Yes	Purity: 100% UVCB; [redacted]	[redacted] OECD 404: Acute dermal irritation study [redacted] in	[redacted] OECD 405 Acute Eye Irritation Study [redacted] in		

Constit-uents	Specifi-cation supported (yes/no)	Proposed Specification [% w/w]	Batches used for (eco) toxicity studies [% w/w]			
			Batch No. Study type (Reference)	Batch No. Study type (Reference)	Batch No. Study type (Reference)	Batch No. Study type (Reference)
			rabbits (Anonymous 2011a)**	Rabbits (Anonymous 2011b)**		
	Yes	Purity: 100% UVCB; [redacted]	[redacted] OECD 203: Fish, acute toxicity Test. Anonymous 2012a	[redacted] OECD 201: Alga, Growth Inhibition Test. Anonymous 2012b		
Active substance	No	Purity: 100% UVCB; [redacted]	[redacted] OECD 406: Skin Sensitisation - Buehler Test – [redacted] (Anonymous 2011c)			
Active substance	Yes	[redacted] Purity: 100% UVCB; [redacted]	[redacted] OECD 429: Skin sensitisation study [redacted] by local lymph			

Constit-uents	Specifi-cation supported (yes/no)	Proposed Specification [% w/w]	Batches used for (eco) toxicity studies [% w/w]			
			Batch No. Study type (Reference)	Batch No. Study type (Reference)	Batch No. Study type (Reference)	Batch No. Study type (Reference)
		[redacted]	node assay in mice (Anonymous 2016e)**			
	Yes	[redacted] Purity: 100% UVCB; [redacted]	[redacted] OECD 207 Earthworm, acute toxicity test. (Anonymous 2016b)	OECD 216 Soil microorganism: Nitrogen transformation test. (Anonymous 2016c)	[redacted] OECD 216 Soil microorganism: Carbon transformation test. (Anonymous 2016d)	
	Yes	[redacted] Purity: 100% UVCB; [redacted]	[redacted] OECD 222: Earthworm reproduction test (Anonymous 2021g) [redacted] OECD 111: Hydrolysis as a function of pH. (Anonymous 2021b)	[redacted] OECD 203: Fish, Acute toxicity test. (Anonymous 2021d)	[redacted] OECD 202: Daphnia sp. Acute immobilisation test. (Anonymous 2021e)	[redacted] OECD 201: Alga, Growth inhibition test. (Anonymous 2021f)
	Yes	[redacted] Purity: 100% UVCB; [redacted]	[redacted] OECD 301B: Ready biodegradability- CO_2 Evolution test. (Anonymous 2021c)			
	No	[redacted]	[redacted]			

Constit-uents	Specifi-cation supported (yes/no)	Proposed Specification [% w/w]	Batches used for (eco) toxicity studies [% w/w]			
			Batch No. Study type (Reference)	Batch No. Study type (Reference)	Batch No. Study type (Reference)	Batch No. Study type (Reference)
	No	[redacted] Purity: not determined	[redacted] Degradation of garlic extract, study similar to OECD 307 (Anonymous 2019b)	Degradation of Garlic Extract in "Local River water" (Anonymous 2019c)		
	No	[redacted] Purity: 100% UVCB [redacted]	[redacted] OECD 121: Estimation of Adsorption Coefficient (Anonymous 2022c)			

*If specification is not supported by a batch used in a study, constituent(s) which give concern are highlighted.

** Manufacturing process and source material have not changed compared to the proposed specification (cf. Appendix IV).

A.1.3. Physical and chemical properties of the active substance

Table A.9 Physical and chemical properties of the active substance

Property	Result	Test method applied or description in case of deviation	Remarks / Discussion / Justification for waiving	References
Aggregate state at 20°C and 101.3 kPA	Free-flowing homogeneous liquid	Visual assessment	GLP Test substance purity = 999 g/L garlic concentrate [redacted]	Anonymous 2014a
Physical state (appearance) at 20°C and 101.3 kPA	Free-flowing homogeneous liquid	Visual assessment	GLP Test substance purity = 999 g/L garlic concentrate [redacted]	Anonymous 2014a
Colour at 20°C and 101.3 kPA	Opaque brown Colour; Munsell code 5YR 4/6	Visual assessment	GLP Test substance purity = 999 g/L garlic concentrate [redacted]	Anonymous 2014a
Odour at 20°C and 101.3 kPA	Strong garlic	Olfactory assessment	GLP Test substance purity = 999 g/L garlic concentrate [redacted]	Anonymous 2014a
Melting / freezing point	115°C The liquid was dried to a solid in order to perform the test	EC A1 (capillary method). [redacted]	GLP Batch number 12909L	Anonymous 2002a
pH at 20°C	Neat = 5.50 1% dilution = 5.96	CIPAC MT 75	GLP Test substance purity = 999 g/L garlic concentrate [redacted]	Anonymous 2016a

Property	Result	Test method applied or description in case of deviation	Remarks / Discussion / Justification for waiving	References
Boiling point at	100.3°C	EU A2	GLP [redacted]	Anonymous 2002a
Relative density	1.2927 at 20°C	EU A3 (pycnometer)	GLP Test substance purity = 999 g/L garlic concentrate [redacted]	Anonymous 2014a
Granulometry	N/A		The study does not need to be conducted because the substance is not a solid	
Vapour pressure	2.18 kPa at 20°C 3.08 kPa at 25°C	EU A4 (static method)	GLP [redacted]	Anonymous 2002a
Henry's law constant	3.6E-6 atm.m^3.mol^{-1}.	Calculation	[redacted]	-
Surface tension	41.5 mN/m at 20°C (neat); the substance is considered surface active	EU A5 (plate method)	GLP Test substance purity = 999 g/L garlic concentrate [redacted]	Anonymous 2016a
Water solubility at 20°C	>1000g/L at 20°C	EU A6 (preliminary test only)	GLP [redacted]	Anonymous 2002a
Partition coefficient (n-octanol/water) and its pH dependency at 20°C	Log Pow = -1.49 (1:1 octanol:water), -2.13 (2:1 octanol:water), -1.69 (1:2 octanol:water) (measurements were performed with the UVCB active substance	EU A8 (shake flask)	GLP [redacted]	Anonymous 2002a

Property	Result	Test method applied or description in case of deviation	Remarks / Discussion / Justification for waiving	References
	as a whole)			
Thermal stability and identity of breakdown products	The results of 2-week 54°C and 2-year ambient storage stability studies show no significant changes between pre-storage and post storage samples. Given the boiling point of the active substance (100.3 C), no data up to 150 C has to be provided.	In-house method	GLP Test substance purity = 999 g/L garlic concentrate [redacted]	Anonymous 2014a Anonymous 2016a
Reactivity towards container material	The results of a 2-year ambient storage stability study show no significant changes between pre-storage and 24-month storage samples.	In-house method	GLP Test substance purity = 999 g/L garlic concentrate [redacted]	Anonymous 2016a
Dissociation constant	N/A		The study does not need to be conducted because the identified marker compounds do not have an ionic structure	
Viscosity	Results at variable shear rates: 637.1 – 778.1 mPa.s at 20°C, 220.1 - 354.1	OECD 114 GLP	GLP Test substance purity = 999 g/L garlic concentrate [redacted]	Anonymous 2016a

Property	Result	Test method applied or description in case of deviation	Remarks / Discussion / Justification for waiving	References
	mPa.s at 40°C Non-Newtonian liquid			
Solubility in organic solvents, including effect of temperature on solubility	Not determined		The active substance thermally treated garlic juice is a plant juice and soluble in water. The solubility in other solvents was not tested and is not required. As the active substance contain organo-sulfur polysulfides which are soluble in organic solvents e.g. ethanol, methanol, acetone, dichloromethane and acetonitrile. The analytical studies (see section 5) carried out, used methanol and acetonitrile to extract polysulfides from thermally treated garlic juice.	
Stability in organic solvents used in biocidal products and identity of relevant degradation products	N/A		The active substance as manufactured is not delivered in an organic solvent.	

A.1.4. Physical hazards and respective characteristics

The active substance is not classified for physical hazards.

Table A.10 Physical hazards and respective characteristics

Hazard class / characteristics	Guideline and Method	Parameter(s)	Results / Waiver	Reference
Explosives			Not explosive [redacted]	Anonymous 2016a Abe 2019

Hazard class / characteristics	Guideline and Method	Parameter(s)	Results / Waiver	Reference
			[redacted]	
Flammable gases			N/A – substance is not a gas	
Flammable aerosols			N/A – substance is not an aerosol	
Oxidising gases			N/A – substance is not a gas	
Gases under pressure			N/A – substance is not a gas under pressure	
Flammable liquids	EC A9; Pensky-Martens closed cup GLP Test substance purity = 999 g/L garlic concentrate (batch number 13105012C)		No flash point observed before boiling at ca. 100°C.	Anonymous 2016a
Flammable solids			N/A – substance is not a solid	
Self-reactive substances and mixtures			Not self-reactive [redacted]	Anonymous 2016a Abe 2019

Hazard class / characteristics	Guideline and Method	Parameter(s)	Results / Waiver	Reference
			[redacted]	

Hazard class / characteristics	Guideline and Method	Parameter(s)	Results / Waiver	Reference
			[redacted]	
Pyrophoric liquids			Not pyrophoric Based on experience in handling and use, the active substance is stable in air at room temperature for prolonged periods of time.	
Pyrophoric solids			N/A – substance is not a solid	
Self-heating substances and mixtures			N/A - the phenomenon of self-heating applies only to solids	
Substances and mixtures which in contact with water emit flammable gases			No flammable gases emitted when substance in contact with water Based on experience in handling and use and the fact that water is present in the composition of the technical active substance.	
Oxidising liquids			[redacted]	Anonymous 2016a

Hazard class / characteristics	Guideline and Method	Parameter(s)	Results / Waiver		Reference
			[redacted] This active substance contains no molecules/ groups listed as oxidants (Urben 2006).		
Oxidising solids			N/A – substance is not a solid		
Organic peroxides			N/A – the substance is not an organic peroxide		
Corrosive to metals	UN Test C.1. GLP [redacted]	[redacted]	Steel corrosion:	Aluminium corrosion:	Anonymous 2023
			No localised corrosion observed	No localised corrosion observed	
			Uniform corrosion mass loss: 2.80 % (w/w) (gas phase); 1.65 % (w/w) (plate half immersed); 0.27 % (w/w) (liquid phase) Results to not exceed threshold values for	Uniform corrosion mass loss: 0.01 % (w/w) (gas phase); 0.06 % (w/w) (plate half immersed); 0.10 % (w/w) (liquid phase) Results to not exceed threshold values for	

Hazard class / characteristics	Guideline and Method	Parameter(s)	Results / Waiver		Reference
			uniform corrosion.	uniform corrosion.	
			Conclusion: the a.s. is not corrosive to metals and does not fulfil classification criteria of corrosive to metals		
Auto-ignition temperature (liquids and gases)	EC A15 GLP Test substance purity = 999 g/L garlic concentrate [redacted]		No self-ignition up to 388°C		Anonymous 2016a
Relative self-ignition temperature for solids			N/A – substance is not a solid		
Dust explosion hazard			N/A – the substance is not a solid		

A.1.5. Assessment of physical hazards according to the CLP criteria

A.1.5.1. Assessment of physical hazards

[The summary of physical hazards and respective characteristics can be found in Part A, section 1.4.]

A.1.5.2. Explosives

Table A.11 Summary table of studies on explosives

Method	Results	Remarks	Reference
Literature reference. oxygen balance	[redacted]This active substance contains no molecules/ groups listed as oxidants (Urben 2006).	-	Anonymous 2016a

A1.5.2.1 Short summary and overall relevance of the provided information on explosives

Literature indicates no explosivity.

A1.5.2.2 Comparison with the CLP criteria

CLP criteria for explosives not met.

A1.5.2.3 Conclusion on classification and labelling for explosives

Not explosive

A.1.5.3. Flammable gases (including chemically unstable gases)

Not applicable for CLH report

A.1.5.4. Flammable aerosols and aerosols

Not applicable for CLH report

A.1.5.5. Oxidising gases

Not applicable for CLH report

A.1.5.6. Gases under pressure

Not applicable for CLH report

A.1.5.7. Flammable liquids

Table A.12 Summary table of studies on flammable liquids

Method	Results	Remarks	Reference
EC A9; Pensky-Martens closed cup	No flash point observed before boiling at ca. 100°C	Measurement carried out up to boiling temperature	Anonymous 2016a

A1.5.7.1 Short summary and overall relevance of the provided information on flammable liquids

Study indicates no flash point

A1.5.7.2 Comparison with the CLP criteria

CLP criteria for flammable liquids not met.

A1.5.7.3 Conclusion on classification and labelling for flammable liquids

Not flammable

A.1.5.8. Flammable solids

Not applicable for CLH report

A.1.5.9. Self-reactive substances

Not applicable for CLH report

A.1.5.10. Pyrophoric liquids

Not applicable for CLH report

A.1.5.11. Pyrophoric solids

Not applicable for CLH report

A.1.5.12. Self-heating substances

Not applicable for CLH report

A.1.5.13. Substances which in contact with water emit flammable gases

Not applicable for CLH report

A.1.5.14. Oxidising liquids

Table A.13 Summary table of studies on oxidising liquids

Method	Results	Remarks	Reference
Oxygen balance	[redacted] This active substance contains no molecules/ groups listed as oxidants (Urben 2006).	--	Anonymous 2016a

A1.5.14.1 Short summary and overall relevance of the provided information on oxidising liquids

Calculation of oxygen balance indicates no oxidising properties

A1.5.14.2 Comparison with the CLP criteria

CLP criteria for oxidising liquids not met.

A1.5.14.3 Conclusion on classification and labelling for oxidising liquids

Not oxidising

A.1.5.15. Oxidising solids

Not applicable for CLH report

A.1.5.16. Organic peroxides

Not applicable for CLH report

A.1.5.17. Corrosive to metals

Table A.11 Summary table of studies on corrosive to metals

Method	Results		Remarks	Reference
UN Test C.1.	Steel corrosion:	Aluminium corrosion:	--	Anonymous 2023
	No localised corrosion observed	No localised corrosion observed		
	Uniform corrosion mass loss: 2.80 % (w/w) (gas phase); 1.65 % (w/w) (plate half immersed); 0.27 % (w/w) (liquid phase) Results to not exceed threshold	Uniform corrosion mass loss: 0.01 % (w/w) (gas phase); 0.06 % (w/w) (plate half immersed); 0.10 % (w/w) (liquid phase) Results to not exceed threshold values		

Method	Results		Remarks	Reference
	values for uniform corrosion.	for uniform corrosion.		
	Conclusion: the a.s. is not corrosive to metals and does not fulfil classification criteria of corrosive to metals			

A1.5.17.1 Short summary and overall relevance of the provided information on corrosive to metals

UN Test C.1 indicates no corrosive properties.

A1.5.17.2 Comparison with the CLP criteria

CLP criteria for corrosive to metals not met.

A1.5.17.3 Conclusion on classification and labelling for corrosive to metals

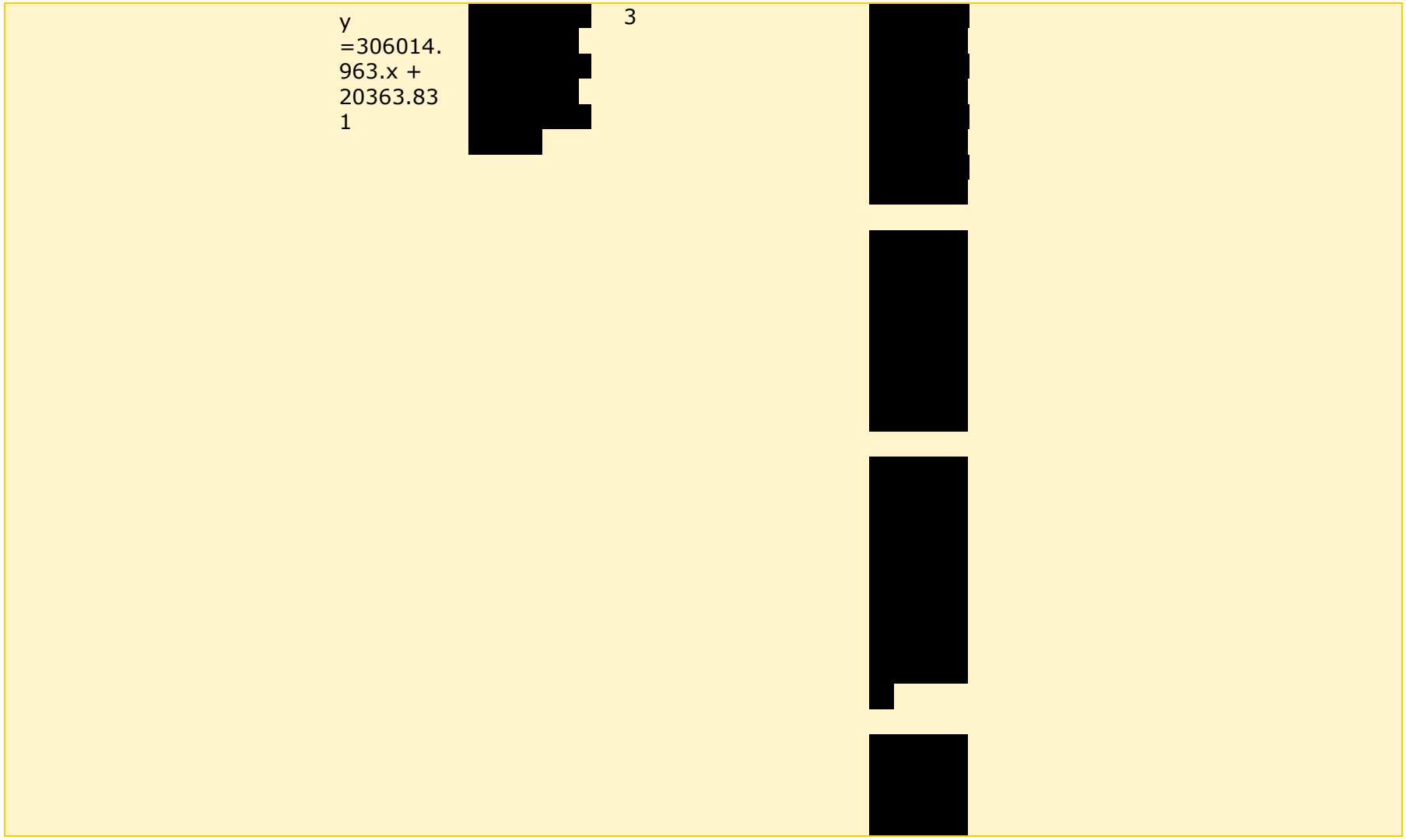
Not corrosive to metals

A.1.6. Analytical methods for detection and identification

Table A.14 Analytical methods

Analytical methods						
Analyte	Method	Linearity	Specificity	Recovery rate (%)	Limit of	Reference

Analytical methods								
(type of analyte e.g. active substance, metabolite/ degradant etc.)				Fortification range / Number of measurements	Mean	RSD	quantification (LOQ), Maximum Residue Limits or other limits	
Total polysulfide / Diallyl trisulfide (DAS3) [1]	[redacted] HPLC-UV [redacted]	n = 6 0.001-0.127 mg/mL (0.01-1.27% w/w) r^2 = 0.9997 y = 14738.77360x – 7.65572	[redacted] No interferences were noted.	0.425 g DAS3/kg[8] / n = 5 4.555 g DAS3/kg[8] / n = 5	106.6 99.5	1.36 0.62 [redacted]	0.43 g DAS3/kg	Anonymous 2014b
Total polysulfide / Diallyl trisulfide (DAS3) [1]	[redacted]: HPLC-DAD [redacted]	n = 5 40.155-704.480 µg DAS3/mL (0.40-7.04% w/w) r^2 = 0.99937	Absence of interference [redacted]	2.5% w/w[3] / n = 3 3.2% w/w[3]/ n = 3 4.0% w/w[3]/ n =	100.9 99.5 98.5	0.69 1.01 1.62	2.5% w/w[4]	**Anonymous 2021a**


y =306014.963.x + 20363.831
3

[redacted]

[1] To characterize the active substance, total polysulfide content (quantified against diallyl trisulfide – DAS3) was determined.

[2] [redacted]

*The test item used in the study is considered equivalent to the active substance (refer to Confidential Annex for specific details).

[3] Fortification of thermally treated garlic juice test item (i.e. standard addition method) with DAS3 standard solution.

[4] Equivalent to the lowest validated level.

[5] [redacted]

[6] Total polysulfide content based on the sum of individual DAS chromatographic peak areas.

[7] Calculated from values in the report for precision analysis

[8] %RSD>%RSDr. However, the result is still accepted given the Horrat value is marginally >1 (1.04).

Analytical methods for monitoring								
Analyte (type of analyte e.g. active substance)	Analytical method	Fortification range / Number of measurements	Linearity	Specificity	Recovery rate (%)			Limit of quantification (LOQ) or other limits	**Reference**
					Range	Mean	RSD		
Monitoring methods are not required – see individual sections below.									

Analytical methods for soil								
Analyte (type of analyte e.g. active substance)	Analytical method	Fortification range / Number of measurements	Linearity	Specificity	Recovery rate (%)			Limit of quantification (LOQ) or other limits	**Reference**
					Range	Mean	RSD		
The active ingredient is [redacted] garlic juice [redacted] The majority of components are unspecific plant material (e.g. carbohydrates, proteins, lipids, minerals etc.). The active substance does not contain chemical additives and is considered to rapidly degrade in the environment. As such, a monitoring method in soil is not necessary.									

Analytical methods for air								
Analyte (type of analyte e.g. active substance)	Analytical method	Fortification range / Number of measurements	Linearity	Specificity	Recovery rate (%)			Limit of quantification (LOQ) or other limits	**Reference**
					Range	Mean	RSD		
The active substance is [redacted] garlic juice [redacted]. The majority of components are unspecific plant material (e.g. carbohydrates, proteins, lipids, minerals etc.). The active substance does not contain chemical additives and is considered to rapidly degrade in the environment. Garlic is also an edible foodstuff and no MRLs in foodstuffs of plant and animal origin have been set. Thermally treated garlic juice has a vapour pressure of 2.18 kPa at 20°C. As such, a monitoring methods in air are not required.									

Analytical methods for water								
Analyte (type of analyte e.g. active substance)	Analytical method	Fortification range / Number of measurements	Linearity	Specificity	Recovery rate (%)			Limit of quantification (LOQ) or other limits	**Reference**
					Range	Mean	RSD		
The active substance is [redacted] garlic juice [redacted] The majority of components are unspecific plant material (e.g. carbohydrates, proteins, lipids, minerals etc.). The active substance does not contain chemical additives. Garlic is also an edible foodstuff and no MRLs in foodstuffs of plant and animal origin have been set. The quantity of garlic consumed as part of a normal diet would far outweigh the expected amount present in drinking water, with the potential to be consumed, as a result of biocidal product use. The active substance is expected to rapidly degrade in the environment – being removed from the water compartment before reaching the sediment phase. As such, a monitoring methods in surface and drinking water and sediment are not required.								

Analytical methods for animal and human body fluids and tissues								
Analyte (type of analyte e.g. active substance)	Analytical method	Fortification range / Number of measurements	Linearity	Specificity	Recovery rate (%)			Limit of quantification (LOQ) or other limits	**Reference**
					Range	Mean	RSD		
The active substance is not classified as toxic or very toxic and no MRLs have been set. Monitoring methods in body fluids and tissues are not required.								

Analytical methods for monitoring of active substances and residues in food and feeding stuff								
Analyte (type of analyte e.g. active substance)	Analytical method	Fortification range / Number of measurements	Linearity	Specificity	Recovery rate (%)			Limit of quantification (LOQ) or other limits	**Reference**
					Range	Mean	RSD		
Not required for PT19 and no MRLs have been set.								

Conclusion
HPLC-UV and HPLC-DAD methods for the determination of total polysulfides in thermally treated garlic juice (formerly named "*garlic extract*") are presented. The [redacted] method has been evaluated previously in the EU as part of the Annex I renewal of garlic extract (renamed under BPR to "*thermally treated garlic juice*") as an active substance under PPP Regulation (EC) No Reg. 1107/2009. The analytical procedure was considered successfully validated in terms of specificity, linearity, precision and accuracy in accordance with the requirements of SANCO/3030/99. Method [redacted] has not been previously evaluated at EU level, however is very similar in procedure to method [redacted]. The method has been successfully validated in accordance with SANCO/3030/99 rev.5. Monitoring methods are not required: The active substance is [redacted] garlic juice [redacted] The majority of components are unspecific plant material (e.g. carbohydrates, proteins, lipids, minerals etc.). The active substance does not contain chemical additives. The active substance is expected to rapidly degrade in the environment Garlic is not classified as toxic or very toxic and no MRLs have been set. Thermally treated garlic juice has a vapour pressure of 2.18 kPa at 20°C.

A.2. Effects against target organisms

Function and field of use envisaged

The intended field of use of active substance is avoiding the excretion of cats in lawns and flower beds (outdoors).

A.2.1. Intended uses

Table A.15 Summary table of intended uses

Summary table of intended use(s)	
Product Type	19
Product description	Katzenschreck
Target organisms (including development stage)	Cats, of all ages
Description of use(s)	Carrier based biocidal product for garden use (outdoor). Deters cats from defecating in treated areas.
Mode of action	Olfactory repellent. Organosulfur compounds produce a repellent effect to cats.
Objects to be protected	Lawns, flower beds
Concentration of product in the in-use formulation/product	Not applicable
Concentration of active substance in the in-use formulation/product	100% biocidal active substance (thermally treated garlic juice) [redacted] in the carrier material (granules) which is the carrier based biocidal product "Katzenschreck"
Application rate(s)	[redacted]
Frequency of application	Single, can be multiple if required. The product remains efficacious for at least 10 days after application.
Season/period for use (where relevant)	All seasons
Field of use (indoors/outdoors)	Outdoor
Category(ies) of user(s)	Non-professional
Instruction for use	Sprinkle the biocidal product one time near the area that need protecting. Pour directly from the container. Wash hands after use. Re-apply the product after rainfall to ensure the efficacy.

A.2.2. Summary on efficacy

A.2.2.1. Efficacy

The innate efficacy of the active substance is shown as repellent against cats.

Table A.16 Experimental data on the efficacy of the active substance against target organism(s)

Experimental data on the efficacy of the active substance against target organism(s)							
Function	Field of use envisaged	Test substance	Test organism(s)	Test method	Test system / concentrations applied / exposure time	Test results: effects	Reference
Repellent	Outdoors Non-professional use to deter defecation by cats in outdoor spaces	[redacted]	Cats (*Felis catus*)	Field test. [redacted]	[redacted]	[redacted] 94% compared to the pre- application observation [redacted]	Anonymous 2007

Experimental data on the efficacy of the active substance against target organism(s)							
					[redacted]	[redacted]	
Repellent	Outdoors	CLAIL0021 [redacted]	Cats (*Felis catus*)	Field study Indirect [redacted]	Indirect observation of defecation behaviour. [redacted]	**Supporting information:** [redacted] not reaching the requirement of ≥ 80 % efficacy). [redacted]	**Supporting study** Anonymous 1993

A.2.2.2. Mode of action

The principal biologically active compound produced by garlic is a group of organo-sulfur compounds (sulfanes) with antimicrobial and repellent properties. Various pests including mammals are sensitive to organo-sulfur compounds. In many cases the nasal sensitivity of pests is very high compared to humans. This produce a repellent effect.

Perception of chemical stimuli from the environment is essential to most animals; accordingly, they are equipped with a complex olfactory system capable of receiving a nearly unlimited number of odorous substances and pheromones. This enormous task is accomplished by olfactory sensory neurons (OSNs) arranged in several chemosensory compartments in the nose. The sensitive and selective responsiveness of OSNs to odorous molecules and pheromones is based on distinct receptors in their chemosensory membrane; consequently, olfactory receptors play a key role for a reliable recognition and an accurate processing of chemosensory information.

They are therefore considered as key elements for an understanding of the principles and mechanisms underlying the sense of smell. The repertoire of olfactory receptors in mammals encompasses hundreds of different receptor types which are highly diverse and expressed in distinct sub compartments of the nose. Accordingly, they are categorized into several receptor families, including odorant receptors (ORs), vomeronasal receptors (V1Rs and V2Rs), trace amine-associated receptors (TAARs), formyl peptide receptors (FPRs), and the membrane guanylyl cyclase GC-D. This large and complex receptor repertoire is the basis for the enormous chemosensory capacity of the olfactory system.

Mammalian survival depends on ultrasensitive olfactory detection of volatile sulfur compounds, since these compounds can signal the presence of rancid food, O_2 depleted atmospheres, and predators (through carnivore excretions). The 100-million-fold difference in olfactory perception between structurally similar thiols and ethanol has long puzzled that studying olfaction. Mammals detect thiols and other odorants using odorant receptors (ORs), members of the family of seven transmembrane G-protein-coupled receptors (GPCRs). Understanding the regulator cofactors and response of ORs is particularly challenging due to the lack of X-ray structural models. The repellence of garlic is caused by volatile organo-sulfur compounds (allyl- and methyl-sulfides) present in it. The chemoreceptors in the nostrils have the ability to detect these compounds quicker than other organic compounds because of its unique binding nature. Various studies conducted confirmed that human thiol receptor OR2T11 responds specifically to gas odorants of thiol nature requiring ionic copper for its robust activation and that this role of copper is mimicked by ionic and nanoparticulate silver. While copper is both an essential nutrient for life and, in excess, a hallmark of various pathologies and neurodegenerative diseases, its involvement in human olfaction has not been previously demonstrated. When screened against a series of alcohols, thiols, sulfides, and metal-coordinating ligands, OR2T11 responds with enhancement by copper to the mouse semiochemical CH3SCH2SH and derivatives, to four-membered cyclic sulfide thietane and to one- to four-carbon straight- and branched-chain and five-carbon branched-chain thiols but not to longer chain thiols, suggesting compact receptor dimensions. Over the past 40 years several researchers have proposed that transition metals such as Zn^{2+}, Ni^{2+}, Cu^{2+}, or Cu^{+} (generally in the form of metalloproteins)

may mediate taste or odour perception of thiols and amines (Fleischer et al. 2009; Block and Zhuang 2013; Li et al. 2016; Block et al. 2017).

A.2.2.3. Resistance

It is very less likely as thermally treated garlic juice is plant "juice" and consist of multi-components rather single molecule. This has been in use as plant protection product against many pests for many years and there has been no reports on resistance. As the active substance is a repellent (no killing action) and does not give rise to selection pressure, no resistance development is to be expected.

A.2.3. Conclusion on efficacy

Based on efficacy report it can be concluded that the representative product will deter cats (*Felis catus*) from defecation. The field trial was considered as robust [redacted] and the proven efficacy of >90%. Since there are no requirements for PT19 products against vertebrates in the BPR Efficacy Guidance in force at the time of dossier submission, the test setting [redacted] and the minimum necessary efficacy of ≥80% was harmonised in the course of an e-consultation among the BPC WG experts in 2019. [redacted]

A.3. Assessment of effects on Human Health

Thermally treated garlic juice is processed from food grade material [redacted]. [redacted]Garlic has been used in the diet for a very long time and garlic preparations are also marketed for health claims.

Non-clinical and clinical data of Garlic (*Allium sativum* L., bulbus) were assessed by the European Medicines Agency in 2017 (EMA, 2020) because of possible beneficial health effects. Clinical studies assessed were insufficient for a well-established indication. However, traditional use for dried powdered garlic, garlic oil, or dried aged garlic extract may support mild benefits in the prevention of atherosclerosis or relief of symptoms of common cold. Thermally treated garlic juice has been approved as "*garlic extract*" as active pesticidal substance under Regulation (EC) No 1107/2009 in 2021 (cf. Regulation (EU) 2021/129).

Based on arguments that the active substance is made of certified food grade material and exposure via food is considered to be much higher than via the use of thermally treated garlic juice as a biocidal product, most toxicological endpoints have not been addressed. [redacted]

The composition of garlic is complex and characterised by organosulfur compounds formed from aliin and allicin as well as flavonoids, flavonoid glycosides, coumarins, sapogenins and saponins, proteins and enzyme amongst others (EMA, 2020). Unstable allicin (diallyl thiosulfinate) and other thiosulfinates are formed from alliin and as well as other cysteine sulfoxides (S(+)-allyl-L-cysteine sulfoxide), by mechanical processing of fresh garlic, which are partly volatile. Allyl thiosulfinates convert to their spontaneous transformation compounds allyl polysulfides (Lawson and Hunsaker, 2018).

The thermally treated garlic juice supported under the BPR is [redacted] and a food grade garlic juice (100% purity). The active ingredients within are polysulfides, the major polysulfide fractions in thermally treated garlic juice are allyl polysulfides with for identity specification four marker polysulfides (concentration range of [redacted] w/w) are set.
Dietary uptake of garlic compounds via food depends also on the processing methods having a distinct impact on the formed compounds (EMA, 2020, Lawson and Hunsaker, 2018, cf. also chapter B.3).

A number of studies were submitted on skin and eye irritation and skin sensitisation. Thermally treated garlic juice is a skin sensitiser and is classified as skin sensitiser category 1B according to Regulation (EC) No. 1272/2008. Therefore, local risks were assessed for primary or secondary exposure situations.

A.3.1. Toxicokinetics

No toxicokinetic (TK) study according to an OECD TG and GLP was submitted.

A.3.1.1. Short summary and overall relevance of the provided toxicokinetic information

The applicant submitted two literature publications: Park et al. (2017) provided limited TK information that confirm (S)-allyl-l-cysteine (SAC), one major bioactive compound in garlic is metabolized to (S)-allyl-l-cysteine sulfoxide, N-acetyl-(S)-allyl-l-cysteine, and N-acetyl-(S)-allyl-l-cysteine sulfoxide after oral administration.

In the second study by Lawson and Hunsaker (2018), different garlic preparations were compared to fresh garlic (0.35, 0.70, 1.4 or 2.8 g corresponding to 0.87 g to 6.94 g allicin content) after oral uptake of a single dose in 13 healthy volunteers. The breath detectable metabolite allyl methyl sulfide (AMS) was measured over a period of maximum 32 hours. T_{max} was reached after 1.4 to 3.5 hours, depending on the administration (sandwich or capsule) of the meal. C_{max} were calculated to range between 47 to 69 ng/L, both parameter also correlate with the protein content of the meal. No differences between men and women were found, however the sample size was small.

Allicin (diallyl thiosulfinate) and other allyl thiosulfinates as well as allyl polysulfides (that can be transformed from allyl thiosulfinate at ambient temperature) are metabolised by glutathione (in case of an allyl functional group) to allyl mercaptan as an intermediate to AMS. For crushed garlic, AMS is formed by 90% of allyl thiosulfinates; allyl thiosulfinates and allyl polysfulfides produce equimolar amounts of breath AMS (Lawson and Wang, 2005 as cited in Lawson and Hunsaker, 2018). Allicin-derived diallyl disulfide and diallyl trisulfide are also metabolized mainly to AMS. For garlic processed food also y-glutamyl-S-allylcysteine and S-allylcysteine (SAC) played an important contribution to AMS formation (Lawson and Hunsaker, 2018).

Concerning bioequivalence AUC_{AMS} was compared for raw garlic, kitchen prepared garlic or garlic food (n=9) and garlic preparations or supplements (n=13) in 13 subjects. For the bioavailability and bioequivalence experiments 1.4 g homogenate from 0.88 g raw garlic in capsule served as a control. 23 types of "garlic" were tested in total in 43 assays with 7 to 13 subjects in this investigation (Lawson and Hunsaker, 2018).
Alliinase activity was only detected in raw diced garlic amongst the other kitchen-prepared garlic food (such as roasted 160°C or 215°C, boiled 4 min, boiled 45 min) but not in commercial garlic foods (pickled, acid-minced, oil-chopped or black garlic). In short the enzyme alliinase converts alliin into allicin. All of the alliinase-inhibited foods including boiled and roasted kitchen prepared garlic produced less AMS compared to raw garlic homogenate, however the amounts detected indicate that intrinsic AMS formation from S-allyl compounds still occurred. The intensity and duration of cooking made little difference in allicin bioequivalence (temperature, duration). Roasting yielded two times higher allicin bioequivalence as boiling. (For alliinase-inhibited garlic foods, 5.9 g of roasted garlic and 11 g boiled garlic must be consumed to obtain the same equivalence as 2 g raw garlic). C_{max} at 1 hour for garlic foods were 19 to 31% (% referred to the consumption of the control (raw garlic homogenate) at the standard dose). T_{max} for alliinase-inhibited garlic foods was comparable and significantly longer than the control of raw garlic.
In an additional analysis from the same authors it was reported, that the contents of garlic and garlic preparations such as enteric and normal tablet, special extracts or capsules vary both qualitatively and quantitatively (Lawson and Hunsaker, 2018).

A.3.1.2. Values and conclusions used for the risk assessment

Data waiving	
Information requirement	Absorption, Distribution, Metabolism, Excretion (ADME)
Justification	Based on the process how thermally treated garlic juice is manufactured it is reasonable to anticipate that dietary uptake in food or medicinal benefit cover the compounds of thermally treated garlic juice used in the biocidal product (qualitatively and quantitatively, cf. also chapter B.3). Therefore, waiving of the data requirement of Annex II 8.8 of Regulation (EU) No. 528/2012 is acceptable. Literature data indicate rapid uptake and metabolism of garlic compounds

	after oral uptake. Kitchen prepared (e.g. boiled) garlic including alliinase-inhibited foods produced less breath detectable metabolite allyl methyl sulfide compared to raw garlic homogenate, however the amounts detected indicate that intrinsic AMS formation from S-allyl compounds still occurred. Thus it can be concluded, that allyl polysulfides present in thermally treated garlic juice are metabolized similar than kitchen prepared garlic.

A.3.2. Acute toxicity / STOT SE

A.3.2.1. Acute oral toxicity

A3.2.1.1 Short summary and overall relevance of the provided information on acute oral toxicity

No acute oral toxicity (OECD and GLP compliant) study was submitted. Garlic (and oil of garlic) is considered as Generally Recognized As Safe (GRAS) food substance by the U.S. Food and Drug Administration[2]. Accordingly this implies that "there is no evidence in the available information on garlic that demonstrates, or suggests reasonable grounds to suspect, a hazard to the public when they are used at levels that are now current or might reasonably be expected in the future" according to the listing by U.S. FDA.
An overview of single dose toxicity studies of different garlic formulations can be found in EMA (2020).
The applicant provided literature publications for acute oral toxicity. Chutani and Bordia (1981) investigated the beneficial effects on fibrinolytic activity of both raw and fried garlic consumption via oral route at a dose of 0.5 g/kg bw in 20 volunteers with previous diagnosed heart diseases. The paper was not considered relevant and reliable for the endpoint acute toxicity based on poor conduct and reporting of the clinical trial, especially no other acute effects other than fibrinolytic activity were reported according to the risk assessment report for plant protection products (Ireland, 2019). eCA AT shares this conclusion concerning the publication.

A3.2.1.2 Comparison with the CLP criteria

Data lacking.

A3.2.1.3 Conclusion on classification and labelling for acute oral toxicity

No acute oral toxicity studies were submitted; thus, no classification is proposed due to lack of data.

A3.2.1.4 Conclusion on acute oral toxicity related to risk assessment

Data waiving	
Information requirement	Acute oral toxicity
Justification	Based on the process how thermally treated garlic juice is manufactured it is reasonable to anticipate, that dietary uptake as food or for medicinal benefits cover the compounds of thermally treated garlic juice used in the biocidal product (qualitatively and quantitatively, cf. also chapter B.3). Thus dietary exposure is expected to exceed the systemic exposure by dermal (or inhalation) route.

[2] https://www.cfsanappsexternal.fda.gov/scripts/fdcc/?set=SCOGS&sort=Sortsubstance&order=ASC&startrow=1&type=basic&search=garlic

	Garlic is listed as GRAS by U.S. FDA. Therefore, waiving of the data requirement of Annex II 8.7 of Regulation (EU) No. 528/2012 is acceptable.

A.3.2.2. Acute dermal toxicity

A3.2.2.1 Short summary and overall relevance of the provided information on acute dermal toxicity

No acute dermal toxicity (OECD and GLP compliant) study was submitted. The applicant provided a literature publication: Mikail (2010) investigated single doses of aqueous garlic extract at 300, 600, 1200, 2200, 3200 and 4200 mg/kg bw administered subcutaneously in rabbits. The extract was prepared from pulverized air-dried bulbs soaked in distilled water, filtrated and dried (concentrated). The LD50 value was 3034 mg/kg. Post-mortem macroscopic examination showed slight liver congestion in moribund animals (Mikail, 2010). The application route is not considered relevant for the evaluation of the biocidal uses of thermally treated garlic juice.

A3.2.2.2 Comparison with the CLP criteria

Data lacking.

A3.2.2.3 Conclusion on classification and labelling for acute dermal toxicity

No acute dermal toxicity data were submitted. In skin irritation or sensitisation studies no mortalities occurred at the tested concentrations (cf. see A.3.3, A.3.5). No classification is proposed due to the lack of data for this endpoint and no indications for acute dermal toxicity from other toxicity studies (skin irritation, skin sensitisation) are evident.

A3.2.2.4 Conclusion on acute dermal toxicity related to risk assessment

Data waiving	
Information requirement	Acute dermal toxicity
Justification	Please see justification under A.3.2.1.4. Local effects including skin irritation and sensitisation were investigated (cf. see A.3.3 and A3.5).

A.3.2.3. Acute inhalation toxicity

A3.2.3.1 Short summary and overall relevance of the provided information on acute inhalation toxicity

No acute inhalation toxicity study was submitted. Based on occupational data from manufacturing sites (liquid and granular formulations) no reports of adverse inhalation effects from their production team were made according to the applicant. However, this statement has not been underpinned with medical report data from workers in manufacturing plants, therefore this information could not be verified by eCA AT.

According to WHO (1999) and EMA (2020) allergic reactions e.g. contact dermatitis and asthmatic attacks have been reported after inhalative exposure of powdered garlic preparations. One case report of repeated exposure to garlic dust induced asthma in a 30 year old worker in a garlic processing facility (Lybarger et al., 1982).

A3.2.3.2 Comparison with the CLP criteria

Data lacking.

A3.2.3.3 Conclusion on classification and labelling for acute inhalation toxicity

No acute inhalation toxicity data were submitted; thus, no classification is proposed due to lack of data.

A3.2.3.4 Conclusion on acute inhalation toxicity related to risk assessment**Data waiving**	
Information requirement	Acute Inhalation Toxicity
Justification	Based on the process how thermally treated garlic juice is manufactured it is reasonable to anticipate that dietary uptake as a spice in food or traditional medicinal use cover the compounds of thermally treated garlic juice used in the biocidal product (qualitatively and quantitatively, cf. also chapter A.3.1 and B.3). Thus dietary exposure is expected to exceed the systemic exposure by the dermal (or negligible inhalation) route. Thermally treated garlic juice is processed from food grade material. Therefore, waiving of the data requirement of Annex II 8.7 of Regulation (EU) No. 528/2012 is acceptable. Local effects were reported in literature after inhalation of garlic dust/powder, but not with thermally treated garlic juice.

A.3.2.4. Specific target organ toxicity – single exposure Category 1 and 2 (STOT SE 1 and 2)

No data were submitted.

A3.2.4.1 Short summary and overall relevance of the provided information on STOT SE 1 and 2

No data were submitted. Thermally treated garlic juice is processed from food grade material, therefore this endpoint has not been investigated.

A3.2.4.2 Comparison with the CLP criteria

Data lacking.

A3.2.4.3 Conclusion on classification and labelling for STOT SE 1 and 2

No classification is proposed due to a lack of data.

A.3.2.5. Specific target organ toxicity – single exposure Category 3 (STOT SE 3)

No data were submitted.

A3.2.1 Short summary and overall relevance of the provided information on STOT SE 3

No data were submitted. Thermally treated garlic juice is processed from food grade

material, therefore this endpoint has not been investigated.

A3.2.2 Comparison with the CLP criteria

Data lacking.

A3.2.3 Conclusion on classification and labelling for STOT SE 3

No classification is proposed due to a lack of data.

A3.2.4 Overall conclusion on acute toxicity related to risk assessment

Based on the process how thermally treated garlic juice is manufactured it is reasonable to anticipate that dietary uptake as a spice in food or traditional medicinal use cover the compounds of thermally treated garlic juice used in the biocidal product (qualitatively and quantitatively, cf. also chapter A.3.1 and B.3). Thus dietary exposure is expected to exceed the systemic exposure by the dermal (or inhalation) route. Garlic is listed as GRAS by U.S. FDA. Thermally treated garlic juice is processed from food grade material. Therefore, waiving of the data requirement of Annex II 8.7 of Regulation (EU) No. 528/2012 is acceptable.

A.3.3. Skin corrosion and irritation

Table A.17 Summary table of in vitro studies on skin corrosion/irritation

Summary table of in vitro studies on skin corrosion/irritation

Method, Guideline, GLP status, Reliability, Key/supportive study	Test substance (including purity), Vehicle, Doses	Relevant information about the study	Results and remarks	Reference
Acute dermal irritation study OECD 404 (version 2002) GLP Klimisch 1 Key study	[redacted] 4 h (semi-occlusive) Rabbit (New Zealand White), 3 male	Skin reactions recorded at 1, 24, 48 and 72 h and on day 7 post patch removal.	*Animal 1:* Erythema = 1.67 (mean, 24 h-72h), 2.00 (max.) Oedema = 0.67 (mean, 24 h-72h), 1.00 (max.) *Animal 2:* Erythema = 2.00 (mean, 24 h-72h), 2.00 (max.) Oedema = 0.33 (mean, 24 h-72h), 1.00 (max.) *Animal 3:* Erythema = 2.00 (mean, 24 h-72h), 2.00 (max.) Oedema = 0.00 (mean, 24 h-72h), 0.00 (max.) Summary: scores represent values averaged over days 1, 2, and 3: **Animal No.** / **Erythema score** / **Oedema score** **1** / 1.67 / 0.67 **2** / 2 / 0.33 **3** / 2 / 0	Anonymous 2011a

			At day 7 all scores were 0. All observed effects were reversible.	

A3.3.1 Short summary and overall relevance of the provided information on skin corrosion/irritation

One GLP compliant study, conducted to acceptable regulatory guidelines, provide data regarding the potential for skin irritation for the active substance.

In the skin irritation study (OECD 404) [redacted] was applied evenly to one clipped sites (6 cm^2) of each rabbit and 0.5 mL distilled water was applied to another clipped site of three male, young adult New Zealand White rabbits. The treated and the control sites were covered with gauze patches (semi-occlusive). At the end of the 4 hour exposure period, the residual test item was removed.
Skin reactions were observed at 1, 24, 48 and 72 hours and on day 7 post patch removal. The site of application was visually assessed and scored for erythema and oedema. The mean erythema and oedema scores (average 24/48/72 hours) were 1.67 to 2.00 and 0 to 0.67 for the three animals. The observed skin lesions recovered completely within 7 days (Anonymous, 2011a).

A3.3.2 Comparison with CLP criteria

According to Table 3.2.2 of Regulation (EC) No. 1272/2008 a classification for skin irritation category 2 applies if:

(1) Mean score of ≥ 2.3 - ≤ 4.0 for erythema/eschar or for oedema in at least 2 of 3 tested animals from gradings at 24, 48 and 72 hours after patch removal or, if reactions are delayed, from grades on 3 consecutive days after the onset of skin reactions; or
(2) Inflammation that persists to the end of the observation period normally 14 days in at least 2 animals, particularly taking into account alopecia (limited area), hyperkeratosis, hyperplasia, and scaling;
or
(3) In some cases where there is pronounced variability of response among animals, with very definite positive effects related to chemical exposure in a single animal but less than the criteria above.

In a reliable GLP study according to OECD 404 the mean erythema and oedema scores in three New Zealand rabbits were 1.67 to 2.00 and 0 to 0.67, respectively after 24 to 72 hours post exposure. The observed skin lesions recovered completely within 7 days (Anonymous, 2011a).

A3.3.3 Conclusion on classification and labelling for skin corrosion/irritation

Thermally treated garlic juice is not classifiable as irritant to skin according to Regulation (EC) No. 1272/2008.

A3.3.4 Overall conclusion on skin irritation and corrosivity related to risk assessment

Conclusion used in the Risk Assessment – Skin irritation and corrosivity	
Value/conclusion	Neither corrosive nor irritating to the skin.
Justification for the	The conclusion is based on the result of a regulatory accepted GLP study for skin irritation and corrosion.

value/conclusion	
Proposed classification	None

A.3.4. Serious eye damage and Eye irritation

Table A.18 Summary table of in vitro studies on serious eye damage and eye irritation

Summary table of in vitro studies on serious eye damage and eye irritation				
Method, Guideline, GLP status, Reliability, Key/supportive study	**Species, Strain, Sex, No/group Test substance**	**Dose Duration of exposure**	**Results Average score for corneal opacity, iritis, conjunctiva (24, 48, 72 h) per animal, observations and time reversibility**	**Reference**
Primary eye irritation OECD 405 (version 2002) GLP Klimisch 1 Key study	Rabbit (New Zealand White), 3 [redacted]	[redacted] test item and control saline applied in the conjunctival sac Ocular reaction after 1, 24, 48 and 72 h recorded	*Animal 1:* Opacity = 0.00 (mean and max.) Iritis = 0.00 (mean and max.) Conjunctiva redness = 0.67 (mean 24-72 h) 1 (max.) Chemosis = 0.00 (mean and max.) *Animal 2:* Opacity = 0.00 (mean and max.) Iritis = 0.00 (mean and max.) Conjunctiva redness = 0.33 (mean 24-72 h), 1.00 (max.) Chemosis = 0.00 *Animal 3:* Opacity = 0.00 (mean and max.) Iritis = 0.00 (mean and max.) Conjunctiva redness = 0.33 (mean 24-72 h), 1.00 (max.) Chemosis = 0.00 (mean and max.) All effects were fully reversible within 72 hours	Anonymous 2011b

A3.4.1 Short summary and overall relevance of the provided information on serious eye damage/eye irritation

One GLP compliant study, conducted according to an acceptable regulatory guideline provide experimental evidence regarding the potential for eye irritation for the active substance.
In a primary eye irritation study according to OECD TG 405 [redacted] was instilled into the conjunctival sac of one eye of three New Zealand White female rabbits. The contralateral eye served as the control and was treated with [redacted] 0.9% saline. At 24 hour post instillation, the eyes of all the rabbits were gently washed. Animals were observed for 3 days. Irritation was scored according to OECD TG 405.
Mean eye irritation scores (following assessment at 24, 48 and 72 h post instillation) of corneal opacity (0.00), iritis (0.00), conjunctival redness (0.33 to 0.67) and chemosis (0.00) were determined (Anonymous, 2011b).

A3.4.2 Comparison with the CLP criteria

According to Table 3.3.2 of Regulation (EC) No. 1272/2008 a classification for eye irritation category 2 applies if:

Substances that produce in at least 2 of 3 tested animals a positive response of:
(a) corneal opacity ≥1; and/or
(b) iritis ≥1; and/or
(c) conjunctival redness ≥2; and/or
(d) conjunctival oedema (chemosis) ≥2
calculated as the mean scores following grading at 24, 48 and 72 hours after instillation of the test material, and which fully reverses within an observation period of normally 21 days.

In a reliable GLP study according to OECD 405 the mean eye irritation scores (following assessment at 24, 48 and 72 h post instillation) of corneal opacity (0.00), iritis (0.00), conjunctival redness (0.33 to 0.67, fully reversible after 72 hours) and chemosis (0.00) were determined (Anonymous, 2011b).

A3.4.3 Conclusion on classification and labelling for serious eye damage/eye irritation

Thermally treated garlic juice is not classifiable as eye irritant according to Regulation (EC) No. 1272/2008.

A3.4.4 Overall conclusion on eye irritation and corrosivity related to risk assessment

Conclusion used in Risk Assessment – Eye irritation and corrosivity	
Value/conclusion	Neither seriously damaging or irritating to the eye.
Justification for the value/conclusion	The conclusion is based on the result of a regulatory accepted GLP study for acute eye irritation/corrosion.
Proposed classification	None

A.3.5. Skin sensitisation

Table A.19 Summary table of animal studies on skin sensitisation

Summary table of animal studies on skin sensitisation				
Method, Route of exposure, Guideline, GLP status, Reliability, Key/supportive study	**Species, Strain, Sex, No/group**	**Test substance, Vehicle, Dose levels**	**Results (e.g. EC3-value or amount of sensitised animals at induction dose)**	**Reference**
LLNA Topical application OECD 429 GLP, Klimisch 1 Key study	Mouse CBA/J 5 female/dose	[redacted]	Positive at 25% test item solution: EC3 value 11.18% (2795 µg/cm^2) SI for the 1%, 10% and 25% (v/v) treated groups were 2.16, 2.21 and 12.23, respectively.	Anonymous 2016e

			Positive control: SI of 25% HCA was 9.72	

A3.5.1 Short summary and overall relevance of the provided information on skin sensitisation

A LLNA study according to OECD TG 429 and GLP with the active substance thermally treated garlic juice in mouse was submitted.
In a preliminary assay, ear thickness was measured and was >25% at concentrations of 50%, 75% and 100% [redacted] while a solution of 25% provided <25% ear thickness. Skin erythema were observed at 75% and 100% as well as localized alopecia. The preliminary study served for setting the test concentrations in the main study.

Three groups of 5 female mice were treated with [redacted] at concentrations of 1%, 10% and 25% (v/v) in 1% L92 for three consecutive days (days 0, 1 and 2) on the dorsum of both ears (25 mL per ear). In addition, one group served as vehicle control and was treated with 1% L92, the other group served as a positive control treated with HCA (alpha-hexylcinnamaldehyde) at a concentration of 25% (v/v) in 1% L92.
There were no indications of skin irritation at the treatment site or systemic toxicity in [redacted] treated animals.
On day 5, the uptake of intravenously injected 3H-methyl thymidine into the auricular lymph nodes draining at the site of chemical application was measured (5 hours post-administration) to assess the lymph node proliferative response. Stimulation indices (SI) for the 1%, 10% and 25% (v/v) in 1% L92 treated groups were 2.16, 2.21 and 12.23, respectively. A positive response for HCA (SI = 9.72) confirmed the reliability of the test procedure. The SI obtained for [redacted] at 25% showed a greater than threefold increase over the control value with an EC3 value of 11.18% (Anonymous, 2016e).

A3.5.2 Comparison with the CLP criteria

Hazard categories and sub-categories for skin sensitisers according to Table 3.4.2 and 3.4.4 of Regulation (EC) No. 1272/2008 are as followed:

Subcategory 1A:
- Substances showing a high frequency of occurrence in humans and/or a high potency in animals can be presumed to have the potential to produce significant sensitisation in humans. Severity of reaction may also be considered.
- For LLNA: EC3 value ≤2%

Subcategory 1B:
- Substances showing a low to moderate frequency of occurrence in humans and/or a low to moderate potency in animals can be presumed to have the potential to produce sensitisation in humans. Severity of reaction may also be considered.
- For LLNA: EC3 value >2%

With the EC3 of 11.18% (at 25% v/v), classification for skin sensitisation with Skin Sens. 1B, H317 is appropriate.

A3.5.3 Conclusion on classification and labelling for skin sensitisation

The active substance thermally treated garlic juice meets classification criteria for Skin Sens. 1B.

A3.5.4 Overall conclusion on skin sensitisation related to risk assessment

Conclusion used in Risk Assessment – Skin sensitisation	
Value/conclusion	Skin sensitiser.
Justification for the value/conclusion	The conclusion is based on the result of a regulatory accepted GLP study for skin sensitisation.
Proposed classification	Skin Sens. 1B, H317

A.3.6. Respiratory sensitisation

A3.6.1. Short summary and overall relevance of the provided information on respiratory sensitisation

Literature data were submitted on respiratory sensitisation.
While EMA (2020) reported garlic to be traditional used against asthma in several regions of the world, literature and case reports indicate occupational asthma from garlic powder (WHO, 1999, Lybarger et al., 1982, Falleroni et al., 1981). In a review paper by Borelli and co-workers respiratory adverse effects like asthma, dyspnoea, cough, rhinitis or rhinoconjunctivitis from occupational exposure to garlic and garlic dust/powder are described (Borelli et al., 2007).
The literature reported cases of occupational asthma from inhalation of garlic powder (which is chemically different to active substance thermally treated garlic juice), but also dermal contact of different forms of garlic cannot be ruled out as a cause.
Chemical characterisation of plant extracts is a critical factor when relating the published studies to adverse effects. Dried and fresh extract formulations of garlic contain different chemistry (cf. section A.3.1 and B.3) compared to thermally treated garlic juice supported under the BPR. However, thermally treated garlic juice also contains dially disulfides (cf. Appendix VI), the compounds tested positive in eliciting allergic reactions in humans (Borelli et al., 2007, Papageorgiou et al., 1983).
Occupational data from manufacturing sites (liquid and granular formulations) did not report adverse inhalation effects from their production team on this issue according to the applicant. However, no medical reports were submitted to verify this statement.
The evaluation of thermally treated garlic juice under the plant protection legislation (under the name "garlic extract") noted the case reports on allergic reactions in humans to garlic or garlic preparations but concluded that that sensitisation can be addressed at product level with exposure mitigation measures (Ireland, 2019). EFSA (2020) stated that garlic has the potential to cause asthma under occupational exposure by inhalation.

A3.6.2. Comparison with the CLP criteria

Substances shall be classified as respiratory sensitisers in accordance with the criteria in Table 3.4.1 of Regulation (EC) No. 1272/2008:

Category 1: where data are not sufficient for sub-categorisation in accordance with the following criteria:
a) if there is evidence in humans that the substance can lead to specific respiratory hypersensitivity; and/or.
b) if there are positive results from an appropriate animal test.

Sub- category 1A: Substances showing a high frequency of occurrence in humans; or a probability of occurrence of a high sensitisation rate in humans based on animal or other tests (1). Severity of reaction may also be considered.

Sub- category 1B: Substances showing a low to moderate frequency of occurrence in humans; or a probability of occurrence of a low to moderate sensitisation rate in humans

based on animal or other tests (1). Severity of Severity of reaction may also be considered

For human evidence Regulation (EC) No. 1272/2008 also notes that it is necessary for a decision on classification to take into account, in addition to the evidence from the cases the size of the population exposed and the extent of exposure.

Occupational exposure to garlic or garlic dust/powder may induce respiratory sensitisation in susceptible persons. Case reports in literature on the active substance thermally treated garlic juice supported under the BPR were not reported in the submitted data package (inlcuding literature). Dietary exposure in many regions of the world for a long time indicate that the respiratory sensitisation potenital to the general public is low compared to the widespread exposure.

A3.6.3 Conclusion on classification and labelling for respiratory sensitisation

The data were not sufficient to propose classification for respiratory sensitisation to thermally treated garlic juice.

A3.6.4 Overall conclusion on respiratory sensitisation related to risk assessment

Conclusion used in Risk Assessment – Skin sensitisation	
Value/conclusion	Occupational exposure to garlic or garlic dust/powder may induce respiratory sensitisation in susceptible persons (please see section B.3.6 for exposure related considerations).
Justification for the value/conclusion	While literature reports and reviews indicate that garlic and garlic preparations may induce adverse respiratory sensitising effects, no studies or case reports for thermally treated garlic juice supported under the BPR is available.
Proposed classification	No classification proposed.

A.3.7. Repeated dose toxicity/STOT RE

A.3.7.1. Short term repeated dose toxicity

A3.7.1.1 Short-term oral toxicity

No short-term oral toxicity data were submitted.

Data waiving	
Information requirement	Short-term oral toxicity
Justification	Ireland (2019) concluded that the nature of the substance as food grade material and a human food source with a global consumption volume of approximately 26 million tons annually (2016 data) makes systemic toxicity testing scientifically unnecessary. Garlic is listed as GRAS by U.S. FDA. Dietary exposure is expected to exceed the systemic exposure by dermal (or inhalation) route. Please see chapter A.3.1 and B.3 for further toxicokinetic and exposure related justifications. Therefore, waiving of the data requirement of Annex II 8.9 of Regulation (EU) No. 528/2012 is acceptable.

A3.7.1.2 Short-term dermal toxicity

No short-term dermal toxicity data were submitted.

Data waiving	
Information requirement	Short-term oral toxicity
Justification	Waiving of the data requirement of Annex II 8.9 of Regulation (EU) No. 528/2012 is acceptable. The proposed conditions for testing by the dermal route are not met. Dermal exposure is very limited/negligible based on the formulation of the carrier-based biocidal product and instructions for use.

A3.7.1.3 Short-term inhalation toxicity

No short-term inhalation toxicity data were submitted.

Data waiving	
Information requirement	Short-term inhalation toxicity
Justification	Waiving of the data requirement of Annex II 8.9 of Regulation (EU) No. 528/2012 is acceptable. The proposed conditions for testing by the inhalation route are not met. Inhalation exposure is negligible based on the formulation of the carrier-based biocidal product and outdoor use.

A3.7.1.4 Overall conclusion on short-term repeated dose toxicity related risk assessment

Based on the process how thermally treated garlic juice is manufactured it is reasonable to anticipate that dietary uptake in food or for medicinal benefits cover the compounds of thermally treated garlic juice used in the biocidal product (qualitatively and quantitatively, cf. also chapter A.3.1 and B.3). Garlic is listed as GRAS by U.S. FDA. Systemic exposure by the dermal (or negligible inhalation) route from the use of the biocidal product are expected to be very limited. Thermally treated garlic juice is processed from food grade material. Therefore, waiving of the data requirement of Annex II 8.9 of Regulation (EU) No. 528/2012 is acceptable.

A.3.7.2. Sub-chronic repeated dose toxicity

A3.7.2.1 Sub-chronic oral toxicity

No sub-chronic oral toxicity study according to GLP and a regulatory accepted guideline was submitted. The applicant provided a literature paper that investigated garlic enriched diet (dried garlic falkes) administered to horses at a dose of 32 mg/kg bw/d over a course of 83 days. The sample size was limited to 6 horses (6 horses served as a control). While the study results were hampered by the small sample size and horses do not normally represent an accepted animal model for human health, all treated horses showed reduction in haemoglobin and red blood cell counts after the treatment period. No conclusion concerning the benefical effect of improvement of respiratory health could be drawn based on minimal effects and small sample size (Saastamoinen, 2019).

Data waiving	
Information requirement	Sub-chronic oral toxicity

Justification	Please see justification A3.7.1.1.

A3.7.2.2 Sub-chronic dermal toxicity

No sub-chronic dermal toxicity data were submitted.

Data waiving	
Information requirement	Sub-chronic dermal toxicity
Justification	Waiving of the data requirement of Annex II 8.9 of Regulation (EU) No. 528/2012 is acceptable. The proposed conditions for testing by the dermal route are not met. Dermal exposure is very limited based on the formulation of the carrier-based biocidal product and instructions for use.

A3.7.2.3 Sub-chronic inhalation toxicity

No sub-chronic inhalation toxicity data were submitted.

Data waiving	
Information requirement	Sub-chronic inhalation toxicity
Justification	Waiving of the data requirement of Annex II 8.9 of Regulation (EU) No. 528/2012 is acceptable. The proposed conditions for testing by the inhalation route are not met. Inhalation exposure is negligible based on the formulation of the carrier-based biocidal product and outdoor use.

A3.7.2.4 Overall conclusion on sub-chronic repeated dose toxicity related risk assessment

Literature studies as well as EMA (2020) reported effects of garlic and garlic preparations on the blood system. Based on the process how thermally treated garlic juice is manufactured it is reasonable to anticipate that dietary uptake in food or for medicinal benefits cover the compounds of thermally treated garlic juice used in the biocidal product (qualitatively and quantitatively, cf. also chapter A.3.1 and B.3). Thus dietary exposure is expected to exceed the systemic exposure by dermal (or negligible inhalation) routes. Garlic is listed as GRAS by U.S. FDA. Thermally treated garlic juice is processed from food grade material. Therefore, waiving of the data requirement of Annex II 8.9 of Regulation (EU) No. 528/2012 is acceptable.

A.3.7.3. Long-term repeated dose toxicity

A3.7.3.1 Long-term oral toxicity

No long-term oral toxicity data were submitted.

Data waiving	
Information requirement	Long-term oral toxicity
Justification	Please see justification under A3.7.1.1

A3.7.3.2 Long-term dermal toxicity

No long-term dermal toxicity data are submitted.

Data waiving	
Information requirement	Long-term dermal toxicity
Justification	Please see justification under A3.7.2.2

A3.7.3.3 Long-term inhalation toxicity

No long-term inhalation toxicity data were submitted.

Data waiving	
Information requirement	Long-term inhalation toxicity
Justification	Please see justification under A3.7.2.3

A3.7.3.4 Overall conclusion on long-term repeated dose toxicity related risk assessment

Please see conclusion under A3.7.2.4

A.3.7.4. Specific target organ toxicity – repeated exposure (STOT RE)

A3.7.4.1 Short summary and overall relevance of the provided information on STOT RE

No data were submitted. Thermally treated garlic juice is processed from food grade material, therefore this endpoint has not been investigated.

A3.7.4.2 Comparison with the CLP criteria

Data lacking.

A3.7.4.3 Conclusion on classification and labelling for STOT RE

No repeated dose toxicity studies were submitted; thus, no classification for STOT RE is proposed due to lack of data.

A.3.8. Genotoxicity / Germ cell mutagenicity

A.3.8.1. In vitro

No *in vitro* genotoxicity data were submitted.

Data waiving	
Information requirement	Genotoxicity *in vitro*
Justification	Ireland (2019) concluded that the nature of the substance as food grade material and a human food source with a global consumption volume of approximately 26 million tons annually (2016 data) makes systemic toxicity testing scientifically unnecessary. Please see chapter A.3.1 and B.3 for further toxicokinetic and exposure related justifications. Garlic is listed as GRAS by U.S. FDA.

	Thermally treated garlic juice is processed from food grade material. Dietary exposure is expected to exceed the systemic exposure by the dermal (or inhalation) route. Therefore, waiving of the data requirement of Annex II 8.5 of Regulation (EU) No. 528/2012 is acceptable. Nevertheless, EMA (2020) compiled literature studies which indicate that garlic powder and garlic extracts (fresh garlic, alcoholic extracts or the components diallyl sulfide and diallyl disulfide) can induce chromosome aberrations *in vitro* and *in vivo* in various models. However, no regulatory accepted test guideline was used and characterisation on the test item and extracts have not been revealed. The active substance under approval is an UVCB and contains polysulfides which are chemically different from fresh garlic which contain allicin amongst others (cf. section A.3.1 and B.3). Also in the peer review of the active substance under the plant protection regime (under the name "garlic extract"), EFSA (2020) identified no critical areas of toxicological concern.

A.3.8.2. In vivo

No *in vivo* genotoxicity data are submitted.

Data waiving	
Information requirement	Genotoxicity *in vivo*
Justification	Based on accepted waiving of information requirement for *in vitro* genotoxicity, no *in vivo* follow-up studies are necessary. Please see also justification und A.3.8.1.

A3.8.2.1 Short summary and overall relevance of the provided information on germ cell mutagenicity

No data were submitted.

A3.8.2.2 Comparison with the CLP criteria

Data lacking.

A3.8.2.3 Conclusion on classification and labelling for germ cell mutagenicity

No mutagenicity or genotoxicity studies were submitted; thus, no classification is proposed due to lack of data.

A3.8.2.4 Overall conclusion on genotoxicity related to risk assessment

Garlic components and some garlic preparations and extracts have been shown in a few non-guideline literature investigations to exhibit genotoxicity. Thermally treated garlic juice supported under the BPR is a UVCB substance. The identity and characterisation of the tested items in literature studies do not allow a conclusion, if those results would also be relevant for the supported substance. Based on the process how thermally treated garlic juice is manufactured it is reasonable to anticipate that dietary uptake as a spice in food or for medical benefits use cover the compounds of thermally treated garlic juice used in the biocidal product (qualitatively and quantitatively, cf. also chapter A.3.1 and B.3). Garlic is

listed as GRAS by U.S. FDA. Dietary exposure is expected to exceed the systemic exposure by the dermal (or inhalation) route. Thermally treated garlic juice is processed from food grade material. Therefore, waiving of the data requirement of Annex II 8.5 of Regulation (EU) No. 528/2012 is acceptable.

A.3.9. Carcinogenicity

A3.9.1 Short summary and overall relevance of the provided information on germ cell mutagenicity

No carcinogenicity data were submitted.

A.3.9.2 Comparison with the CLP criteria

Data lacking.

A.3.9.3 Conclusion on classification and labelling for carcinogenicity

No carcinogenicity studies were submitted; thus, no classification is proposed due to lack of data.

A.3.9.4 Overall conclusion on carcinogenicity related to risk assessment

No carcinogenicity data were submitted.

Data waiving	
Information requirement	Carcinogenicity
Justification	Based on the process how thermally treated garlic juice is manufactured it is reasonable to anticipate that dietary uptake in food or for medical benefits cover the compounds of thermally treated garlic juice supported under the BPR (qualitatively and quantitatively, cf. also chapter A.3.1 and B.3). Thus dietary exposure is expected to exceed the systemic exposure by the dermal (or inhalation) route. Garlic is listed as GRAS by U.S. FDA. Thermally treated garlic juice is processed from food grade material. Therefore, waiving of the data requirement of Annex II 8.11 of Regulation (EU) No. 528/2012 is acceptable.

A.3.10. Reproductive toxicity

A.3.10.1. Sexual function and fertility

A3.10.1.1 Short summary and overall relevance of the provided information on adverse effects on sexual function and fertility

No regulatory accepted guideline study under GLP on reproductive toxicity was submitted. No literature papers were submitted by the applicant for this endpoint.

A3.10.1.2 Comparison with the CLP criteria

Data lacking.

A3.10.1.3 Overall conclusion on sexual function and fertility related to risk

assessment

No reproductive toxicity data were submitted.

Data waiving	
Information requirement	Effects on fertility
Justification	Ireland (2019) concluded that the nature of the substance as food grade material and a human food source makes systemic toxicity testing scientifically unnecessary. Garlic is listed as GRAS by U.S. FDA. Nevertheless, EMA (2020) indicated in their conclusion on non-clinical data on *Allium sativum* L., bulbus that a potential impact on male fertility cannot be excluded. The conclusion was based on a very old fertility study dated back 1947 and two other investigations by Dixit and Joshi (1982) and Hammami et al. (2008, 2009). Histopathological alterations in testis such as degenerating seminiferous tubules, lowered/arrest of spermatogenesis, decreased testosterone levels associated with LH increase occurred after oral administration of garlic powder or fresh extracts in rats. However, number of animals per dose group were low (max. 6 animals) and test items were not further characterised in addition to poor reporting due to the nature of a published literature article. Hammami et al. (2008, 2009) reported the doses in % of the diet with the highest dose at 30% and 15% fresh garlic, respectively. Dixit and Joshi (1982) administered a limit dose of approximately 300 mg/kg bw/d that was considered as LOEL for garlic powder based on histopathological lesions in the testes and spermatogenesis arrest after 70 days of exposure. However, other literature studies not reported in EMA (2020) indicate an absence of adverse effects on testes or increased measured testosterone serum levels (e.g. Memudu et al. (2015), oral administration of dried garlic powder in aqueous solution to rats) or beneficial mixture effects of diallyl sulfides on rat testes and spermatogenesis when co-administered with lead (Hassan et al., 2019). Experimental data with the active substance thermally treated garlic juice supported under the BPR were not submitted and are not available. Thermally treated garlic juice is processed from food grade material and is a human food source with a global consumption volume of approximately 26 million tons annually (applicant´s statement). Also in the peer review of the active substance thermally treated garlic juice under PPPR (under the name "garlic extract"), EFSA (2020) identified no critical areas of toxicological concern. Dietary exposure is expected to exceed the systemic exposure by the dermal (or inhalation) route. Therefore, waiving of the data requirement of Annex II 8.10 of Regulation (EU) No. 528/2012 is acceptable.

A.3.10.2. Developmental toxicity

A3.10.2.1 Short summary and overall relevance of the provided information on adverse effects on development

No developmental toxicity data were submitted.

A3.10.2.2 Comparison with the CLP criteria

Data lacking.

A3.10.2.3 Overall conclusion on effects on development related to risk assessment

No developmental toxicity data were submitted.

Data waiving	
Information requirement	Effects on development
Justification	Ireland (2019) concluded that the nature of the substance as food grade material and a human food source with a global consumption volume of approximately 26 million tons annually (applicant´s statement) makes systemic toxicity testing scientifically unnecessary. Garlic is listed as GRAS by U.S. FDA. Thermally treated garlic juice is processed from food grade material. (Please see chapter A.3.1 and B.3 for further toxicokinetic and exposure related justifications.) Dietary exposure is expected to exceed the systemic exposure by the dermal (or inhalation) route. Therefore, waiving of the data requirement of Annex II 8.10 of Regulation (EU) No. 528/2012 is acceptable.

A.3.10.3. Effects on or via lactation

A3.10.3.1 Short summary and overall relevance of the provided information on effects on or via lactation

No reproductive toxicity data were submitted.

A3.10.3.2 Comparison with the CLP criteria

Data lacking.

A3.10.3.3 Overall conclusion on effects on or via lactation related to risk assessment

No reproductive toxicity data were submitted.

Data waiving	
Information requirement	Effects on or via lactation
Justification	Please see justification under A.3.10.2.3

A.3.10.4. Conclusion on classification and labelling for reproductive toxicity

No reprotoxicity studies were submitted; thus, no classification is proposed due to lack of data.

A.3.10.5. Overall conclusion on reproductive toxicity related to risk assessment

Some literature data (non-guideline studies) reported adverse effects on male fertility with garlic preparations. Ireland (2019) concluded that the nature of the substance as food grade material and a human food source with a global consumption volume of approximately 26 million tons annually (2016 data) makes systemic toxicity testing scientifically unnecessary. Garlic is listed as GRAS by U.S. FDA. (Please see chapter A.3.1 and B.3 for further toxicokinetic and exposure related justifications).
Dietary exposure is expected to exceed the systemic exposure by the dermal (or inhalation) route. Therefore, waiving of the data requirement of Annex II 8.10 of Regulation (EU) No. 528/2012 is acceptable.

A.3.11. Aspiration hazard

A3.11.1 Short summary and overall relevance of the provided information on aspiration hazard

No aspiration hazard from thermally treated garlic juice is expected (cf. section A.1.3).

A3.11.2 Comparison with the CLP criteria

Data conclusive, but not sufficient for classification.

A3.11.3 Conclusion on classification and labelling for aspiration hazard

No classification proposed.

A.3.12. Neurotoxicity

A3.12.1 Short summary and overall relevance of the provided information on neurotoxicity

No neurotoxicity data were submitted.

A3.12.2 Comparison with the CLP criteria

No data were submitted.

A3.12.3 Conclusion on neurotoxicity related to risk assessment

No data were submitted.

Data waiving	
Information requirement	Neurotoxicity
Justification	The conditions for additional data on neurotoxicity according 8.13.2. of Regulation (EU) No. 528/2012 are not met.

A.3.13. Immunotoxicity

A3.13.1 Short summary and overall relevance of the provided information on immunotoxicity

No immunotoxicity data were submitted.

A3.13.2 Comparison with the CLP criteria

Data lacking.

A3.13.3 Conclusion on immunotoxicity related to risk assessment

No immunotoxicity data were submitted.

Data waiving	
Information requirement	Immunotoxicity
Justification	The conditions for additional data on immunotoxicity according 8.13.4. of Regulation (EU) No. 528/2012 are not met based that dietary exposure is expected to exceed the systemic exposure by the dermal (or inhalation) route.

A.3.14. Endocrine disruption

No studies for endocrine activity or adversity with thermally treated garlic juice according to level 3, 4 or 5 of the OECD conceptual framework for endocrine disruptors[3] were submitted. The applicant submitted an ED assessment and followed the steps of the ED guidance (ECHA and EFSA, 2018). For information gathering available ED databases were searched for thermally treated garlic juice to check if this substance or its constituents are listed in TEDX, SIN, EDSP21 (Toxcast) or SVHC. Diallyl disulfide was listed in Toxcast[4] ER and AR models as inactive. However, thermally treated garlic juice is a UVCB substance but this compound belongs to the marker polysulfides (cf. confidential annex VI) of thermally treated garlic juice supported under the BPR.
In a next step data for assessing potential ED properties of thermally treated garlic juice was gathered by a structured literature review based on the principles of systematic review methodology in the electronic databases Pubmed and Scopus. The applicant justified the selection of these sources based that they are the largest databases with frequency of updates on daily basis.
From the over 100 hits only one paper, Qi et al. (2001) was considered reliable and included as supportive information by the applicant. However, eCA AT noted several limitations in the evaluation of the reliability of the other literature studies.
As indicated in section A.3.10.1 some effects on male fertility were reported by EMA (2020). More recent work by Ezz El Arab et al. (2022) seemed to support the previous findings for different garlic preparations including cooked garlic (smashed, roasted and air dried and grinded to powder), garlic powder and tablets (all administered orally at 5 and 10 mg/kg bw/d during 1 month, male albino rats, strain not specified, n=5 animals per group) and aged garlic extract. Testosterone levels were reduced at all dose groups compared to

[3] https://www.oecd.org/env/ehs/testing/OECD%20Conceptual%20Framework%20for%20Testing%20and%20Assessment%20of%20Endocrine%20Disrupters%20for%20the%20public%20website.pdf
[4] https://comptox.epa.gov/dashboard/chemical/bioactivity-toxcast-models/DTXSID9035206

controls, but histopathological findings in testes varied with dose and garlic preparation (Ezz El Arab et al., 2022). The authors speculate, that testosterone levels could be reduced based on the cholesterol lowering properties of garlic as one possible mode of action amongst others direct hormonal acting mechanistic hypothesis. Garlic is described by EMA (2020) to exhibit mild beneficial effects on lowering levels of total cholesterol, triglycerides, and in a lesser extend to LDL-Cholesterol (supporting traditional use for atherosclerosis).
However, other literature studies not reported in EMA (2020) indicate an absence of adverse effects on testes in rats or increased measured testosterone serum levels (e.g. Memudu et al. (2015), administered orally dried powder in aqueous solution to rats) or beneficial mixture effects of diallyl sulfides on rat testes and spermatogenesis when co-administered with lead (Hassan et al., 2019). Qi and co-workers reported increases in testicular testosterone in rats fed with a high protein diet and garlic powder, but no effect compared to control on a lower 10% protein diet after 28 days. The study investigated effect of garlic either in conjunction with high dose levels of casein (to study effects of increased protein metabolism). Shortening or lard-diet fed rats with garlic powder also showed increased testosterone levels. I.v. administration of diallyl disulfide increased LH serum concentrations (Qi et al., 2001).
While the presented literature studies are not complete and have drawbacks in terms of standardization, validation and reporting as well as test item characterisation a possible effect on male fertility of garlic and/or garlic preparations may or may not occur as different results on testes and hormone levels were reported.
The ECHA and EFSA guidance stipulate that there may be cases in which an ED assessment does not appear scientifically necessary (ECHA and EFSA, 2018). Worldwide consumption of garlic annually at approximately 26 million tons as part of typical diet with consumption at levels ranging from 0.0002 to 0.065 g/kg bw/d or 0.083 g/kg bw/d, corresponding to a daily portion from 0.013 to 3.9 g depending on the country or region. The 97.5th percentile consumption was recorded as 0.64 g/kg bw/d, corresponding to an intake of 42.7 g/day (UK vegetarian) (EFSA, 2012, EFSA, 2020).
Regarding these numbers, it needs to be taken into account, that the composition of compounds taken up via diet depends inter alia on how the garlic was prepared. Formation of the marker substances: allyl polysulfides from thiosulfinates is reported, if garlic is exposed to water (rapid in hot water e.g. via cooking and slow in ambient water) (Lawson and Hunsaker, 2018). Therefore, uptake of thermally treated garlic juice is considered to be most similar to the dietary uptake of cooked or roasted garlic in contradiction to the uptake of raw garlic.
Dietary exposure is expected to exceed the systemic exposure by the dermal (or inhalation) route. Therefore, waiving of the data requirement of Annex II 8.13.3 of Regulation (EU) No. 528/2012 is acceptable.

Data waiving	
Information requirement	Endocrine disruption
Justification	Some experimental data with garlic preparations and garlic components such as diallyl disulfide were available in public literature indicating effects on male fertility. However, no robust guideline conform systemic or reproductive toxicity study including endpoints related to endocrine disruption was submitted. Thermally treated garlic juice is processed from food grade material. Dietary exposure is expected to exceed the systemic exposure by the dermal (or inhalation) route. (Please see chapter A.3.1 and B.3 for further toxicokinetic and exposure related justifications). Therefore, waiving of the data requirement of Annex II 8.13.3 of Regulation (EU) No. 528/2012 is acceptable. Further testing with the active substance

	is not considered appropriate in that specific case, because 'testing does not appear scientifically necessary' (first heading of Annex IV of the Regulation (No) 528/2012). EFSA (2020) concluded also in their peer review evaluation of thermally treated garlic juice (under the name "garlic extract") that although no (eco)toxicological data are available to assess the endocrine-disrupting properties, it does not appear scientifically necessary considering that garlic is a food item for humans.

A.3.15. Further Human data

No further human data were submitted. No relevant health data were available nor were adverse health effects reported for the active substance thermally treated garlic juice from manufacturing plants according to the applicant (cf. IUCLID, section: medical surveillance data on manufacturing plant personnel), however the absence of adverse health effects could not be verified by eCA AT because no (aggregated and anonymized) medical health report data were submitted.

A.3.16. Other data

No other data were submitted.

A.4. Environmental effects assessment

The active ingredient is [redacted] garlic juice obtained from [redacted]. Most of the components are expected to be unspecific plant material (e.g. carbohydrates, proteins, lipids, minerals and others). However, up to 3.6% of the substance is expected to be composed of a number of organopolysulfides (allyl and alkyl polysulfides), to which the biological activity as a pesticide and a repellent is attributed. Four allyl polysulfides (DAS1-DAS4) have been characterised and are regarded as marker ("fingerprint") molecules obtaining together a content of [redacted]%.

A.4.1. Fate and distribution in the environment

A.4.1.1. Degradation

A4.1.1.1 Abiotic degradation

Hydrolysis

Table A.20 Summary table - Hydrolysis

Summary table - Hydrolysis							
Method, Guideline, GLP status, Reliability, Key/supp ortive study	pH	Temp. [°C]	Initial TS concentration, C0 [µg/mL]	Half-life, DT50 [h]	Coeffici -ent of correl- ation, r2	Remarks	Reference
OECD Guideline 111 and OPPTS 835.2120, GLP, Reliability 1, Key study	4 7 9	20°C 30°C 50°C	100 µg/mL	**At 20°C:** pH 4: 1.62 h pH 7: 16.3 h pH 9: 5.11 h **At 30°C:** pH 4: 17.4 h pH 7: 18.4 h pH 9: 12.4 h **At 50°C:** pH 4: 23.1 h pH 7: 7.88 h pH 9: 3.12 h	-	Due to the fact that 90% degradat ion was observed , the DT50 wasderie vedfrom the DT90/3. 32. For pH4 & 9 (T50) DFOP slow phase and for pH9 (T20) HS slow phase was	Anonymous 2021b

						chosen.	

Value used in Risk Assessment	
Value/conclusion	DT50 = 16.3 h (at pH 7 and 20°C)
Justification for the value/conclusion	Due to the fact that 90% degradation was observed, the DT50 was derived from the DT90/3.32. For pH4 & 9 (T50) DFOP slow phase and for pH9 (T20) HS slow phase was chosen. Please see also Appendix 3.

Phototransformation in water

Data waiving	
Information requirement	Data not available. Not applicable.
Justification	It is not feasible to conduct an OECD 316 with the active substance due to fast hydrolysis.

Estimated photo-oxidation in air

Table A.21 Summary table – Photo-oxidation in air

Summary table – Photo-oxidation in air					
Model	Light protection (yes/no)	Estimated daily (24 h) OH concentration [OH/cm³]	Overall OH rate constant [cm³/molecule sec]	Half-life [hr]	**Reference**
Atkinson model (ver. 1.92)	NA	5E5	68.87E-12 to 517.17E-12	0.745 to 5.591	Anonymous 2018

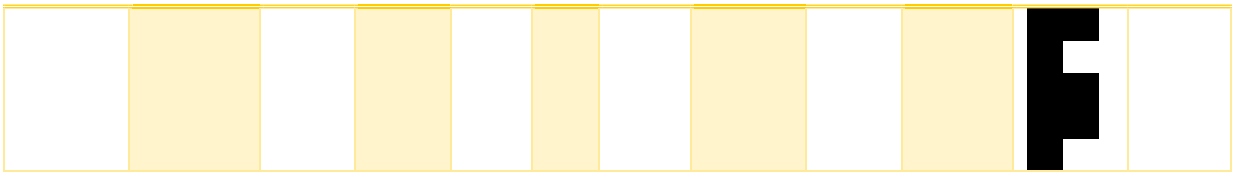
Value used in Risk Assessment	
Value/conclusion	DT50 = 5.59 h
Justification for the value/conclusion	The photochemical oxidative degradation half-life of thermally treated garlic juice marker molecules (diallyl sulphide, diallyl disulfide, diallyl trisulfide and diallyl tetrasulfide) ranged from 0.745 to 5.591 hours via the Atkinson model (version 1.92). The DT50 of 5.591 h is considered the worst-case.

A4.1.1.2 Biotic degradation

A4.1.1.2.1 Biodegradability (ready/inherent)

Table A.22 Summary table – biodegradation studies (ready/inherent)

Summary table - biodegradation studies (ready/inherent)											
Method, Guideline, GLP status, Reliability, Key/supportive study	Test type1	Test parameter	Inoculum			Additional substrate	Test sub-stance conc.	Degradation		Remarks [positive control]	Reference
			Type	Concentration	Adaptation			Incubation period	Degree [%]		
Experimental, OECD Guideline 301B, GLP, Reliability 1, Key study	Ready biodegradability	CO_2 evolution	Secondary effluent sourced from a STP receiving domestic sewage	6.0 E7 CFU/L	-	-	[redacted]	29 d	100% degradation after 29 d (calculated as 140.36% arithmetic mean degradation)	[redacted]	Anonymous 2021c



CFU: Colony Forming Units

Value used in Risk Assessment	
Value/conclusion	Readily biodegradable
Justification for the value/conclusion	Ready biodegradability data are available for thermally treated garlic juice which resulted in 100% degradation (based on CO_2 evolution) after 29 days. The tested substance is a UVCB substance and the 10-day window is not appropriate to be applied. It can be anticipated that a sequential biodegradation of the individual structures is taking place. In this case, a case by case evaluation is recommended (see also OECD Guideline for testing chemicals (2006) section 3 page 8 point 43) Considering all the provided data and the degradation curve, 100% degradation was exceeded on day 17. Due to this we would expect the UVCB substance to be readily biodegradable.

A4.1.1.3 Rate and route of degradation including identification of metabolites and degradation products

A4.1.1.3.1 Biological sewage treatment

Aerobic biodegradation

Data waiving	
Information requirement	Data not available and not required.
Justification	Data assessing the aerobic biodegradation of thermally treated garlic juice during biological sewage treatment are not required, given that the substance is shown to be readily biodegradable.

Anaerobic biodegradation

Data waiving	
Information requirement	Data not available and not required.
Justification	Data assessing the anaerobic biodegradation of thermally treated garlic juice during biological sewage treatment are not required, given that the substance is shown to be readily biodegradable. Based on the intended use of the representative product exposure to anaerobic conditions is unlikely.

STP simulation test

Data waiving	
Information requirement	Data not available and not required.

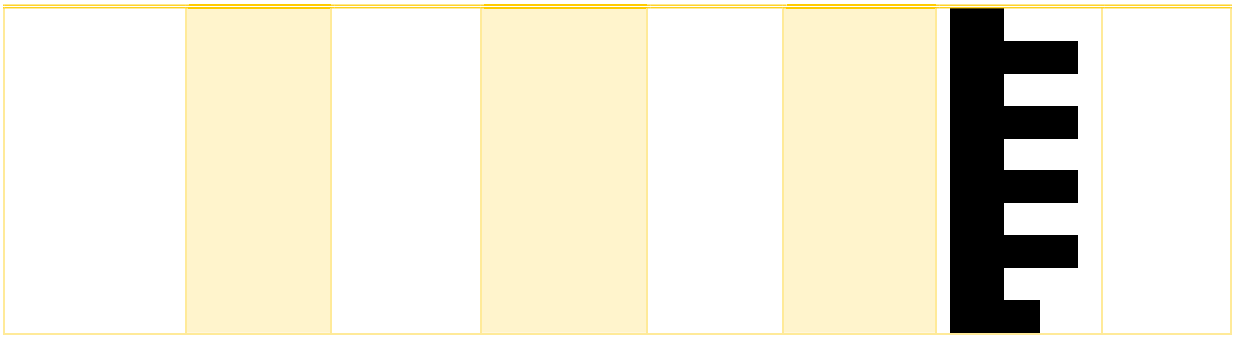
Justification	Data assessing the biodegradation of thermally treated garlic juice in an STP simulation test are not required, given that the substance is shown to be readily biodegradable.

A4.1.1.3.2 Biodegradation in freshwater

Aerobic aquatic degradation

Table A.23 Summary table – freshwater aerobic biodegradation

Summary table – freshwater aerobic biodegradation							
Method, Guideline, GLP status, Reliability, Key/supportive study	Test type1	Exposure	Test substance concentration	Incubation period	Degradation (DT50)	Remarks	Reference
No guideline study, Non-GLP, Reliability: 3, supportive study	Degradation of Garlic extract in "Local River water"	14 days	[redacted]	14 days	4.8 d	[redacted]	Anony-mous 2019c
Scientific literature study, Non-GLP, Reliability 3, supportive study	The study did not follow a standardised guideline	Radiolabelled diallyl disulfide (a thermally treated garlic juice marker molecule) was applied to tap water and samples taken for monitoring at periods of 0, 1, 2, 4, 8, 16, 20 and 24 hours.	[redacted]	24 h; 26°C	<1 day (16% of diallyl disulfide remained 24 h after application)	[redacted]	Anony-mous 1989



Value used in Risk Assessment	
Value/conclusion	Fast aquatic degradation can be confirmed by the submitted hydrolysis study. A definite DT50 can not be set. The provided studies do only provide supportive information. In the provided studies a DT50 of 4.8 days was determined. However, in case a quantitative risk assessment is conducted, the default value of 15 days at 12°C should be used.
Justification for the value/conclusion	A half-life of 4.8 days was determined in a study analysing the degradation of thermally treated garlic juice in river water According to the applicant the study was conducted at room temperature. No further characterisation of the used river water was given. Due to limited information being presented in both study designs, the provided studies are only considered as supporting evidence of the rapid degradability of thermally treated garlic juice. As agreed during the commenting phase, in case a quantitative risk assessment is conducted, the default value of 15 days at 12°C should be used.

Water/sediment degradation test

Data waiving	
Information requirement	Not required
Justification	Data assessing the biodegradation of thermally treated garlic juice in water/sediment are not required, given that the substance is shown to be hydrolysed very fast and readily biodegradable.

A4.1.1.3.3 Biodegradation in seawater

Seawater degradation study

Data waiving	
Information requirement	Not required
Justification	-

Seawater/sediment degradation study

Data waiving	
Information requirement	Not required
Justification	-

A4.1.1.3.4 Higher tier degradation studies in water or sediment

Higher tier degradation studies in water or sediment are not available or considered necessary for thermally treated garlic juice, given that the substance is not applied directly to aquatic systems. According to the degradation studies the substance is readily biodegradable and hydrolyses very fast (<1 day).

A4.1.1.3.5 Biodegradation during manure storage

Data waiving	
Information requirement	Not required
Justification	Thermally treated garlic juice will not be sent to manure storage before release into the environment, as this scenario is not applicable for the intended uses.

A4.1.1.3.6 Biotic degradation in soil

A4.1.1.3.7 Laboratory soil degradation studies

Aerobic biodegradation

Table A.24 Summary table – aerobic biodegradation of thermally treated garlic juice in soil- laboratory study

Summary table – aerobic biodegradation in soil- laboratory study											
Method, Guideline, GLP status, Reliability, Key/supportive study	**Test type1**	**Exposure**	**Test system**				**Test sub-stance concentration**	**Incu-bation period**	**Degr-adation DT50 (days)**	**Remarks**	**Reference**
			Soil origin	**Soil type**	**pH**	**OC %**					
No guideline study similar to OECD 307, Non-GLP, Reliability: 2, key study	no	Aerobic, 20°C, dark	Soil I: Norwich, Norfolk	Sandy loam	6.7	3.8	[redacted]	6 days	3.01 ± 0.25	[redacted]	Anonymous 2019b
			Soil II: Manae, Cambridgeshire	Clay loam	6.2	16.7			4.98 ± 0.08		
			Soil III:	San	7.	2.			3.63		

Summary table – aerobic biodegradation in soil- laboratory study											
Method, Guideline, GLP status, Reliability, Key/supportive study	**Test type1**	**Exposure**	**Test system**				**Test sub-stance concentration**	**Incu-bation period**	**Degr-adation DT50 (days)**	**Remarks**	**Reference**
			Soil origin	**Soil type**	**pH**	**OC %**					
			Ipswich, Suffolk	dy silt loam	1	4			± 0.26	[redacted]	
			Soil IV: Kings Lynn, Norfolk	Loamy sand	7.7	5.1			2.01 ± 0.13		
1 Test according to OECD criteria											

Value used in Risk Assessment	
Value/conclusion	DT_{50} = 6.86 days at 12°C
Justification for the value/conclusion	More than three DT_{50}-values are available, therefore the geometric mean will be used: Degradation half-life in soil, DT_{50} = 3.23 days at 20°C; converted to standard condition DT_{50} = 6.86 days at 12°C.

Anaerobic biodegradation

Data waiving	
Information requirement	Data not available and not required.
Justification	Data assessing the anaerobic biodegradation of thermally treated garlic juice are not required, given that the substance is shown to be readily biodegradable. Based on the intended use of the representative product exposure to anaerobic conditions is unlikely.

A4.1.1.3.8 Higher tier degradation studies in soil

Data waiving	
Information requirement	Data not available and not required
Justification	According to the BPR guidance data requirements (Volume IV, Part A,

	May 2018), field studies are required only if the $DegT_{50lab}$ >60 days in one or more soils determined at 20°C. The degradation studies available for garlic in soil under laboratory conditions reported DT_{50Lab} values below 60 days, therefore no higher tier degradation studies are required.

Field dissipation studies (field studies, two soil types)

Data waiving	
Information requirement	Data not available and not required.
Justification	-

A4.1.1.3.9 Short summary and overall relevance of the provided information on degradation and conclusion on rapid degradation

Thermally treated garlic juice undergoes rapid hydrolysis (DT_{50} = 16.3 h at 20°C & pH 7; Anonymous 2021b).

The photochemical oxidative degradation half-lives of thermally treated garlic juice marker molecules (diallyl sulfide, diallyl disulfide, diallyl trisulfide and diallyl tetrasulfide) ranged from 0.745 to 5.591 hours via the Atkinson model (version 1.92) (e), with the DT_{50} of 5.591hours considered the worst-case representative value for thermally treated garlic juice.

Thermally treated garlic juice can be classified as readily biodegradable data according to the results of a ready biodegradability test (OECD 301B, Anonymous 2021c).

Thermally treated garlic juice is derived from a natural plant material consisting of a complex mixture of naturally occurring compounds (polysulfides and plant matrix) which are expected to degrade quickly in the environment like any other plant debris.

In addition, supporting data on the rapid degradation of the active components of thermally treated garlic juice in the aquatic compartment are available in the scientific literature (Anonymous 1989), which showed that only 16% of the active component diallyl disulfide remained 24 hours after the application, implying a DT50water of <1 day for the surface water compartment. In another degradation study, a DT50 of 4.8 days was determined (Anonymous 2019c). However, the provided studies can only be rated as supportive information due to limited information on the study design. The US EPA stated that "garlic is presumed to be non-persistent since it is material known to rapidly degrade in the environment" (US EPA 1992).

Under the proposed uses, any potential residues reaching wastewater treatment plants will be indistinguishable from other naturally occurring residues of biological origin. Results from the toxicity control of a reliable OECD Guideline 301B ready biodegradability study concluded that thermally treated garlic juice is not inhibitory to sewage microorganisms, with the toxicity control having attained 35.8% degradation after 7 days and 90.9% degradation after 29 days (Anonymous 2021c).

Thermally treated garlic juice is therefore concluded to be rapidly degradable (both in the environment and in wastewater treatment plants).

A.4.1.2. Distribution

A4.1.2.1 Adsorption onto/desorption from soils

It is technically not possible to experimentally determine adsorption coefficient for thermally treated garlic juice as it is a complex mixture of naturally occurring substances. Upon release to the environment each of the components in the mixture will behave independently and will exhibit its own mobility and degradation characteristics. In this case it is considered appropriate to determine the adsorption characteristics for the biologically active polysulfides, although it is noted that in the active substance these molecules may behave differently. An OECD 121 laboratory study was conducted to derive the Koc for three marker compounds.

Table A.24 Summary table – Adsorption/desorption

Summary table – Adsorption/desorption									
Method, Guideline, GLP status, Reliability	Soil	Adsorbed AS [%]	Ka	KaOC	Kd KdOC Ka/Kd	Kf	1/n	Remarks	Reference
OECD 121, GLP, Reliability 1	HPLC Method	DAS 1-4	Not relevant for OECD 121	**DAS 1:** 575.44 **DAS 2:** 1778.28 **DAS 3:** 3981.07	Not relevant for OECD 121	Not relevant for OECD 121	Not relevant for OECD 121	The retention time of DAS4 was outside the calibration range and was therefore not calculated.	Anonymous 2022c

Ka = Adsorption coefficient
KaOC = Adsorption coefficient based on organic carbon content
Kd = Desorption coefficient
KdOC = Desorption coefficient based on organic carbon content
Ka/ Kd = Adsorption / Desorption distribution coefficient

Value used in Risk Assessment	
Value/conclusion	Koc = 575.44 – 3981.07 L/kg
Justification for the value/conclusion	-

A4.1.2.2 Higher tier soil adsorption studies

No data submitted. Thermally treated garlic juice was tested to be readily biodegradable, therefore higher tier soil adsorption studies are not considered necessary.

A4.1.2.3 Volatilisation

Regarding volatilisation, please see Part A, section 1.3 Physical and chemical properties of the active substance.

A.4.1.3. Bioaccumulation

Measured aquatic bioconcentration

Data waiving	
Information requirement	Data not available and not required
Justification	Study not necessary because the substance has a low potential for bioaccumulation based on having a log Kow <3 (thermally treated garlic juice was shown to have a log Kow value of -1.49).

Estimated aquatic bioconcentration

Data waiving	
Information requirement	Data not available and not required
Justification	Study not necessary because the substance has a low potential for bioaccumulation based on having a log Kow <3 (thermally treated garlic juice was shown to have a log Kow value of -1.49).

Measured terrestrial bioconcentration

Data waiving	
Information requirement	Data not available and not required
Justification	Study not necessary because the substance has a low potential for bioaccumulation based on having a log Kow <3 (thermally treated garlic juice was shown to have a log Kow value of -1.49).

Estimated terrestrial bioconcentration

Data waiving	
Information requirement	Data not available and not required
Justification	Study not necessary because the substance has a low potential for bioaccumulation based on having a log Kow <3 (thermally treated garlic juice was shown to have a log Kow value of -1.49).

A.4.1.4. Monitoring data

No monitoring data are available.

A.4.2. Effects on environmental organisms

A.4.2.1. Atmosphere

The photochemical oxidative degradation half-life of thermally treated garlic juice marker molecules (diallyl sulfide, diallyl disulfide, diallyl trisulfide and diallyl tetrasulfide) was shown to range from 0.745 to 5.591 hours via the Atkinson model (version 1.92) (assuming a constant hydroxyl concentration of 5E05 radicals/cm^3). Hydrogen abstractions and reactions with nitrogen and sulfur were predicted to contribute to the overall atmospheric photochemical degradation pathway, and the overall bimolecular rate constant for the process (kOH) was calculated to range from 68.87E-12 to 517.17E-12 cm^3/molecule-sec. The photochemical oxidative degradation of garlic in air is therefore concluded to be rapid and consequently, air is not expected to be an environmental compartment of concern.

A.4.2.2. Toxicity to sewage treatment plant (STP) microorganisms

Inhibition of microbial activity (aquatic)

Table A.25 Summary table – Inhibition of microbial activity

Summary table – inhibition of microbial activity									
Method, Guideline, GLP status, Reliability, Key/supportive study	Species/ Inoculum	Endpoint	Exposure		Results			Remarks	Reference
			Design	Duration	NOEC	EC 10	EC50		
Experimental, OECD Guideline 301B, GLP, Reliability 1, Key study	sewage, domestic	Biodegradation (CO_2 evolution)	Static	28 d	25 mg/L	-	-	Ready biode-grad-ability study toxicity control	Anonymous 2021c

Value used in Risk Assessment	
Value/conclusion	NOEC (28-d) = 25 mg/L $PNEC_{stp}$ (thermally treated garlic juice) = 2.5 mg/L
Justification for the value/conclusion	The toxicity control attained 35.80% degradation after 7 days and 90.87% degradation after 29 days, indicating that thermally treated garlic juice was not inhibitory to the inoculum microorganisms. An assessment factor of 10 was applied to the test concentration at which no toxicity to the inoculum was observed.

A.4.2.3. Aquatic compartment

A4.2.3.1 Freshwater compartment

Acute/short-term toxicity (freshwater)

Table A.26 Summary table – acute/short-term aquatic toxicity

Summary table – acute/short-term aquatic toxicity										
Method, Guideline, GLP status, Reliability, Key/supportive study	Species	Endpoint/ Type of test	Test material	Exposure		Results [mg thermally treated garlic juice/L]			Remarks	Reference
				Design	Duration	NOEC	LC/EC10	LC/EC50		
Fish										
Fish, acute toxicity test, OECD Guideline 203, GLP, Reliability 1, **Key study**	*Cyprinus carpio*	LC_{50} (mortality)	Thermally treated garlic juice[1]	Semi-static	96 h	8.23 (geometric mean measured)	-	11.7 (geometric mean measured)	[redacted]	Anonymous (2021d)
Fish, acute toxicity test, OECD Guideline 203, GLP, Reliability 3, Supporting study	*Cyprinus Carpio*	LC_{50} (mortality)	Thermally treated garlic juice[1]	Semi-static	96 h	9.9 (nominal)	-	19.6 (nominal)	Nominal concentrations, no verification of the test substance concentrations at the end of the test	Anonymous (2012a)
Invertebrates										
Daphnia sp. Acute immobilisation test, OECD Guideline 202, GLP, Reliability 1, **Key study**	*Daphnia magna*	EC_{50} (immobilisation)	Thermally treated garlic juice[1]	Semi-static	48 h	2.58 (geometric mean measured)	-	13.7 (geometric mean measured)	-	Anonymous (2021e)
Daphnia sp. Acute immobilisation test,	*Daphnia magna*	EC_{50} (immobilisati	Garlic Juice	Static	48 h	1.0 (nomina	-	9.3 (nominal)	No diallylsulfides	Anonymous

OECD Guideline 202, GLP, Reliability 3, Supporting study		on)	concentrate 883			l)			or any other marker molecules were measured. No information on the tested substance beside the test substance description as "[redacted]". It is not possible to decide if the used test item in this study equals thermally treated garlic juice in its characteristics.	(2000 a)
Algae (growth inhibition)[1]										
Freshwater algae growth inhibition test, OECD Guideline 201, GLP, Reliability 1, **Key study**	*Pseudokirchneriella subcapitata*	ErC_{50} (growth rate inhibition)	Thermally treated garlic juice[1]	Static	72 h	2.55 (geometric mean measured)	8.52 (geometric mean measured)	19.2 (geometric mean measured)	No DAS3 was detected after 48 hrs.	Anonymous (2021 f)
Freshwater algae growth inhibition test, OECD Guideline 201, GLP, Reliability 3, Supporting study	*Pseudokirchneriella subcapitata*	ErC_{50} (growth rate inhibition)	Thermally treated garlic juice[1]	Static	72 h	8.1 (nominal)	-	57.8 (nominal)	Nominal concentrations, no verification of the test substance concentrations at the end of the test	Anonymous (2012 b)

[1] in the study named [redacted]

Value used in Risk Assessment	
Value/conclusion	LC50 (96 h, fish) = 11.7 mg/L $PNEC_{Water}$(thermally treated garlic juice) = 11.7E-03 mg/L
Justification for the value/conclusion	The acute toxicity data for *Cyprinus carpio* is used for the derivation of the PNEC (thermally treated garlic juice) for the risk assessment. Since there is no chronic data available, an assessment factor of 1000 is applied resulting in a PNEC of 11.7E-03 mg/L.

Chronic/long-term toxicity (freshwater)

Data waiving	
Information requirement	Data not available and not required.
Justification	Chronic freshwater toxicity data are not available or considered necessary, given that continuous direct release to surface water will not occur based on the intended use of the active substance. Therefore, the PNEC freshwater was derived based on available acute freshwater toxicity data. Thermally treated garlic juice is expected to be rapidly degradable and to have low bioaccumulation potential, thus chronic aquatic toxicity is not expected.

A4.2.3.2 Sediment compartment

Acute/short-term toxicity (freshwater sediment)

Data waiving	
Information requirement	Data not available and not required. For PNEC derivation see Point A.4.4. Derivation of PNECs.
Justification	Freshwater sediment toxicity data are not available, therefore the PNEC sediment (freshwater) value was derived via the equilibrium partitioning method and sediment toxicity testing are not considered necessary.

Chronic/long-term toxicity (freshwater sediment)

Data waiving	
Information requirement	Data not available and not required.
Justification	Freshwater sediment toxicity data are not available, therefore the PNEC sediment (freshwater) value was derived via the equilibrium partitioning method and sediment toxicity testing are not considered necessary.

A4.2.3.3 Marine compartment

Acute/short-term toxicity (seawater)

Data waiving	
Information	Data not available. For PNEC derivation see Point A.4.4. Derivation of

requirement	PNECs. $PNEC_{seawater}$(thermally treated garlic juice) = 11.7E-04 mg/L
Justification	Acute marine water toxicity data are not available, therefore the PNEC marine water value was derived based on available acute freshwater toxicity data, as per the Guidance on the BPR: Volume IV (parts B+C).

Chronic/long-term toxicity (seawater)

Data waiving	
Information requirement	Data not available and not required
Justification	Chronic marine water toxicity data are not available, therefore PNEC marine water values have been derived based on available acute freshwater toxicity data, as per the Guidance on the BPR: Volume IV (parts B+C). Thermally treated garlic juice is expected to be rapidly degradable and to have low bioaccumulation potential, thus chronic toxicity is not expected.

A4.2.3.4 Sea sediment compartment

Acute/short-term toxicity (sea sediment)

Data waiving	
Information requirement	Data not available and not required. For PNEC derivation see Point A.4.4. Derivation of PNECs.
Justification	Marine sediment toxicity data are not available, therefore the PNEC sediment (marine water) value was derived via the equilibrium partitioning method and sediment toxicity testing are not considered necessary.

Chronic/long-term toxicity (sea sediment)

Data waiving	
Information requirement	Data not available and not required
Justification	Marine sediment toxicity data are not available, therefore the PNEC sediment (marine water) value was derived via the equilibrium partitioning method and sediment toxicity testing are not considered necessary.

A4.2.3.5 Higher tier studies on aquatic organisms

No further studies are required.

A.4.2.4. Terrestrial compartment

Toxicity to terrestrial organisms, acute/short-term tests

Table A.27 Summary table – acute/short-term terrestrial toxicity

Summary table – acute/short-term terrestrial toxicity											
Method, Guideline, GLP status, Reliability, Key/supportive study	Species	Endpoint/ Type of test	Test material	Exposure		Organic matter (%)	Results (in dry weight)			Remarks	Reference
				Design	Duration		NOEC	LC/EC10	LC/EC50		
Earthworm/soil-dwelling non-target invertebrates											
Earthworm, acute toxicity test, OECD 207, GLP, Reliability 1, Key study	*Eisenia fetida*	LC_{50} (mortality)	Thermally treated garlic juice (formerly named "*garlic extract*")	Laboratory study, artificial soil	14 d	10	1250 mg/kg soil dw		4729.1 mg/kg soil dw		Anonymous (2016b)

Value used in Risk Assessment	
Value/conclusion	14-d LC50 = 4729.1 mg/kg soil dw $PNEC_{soil}$: 4.73 mg/kg soil dw 4.19 mg/kg soil wwt
Justification for the value/conclusion	An acute earthworm toxicity study is available, which resulted in a 14-day LC50 value of 4729.1 mg/kg soil dw.

Toxicity to terrestrial organisms, chronic/long-term tests

Table A.28 Summary table – chronic/long-term terrestrial toxicity

Summary table – acute/short-term terrestrial toxicity									
Method, Guideline, GLP status, Reliability, Key/supportive study	Species	Endpoint/ Type of test	Test material	Exposure		Organic matter (%)	Results (in dry weight)	Remarks	Reference
				Design	Duration		LOEC/NOEC/EC10		
Earthworm/soil-dwelling non-target invertebrates									
Earthworm, chronic toxicity test, OECD Guideline 222, GLP, Reliability 1, Key study	*Eisenia fetida*	Reproduction	Thermally treated garlic juice (formerly named "*garlic extract*")	Laboratory study, artificial soil	56 d	10	NOEC = 5000.0 mg/kg dw; LOEC = >5000.0 mg/kg dw	The results on Day 28 and Day 56 were below the lower limit of quantification.	Anonymous 2021g
Soil microflora									
Soil microorganism: Nitrogen transformation test, OECD Guideline 216, GLP, Reliabili	Soil microorganisms	Nitrate formation rate	Thermally treated garlic juice (formerly named "*garlic extract*")	Laboratory study, collected soil	28 d	-	NOEC = 120 L/ha soil	-	Anonymous 2016c

ty 1									
Soil microorganism: Carbon transformation test, OECD Guideline 217, GLP, Reliability 1	Soil microorganisms	Respiration rate	Thermally treated garlic juice(formerly named "*garlic extract*")	Laboratory study, collected soil	28 d	-	NOEC = 120 L/ha soil	-	Anonymous 2016d

Value used in Risk Assessment	
Value/conclusion	14-d LC50 = 4729.1 mg/kg soil dw PNECsoil: 4.73 mg/kg soil dw 4.19 mg/kg soil wwt
Justification for the value/conclusion	The key chronic soil dwelling toxicity data for thermally treated garlic juice is the chronic earthworm toxicity study, which resulted in a 56-day NOEC (based on effects upon reproductive output) of 5000.0 mg/kg dw. The chronic study was compared to the acute toxicity study. Beside the difference in moisture content (~10%) no other variations between the studies were observed. Both studies were conducted according the the guidelines. For the risk assessment the more conservative 14-day LC50 of 4729.1 mg/kg soil dw was chosen.

A.4.2.5. Groundwater

A groundwater assessment was conducted (cf. Appendix III: Environmental emission (and exposure) calculations) and the trigger value of 0.1 µg/L of the drinking water directive (EU 2020/2184) was exceeded. However, thermally treated garlic juice meets the cut-off criteria by having a DT50<21 d at 20°C and a Koc>500 L/kg and therefore, no unacceptable risk is expected regarding the environmental compartment groundwater.

A.4.2.6. Birds and mammals

No toxicity studies for birds and mammals are available. A study where European starlings significantly reduced their food consumption, even after overnight food deprivation, by 61-65% compared to the controls is available. The avoided food mixture contained up to 50% food-grade garlic oil impregnated granules.

Considering the EFSA conclusion on garlic extract (2012 and 2020) that states, that the substance (renamed in the BPR to "*thermally treated garlic juice*") is a repellent for birds and mammals and the provided scientific literature starling study (Anonymous, 2004), it can be concluded that the risk of thermally treated garlic juice to birds and mammals can be considered as low.

Data waiving	
Information requirement	Not available and not required
Justification	According to the EFSA conclusion (2012 and 2020), thermally treated garlic juice (named as "*garlic extract*" in the EFSA conclusion) is a repellent for birds and mammals. The scientific literature study (Anonymous 2004) on starlings supports those findings and a risk to birds and mammals is considered to be low. Testing is therefore not necessary.

A.4.2.7. Primary and secondary poisoning

Primary poisoning

Data waiving	
Information requirement	Not available and not required
Justification	According to the EFSA conclusion (2012 and 2020), thermally treated garlic juice (named as "*garlic extract*" in the EFSA conclusion) is a repellent for birds and mammals. The scientific literature study (Anonymous 2004) on starlings supports those findings and a risk to birds and mammals is considered to be low. Testing is therefore not necessary.

Secondary poisoning

Data waiving	
Information requirement	Not available and not required
Justification	The bioaccumulation potential of thermally treated garlic juice is considered to be low, given that the log Kow was determined to be -1.49 (i.e. <3). Consequently, the risk is considered to be low for secondary poisoning.

A.4.3. Endocrine disruption

Conclusion used in Risk Assessment – Endocrine disruption	
Conclusion	Thermally treated garlic juice is not considered to have endocrine disrupting properties with respect to non-target organisms.
Justification for the conclusion	There are no indications of endocrine disruption in the data set. Unfortunately, there is insufficient information available to fully assess the endocrine disrupting properties of the substance regarding non-target organisms. However, no information is requested based on the following justification(s): Scientific necessity: Garlic is widely used as food by human and the active substance thermally treated garlic juice is manufactured from food grade material. Data to fulfil this data point was not considered necessary for the renewal decision under the PPP legislation of Regulation (EC) No. 1107/2009, nor considered necessary for approval via Regulation (EU) No. 528/2012 based on scientific reasons (Annex IV, Regulation (EU) No. 528/2012). It is concluded that the ED criteria are not met.

A.4.4. Derivation of PNECs

Table A.29 Derivation of PNECs

Compartment	PNEC	Remarks/Justification
Freshwater	$PNEC_{freshwater}$: 11.7 µg/L	Organism: *Cyprinus carpio* Endpoint: EC_{50} (96 h) 11.7 mg/L Assessment factor: 1000 Extrapolation method: Assessment factor Justification: Since the three taxonomic groups (fish, invertebrates, algae) are covered but only short-term toxicity data are available for fish and invertebrates, an assessment factor of 1000 is applied.
Marine water	$PNEC_{marine\ water}$: 1.17 µg/L	Organism: *Cyprinus carpio* Endpoint: EC_{50} (96 h) 11.7 mg/L Assessment factor: 10000 Extrapolation method: Assessment factor Justification: No data are available for marine water toxicity. However, freshwater data are available for acute fish toxicity, acute daphnia toxicity and algal toxicity and according to the Guidance on the BPR: Volume IV (parts B + C) it is appropriate to use freshwater data for marine/estuarine species. The $PNEC_{marine\ water}$ was therefore derived based on the EC_{50} value of 11.7 mg/L and an assessment factor of 10000.

STP	$PNEC_{stp}$: 2.5 mg/L	Organism: sewage domestic sludge Endpoint: NOEC (28 days) 25.0 mg/L Assessment factor: 10 Extrapolation method: Assessment factor Justification: The NOEC was derived from the toxicity control of a Ready Biodegradability test (OECD 301B). An assessment factor of 10 was applied to the test concentration at which no toxicity to the inoculum was observed.
Sediment (freshwater)	$PNEC_{sediment\ (freshwater)}$: 0.156 mg/kg sediment wwt	Extrapolation method: Equilibrium partitioning method Justification: No sediment toxicity data are available for thermally treated garlic juice, therefore a $PNEC_{sediment\ (freshwater)}$ was derived via the equilibrium partition method (EPM), based on the $PNEC_{freshwater}$ of 9.3 µg/L and an estimated Koc of 575.4.
Sediment (marine water)	$PNEC_{sediment\ (marine\ water)}$: 15.6 µg/kg sediment wwt	Extrapolation method: Equilibrium partitioning method Justification: No sediment toxicity data are available for thermally treated garlic juice, therefore a $PNEC_{sediment\ (marine\ water)}$ was derived via the equilibrium partition method (EPM), based on the $PNEC_{marine\ water}$ of 11.7 µg/L and a Koc of 575.4.
Soil	$PNEC_{soil}$: 4.73 mg/kg soil dw 4.19 mg/kg soil wwt	Organism: *Eisenia fetida* Endpoint: LC_{50} (14 d) 4729.1 mg/kg soil dw Assessment factor: 1000 Extrapolation method: Assessment factor Justification: Data are available for acute and chronic toxicity to earthworms and toxicity to soil microorganisms. The PNEC soil was derived based on the most conservative LC_{50} value of 4729.1 mg/kg soil dry weight from the acute earthworm toxicity study and an Assessment Factor of 1000.
Secondary poisoning	No potential for bioaccumulation	The bioaccumulation potential of thermally treated garlic juice is considered to be low, given that the log Kow was determined to be -1.49 (i.e. <3). Consequently, the risk is considered to be low for secondary poisoning.
Air	Not applicable	No hazard identified

A.4.5. Overall summary of acute and chronic aquatic toxicity data and Comparison with the CLP criteria

A.4.5.1. Short-term (acute) aquatic hazard

Table A.30 Summary of key information on acute/ short-term aquatic toxicity relevant for acute classification

Method	Species	Test material	Results	Remarks	Reference
Fish					
Fish, acute toxicity test, OECD 203, GLP, Reliability 1, Key study	*Cyprinus carpio*	Thermally treated garlic juice (formerly named "*garlic extract*")	LC_{50}: 11.7 mg/L (geometric mean measured)	-	Anonymous (2021d)
Invertebrates					
Daphnia sp. Acute immobilisation test, OECD 202, GLP, Reliability 1, Key study	*Daphnia magna*	Thermally treated garlic juice (formerly named "*garlic extract*")	EC_{50}: 13.7 mg/L (geometric mean measured)	-	Anonymous (2021e)
Algae					
Freshwater alga and cyanobacteria growth inhibition test, OECD 201, GLP, Reliability 1, Key study	*Pseudokirchneriella subcapitata*	Thermally treated garlic juice (formerly named "*garlic extract*")	ErC_{50}: 19.2 mg/L (geometric mean measured)	-	Anonymous (2021f)

A.4.5.2. Chronic/ long-term aquatic hazard (including information on bioaccumulation and degradation)

No chronic aquatic toxicity data are available. Chronic aquatic hazard classification has been based on available acute aquatic toxicity data.

A.4.5.3. Conclusion on classification and labelling for environmental hazards and comparison with the CLP criteria

Studies assessing the acute aquatic ecotoxicity of the substance are available for fish, daphnia and algae, with the lowest resulting L(E)C_{50} value being 11.7 mg/L (the 96-hour LC_{50} derived from the acute *Cyprinus carpio* toxicity study). The substance is therefore 'not classified' as an acute aquatic environment hazard under the CLP Regulation.

Chronic aquatic ecotoxicological data are not available, however the substance is concluded to be 'rapidly degradable' and to have low bioaccumulation potential. It is therefore concluded that the substance is 'not classified' as a chronic aquatic environment hazard under the CLP Regulation.

A.5. Assessment of additional hazards

A.5.1. Hazardous to the ozone layer

Thermally treated garlic juice contains neither Cl, Br nor F substituents. The photochemical oxidative degradation half-life of thermally treated garlic juice marker molecules (diallyl sulfide, diallyl disulfide, diallyl trisulfide and diallyl tetrasulfide) was shown to range from

0.745 to 5.591 hours via the Atkinson model. It is therefore concluded that thermally treated garlic juice degrades rapidly in air and the atmospheric lifetime is not long enough.

A.5.1.1. Short summary and overall relevance of the provided information on ozone layer hazard

See point A.5.1.

A.5.1.2. Comparison with the CLP criteria

Not classified as hazardous to ozone layer.

A.6. Additional Labelling

Supplemental hazard labelling information is not relevant.

A.7. Assessment of exclusion criteria, substitution criteria and POP

A.7.1. Exclusion criteria

A.7.1.1. Assessment of CMR properties

Criteria (BPR Article 5[1])	Assessment
Active substances which have been classified in accordance with Regulation (EC) No 1272/2008 as, or which meet the criteria to be classified as, carcinogen category 1A or 1B	As thermally treated garlic juice is manufactured from food grade material, a lack of carcinogenic potential was assumed. No data were submitted and no carcinogenicity toxicity evaluation has been carried out.
Active substances which have been classified in accordance with Regulation (EC) No 1272/2008 as, or which meet the criteria to be classified as, mutagen category 1A or 1B	As thermally treated garlic juice is manufactured from food grade material, a lack of mutagenic potential was assumed. No mutagenicity evaluation has been carried out.
Active substances which have been classified in accordance with Regulation (EC) No 1272/2008 as, or which meet the criteria to be classified as, toxic for reproduction category 1A or 1B	As thermally treated garlic juice is manufactured from food grade material, a lack of reproductive toxicity was assumed. No reproductive toxicity evaluation has been carried out.
Conclusion on CMR properties	**The exclusion criteria in BPR Article 5(1)a-c are not met.**

A.7.1.2. Assessment of endocrine disrupting properties

Criteria (BPR Article 5)	Assessment
Active substances which, on the basis of the criteria specified pursuant to the first subparagraph of paragraph 3 are considered as having endocrine-disrupting properties that may cause adverse effects in humans and to the environment.	No data with respect to the potential for endocrine disruption are submitted, nor considered scientifically necessary as the active substance is a food grade ingredient and form part of typical dietary consumption at levels ranging from 0.0002 to 0.065 g/kg bw/day, corresponding to a daily portion from 0.013 to 3.9 g depending on the country or region (EFSA, 2012). Further testing with the active substance is not considered appropriate in that specific case, because 'testing does not appear scientifically necessary' (first heading of Annex IV of the Regulation (EU) No 528/2012). Data to fulfil this data point was not considered necessary for the renewal decision under the PPP legislation of Regulation (EC) No. 1107/2009, nor considered necessary for authorisation via Regulation (EU) No. 528/2012 based on scientific reasons (Annex IV, Regulation (EU) No. 528/2012).

Conclusion on ED properties:	**The exclusion criteria with respect to potential endocrine disruption are not met.**

A.7.1.3. PBT Assessment (following Annex XIII to Regulation (EC) No 1907/2006)

Assessment of persistence

Thermally treated garlic juice is readily biodegradable and therefore not considered to be P/vP.

Conclusion on P / vP properties	**It is concluded that thermally treated garlic juice does not meet the criteria to be considered P or vP**

Assessment of bioaccumulation

The log Kow of thermally treated garlic juice was concluded to be -1.49. Therefore, thermally treated garlic juice is not considered to be B or vB.

Conclusion on B / vB properties	**It is concluded that thermally treated garlic juice does not meet the criteria to be considered B or vB**

Assessment of toxicity

Chronic aquatic ecotoxicological data are not available, however acute aquatic ecotoxicological data are available for fish, daphnia and algae, with the lowest resulting L(E)C_{50} value being 11.7 mg/L (from the 96h acute fish toxicity). The substance is therefore

'not classified' as an acute aquatic environmental hazard under the CLP regulation. Given that the substance is concluded to be 'rapidly degradable' and not bioaccumulative, it is also concluded to be 'not classified' as a chronic aquatic environmental hazard under the CLP regulation, thus chronic aquatic ecotoxicity is not expected. Thermally treated garlic juice is therefore not considered to be toxic from an ecotoxicological perspective. For human health, thermally treated garlic juice is also not considered to be toxic.

Assessment

T Criteria	Assessment
NOEC/EC10 (long-term) <0.01 mg/L for freshwater or seawater organisms, or	Long-term aquatic toxicity data are not available.
Substance meets the criteria for classification as carcinogenic (category 1A or 1B), germ cell mutagenic (category 1A or 1B), or toxic for reproduction (category 1A, 1B or 2) according to the CLP Regulation, or there is other evidence of chronic toxicity, as identified by the substance meeting the criteria for classification: specific target organ toxicity after repeated exposure (STOT RE category 1 or 2) according to the CLP Regulation.	The criteria for toxicity are not met (cf. section A.3.7, A.3.8, A.3.9 and A.3.10).

Conclusion on T properties	**It is concluded that thermally treated garlic juice does not meet the criteria to be considered T**

Summary and overall conclusions on PBT or vPvB properties

Overall conclusion:

Based on the assessment described in the subsections above the active substance thermally treated garlic juice is not a PBT / vPvB substance.

A.7.2. Substitution criteria

Substitution criteria (BPR, Article 10)	Assessment
One of the exclusion criteria listed in Article 5(1) is met but AS may be approved in accordance with Article 5(2)	No
The criteria to be classified, in accordance with Regulation (EC) No 1272/2008, as a respiratory sensitiser are met	No
The acceptable daily intake, acute reference dose or acceptable operator exposure level, as appropriate, is significantly lower than those of the majority of approved active substances for the same product-type and use scenario	N/A – qualitative risk assessments conducted.
Two of the criteria for being PBT in accordance with Annex XIII to	No

Regulation (EC) No 1907/2006 are met	
There are reasons for concern linked to the nature of the critical effects which, in combination with the use patterns, amount to use that could still cause concern, such as high potential of risk to groundwater, even with very restrictive risk management measures	No
The AS contains a significant proportion of non-active isomers or impurities.	No

Conclusion on substitution criteria	**The substitution criteria in BPR Article 10(1)a-f are not met.**

A.7.3. Assessment of long-range environmental transportation and impact on environmental compartments

	Assessment
The active substance or a degradation product is a persistent organic pollutant (POP) listed in Annex I of EC 850/2004	Thermally treated garlic juice is not considered a POP, as it is not listed in Annex I of Regulation (EC) No 850/2004.
Assessment of long-range transport potential (LRTAP): Vapour pressure <1000 Pa and half-life in air > 2 days or Monitoring data in remote area showing that the substance is found in remote regions or Result of multimedia modelling	The photochemical oxidative degradation half-life of thermally treated garlic juice marker molecules (diallyl sulfide, diallyl disulfide, diallyl trisulfide and diallyl tetrasulfide) was shown to range from 0.745 to 5.591 hours via the Atkinson model. It is therefore concluded that thermally treated garlic juice degrades rapidly in air and therefore is not considered to have LRTAP. No environmental monitoring data available.
The active substance or a degradation product is vP/vB or T?	It is concluded that thermally treated garlic juice is neither vP/ vB nor T.

Conclusion on LRTAP/POP assessment	**thermally treated garlic juice does not have LRTAP and is not considered a POP.**

B. Exposure assessment and effects of the active substance in the biocidal product(s)

B.1. General product information

B.1.1. Identification of the product

Name(s) of the product	
Trade name(s) or proposed Trade name(s)	KATZENSCHRECK
Manufacturer's development code and number of the product	CR2
Formulation type	GR - Granules

B.1.2. Complete qualitative and quantitative composition of the biocidal product

The carrier based biocidal product consists of [redacted] with the active substance. According to CA-Nov16-Doc.4.3.handling carriers_rev2_final, this is a "type A" carrier based biocidal product: the carrier component fulfils the function of a simple carrier matrix. The carrier component was not considered for the calculation of the active substance concentration and for the determination of the classification.

Active substance(s)					
ISO or Trivial name	IUPAC name or other accepted chemical name	EC number	CAS number	Composition / all constituents (upper and lower concentration limit in % (w/w))	Concentration in the product in % (w/w)
Thermally treated garlic juice (formerly named "*garlic extract*")	Thermally treated garlic juice (formerly named "*garlic extract*")	---	--- ---	100	100

Other components / ingredients of the product					
ISO or Trivial name	IUPAC name or other accepted chemical name	EC number	CAS number	Concentration in in the product in % (w/w)	Function
Please see confidential annex for details on carrier					N/A

B.1.3. Physical, chemical and technical properties

Property	Result	Test method applied or description in case of deviation	Remarks / Discussion / Justification for waiving	References
Physical state at 20°C and 101.3 kPA	Granular solid	OPPTS 830.6303	[redacted]	Anonymous 2022a
Colour at 20°C and 101.3 kPA	Grey 5GY8/1	OPPTS 830.6302	[redacted]	Anonymous 2022a
Odour at 20°C and 101.3 kPA	Mild garlic	OPPTS 830.63042	[redacted]	Anonymous 2022a
Acidity / alkalinity	pH (1% dilution/ dispersion) = 7.84	CIPAC MT 75.3	[redacted]	Anonymous 2022a
Relative density	Bulk density: 0.85 g/mL Tap density: 0.88 g/mL	CIPAC MT 186	[redacted]	Anonymous 2022a
Storage stability, stability and shelf-life				
Accelerated storage	The product in different commercial packaging – HDPE bottle, cardboard can, and aluminium foil bag - is stable after storage at 54°C for 14 days.	CIPAC MT 46.4 (14 days at 54°C) The following tests were carried out before and after storage	[redacted]	Anonymous 2022a

Property	Result	Test method applied or description in case of deviation	Remarks / Discussion / Justification for waiving	References
	See table at the end of the present section for detailed summary of results Initial active substance content: 0.0071±0.001% (expressed as total polysulfide content)	HPLC validated (SANCO3030/99 rev.5) method (active substance content) OPPTS 830.6302 (colour) OPPTS 830.6303 (physical state) OPPTS 830.6304 (odour) OPPTS 830.6320 (packaging) CIPAC MT 75.3 (pH) CIPAC MT 170 (dry sieve) CIPAC MT 178.2 (attrition) CIPAC MT 171.1 (dustiness) CIPAC MT 172 (flowability) (please refer to the summary table at the end of this section for detailed results)		
Long term storage at ambient temperature	Study in progress			
Low temperature stability (liquids)	Not applicable to a solid formulation			
Effects on content of the active substance				
Light	All packaging types are opaque to light			
Temperature and humidity	Not relevant – all packaging types are			

Property	Result	Test method applied or description in case of deviation	Remarks / Discussion / Justification for waiving	References
	water proof and seal tight.			
Reactivity towards container material	Product stored at 54°C in all packaging types did not show any leaks, discoloration or panelling.		[redacted]	Anonymous 2022a
Technical characteristics				
Wettability			N/A – product is not added to water for use	
Suspensibility, spontaneity and dispersion stability	NA		N/A – product is not added to water for use.	
Wet sieve analysis and dry sieve test	NA		N/A – product is not added to water for use. Please see particle size distribution, content of dust / fines.	
Emulsifiability, re-emulsifiability and emulsion stability	NA		N/A – product is not added to water for use.	
Disintegration time	NA		N/A – product is not added to water for use.	
Particle size distribution, content of dust / fines, attrition, friability	Dry sieve test: - Residue ≥90% = 850 µm - Residue ≤10% = 1.18 mm Dustiness: 1.3 ± 0.2 mg/30g	CIPAC MT 170 (dry sieve) CIPAC MT 171.1 (dustiness)	[redacted]	Anonymous 2022a

Property	Result	Test method applied or description in case of deviation	Remarks / Discussion / Justification for waiving	References
Attrition, friability	Attrition resistance = 99.31%	CIPAC MT 178	[redacted]	Anonymous 2022a
Persistent foaming	NA		N/A – product is not added to water for use	
Flowability,	Test item drops spontaneously through the 4.75mm mesh sieve	CIPAC MT 172	[redacted]	Anonymous 2022a
Pourability, dustability			N/A – product is not added to water for use	
Burning rate – smoke generators			N/A – product is not smoke generator	
Burning completeness – smoke generators			N/A – product is not smoke generator	
Composition of smoke – smoke generators			N/A – product is not smoke generator	
Spraying pattern - aerosols			N/A – product is not an aerosol	
Other technical characteristics			N/A – no other technical characteristics are addressed.	
Physical and chemical compatibility with other products including other biocidal products with which its uses is to be authorised				
Physical compatibility			N/A – not authorised to be used with other	

Property	Result	Test method applied or description in case of deviation	Remarks / Discussion / Justification for waiving	References
			biocidal products	
Chemical compatibility			N/A – not authorised to be used with other biocidal products	
Degree of dissolution and dilution stability			N/A – product is not added to water for use.	
Surface tension			N/A – product is not added to water for use.	
Viscosity			N/A – the product is not a liquid	

Summary of results of Accelerated Storage Stability of Garlic Repellent Granules at 54 ± 2°C for 14 Days with Different Commercial Packages

	Parameter	Results of Analysis				Method/Guideline
		Initial	Sample stored at 54 ± 2°C for 14 days (Aged)			
		HDPE Bottle	HDPE Bottle	Carboard Can	Aluminium foil bag	
1	Active ingredient (A.I.) Content (% m/m) -As total Polysulfides	0.071 ± 0.001	0.071 ± 0.001	0.072 ± 0.001	0.072 ± 0.001	Validated HPLC Method
2	Appearance - Color - Odor - Physical state	5GY 8/1 (Grey) Mild, moderate garlic like Granules	5GY 8/1 (Grey) Mild, moderate garlic like Granules	5GY 8/1 (Grey) Mild, moderate garlic like Granules	5GY 8/1 (Grey) Mild, moderate garlic like Granules	OCSPP 830.6302 OCSPP 830.6304 OCSPP 830.6303
3	Commercial Packaging (Storage stability)	No perforations, leakage, discolorations, darkening and corrosion to packaging material at the conclusion of the storage period				OCSPP 830.6320 Visual
4	pH (1% w/v aqueous dispersion)	7.84 ± 0.01	7.85 ± 0.01	7.85 ± 0.01	7.90 ± 0.03	CIPAC MT 75.3 CIPAC MT 31.1
5	Oxidizing Properties	Non-oxidizing	NA			EEC A.17
6	Flammability	Non-flammable	NA			EEC A.10
7	Relative Self-ignition	More than 400°C	NA			EEC A.16
8	Bulk Density, g/mL -Bulk density -Tap density	0.85 ± 0.00 0.88 ± 0.01	0.85 ± 0.00 0.88 ± 0.00	0.85 ± 0.00 0.88 ± 0.00	0.85 ± 0.00 0.88 ± 0.01	CIPAC MT 186
9	Dry sieve Test - Residue ≥ 90% - Residue ≤ 10%	850 µm 1.18 mm	850 µm 1.18 mm	850 µm 1.18 mm	850 µm 1.18 mm	CIPAC MT 170
10	Attrition resistance (% m/m)	99.31 ± 0.05	99.42 ± 0.06	99.43 ± 0.11	99.51 ± 0.08	CIPAC MT 178.2
11	Dustiness (mg/30g)	1.3 ± 0.2	1.4 ± 0.1	1.5 ± 0.1	1.4 ± 0.1	CIPAC MT 171.1
12	Flowability	Free flowing granules, devoid of lumps	Test item drops spontaneously through the test sieve of 4.75 mm IS sieve			CIPAC MT 172

B.1.4. Hazard identification for physical and chemical properties

Table A.12 Physical hazards and respective characteristics

Hazard class / characteristics	Guideline and Method	Purity of the test substance (% (w/w)	Parameter(s)	Results / Waiver	Reference
Explosives				The study does not need to be conducted because there are no chemical groups associated with explosive properties present in either the active substance constituents or the co-formulant.	
Flammable gases				N/A – product is not a gas	
Flammable aerosols				N/A – product is not an aerosol	
Oxidising gases				N/A – product is not a gas	
Gases under pressure				N/A – product is not a gas under pressure	
Flammable liquids				N/A – product is not a liquid	
Flammable solids	EEC A.10	Test item: [redacted]		Not flammable	Anonymous 2022a

Hazard class / characteristics	Guideline and Method	Purity of the test substance (% (w/w)	Parameter(s)	Results / Waiver	Reference
		[redacted]			
Self-reactive substances and mixtures				The study does not need to be conducted because there are no chemical groups associated with explosive or self-reactive properties present in either the active substance constituents or the co-formulant.	
Pyrophoric liquids				N/A – product is not a liquid	
Pyrophoric solids				Not pyrophoric based on experience in handling and use	
Self-heating substances and mixtures				Relative self-ignition temperature >400°C	
Substances and mixtures which in contact with water emit flammable gases				No flammable gases emitted when product is in contact with water based on experience in handling and use.	
Oxidising liquids				N/A – product is not a liquid	

Hazard class / characteristics	Guideline and Method	Purity of the test substance (% (w/w)	Parameter(s)	Results / Waiver	Reference
Oxidising solids	EEC A.17	Test item: [redacted]		Non-oxidising	Anonymous 2022a
Organic peroxides				The study does not need to be conducted because there are no organic peroxides present in the product	
Corrosive to metals				The study does not need to be conducted because there is no established suitable test method for solids	
Auto-ignition temperature (liquids and gases)				N/A – the substance is not a liquid or gas	
Relative self-ignition temperature for solids	EEC A.16	Test item: [redacted]		>400°C	Anonymous 2022a

Hazard class / characteristics	Guideline and Method	Purity of the test substance (% (w/w)	Parameter(s)	Results / Waiver	Reference
Dust explosion hazard				The product is unlikely to be oxidizable due to its inorganic nature and is dust free. 98% is sepiolite, a clay mineral composed of magnesium silicate.	

B.1.5. Analytical methods for detection and identification

Analytical methods for the analysis of the product as such including the active substance, impurities and residues									
Analyte (type of analyte e.g. active substance)	Analytical method	Fortification range / Number of measurements	Linearity	Specificity	Recovery rate (%)			Limit of quantification (LOQ) or other limits	**Reference**
					Range	Mean	RSD		
Active substance (polysulfides in [redacted])	[redacted]	concentration range of 2.432 µg/mL to 54.720 µg/mL number of measurements = 5	linear (r = 0.99986)	There was no interference observed at the retention time of the analyte.	100.46 to 104.95	103.0	1.32	Not required	Anonymous 2022b

	E								

Analytical methods for monitoring									
Analyte (type of analyte e.g. active substance)	Analytical method	Fortification range / Number of measurements	Linearity	Specificity	Recovery rate (%)			Limit of quantification (LOQ) or other limits	**Reference**
					Range	Mean	RSD		
Not required – refer to active substance data set.									

Analytical methods for soil									
Analyte (type of analyte e.g. active substance)	Analytical method	Fortification range / Number of measurements	Linearity	Specificity	Recovery rate (%)			Limit of quantification (LOQ) or other limits	**Reference**
					Range	Mean	RSD		
Not required – refer to active substance data set.									

Analytical methods for air									
Analyte (type of analyte e.g. active substance)	Analytical method	Fortification range / Number of measurements	Linearity	Specificity	Recovery rate (%)			Limit of quantification (LOQ) or other limits	**Reference**
					Range	Mean	RSD		
Not required – refer to active substance data set.									

Analytical methods for water								
Analyte (type of analyte e.g. active substance)	Analytical method	Fortification range / Number of measurements	Linearity	Specificity	Recovery rate (%)			Limit of quantification (LOQ) or other limits	**Reference**
					Range	Mean	RSD		
Not required – refer to active substance data set.									

Analytical methods for animal and human body fluids and tissues								
Analyte (type of analyte e.g. active substance)	Analytical method	Fortification range / Number of measurements	Linearity	Specificity	Recovery rate (%)			Limit of quantification (LOQ) or other limits	**Reference**
					Range	Mean	RSD		
Not required – refer to active substance data set.									

Analytical methods for monitoring of active substances and residues in food and feeding stuff								
Analyte (type of analyte e.g. active substance)	Analytical method	Fortification range / Number of measurements	Linearity	Specificity	Recovery rate (%)			Limit of quantification (LOQ) or other limits	**Reference**
					Range	Mean	RSD		
Not required – refer to active substance data set.									

Conclusions
A validated method to determine components of the active substance in a test item representative of the active substance is presented in the active substance data set. The method is being read-across here to support determination of the active substance in the biocidal product. Monitoring methods are not required for the biocidal product – refer to active substance data set.

B.2. Efficacy

Please refer to section A.2 where Efficacy is covered in detail.

B.3. Human exposure assessment

The manufacturing process of thermally treated garlic juice covers processes [redacted]
Rapid formation of the marker substances: allyl polysulfides from thiosulfinates is reported, if garlic is exposed to hot water e.g. via cooking (Lawson and Hunsaker, 2018).
[redacted] it is reasonable to anticipate that dietary uptake of industrially manufactured [redacted] garlic food products cover human exposure to allyl polysulfides and other compounds of thermally treated garlic juice used in the biocidal product. Exposure to the biocidal product is expected to be a minor contribution to the potential total uptake of an individual referring to the following assessment.

Thermally treated garlic juice is a UVCB and characterised by the sulfur containing marker compounds: Diallyl monosulfide ($C_6H_{10}S$, 114.05 g/mol), Diallyl disulfide ($C_6H_{10}S2$, 146.27 g/mol), Diallyl trisulfide ($C_6H_{10}S_3$, 178.34 g/mol) and Diallyl tetrasulfide ($C_6H_{10}S_4$, 210.40 g/mol). These diallyl polysulfides are reaction products of the organo-sulfur compounds of the initial raw garlic.

[redacted]

The following quantitative exposure predictions are expressed as levels related to the external exposure to the active substance thermally treated garlic juice [mg/kg bw/d].
In addition, the exposure levels will be expressed as exposure level to allyl polysulfides in [µmol/d] for comparing the exposure levels with the levels given in the table below.
As the exact composition of DAS1, DAS2, DAS3 and DAS4 in the active substance is confidential, the whole amount of diallyl polysulfides is assumed to be diallyl monosulfide (DAS1). This is considered to be the reasonable worst case, DAS1 has the lowest molecular weight among these four diallyl polysulfides leading to the highest µmol-values per weight [mg].

Diallyl polysulfides can be also taken up via diet. Table 4 of Lawson and Hunsaker (2018) provides allyl polysulfide contents of kitchen-prepared and commercial garlic foods.

Table B.3. Composition of garlic products (Source: Lawson and Hunsaker, 2018, table 4)

Commercial garlic foods		
	Dose garlic [g]	Allyl polysulfides [µmol]*
Pickled	12	9.0
Acid-minced	7	21
Oil-chopped	2.5	36
Black garlic	10.2	0.8
Kitchen-prepared garlic foods		
	Dose garlic [g]	Allyl polysulfides [µmol]*
Roasted 160°C	6.1	19.6
Roasted 215°C	5.5	7.9

Boiled 4 min	7.6	1.7
Boiled 45 min	5.5	2.2
Raw, diced	1.5	nd, <0.2

*as _mol of S-allyl per dose consumed

B.3.1. Identification of main paths of human exposure towards active substance from its use in biocidal product

The biocidal product Katzenschreck is intended to be used as a repellent (PT19) for control of domestic cats in outdoor amenity areas by non-professionals. [redacted]

Table B.3. Summary table: relevant paths of human exposure

Summary table: relevant paths of human exposure							
Exposure path	**Primary (direct) exposure**			**Secondary (indirect) exposure**			
	Industrial use	**Professional use**	**Non-professional use**	**Industrial use**	**Professional use**	**General public**	**Via food**
Inhalation	No	No	N.r.	No	No	N.r.	No
Dermal	No	No	Yes	No	No	Yes	No
Oral	No	No	N.r.	No	No	N.r.	No

There are no proposed industrial or professional uses of Katzenschreck.

Non-professional users might be exposed when handling the biocidal product. Exposures may occur via the dermal route. Nevertheless, inhalation and oral exposure are considered to be not relevant. The general public may be indirectly exposed dermally as a result of secondary exposure where they re-enter areas after treatment.

A qualitative risk assessment is prepared, taking into account the hazard profile of the active substance and the biocidal product. To compare dietary uptake, some quantitative exposure estimates are provided for describing the exposure potential and expected levels of exposure.

Inhalation exposure

Katzenschreck is a ready to use non-dusty granule. Referring to the particle size distribution of the granules (≥90% = 850 µm), inhalation exposure from dust particles is not considered to be relevant. The UVCB-substance thermally treated garlic juice reveals a high vapour pressure (2180 Pa at 20°C). Inhalation exposure to gaseous release of volatile substance constituents is expected to be a source of potential exposure. Nevertheless, the treatments are performed outdoors and the amount of thermally treated garlic juice used per m^2 is low (0.2 g/m^2). Therefore, relevant levels of inhalation exposure are not expected.

Dermal exposure

Non-professional users may be exposed dermally when handling the granule. General public might be exposed when they enter treated areas and touch treated surfaces.

Oral exposure

Significant levels of accidental ingestion of granules by an adult user are considered to be

unlikely. The same applies for the general public after entering treated surfaces.

B.3.2. List of scenarios

Summary table: scenarios			
Scenario number	**Scenario (e.g. mixing/ loading)**	**Primary or secondary exposure Description of scenario**	**Exposed group (e.g. professionals, non-professionals, bystanders)**
1.	Outdoor application of the product	Primary exposure: An adult user applies the product Katzenschreck by pouring from the container.	Non-professional
2.	Exposure to the product from re-entry into treated areas	Secondary exposure: An adult and/or child re-enters an area treated with Katzenschreck following the application of the product.	Bystanders (general public)

B.3.3. Industrial exposure

The biocidal product Katzenschreck is not used by industrial users.

B.3.4. Professional exposure

The biocidal product Katzenschreck is not used by professional users.

B.3.5. Non-Professional exposure

The biocidal product is applied to discourage the fouling of borders, beds and other areas of the garden by cats. It is used by non-professional users only. To compare dietary uptake, some quantitative exposure estimates are provided for describing the exposure potential and expected level of exposure.

B.3.5.1. Scenario 1: Primary exposure: An adult user applies Katzenschreck by pouring from the product container.

The solid granular product is applied uniformly by pouring directly from the container. The product is applied by non-professionals [redacted] and is reapplied as required to maintain adequate control.

Pouring directly from container

No model for this particular use and PT is available. Nevertheless, Consumer spraying and dusting model 2 (Hand-held flexible Duster, TNsG 2002 user guidance)[5] is expected to be applicable as conservative approach instead. The model covers scattering granules for broadcast flea treatment (carpet) (directly from package or from bucket with spoon or

[5] Recommendation no. 6 of the BPC Ad hoc Working Group on Human Exposure: Methods and models to assess exposure to biocidal products in different product types, Version 4: model 48 (PT 18)

beaker) and refers to the use of granules (95% of particles greater than 180 µm).

The indicative values provided for the model are:

Dermal exposure:

Hand/forearm: 2.73 mg b.p./min (75th percentile)

Legs/feet/face: 2.74 mg b.p./min (75th percentile)

Inhalation exposure:

2.47 mg b.p./m^3 (75th percentile)

Duration: 120 min

Comparing the use of the biocidal product Katzenschreck and the indicative values of the model, dermal exposure of the body is expected to be limited to hands and forearms, as the the granules of Katzenschreck are significantly bigger than in the model for broadcast flea treatment (180 µm) and the dustiness of the granules of Katzenschreck is low (≥90% = 850 µm).

Based on the same considerations, inhalation exposure to the biocidal product is not expected to be relevant, as the particle size limits the potential for inhalation.

Regarding the duration of treating areas with this biocidal product, no default values are available for this type of product. Applying the biocidal product one hour per activity and day is expected to be a conservative assumption. Applying a single package (maximum size) corresponds to the use of 1000g biocidal product and to the treatment of 100 m^2 (= 10m x 10m).

Potential dermal exposure (external exposure on skin: hands and forearms)

= 2.73 mg b.p./min x 60 min/d x 2% a.s. / 60kg bw[6]

= 0.055 mg a.s./kg bw/d

Considering the default surface area of both hands (820cm^2)[6], the local external dermal exposure concentration on skin is 0.004 mg/cm^2.

= 2.73 mg b.p./min x 60 min/d x 2% a.s. / 820cm^2

= 0.004 mg a.s./cm^2

Considering the active substance thermally treated garlic juice contains up to [redacted] w/w diallyl sulfides, this corresponds to 0.098 mg diallyl polysulfids/d for the user.

= [redacted]

= 0.098 mg diallyl polysulfids/d = 98 µg diallyl polysulfids/d

Assuming the whole amount of diallyl polysulfides to be diallyl monosulfide ($C_6H_{10}S$, 114.05

[6] Recommendation no.14 of the BPC Ad hoc Working Group on Human Exposure: Default human factor values for use in exposure assessments for biocidal products

g/mol = 114.05 µg/µmol) as reasonable worst case, as the exact composition of DAS1, DAS2, DAS3 and DAS4 is confidential, 0.098 mg diallyl polysulfids/d are equal to 0.86 µmol diallyl polysulfids/d. This value corresponds for example to 0.27 g roasted garlic (see table B.3), which is below the chronic dietary uptake for an adult.

Summary table: external exposure from non-professional uses					
Exposure scenario	Tier/PPE	Estimated inhalation uptake (mg/kg bw/d)	Estimated dermal uptake (mg/kg bw/d)	Estimated oral uptake (mg/kg bw/d)	Estimated total uptake (mg/kg bw/d)
Scenario 1	1 / no PPE	n.r.	0.055	n.r.	0.055*

* The local dermal maximum concentration on skin (hands and forearms) is predicted to be 0.004 mg a.s./cm^2 (=4 µg/cm^2).

B.3.5.2. Combined scenarios

Combined exposure is not considered to be relevant based on the infrequent use of the bioicidal product and the low contribution to the total uptake assuming potential dietary uptake in food in addition.

B.3.6. Secondary exposure of the general public excluding dietary exposure

A secondary exposure scenario describes the exposure of individuals to a substance through being present during an application task or being present in places where a substance has been used.

B.3.6.1. Scenario 2: Secondary exposure: An adult and/or child re-enters an area treated with Katzenschreck following the manual application of the product.

Secondary exposure to the product Katzenschreck may potentially occur where a member of the general public (adult, child, toddler) re-enters an area after treatment and is exposed to contaminated areas. The granules have been generated with sufficient weight to penetrate foliage and fall onto the desired target area (the soil of borders, flower beds etc.).

Exposure of toddlers is considered to be the reasonable worst case including potential dermal and oral exposure. Therefore, a quantitative exposure estimate is provided. As no specific model is available, "Recommendation no. 5 of the BPC Ad hoc Working Group on Human Exposure Non-professional use of antifouling paints: exposure assessment for a toddler" is used as a conservative surrogate.

The recommendation contains parameters for estimating exposure of toddlers to paint.

The applied transfer coefficient (3%) of dried paint (here: granules) from treated surface to hand is considered to be representative for the covered areas.

The transfer coefficient (50%) of granules from hand to mouth is expected to be most appropriate, as exposure might also lead to a non-visible granule layer on skin unnoticed by

the parents.

The following parameters of the model are applied for the following calculations.

Parameter	Value
Transfer coefficient of paint from treated surface to hand (for dried paint)	3%[1]
Area of toddler hands – palms only of both hands	115.2 cm^2 [2]
Proportion of palms of hand in contact with the paint (for wet paint)	100%[3]
Transfer coefficient of paint from hand to mouth (for dried paint)	50%[4]
Toddler body weight	10 kg[5]

[1] TNsG (2002), Part 2, page 204 transfer coefficient – dislodgeable residues, substrate: painted wood (MDF), residue of dried fluid on the dried surface of painted wood.
[2, 5] Recommendation no. 14 of the BPC Ad hoc Working Group on Human Exposure - Default human factor values for use in exposure assessments for biocidal products
[3] The hands might be pressed into the paint and smeared around.
[7] For dried paint: A transfer coefficient of 50 % is the default assumption from the Pest Control Fact Sheet (2006; section 2.2.7 "Parameters for hand-mouth contact"). The dried paint does not result in a visible layer on the skin and may go unnoticed by the toddler's parents, and by the toddler itself, when the toddler is mouthing its hands/fingers. Thus, rather than merely sucking two fingers from one hand (as in the wet paint scenario), the toddler could lick/suck the whole of its two hands, but only 40% of the surface area of the palms of both hands is contaminated. In the absence of data to the contrary, it is assumed all dried paint entering the mouth is ingested to become a systemic dose.

Assuming a toddler is exposed to a treated surface (10 g b.p./m^2 = 1 mg b.p./cm^2), the following exposure levels are predicted for the dermal and oral route. As for recommendation no. 5, single exposure per day is assumed.

Dermal exposure

Potential dermal exposure (external exposure on palms of both hands)

= 1 d^{-1} x 1 mg b.p./cm^2 x 2% x 3% x 115.2 cm^2 x 100% / 10kg bw

= 0.007 mg a.s./kg bw/d

The local external dermal exposure concentration on skin is 0.6 µg/cm^2 (amount of a.s. deposited per cm^2 on contaminated skin).

= 1 mg b.p./cm^2 x 2% x 3%

= 0.6 µg a.s./cm^2

Considering the active substance thermally treated garlic juice contains up to [redacted] w/w diallyl sulfides, 0.007mg a.s./kg bw/d correspond to 0.002 mg diallyl polysulfids/d for the exposed toddler.

= [redacted]

= 0.002 mg diallyl polysulfids/d = 2 µg diallyl polysulfids/d

Assuming the whole amount of diallyl polysulfides to be diallyl monosulfide ($C_6H_{10}S$, 114.05 g/mol = 114.05 µg/µmol) as reasonable worst case, as the exact composition of DAS1, DAS2, DAS3 and DAS4 is confidential, 0.002 mg diallyl polysulfids/d are equal to 0. 018 µmol diallyl polysulfids/d.

Oral exposure

Potential oral exposure

= 1 d^{-1} x 1 mg b.p./cm^2 x 2% x 3% x 115.2 cm^2 x 100% x 50%/ 10kg bw

= 0.003 mg a.s./kg bw/d

Considering the active substance thermally treated garlic juice contains up to [redacted] w/w diallyl sulfides, this corresponds to 0.001 mg diallyl polysulfids/d for the exposed toddler.

= [redacted]

= 0.001 mg diallyl polysulfids/d = 1 µg diallyl polysulfids/d

Assuming the whole amount of diallyl polysulfides to be diallyl monosulfide ($C_6H_{10}S$, 114.05 g/mol = 114.05 µg/µmol) as reasonable worst case, as the exact composition of DAS1, DAS2, DAS3 and DAS4 is confidential, 0.001 mg diallyl polysulfids/d are equal to 0.009 µmol diallyl polysulfids/d.

Summary table: external exposure of toddler (secondary exposure)

Exposure scenario	Tier/PPE	Estimated inhalation uptake (mg/kg bw/d)	Estimated dermal uptake (mg/kg bw/d)[1]	Estimated oral uptake* (mg/kg bw/d)[1]	Estimated total uptake (mg/kg bw/d)
Scenario 2	1 / no PPE	n.r.	0.007	0.003	0.010

* The local dermal maximum concentration on skin (hands and forearms) is predicted to be 0.6 µg a.s./cm^2.
[1]Reasonable worst case oral exposure is considered to be 50% oral uptake of dermal (=total) exposure on skin (via hand-to-mouth transfer).

B.3.6.2. Combined scenarios

Combined exposure is not considered to be relevant based on the infrequent use of the bioicidal product and the low contribution to the total uptake assuming potential dietary uptake in food in addition.

B.3.7. Dietary exposure from the use of the product

Dietary exposure is not relevant based on the proposed use of the product. Because of the outdoor use in private areas and surroundings only, contamination of food or drinking water and exposure to livestock is not foreseen.

B.3.7.1. List of scenarios

No scenarios assessed.

B.3.7.2. Information of non-biocidal use of the active substance

Summary table of other (non-biocidal) uses			
	Sector of use[1]	**Intended use**	**Reference value(s)[2]**
1.	Plant protection use	Insecticide, nematicide & repellent	None derived; no AOEL or MRL set.

B.3.7.3. Estimating Livestock Exposure to Active Substances used in Biocidal Products

Not applicable. Exposure of livestock to the product Katzenschreck will not occur; the uses proposed would not result in livestock exposure.

B.3.7.4. Estimating transfer of biocidal active substances into foods as a result of professional and/or industrial application(s)

Not applicable. The product Katzenschreck has no professional/industrial uses ; there is no potential for transfer of the biocidal active substance into food as a result of professional/industrial use.

B.3.7.5. Estimating transfer of biocidal active substances into foods as a result of non-professional use

Not applicable. The transfer of the active substance into food as a result of non-professional use is not envisaged.

B.3.8. Exposure associated with production, formulation and disposal of the biocidal product

Manufacture of the active substance, formulation of the product and its subsequent packaging are not within the scope of BPR, and therefore, have not been addressed within this dossier as other legislation applies. The disposal of the product Katzenschreck should at all times comply with the requirements of relevant waste and environmental protection legislation and in accordance with regional authorities.

B.3.8.1. Scenarios

Not considered relevant.

B.3.8.2. Combined scenarios

Not considered relevant.

B.3.9. Combined residential scenarios

Combined exposure is not considered relevant.

B.4. Environmental exposure assessment

General information

Assessed PT	PT 19
Assessed scenarios	Quantitative environmental risk assessment was not considered necessary. The environmental background concentrations of polysulfides released into the environment due to agricultural activity is compared with the emissions of polysulfides reaching soil based on the proposed application rate.
ESD(s) used	-
Approach	Quantitative environmental risk assessment was not considered necessary. A qualitative environmental risk assessment based on a study (Anonymous 2021h) submitted by the applicant was conducted.
Distribution in the environment	Direct emission to soil
Groundwater simulation	No
Confidential Annexes	No
Lifecycle steps assessed	Production: No Formulation: No Use: No Service life: No
Remarks	-

Biocidal product specific data

The product is intended for outdoor use as a PT19 cat repellent used by non-professionals only, with intended applications to soil or gravel surface due to application on lawns and flower beds. The product does not contain any environmentally relevant substances of concern or co-formulants which are likely to affect the overall fate (degradation or mobility) or ecotoxicity profile of the active substance in the environment. Therefore, the ecotoxicological effects and environmental fate and behaviour of the product may be adequately extrapolated from data available for the active substance only.

B.4.1. Emission estimation

Available information on the active substance indicates that the substance is not classified as an acute or chronic environmental hazard under the CLP criteria, is not bioaccumulative and is expected to be rapidly degradable in the environment.

The applicant submitted a study (Anonymous 2021h) showing the effective concentrations released into the environment through agricultural activity and compare the emissions due to the maximum approved application levels proposed by application of the biocidal product. The approach taken in this study is estimating the concentration of sulfoxides (as Polysulfide Alliin Equivalents), which would arise in soil if garlic (*Allium sativum*) and onion (*Allium cepa*) crops were tilled back into the field (e.g. tillage of non-marketable crop). The estimates are based on field yields of onion and garlic that are produced in the Europe and sulfoxide (alliin) content found in these crops based on literature data.
The Alliums are rich in sulfur chemistry and the bioactive molecules they produce are organo-sulfur molecules (polysulfides). The polysulfides are formed in the Alliums by an enzymatic reaction when plants/ bulbs are crushed. When fresh garlic is chopped or crushed, sulfoxides are cleaved by enzyme allinase to sulfenic acid intermediates, whose condensation produces thiosulfinates (e.g. allicin) which features the thiosulfinate functional group, R-S(O)-S-R. Allicin changes into a series of other sulfur-containing compounds such as diallyl disulfides (polysulfides).
The substrate/ precursor in this enzymatic reaction is a "sulfoxide" (alliin in case of garlic). The amount of this sulfoxide present in plant can give an estimate of polysulfides that can be release from a crop. The onion was used for the lower bound estimate because of the much lower alliin content occurring in this plant in comparison to garlic which was used for the upper bound estimate.
The study states that the values calculated from average garlic yield and minimum and maximum alliin equivalents are considered for emission estimates. The average estimated concentration of sulfoxides (as Polysulfide Alliin Equivalents (PAE)) range between 3.2 kg/ha and 64.7 kg/ha (Anonymous 2021h).

The emission calculation regarding the application of the biocidal product in this study is based on an estimated maximum amount of polysulfide contents in the active substance of 3.6% (Anonymous 2021h). [redacted]

The emission calculation regarding the application of the biocidal product will release a fraction [redacted] multiplied by a fraction of 3.6% polysulfides according to Anonymous 2021h) and [redacted] biocidal product Katzenschreck included in this active substance dossier, calculated by the eCA), respectively.

[redacted]

Comparing emissions of the biocidal product application with the minimum and maximum residue values, agricultural activity leads to 44 and 899 times higher emissions. Environmental risk is therefore considered to be negligible compared to agricultural activity and therefore no quantitative risk assessments is considered.

A semiquantivative risk assessment was conducted (cf. Appendix III: environmental emission and exposure calculations) for the environmental compartment soil due to direct release to soil based on application of the b.p. The PEC/PNEC ratio is <1 and therefore no unacceptable risk is identified for the environmental compartment soil.

B.4.1.1. Scenarios

A semi-quantitative risk assessment was conducted (cf. Appendix III: environmental emission and exposure calculations) for the environmental compartment soil due to direct release to soil based on application of the b.p. The PEC/PNEC ratio is <1 and therefore no unacceptable risk is identified for the environmental compartment soil.

For the sake of completeness:
Treatment of paved grounds is not part of the intended use. Objects to be protected are lawns and flower beds. The description of use is as follows: "Carrier based biocidal product for garden use (outdoor). Deters cats from defecating in treated areas." Thinking about typical defecation behaviour of cats it is not expected that defecation will take place on paved grounds as cats prefer areas with substrate to scrape and dig around and to cover their faeces. Summarising all mentioned points no necessity is seen to consider release pathways to STP via paved grounds.

B.4.2. Fate and distribution in exposed environmental compartments

The product is applied as a granular formulation to soil or gravel surfaces, by lightly scattering over the area to be protected (lawns, flower beds). Direct exposure to the soil compartment will therefore occur due to product use.

The product does not contain any co-formulants which would affect the environmental fate properties of the active substance once released into the environment. Consequently, the data available for the active substance can be adequately extrapolated to the product formulation and the environmental properties of the formulated product have not been specifically tested.

Thermally treated garlic juice is derived from a natural plant material consisting of a complex mixture of naturally occurring compounds (polysulfides and plant matrix) which are expected to degrade rapidly in the environment like any other plant debris. Thermally treated garlic juice is subject to degradation in the same way as any other plant debris and its degradation products are the same as substances naturally found in the environment. Fast degradation of the active components of thermally treated garlic juice can be confirmed by the hydrolysis study (DT50 = 16.3 h at pH 7 and 12°C) and supported by a freshwater degradation study which indicate a half-life of 4.8 days. In addition, the US EPA stated that "garlic is presumed to be non-persistent since it is material known to rapidly degrade in the environment" (US EPA 1992).

An estimate of the half-life in air of the thermally treated garlic juice marker molecules, resulting from photochemical oxidative degradation by reaction with atmospheric hydroxyl radicals is available and was shown to range from 0.745 to 5.591 hours via the Atkinson model (performed with the Atmospheric Oxidation Program, assuming a constant hydroxyl concentration of 5E05 radicals/cm^3). Hydrogen abstractions and reactions with nitrogen and sulfur were predicted to contribute to the overall atmospheric photochemical degradation pathway, and the overall bimolecular rate constant for the process (kOH) was calculated to be 68.87E-12 to 517.17E-12 cm^3/molecule-sec. The photochemical oxidative degradation of garlic in air is therefore concluded to be rapid and consequently, air is not an environmental compartment of concern.

Identification of relevant receiving compartments based on the exposure pathway									
	Fresh - water	Sediment	Sea-water	Seawater sediment	STP	Air	Soil	Ground - water	Other
Scenario	-	-	-	-	-	-	+	+	-

B.4.3. Calculated PEC values

Quantitative environmental risk assessment was not considered necessary and consequently PEC values were not calculated.

B.4.4. Primary and Secondary poisoning

The EFSA conclusion on garlic extract (2012) states that the active substance (renamed under BPR to "*thermally treated garlic juice*"), is a repellent for birds and mammals and

consequently concluded that the risk of garlic extract (BPR name: thermally treated garlic juice) to birds and mammals can be considered as low. Furthermore, the active substance was concluded to be not bioaccumulative due to having a partition coefficient (log Kow) value of -1.49 (i.e. less than the trigger value of 3). It is therefore concluded that for thermally treated garlic juice the risk of primary and secondary poisoning is negligible.

B.5. Assessment of effects on Human Health for the product

B.5.1. Product

The carrier based biocidal product 'KATZENSCHRECK' comprises of 100% w/w thermally treated garlic juice (formerly named "*garlic extract*") which contains diallyl polysulfides as active marker molecules (the carrier (cf. appendix VI) was not considered for the classification). The product is intended to be used as a repellent (PT19) for the control of domestic cats in outdoor amenity areas.
The product does not contain any co-formulant that is considered as substance of concern (SoC) or any endocrine disruptor's property.

B.5.2. Dermal absorption

No product specific dermal absorption data were submitted. No systemic exposure assessment was performed.

Data waiving	
Information requirement	Dermal Absorption
Justification	Data was not considered necessary as no systemic exposure calculations were required.

B.5.3. Acute toxicity

Please see section A.3.2

B.5.4. Corrosion and irritation

Please see section A.3.3.

B.5.5. Sensitisation

B.5.5.1. Skin sensitisation

Data for the biocidal product (100 % thermally treated garlic juice, formerly named "*garlic extract*") are compiled in section A.3.5. In addition the applicant submitted experimental data with a granular based product [redacted] used as a pesticide. However, as the batch did not support the reference specification the results are briefly summarized for information only.
Nevertheless, it is likely that the carrier based biocidal product [redacted] ([redacted] thermally treated garlic juice) has a lower or no sensitising potential. However, in absence of adequate data, classification is based on thermally treated garlic juice 100% without the consideration of the carrier component

Method, Route of exposure, Guideline, GLP status, Reliability, Key/suppor. study	Species, Strain, Sex, No/group	Test substance (including purity)	Results (e.g. EC3-value or amount of sensitised animals at induction dose)	Reference
Buehler test Topical application OECD 406 GLP Reliability 4	Guinea pig Hartley Male & Female 20/gp	[redacted]	No. of animals showing reactions following induction: 0/20	Anonymous 2011c

Supporting study		[redacted]		

Conclusion used in Risk Assessment – Skin sensitisation	
Value/conclusion	Skin sensitiser
Justification for the value/conclusion	The conclusion is based on the result of a regulatory accepted GLP study for skin sensitisation with thermally treated garlic juice (formerly named "garlic extract").
Proposed classification	Skin Sens. 1B, H317

B.5.5.2. Respiratory sensitisation

Please see section A.3.6.

B.5.6. Other

No other data were submitted.

B.6. Environmental effects assessment for the product

B.6.1. Atmosphere

The photochemical oxidative degradation half-life of thermally treated garlic juice marker molecules (diallyl sulfide, diallyl disulfide, diallyl trisulfide and diallyl tetrasulfide) was shown to range from 0.745 to 5.591 hours via the Atkinson model (version 1.92) (assuming a constant hydroxyl concentration of 5E5 radicals/cm^3). Hydrogen abstractions and reactions with nitrogen and sulfur were predicted to contribute to the overall atmospheric photochemical degradation pathway, and the overall bimolecular rate constant for the process (kOH) was calculated to range from 68.87E-12 to 517.17E-12 cm^3/molecule-sec. The photochemical oxidative degradation of garlic in air is therefore concluded to be rapid and consequently, air is not an environmental compartment of concern.

B.6.2. STP

Although garlic possesses antibacterial activity, to date the literature does not report effects on wastewater treating bacteria. Furthermore, the active compounds in thermally treated garlic juice are polysulfides and based on their chemical structure it can be assumed that during the activated sludge treatment these compounds are easily degradable by microorganisms using them as energy, carbon, and sulfur source. It is therefore considered that toxicity to sewage treatment plant microorganisms is unlikely.

B.6.3. Aquatic compartment

Acute freshwater toxicity study data are available for three taxonomic groups (fish, invertebrates, algae) for the active substance (thermally treated garlic juice), with the most conservative EC50 value being 11.7 mg/L (from a 96-hour acute fish toxicity study). Chronic freshwater toxicity data are not available or considered necessary, given that continuous direct release to surface water will not occur based on the intended use of the active substance. Thermally treated garlic juice is processed from food grade material [redacted] and available information indicates that the substance is not classified as an acute or chronic environmental hazard under the CLP criteria, based on acute freshwater toxicity data and the fact that the substance is not bioaccumulative and is readily degradable in the environment. Risk to the aquatic compartment is therefore considered to be negligible.

B.6.4. Terrestrial compartment

Data are available for acute toxicity to earthworms and toxicity to soil microorganisms for the active substance (thermally treated garlic juice), with the most conservative LC_{50} value being 4729.1 mg/kg soil dry weight from the acute earthworm toxicity study. Thermally treated garlic juice is processed from food grade material obtained from crushed garlic cloves and available information indicates that the substance is not bioaccumulative and readily degradable in the environment. Risk to the terrestrial compartment is therefore considered to be negligible.

B.6.5. Primary and Secondary poisoning

The EFSA conclusion on garlic extract (2012) states that the active substance (renamed under BPR to thermally treated garlic juice), is a repellent for birds and mammals and consequently concluded that the risk of garlic extract (BPR name: thermally treated garlic juice) to birds and mammals can be considered as low. Furthermore, the active substance was concluded to

be not bioaccumulative due to having a partition coefficient (log Kow) value of -1.49 (i.e. less than the trigger value of 3). It is therefore concluded that for thermally treated garlic juice the risk of primary and secondary poisoning is negligible.

C. Risk characterisation of the biocidal product(s)

C.1. Risk Characterisation for human health

C.1.1. Critical endpoints

C.1.1.1. Systemic effects

No data were submitted. For justifications please see section A.3.

C.1.1.2. Local effects

Route	Study (reference) Test substance	Relevant effects NOAEC/LOAEC	Classification	Hazard category[1]
Dermal	LLNA (Anonymous 2016e) [redacted] (100% thermally treated garlic juice, formerly named "*garlic extract*")	Moderate skin sensitiser[1]	Skin. Sens 1B, H317	Medium
	Primary dermal irritation (Anonymous 2011a) [redacted] (100% thermally treated garlic juice, formerly named "*garlic extract*")	Signs of irritation, but not sufficient for classification according to Reg. (EC) No. 1272/2008	None	None

[1] According to ECHA guidance Vol III Part B (ECHA, 2017).

C.1.1.3. Absorption

Route	Study	Test substance and concentration of a.s.	Value
Oral	--	--	--
Dermal	--	--	--
Inhalation	--	--	--

No experimental data were submitted.

C.1.2. Reference values

C.1.2.1. Reference values to be used in Risk Characterisation

No data for the derivation of quantitative reference values are available. Therefore, no reference values have been deduced and a qualitative risk assessment has been conducted. Nevertheless, a quantitative exposure assessment has been prepared and is given in section B.3 for describing the exposure potential to humans via use of this biocidal product.

For skin sensitisation no local reference values were derived based that for this hazard category no quantitative local risk assessment is normally performed (ECHA, 2017).

EFSA (2020) stated the dietary intake values of the European population to garlic from PRIMoV3.1[7]. The largest chronic consumption of garlic is 0.0833 g/kg bw/d (for RO (Romania) general, equal to an intake of 4.9 g/day). For children (Italy) the largest chronic consumption is 0.0182 g/kg bw/d. The 97.5th percentile consumption was 0.64 g/kg bw, corresponding to an intake of 42.7 g/day (for an UK vegetarian) representing largest acute consumption. For children (Italy) the value is 3.53 g/kg bw according to the PRIMoV3.1 tool.

C.1.2.2. Uncertainties and assessment factors

No systemic reference values were derived, thus no AF were assigned.

C.1.2.3. Maximum residue limits or equivalent

Not relevant.

C.1.2.4. Specific reference value for groundwater

Not relevant.

C.1.3. Industrial uses

There are no industrial exposure scenarios relevant to the PT19 use of the product Katzenschreck; the biocidal product is intended for non-professional use only.

C.1.4. Professional uses

There are no professional exposure scenarios relevant to the PT19 use of the product Katzenschreck; the biocidal product is intended for non-professional use only.

C.1.5. Non-professional users

The biocidal product is applied to discourage the fouling of borders, beds and other areas of the garden by cats. The solid (granular) carrier based biocidal product is intended to be applied by non-professional users (only), without dilution, [redacted] with reapplication after 10 days or shorter in case of rain. [redacted] They are applied uniformly by pouring directly from the container and are reapplied as required to maintain adequate control. As the treatments are performed outdoors, the amount of thermally treated garlic juice used per m^2 is low [redacted]

C.1.5.1. Systemic effects

Risk Characterisation for systemic effects

No toxicological reference values (AELs) have been defined for the active substance (cf.

[7]Available at https://www.efsa.europa.eu/en/applications/pesticides/tools 2022-12-19

section A.3.1 and B.3 for justifications).

Referring to the human exposure section, inhalation and oral exposure are not considered to be relevant.

Regarding dermal exposure, 0.055 mg a.s./kg bw/d potential dermal exposure on skin (4 µg/cm^2) are predicted for pouring directly from a container.

It needs to be taken into account that these exposure levels are no internal exposure levels, absorption values are not considered to allow a better comparison with dietary intake values.

The EFSA conclusion on the pesticide risk assessment for garlic extract (renamed under BPR to "*thermally treated garlic juice*") states that "consumer exposure from the culinary use of garlic will be significantly higher than exposure from the use as a plant protection product", (EFSA, 2012). The application rate of the product [redacted]

Chronic dietary intake of garlic range from 0.0002 to 0.065 g/kg bw/day (= 0.2 to 65 mg/kg bw/d), corresponding to a daily portion from 0.013 to 3.9 g depending on the country or region (EFSA, 2012). In 2020 EFSA used the updated dietary intake values of the European population to garlic from PRIMoV3.1. The largest chronic consumption of garlic is 0.0833 g/kg bw/d (~83 mg/kg bw/d for RO general, equal to an intake of 4.9 g/d). The 97.5th percentile consumption was 0.64 g/kg bw/d, corresponding to an intake of 42.7 g/day (for an UK vegetarian) for acute consumption (EFSA, 2020).
These figures on dietary garlic intake do not distinguish between the different forms and preparations of garlic (e.g. raw, cooked, boiled garlic) resulting in potentially different compositions of compounds taken up. Nevertheless, **0.055 mg/kg bw/d external dermal exposure to thermally treated garlic juice is low in this context.** However, a comparison is further hampered with respect to the "concentration" step during active substance manufacturing (cf. appendix VI for more detailed information). The constituents of thermally treated garlic juice like the marker substances could be constituents of the diet as well. Referring to the exposure assessment of adult users, 0.055 mg a.s./kg bw/d was estimated to correspond to 0.86 µmol diallyl polysulfids/d (marker substances). Some garlic foods (please see section B.3.) are considered to be significant higher sources of exposure. For example, 6.1 g roasted garlic (160°C) contains 19.6 µmol allyl polysulfides. 0.86 µmol corresponds to 0.27 g roasted garlic (see table B.3), which is below the chronic dietary uptake for an adult of 4.9 g/d. Thus, preparations of garlic intended for food or supplements are also expected to reveal similar constituents and quantities of constituents like thermally treated garlic juice.
This assumption is also supported by toxicokinetic data. It is concluded that allyl polysulfides present in thermally treated garlic juice supported under the BPR are metabolized similar than kitchen prepared garlic. Literature data indicate rapid uptake and metabolism of garlic compounds after oral uptake. Kitchen prepared (e.g. boiled) garlic including alliinase-inhibited foods produced less of the breath detectable metabolite allyl methyl sulfide (AMS) compared to raw garlic homogenate. However, the amounts detected indicate that intrinsic AMS formation from S-allyl compounds still occurred (Lawson and Hunsaker, 2018, cf. also section A.3.1).

It seems to be conclusive, that the uptake of allyl polysulfides and other thermally treated garlic juice compounds might lead to potentially significantly higher contributions to the total uptake via diet than the biocidal use.
Whereas the use of the biocidal product is not envisaged to be performed daily, dietary uptake might be more frequent. In addition, the predicted exposure levels are external exposure levels. A lower dermal absorption than the predicted value is not taken into account. Washing hands after use is not considered in this worst case calculation, as recommended by the label, which will reduce further the exposure.

C.1.5.2. Local effects

Risk Characterisation for local effects

Hazard		Exposure					Risk	
Hazard category	Effects in terms of C&L	Who is exposed	Tasks, uses, processes	Potential exposures route	Frequency and duration of potential exposure	Potential degree of exposure	Relevant RMM & PPE	Conclusion on risk
Medium	Skin Sens. 1B, H317 Moderate sensitiser	Non-professional	Application of product from shaker pack	Dermal	Max. 60 minutes, repetition after 10 days or less depending on rainfall	Exposure expected to be low (pouring directly from container) Hand exposure was estimated: 4 µg/cm^2	Labelling as skin sensitiser Non-dusty granule product Washing of hands after use/contact Keep out of reach of children	Risk acceptable + limited frequency + high ventilation + low exposure + level of exposure during application would most likely not induce skin sensitisation due to an EC3 value 11.18% or 2 795 µg/cm^2

C.1.5.3. Conclusion

Regarding the envisaged use of the biocidal product, dermal exposure is considered to be the main route of exposure. Inhalation exposure is not considered to be relevant based on the particle size, distribution and anti-dustiness of the product was well as outdoor use. Oral exposure is not considered to be relevant for adult users in this case.

Primary exposure to the active substance is expected to be low as demonstrated by the exposure predictions and considering dietary consumption of kitchen-prepared foods containing garlic (as well as commercial garlic products). As garlic reveals different compositions of sulfur containing compounds based on its preparation, the calculated exposure levels were also converted to µmol diallyl polysulfids/d. These values are also low in comparison to amounts of polysulfids taken up by particular garlic foods.

Therefore, exposure to the active substance thermally treated garlic juice is considered to be covered by common dietary uptake.

The local risk to non-professional users during application of the carrier based biocidal product Katzenschreck is acceptable without the use of PPE. Packaging, labelling and safety instructions are adequate and dermal exposure during application is low due to pouring the product from a container. Moreover, use instructions include « Pour directly from the container and wash hands after use ». In addition, the predicted dermal exposure levels would likely not induce skin sensitisation.

C.1.6. Secondary (indirect) exposure as a result of use

Secondary exposure to the product Katzenschreck may potentially occur when a member of the general public (adult, child, toddler) re-enters an area after treatment and is exposed to contaminated areas.

The exposure of general public that would occur falls within the risk envelop considered for the individual directly handling the product. This is considered to apply for children and toddlers as well, as the concentrations deposited on skin are expected to be significantly lower than the calculated levels for non-professional exposure. The estimate is supported by a quantitative exposure calculation and compared to dietary intake values for toddlers. A local risk assessment was performed for the general population as well.

C.1.6.1. Systemic effects

No toxicological reference values (AELs) have been defined for the active substance (cf. section A.3 for justifications). Dietary exposure to compounds of the active substance (like the marker substances DAS1 to DAS4) is expected to exceed potential systemic exposure via the biocidal use (cf. section C.1.5.1 for dietary intake values).

Exposure of toddlers is considered to be the reasonable worst case including potential dermal and oral exposure. Secondary exposure of toddler was predicted to be 0.010 mg a.s./kg bw/d (dermal concentration: 0.6 µg a.s./cm^2) for entering treated areas (corresponding to 0.018 µmol diallyl polysulfids/d).

Some garlic foods (please see section B.3.) are considered to be significant higher sources of potential exposure. For example, 6.1 g roasted garlic (160°C) contains 19.6 µmol allyl polysulfides. 0.018 µmol corresponds to 5.6 mg roasted garlic. Assuming a bodyweight of 10 kg for toddler, the predicted exposure via the b.p. is equal to the exposure to 0.56 mg roasted

garlic/kg bw/d.

In 2020, EFSA used the dietary intake values of the European population to garlic from PRIMoV3.1 for adults (EFSA, 2020). In this data base also dietary intake values for toddlers are reported for two countries. The intake values in PRIMo rev.3.1 ranged from 0.0051 to 0.0101 g/kg bw/d for toddlers in France and Italy, respectively (EFSA_PRIMo_rev3.1 Excel, 2018). Thus for toddlers the biocidal exposure of 0.007 mg/kg bw/d is far below the dietary intakes of 5.1 to 10.1 mg/kg bw/d. Assuming a bodyweight of 10 kg for toddler, these intake values correspond to 51 and 101 mg/d.

C.1.6.2. Local effects

Risk Characterisation for local effects

Hazard			Exposure				Risk	
Hazard category	Effects in terms of C&L	PT	Who is exposed	Tasks, uses, processes	Potential exposures route	Frequency and duration of potential exposure	Potential degree of exposure	Relevant RMM & PPE	Conclusion on risk
Medium	Skin Sens. 1B, H317		General public	Secondary exposure to applied product	Dermal, Frequent exposure not expected	Any exposure of general public that would occur is expected to fall within the risk considered for the individual directly handling the product (4 µg a.s./cm^2). Frequent exposure not expected Application rate: 10 g b.p./m^2	Potential for exposure is low (outdoor use). Product is expected to be applied in areas where secondary exposure is unlikely. The granules have been generated with sufficient weight to penetrate foliage and fall onto the desired target area (the soil of borders, flower beds etc.). Therefore, it is unlikely, that deposited amounts are transferred or dislodged significantly via dermal contact. Any exposure of general public that would occur is expected to fall within the risk considered for persons directly handling the product.	Labelling as skin sensitiser Non-dusty granule product Washing of hands after contact Keep out of reach of children	Risk acceptable +limited frequency +low exposure +high ventilation (outdoor use) +expected level of exposure and skin concentration of Katzenschreck is not considered to induce sensitisation

C.1.6.3. Conclusion

Regarding the envisaged use of the biocidal product, dermal exposure is considered to be the main route of secondary exposure. Inhalation exposure is not considered to be relevant as the biocidal product is applied outdoors. Hand-to-mouth transfer of toddlers was considered regarding entering treated areas. Dietary exposure is expected to exceed the secondary systemic exposure of the biocidal product as demonstrated by a comparison of a reasonable worst case exposure calculation and dietary intake data for garlic for toddlers. However, significant exposure of toddlers and children via dermal and hand-to-mouth transfer is prevented by the pattern of use and by the risk mitigation measure "Keep out of reach of children".

The local risk to the general public from secondary exposure is acceptable without the use of PPE.

C.1.7. Indirect exposure via food

Based on the proposed use of the product, contamination of food, drinking water and livestock is not foreseen.

For the general population dietary uptake of garlic in food occurs.

C.1.8. Other (domestic animals)

Available literature indicate that some animal species are sensitive to garlic, especially cats and dogs (e.g. Salgado et al., 2011, Cope, 2005, Gugler et al., 2013, Cortinovis and Caloni, 2016, Kovalkovicova et al., 2009). Ingestion of garlic has been shown to induce haemolytic anemia and haemolyses in these sensitive species. Based on the mode of action of the carrier-based biocidal product cats are less likely to defecate in treated areas but are still present in the treated area, and therefore exposed in this context.

Tolerable doses for onion or synthetically derived isolate from cooked onion are available in literature. Consumption of around 5 g/kg of onions in cats or 15 to 30 g/kg in dogs has resulted in clinically hematologic changes. Onion toxicosis is consistently noted in animals that acutely ingest more than 0.5% onions of the body weight (Cope, 2005, Gugler et al., 2013, Yamato et al., 1998).

For dogs garlic is considered to be less toxic compared to onion (Salgado et al., 2011). Lee et al. (2000) fed a dose of 5 g/kg bw/d garlic extract over a period of 7 days to mixed-breed dogs. No dog developed clinically hemolytic anemia but changes in hematology including haemolyses from oxidative injury to erythrocytes occurred. One of the bioactive substances is sodium 2-propenyl thiosulfate identified in boiled garlic. The compound was incubated with canine erythrocytes that resulted in increased methemoglobin concentration and Heinz body formation (Yamato et al., 2003). However, the dose of 5 g/kg bw/d is several factors of magnitude higher than the calculated primary and secondary exposure values for adults and toddlers (cf. section C.1.5 and C.1.6.). No harmonized scenario is available to calculate exposure for pets including dogs. Efficacy studies regarding the treatment of food trays or its vicinity for cats and rabbits with biocidal products of thermally treated garlic juice (formerly named "*garlic extract*") were originally submitted (Anonymous 1993, Anonymous 2000b; Anonymous 2001). These studies could not be considered for the efficacy assessment based on an e-consultation in October 2019 ("e-consultation for active substances formerly covered

by the food and feed derogation") because treated food trays are not considered relevant to show an effect of the reduction of defaecation in desired areas (gardens). However, the application of the product near or in the food tray reduced the consumption of feed. This indicates a repellency effect of thermally treated garlic juice concerning feed uptake.

In a rabbit feeding repellency trials (Anonymous, 2000b and 2001) 20 individually caged rabbits (*O. cuniculus*) received their feed in bowls either untreated or with wrapped garlic granules (45% active substance, but without direct feed contact at the bottom) for up to 6 weeks. A two-choice test was used, with sliced carrot presented in two separate bowls, one with control prills and one with the test item. Bowls were placed in separate feeding stations, located as far apart as possible within the pen to avoid garlic odour impacting upon the control. The results indicated that on average the rabbits ate more carrot from the bowls with non-garlic prills than from the bowls with the biocidal product.

For cats a field study has been provided concerning feed consumption (Anonymous, 1993, summary provided in section B.2). [redacted]

These results are in line with feeding habits of cats that are very selective in their alimentary pattern. Thus only very few poisoning cases with *Allium spp*. were reported for Italy, 4 cats compared to 69 dogs between 1994 and 2008 (Cortinovis and Caloni, 2016). Onion or garlic bulbs have been fed (un)intentionally or accidentally via the diet as reported in poison cases in the literature (e.g. Cortinovis and Caloni, 2016, Kovalkovicova et al., 2009, Salgado et al., 2011, Yamato et al., 2003).

The carrier-based biocidal product Katzenschreck is not intended to be mixed up with feed. In conclusion it is extremely unlikely due to the mode of action (olfactory repellent) that thermally treated garlic juice on an inert carrier will be consumed by cats or other animals. The qualitative risk assessment for domestic animals is acceptable for the intended use.

C.2. Risk characterisation for the environment

C.2.1. Atmosphere

The photochemical oxidative degradation half-life of thermally treated garlic juice marker molecules (diallyl sulfide, diallyl disulfide, diallyl trisulfide and diallyl tetrasulfide) was shown to range from 0.745 to 5.591 hours. The photochemical oxidative degradation of garlic in air is therefore concluded to be rapid and consequently, air is not an environmental compartment of concern.

C.2.2. Sewage treatment plant (STP)

The sewage treatment plant is not considered to be a compartment of concern.

C.2.3. Aquatic compartment

Due to the intended use of application on lawns and flower beds the aquatic compartment is not considered to be affected.

C.2.4. Terrestrial compartment

The applicant submitted a study (Anonymous 2021) showing the effective concentrations released into the environment through agricultural activity and compare the emissions due to the maximum approved application levels proposed by application of the biocidal product.

The study states that the values calculated from average garlic yield and minimum and maximum alliin equivalents are considered for emission estimates. The average estimated concentration of sulfoxides range between 3.2 kg/ha and 64.7 kg /ha.

The emission calculation regarding the application of the biocidal product is based on the maximum amount of polysulfide contents in the active substance of 3.6%.

The emission calculation regarding the application of the biocidal product will release a fraction [redacted]

Comparing emissions of the biocidal product application with the minimum and maximum residue values, agricultural activity leads to 44 and 899 times higher emissions.

A semi-quantitative risk assessment was conducted (cf. Appendix III: environmental emission and exposure calculations) for the environmental compartment soil due to direct release to soil based on application of the b.p. The PEC/PNEC ratio is <1 and therefore no unacceptable risk is identified for the environmental compartment soil.
Based on the considerations above an environmental risk is therefore considered to be negligible.

C.2.5. Groundwater

A groundwater assessment was conducted (cf. Appendix III: Environmental emission (and

exposure) calculations) and the trigger value of 0.1 µg/L of the drinking water directive (EU 2020/2184) was exceeded. However, thermally treated garlic juice meets the cut-off criteria by having a DT50<21 d at 20°C and a Koc>500 L/kg and therefore, no unacceptable risk is expected regarding the environmental compartment groundwater.

C.2.6. Primary and Secondary poisoning

The bioaccumulation potential of thermally treated garlic juice is considered to be low, given that the log Kow was determined to be -1.49 (i.e. <3). Consequently, no unacceptable risk is considered regarding primary and secondary poisoning.

C.2.7. Aggregated exposure (combined for relevant emission sources)

Based on the "decision tree on the need for estimation of aggregated exposure", no risk assessment regarding aggregated exposure is assumed.

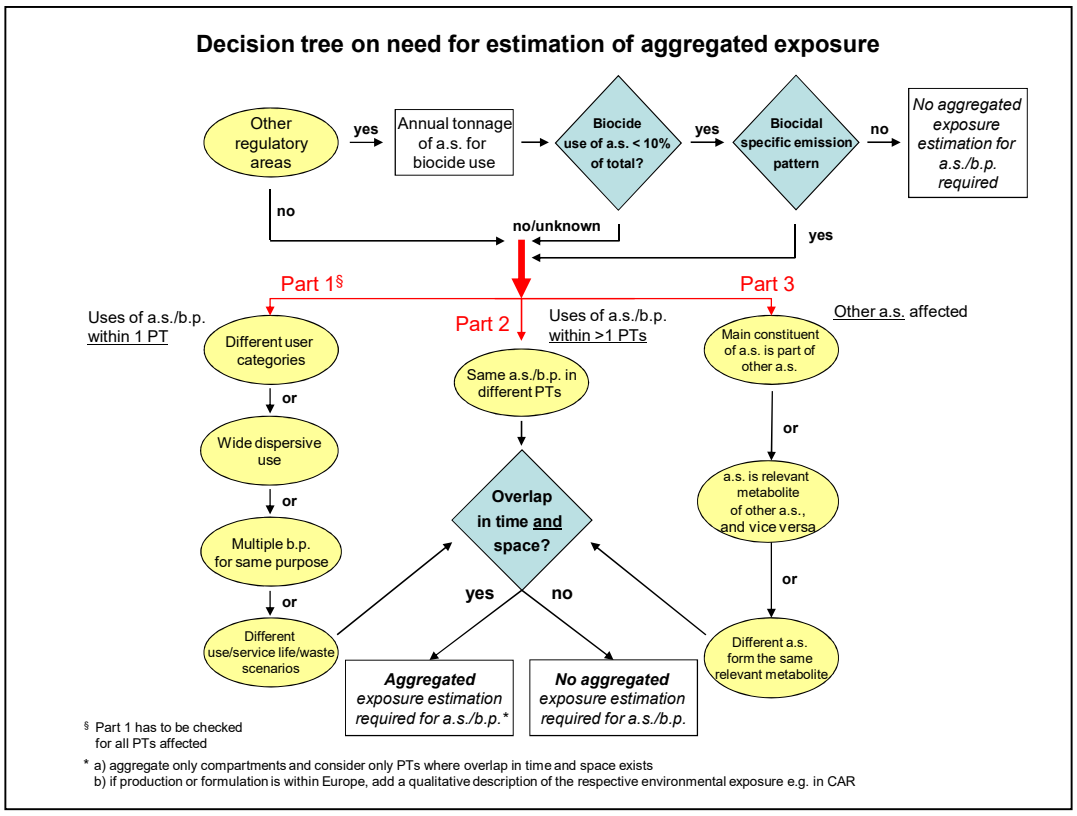


Figure 1: Decision tree on the need for estimation of aggregated exposure

C.3. Risk characterisation for the physico-chemical properties

The results of the relevant studies show that the biocidal product does not need to be classified for physical-chemical hazards.

C.4. Measures to protect man, animals and the environment

No measures required.

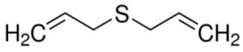
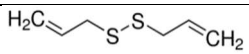
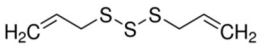
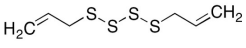
D. Appendices

APPENDIX I: LIST OF ENDPOINTS

Chapter 1: Identity, Physical and Chemical Properties, Classification and Labelling

Active substance	Thermally treated garlic juice
Product-type	PT 19

Identity

Chemical name (IUPAC)	Thermally treated garlic juice (intended new name, formerly named garlic extract)
Chemical name (CA)	Garlic, ext. (historical name)
CAS No	N/A
EC No	N/A
Other substance No.	N/A
Minimum purity of the active substance as manufactured (g/kg or g/l)	1000 g/kg
Identity of relevant impurities and additives (substances of concern) in the active substance as manufactured (g/kg)	N/A
Molecular formula	Marker compounds: 1. C6H10S (Diallyl monosulfide, DAS1) 2. C6H10S2 (Diallyl disulfide, DAS2) 3. C6H10S3 (Diallyl trisulfide, DAS3) 4. C6H10S4 (Diallyl tetrasulfide, DAS4)
Molecular mass	N/A
Structural formula	**Marker molecule** / **Structural formula** Diallyl monosulfide (DAS1)  Diallyl disulfide (DAS2)  Diallyl trisulfide (DAS3)  Diallyl tetrasulfide (DAS4)  The content of the sum of this four marker compounds (= total polysulfide content) is [redacted]

Physical and chemical properties

Melting point (state purity)	115°C (dried material)
Boiling point (state purity)	100.3°C (999 g/L)
Thermal stability / Temperature of decomposition	No decomposition upon boiling (999 g/L)
Appearance (state purity)	Free-flowing opaque brown homogeneous liquid (999 g/L)
Relative density (state purity)	1.2927 (999 g/L)
Surface tension (state temperature and concentration of the test solution)	41.5 mN/m at 20°C, neat
Vapour pressure (in Pa, state temperature)	2180 Pa at 20°C
Henry's law constant (Pa m3 mol -1)	0.36 Pa m3 mol -1
Solubility in water (g/l or mg/l, state temperature)	>1000g/L at 20ºC
Solubility in organic solvents (in g/l or mg/l, state temperature)	Not determined
Stability in organic solvents used in biocidal products including relevant breakdown products	The active substance as manufactured is not delivered in an organic solvent
Partition coefficient (log POW) (state temperature)	-1.49 (1:1 octanol: water) -2.13 (2:1 octanol:water) -1.69 (1:2 octanol:water) At 20°C
Dissociation constant	N/A – constituents do not have ionic structure
UV/VIS absorption (max.) (if absorption > 290 nm state ε at wavelength)	210 to 252 nm
Explosives	Not explosive
Flammable gases	N/A – substance is not a gas
Flammable aerosols	N/A – substance is not an aerosol
Oxidising gases	N/A – substance is not a gas
Gases under pressure	N/A – substance is not a gas under pressure
Flammable liquids	No flash point observed before boiling
Flammable solids	N/A – substance is not a solid
Self-reactive substances and mixtures	Not self -reactive
Pyrophoric liquids	Not pyrophoric
Pyrophoric solids	N/A – substance is not a solid
Self-heating substances and mixtures	N/A – self-heating phenomenon applies only to solids
Substances and mixtures which in contact with water emit flammable gases	No flammable gases emitted when substance in contact with water
Oxidising liquids	Not oxidising
Oxidising solids	N/A – substance is not a solid
Organic peroxides	N/A – substance is not an organic peroxide
Corrosive to metals	Not corrosive to metals
Auto-ignition temperature(liquids and gases)	No self-ignition up to 388°C
Relative self-ignition temperature for solids	N/A – substance is not a solid
Dust explosion hazard	N/A – substance is not a solid

Classification and proposed labelling

with regard to physical hazards	-
with regard to human health hazards	Skin Sens 1B, H317
with regard to environmental hazards	-

Chapter 2: Methods of Analysis

Analytical methods for the active substance

Technical active substance (principle of method)	HPLC-UV at 240 nm (total polysulfides, quantified against DAS3)
Impurities in technical active substance (principle of method)	N/A

Analytical methods for residues

Soil (principle of method and LOQ)	N/A
Air (principle of method and LOQ)	N/A
Water (principle of method and LOQ)	N/A
Body fluids and tissues (principle of method and LOQ)	N/A
Food/feed of plant origin (principle of method and LOQ for methods for monitoring purposes)	N/A
Food/feed of animal origin (principle of method and LOQ for methods for monitoring purposes)	N/A

Chapter 3: Impact on Human Health

Absorption, distribution, metabolism and excretion in mammals

Rate and extent of oral absorption:	N/A
Rate and extent of dermal absorption:	N/A
Rate and extent of inhalation absorption	N/A
Distribution:	N/A
Potential for accumulation:	N/A
Rate and extent of excretion:	N/A
Toxicologically significant metabolite(s)	N/A

Acute toxicity

Rat LD50 oral	N/A
Rat LD50 dermal	N/A
Rat LC50 inhalation	N/A

Skin corrosion/irritation	Not corrosive or irritating to skin

Eye irritation	Not irritating to eyes

Respiratory tract irritation	N/A

Skin sensitisation LLNA	Positive, EC3 value 11.18% Skin sens. 1B, H317

Respiratory sensitisation (test method used and result)	N/A

Repeated dose toxicity

Short term

Species / target / critical effect	N/A
Relevant oral NOAEL / LOAEL	N/A
Relevant dermal NOAEL / LOAEL	N/A
Relevant inhalation NOAEL / LOAEL	N/A

Sub-chronic

Species/ target / critical effect	N/A*
Relevant oral NOAEL / LOAEL	N/A*
Relevant dermal NOAEL / LOAEL	N/A*
Relevant inhalation NOAEL / LOAEL	N/A*

Long term

Species/ target / critical effect	N/A*
Relevant oral NOAEL / LOAEL	N/A*
Relevant dermal NOAEL / LOAEL	N/A*
Relevant inhalation NOAEL / LOAEL	N/A*

Genotoxicity

Carcinogenicity	
Species/type of tumour	N/A
Relevant NOAEL/LOAEL	N/A

Reproductive toxicity

Developmental toxicity

Species/ Developmental target / critical effect	N/A*
Relevant maternal NOAEL	N/A*
Relevant developmental NOAEL	N/A*

Fertility

Species/critical effect	N/A*
Relevant parental NOAEL	N/A*
Relevant offspring NOAEL	N/A*
Relevant fertility NOAEL	N/A*

Neurotoxicity

Species/ target/critical effect	N/A

Developmental Neurotoxicity

Species/ target/critical effect	N/A

Immunotoxicity

Species/ target/critical effect	N/A

Developmental Immunotoxicity

Species/ target/critical effect	N/A

Summary

	Value	Study	Safety factor
$AEL_{long-term}$	None	N/A	N/A
$AEL_{medium-term}$	None	N/A	N/A
$AEL_{short-term}$	None	N/A	N/A
ADI[8]	None	N/A	N/A
ARfD	None	N/A	N/A

[8] If residues in food or feed.

MRLs

Relevant commodities	Not relevant

Reference value for groundwater

According to BPR Annex VI, point 68	Not relevant

Dermal absorption

Study (in vitro/vivo), species tested	N/A
Formulation (formulation type and including concentration(s) tested, vehicle)	N/A
Dermal absorption values used in risk assessment	N/A

* no regulatory guideline study available

Chapter 4: Fate and Behaviour in the Environment

Route and rate of degradation in water

Hydrolysis of active substance and relevant metabolites/ degradants (DT50) (state pH and temperature)	DT50 = 16.3 h (at pH7 and 20°C)
pH 5	No data available
pH 9	DT50 = 5.11 h (at pH 9 and 20°C)
Other pH: At pH 4	DT50 = 1.62 h (at pH 4 and 20°C)
Photolytic / photo-oxidative degradation of active substance and resulting relevant metabolites/ degradants	DT50 = 5.591 h
Readily biodegradable (yes/no)	Yes
Inherent biodegradable (yes/no)	-
Biodegradation in freshwater	-
Biodegradation in seawater	N/A
Non-extractable residues	N/A
Distribution in water / sediment systems (active substance)	N/A
Distribution in water / sediment systems (metabolites/ degradants)	N/A

Route and rate of degradation in soil

Mineralization (aerobic)	No data available.
Laboratory studies (range or median, with number of measurements, with regression coefficient)	No data available.
DT50lab (20°C, aerobic):	DT_{50} = 3.23 days at 20°C DT_{50} = 6.86 days at 12°C
DT90lab (20°C, aerobic):	No data available.
DT50lab (10°C, aerobic):	No data available.
DT50lab (20°C, anaerobic):	No data available.
degradation in the saturated zone:	No data available.
Field studies (state location, range or median with number of measurements)	No data available.
DT50f:	No data available.
DT90f:	No data available.
Anaerobic degradation	N/A
Soil photolysis	N/A
Non-extractable residues	N/A

Relevant metabolites - name and/or code, % of applied a.i. (range and maximum)	N/A
Soil accumulation and plateau concentration	N/A

Adsorption/desorption

Ka , Kd Kaoc , Kdoc pH dependence (yes / no) (if yes type of dependence)	Diallyl sulfide: 575.4 L/kg Diallyl disulfide: 1778.3 L/kg Diallyl trisulfide: 3981.1 L/kg

Fate and behaviour in air

Direct photolysis in air	N/A
Quantum yield of direct photolysis	N/A
Photo-oxidative degradation in air	DT_{50} values range from 0.745 to 5.591 hours derived by the Atkinson model (version 1.92) for the marker molecules in thermally treated garlic juice (diallyl sulfide, diallyl disulfide, diallyl trisulfide, diallyl tetrasulfide). OH radical (24 h) concentration assumed = 5E5molecules/cm^3.
Volatilization	N/A

Reference value for groundwater

According to BPR Annex VI, point 68	N/A

Monitoring data, if available

Soil (indicate location and type of study)	No data available
Surface water (indicate location and type of study)	No data available
Groundwater (indicate location and type of study)	No data available
Air (indicate location and type of study)	No data available

Chapter 5: Effects on Non-target Species

Toxicity data for aquatic species (most sensitive species of each group)			
Species	Time-scale	Endpoint	**Toxicity**
Fish			
Cyprinus Carpio	96 h	Mortality	LC_{50}: 11.7 mg/L (geometric mean measured)
Invertebrates			
Daphnia magna	48 h	Immobilisation	EC_{50}: 13.7 mg/L (geometric mean measured)
Algae			
Pseudokirchneriella subcapitata	72 h	Growth rate inhibition	ErC_{50}: 19.2 mg/L (geometric mean measured) NOEC: 2.55 mg/L (geometric mean measured)

Effects on earthworms or other soil non-target organisms

Acute toxicity to earthworms (*Eisenia fetida*)	14-d LC_{50}: 4729.1 mg/kg soil dw
Reproductive toxicity to earthworms (*Eisenia fetida*)	56-d NOEC = 5000 mg/kg dw

Effects on soil micro-organisms

Nitrogen mineralization	28-d NOEC: 120 L/ha soil
Carbon mineralization	28-d NOEC: 120 L/ha soil

Effects on terrestrial vertebrates

Acute toxicity to mammals	No data available
Acute toxicity to birds	No data available
Dietary toxicity to birds	No data available
Reproductive toxicity to birds	No data available

Effects on honeybees

Acute oral toxicity	No data available
Acute contact toxicity	No data available

Effects on other beneficial arthropods

Acute oral toxicity	No data available
Acute contact toxicity	No data available
Acute toxicity to ……..	No data available

Bioconcentration

Bioconcentration factor (BCF)	N/A (not bioaccumulative based on log Kow of -1.49)
Depuration time (DT50)	N/A
Depuration time (DT90)	N/A
Level of metabolites (%) in organisms accounting for > 10 % of residues	N/A

Chapter 6: Other End Points

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APPENDIX II: HUMAN EXPOSURE CALCULATIONS

Not applicable.

APPENDIX III: ENVIRONMENTAL EMISSION (AND EXPOSURE) CALCULATIONS & SUPPORTIVE INFORMATION FOR THE HYDROLYSIS STUDY

Semiquantitative approach for soil risk assessment

Application rate: [redacted]

RHOsoil = 1700 kg/m³

PNECsoil = 4.73 mg/kg soil dw = 4.73 / 1.13 = 4.186 mg/kg ww

Soil depth: 0.5 m:

0.5 m³ soil is contaminated with [redacted].:

[redacted] / (1700/2) kg = [redacted] mg/kg ww

PEC = [redacted] mg/kg ww

PNEC = 4.186 mg/kg ww

PEC/PNEC = 0.056

An AF of 1000 was used to derive the PNECsoil (acute earthworm study). Combined with the fact that no degradation was included in the calculations, this leads to a very conservative estimation.

The PEC/PNEC ratio is <1 and therefore no unacceptable risk is identified for the environmental compartment soil.

GROUNDWATER ASSESSMENT

Application rate: [redacted]

Depth of the soil volume (direct release to soil): 0.5 m

0,5 m³ soil is contaminated with [redacted]

[redacted]

Tier 1:

The equation for deriving the concentration in the pore water is:

$$PEClocal_{soil,porew} = \frac{PEClocal_{soil} \cdot RHO_{soil}}{K_{soil\text{-}water} \cdot 1000}$$

Ksoil-water = 17.46 m³/m³
RHOsoil = 1700 kg/m³

PEClocalsoil, porewater = ([redacted] mg/kgwwt * 1700 kg/m³) / (17.46 m³/m³ * 1000)

PEClocalsoil, porewater = [redacted]

The concentration in soil porewater exceeds the trigger value of 0.1 µg/L of the drinking water directive (EU 2020/2184). However, following the tiered approach to biocide groundwater assessments according to BPC Volume IV Environment - Assessment and Evaluation (Parts B + C; 2017) a Tier 2 approach takes into consideration the cut-off criteria regarding groundwater assessment:

- DT50 < 21 d at 20°C and
- Koc > 500 L/kg) could be used

for biocide application rates up to 100 kg a.s./ha per year.

Tier 2:

Thermally treated garlic juice:

DT50 = 6.86 d (at 12°C)
Koc = 575.4 – 3981 L/kg (Koc of [redacted] calculated using OECD 121 HPLC Method)

Thermally treated garlic juice meets the cut-off criteria of the groundwater assessment and therefore, no unacceptable risk is expected regarding the environmental compartment groundwater.

Further remarks on the provided hydrolysis study (Anonymus 2021b):

[redacted]

From the current point of view no major differences are expected in the hydrolysis behaviour between the different marker molecules (diallylsulfides) that can be only differentiated due to the number of sulfide bonds within their chemical structure. The purpose of the study was to characterise garlic by using the marker molecules. [redacted]

APPENDIX IV: LIST OF TERMS AND ABBREVIATIONS

ADME	Absorption, Distribution, Metabolism, Excretion
AF	Assessment factor
AR	Androgen receptor
AMS	allyl methyl sulfide
a.s.	active substance
b.p.	biocidal product
BPR	Biocidal Product Regulation (EU) No 528/2012
bw	body weight
CLP	Classification, Labelling and Packaging
CMR	Carcinogenic Mutagenic Reprotoxic
DAS(1-7)	Diallyl (mono-hepta)sulfide
dw	dry weight
eCA AT	evaluating competent authority Austria
EDSP21	Endocrine Disruption Screening Program for the 21st Century
ED	endocrine disruptor
ER	oestrogen receptor
GLP	Good laboratory practice
GRAS	Generally Recognized As Safe
HCA	alpha-hexylcinnamaldehyde
HDPE	High Density Polyethylene
HPLC	High Performance Liquid Chromatography
HPLC-DAD	High-performance liquid chromatography – Diode-array detection
HPLC-UV	High-performance liquid chromatography - Ultraviolet
i.v.	intravenous
LDL	Low Density Lipoprotein
LLNA	Local lymph node assay
LH	Luteinizing Hormone

N/A	not applicable
OECD TG	Organisation for Economic Co-operation and Development Test Guideline
PBT	Persistent Bioaccumulative Toxic
PPP	Plant Protection Products
PT	product-type
RSD	Relative Standard Deviation
SI	Stimulation indices
SAC	allylcysteine
SVHC	Substance of very high concern
TK	Toxicokinetic
Toxcast	Toxicity ForeCaster
U.S. FDA	U.S. Food and Drug Administration
UVCB	**U**nknown or **V**ariable composition, **C**omplex reaction product or **B**iological origin
V	Volume
vP/vB	very persistent/very bioaccumulative
wwt	wet weight

APPENDIX V: OVERALL REFERENCE LIST (INCLUDING DATA OWNER AND CONFIDENTIALITY CLAIM)

Author	Year	Section No / Reference No	Title. Source (where different from company) Company, Report No. GLP (where relevant) / (Un)Published	Data Protection Claimed (Y/N)	Owner	Applicability CAR	Applicability CLH
Anonymous	2014b	A.1.6.	[redacted] - Validation of the analytical method used to determine Total Polysulfide Content (quantified against DATS) [redacted] GLP Unpublished	Yes	Ecospray Limited	Yes	No
Anonymous	2002a	A.1.3.	Determination of specified physical chemistry parameters of garlic concentrate [redacted], a	Yes	Ecospray Limited	Yes	No

Author	Year	Section No / Reference No	Title. Source (where different from company) Company, Report No. GLP (where relevant) / (Un)Published	Data Protection Claimed (Y/N)	Owner	Applicability CAR	Applicability CLH
			soluble concentrate formulation in compliance with good laboratory practice [redacted] GLP Unpublished				
Anonymous	2014a	A.1.3.	[redacted] - Determination of physical chemical properties before and after an accelerated storage procedure for 14 days at 54 deg C [redacted] GLP Unpublished	Yes	ECOSpray Limited	Yes	No
Anonymous	2016a	A.1.3. A.1.4.	[redacted] - Determination of physical chemical properties before and after 2 years storage under ambient conditions [redacted] GLP Unpublished	Yes	Ecospray Limited	Yes	Yes
Anonymous	2021b	A.1.2. A.4.1.1.1.	Garlic extract ([redacted]): Hydrolysis as a function of pH; [redacted] GLP; Unpublished	Yes	Ecospray Ltd.	Yes	Yes
Anonymous	2018	A.4.1.1.1.	Garlic extract: Fate and behaviour in air; Ecospray Limited UK; Non-GLP; Unpublished	Yes	Ecospray Ltd.	Yes	Yes
Anonymous	2021c	A.4.1.1.2.1. A.4.2.2.	Garlic extract ([redacted]): Ready biodegradability – CO2 evolution test; [redacted] GLP; Unpublished	Yes	Ecospray Ltd.	Yes	Yes
Anonymous	1989	A.4.1.1.3.2.	Environmental persistence of diallyl disulfide, an insecticidal principle of garlic and its metabolism in mosquito, *Culex pipiens quinquifasciatus* Say. *Chemosphere*, 18, 1525-1529; Peer reviewed scientific literature; Non-GLP; Published	No	Publicly available literature	Yes	Yes

Author	Year	Section No / Reference No	Title. Source (where different from company) Company, Report No. GLP (where relevant) / (Un)Published	Data Protection Claimed (Y/N)	Owner	Applicability CAR	CLH
Anonymous	2021d	A.1.2. A.4.2.3.1. A.4.5.1.	Garlic extract ([redacted]): Fish, acute toxicity test with common carp (*Cyprinus carpio*); [redacted] GLP; Unpublished	Yes	Ecospray Ltd.	Yes	Yes
Anonymous	2012a	A.1.2. A.4.2.3.1.	Acute toxicity study of [redacted], in common carp, *Cyprinus carpio*; [redacted] GLP; Unpublished	Yes	Ecospray Ltd., (Co-Sponsor: [redacted]	Yes	Yes
Anonymous	2021e	A.1.2. A.4.2.3.1. A.4.5.1.	Garlic extract ([redacted]): *Daphnia magna*, acute immobilization test; [redacted] GLP; Unpublished	Yes	Ecospray Ltd.	Yes	Yes
Anonymous	2021f	A.1.2. A.4.2.3.1. A.4.5.1.	Garlic extract ([redacted]): Alga, growth inhibition test with *Raphidocelis subcapitata* (formerly *Pseudokirchneriella subcapitata*); [redacted] GLP; Unpublished	Yes	Ecospray Ltd.	Yes	Yes
Anonymous	2012b	A.1.2. A.4.2.3.1.	Alga (*Pseudokirchneriella subcapitata*), growth inhibition test with [redacted]; GLP; Unpublished	Yes	ECOspray Ltd., (Co-Sponsor: [redacted]	Yes	Yes
Anonymous	2016b	A.1.2. A.4.2.5.	Acute toxicity study of [redacted], NEMguard Liquid to earthworm, *Eisenia fetida*; [redacted] GLP; Unpublished	Yes	Ecospray Ltd.	Yes	No
Anonymous	2021g	A.1.2. A.4.2.5.	Effect of garlic extract (Code: [redacted]) on reproduction of earthworm (*Eisenia fetida*) [redacted] GLP; Unpublished	Yes	Ecospray Ltd.	Yes	No
Anonymous	2016c	A.1.2. A.4.2.5.	Effect of [redacted], [redacted] Liquid on soil microorganisms: Nitrogen transformation test; [redacted] GLP; Unpublished	Yes	Ecospray Ltd.	Yes	No

Author	Year	Section No / Reference No	Title. Source (where different from company) Company, Report No. GLP (where relevant) / (Un)Published	Data Protection Claimed (Y/N)	Owner	Applicability CAR	CLH
Anonymous	2016d	A.1.2. A.4.2.5.	Effect of [redacted], [redacted] on soil microorganisms: Carbon transformation test; [redacted] GLP; Unpublished	Yes	Ecospray Ltd.	Yes	No
Anonymous	2000a	A.4.2.3.1.	Garlic juice: Daphnia magna, acute immobilization test; [redacted] GLP; Unpublished	Yes	Ecospray Ltd.	Yes	Yes
Anonymous	2019b	A.4.2. A4.1.1. 3.7.	Soil degradation study of [redacted] Unpublished	Yes	Ecospray Ltd.	Yes	Yes
Anonymous	2019c	A.1.2. A.4.1.1. 3.2.	Degradation of Garlic Extract in "Local River water" [redacted] Non GLP Published	Yes	Ecospray Ltd.	Yes	Yes
Anonymous	2022c	A.1.2. A.4.1.2. 1.	Garlic extract, ([redacted]): Estimation of Adsorption Coefficient [redacted] GLP Unpublished	Yes	Ecospray Ltd.	Yes	Yes
Anonymous	2004	A.4.2.7. A.4.2.8.	Garlic oil Aversion of European Starlings (Sturnus vulgaris) to Garlic Oil Treated Granules: Garlic Oil as an Avian Repellent. Garlic Oil Analysis by Nuclear Magnetic Resonance Spectroscopy [redacted] Published	Yes	Ecospray Ltd.	Yes	No
Anonymous	2022a	B.1.3. B.1.4.	ACCELERATED STORAGE STABILITY OF GARLIC REPELLENT GRANULES AT 54 ± 2°C FOR 14 DAYS WITH DIFFERENT COMMERCIAL PACKAGES; GLP; Unpublished	Y	Ecospray Ltd.	Yes	Yes
Anonymous	2022b	B.1.5.	METHOD DEVELOPMENT AND VALIDATION FOR GARLIC REPELLENT GRANULES; GLP;	Yes	Ecospray Ltd.	Yes	No

Author	Year	Section No / Reference No	Title. Source (where different from company) Company, Report No. GLP (where relevant) / (Un)Published	Data Protection Claimed (Y/N)	Owner	Applicability CAR	CLH
			Unpublished				
Anonymous	1993	A.2.1.1. C.1.8	Supporting study: Cat repellent – field test	Y	Ecospray Ltd.	Yes	No
Anonymous	2007	A.2.1.1.	Efficacy of [redacted] Repellence against Cats – Field Test	N	[redacted]	Yes	No
Anonymous	2011a	A.1.2. A.3.3. C.1.1.2.	Acute dermal irritation study of [redacted], in rabbits [redacted] GLP Unpublished	Yes	Ecospray Ltd., (Co-Sponsor: [redacted]	Yes	Yes
Anonymous	2011b	A.1.2. A.3.4.	Acute eye irritation study of [redacted], in rabbits [redacted] GLP Unpublished	Yes	Ecospray Ltd., (Co-Sponsor: [redacted]	Yes	Yes
Anonymous	2011c	A.1.2. B.5.5.1.	Skin sensitisation – Buehler test – on [redacted] GLP Unpublished	Yes	Ecospray Ltd., (Co-Sponsor: [redacted]	Yes	No
Anonymous	2016e	A.1.2. A.3.5. C.1.1.2.	Skin sensitisation study of [redacted], [redacted] by local lymph node assay in mice [redacted] GLP Unpublished	Yes	Ecospray Ltd.	Yes	Yes
Anonymous	2021a	A.1.6. Confidential Annex	Five Batch Analysis of Garlic Extract ([redacted]) [redacted] GLP Unpublished	Yes	Ecospray Ltd.	Yes	Yes
Anonymous	2017a	Confidential Annex	Test certificate [redacted] Non-GLP Unpublished	Yes	Ecospray Ltd	Yes	Yes
Anonymous	2019a	Confidential Annex	Garlic Extract Identity, Manufacture and Composition [redacted] Non-GLP Unpublished	Yes	Ecospray Ltd	Yes	Yes

Author	Year	Section No / Reference No	Title. Source (where different from company) Company, Report No. GLP (where relevant) / (Un)Published	Data Protection Claimed (Y/N)	Owner	Applicability CAR	CLH
Anonymous	2021h	B.4.1.	NATURAL CONCENTRATIONS OF POLYSULFIDES RELEASED FROM ALLIUM CROPS	No	Ecospray Ltd	Yes	No
Anonymous	2000b	C.1.8	RABBIT FEEDING REPELLENCY TRIALS USING GARLIC II	Yes	Ecospray Ltd	Yes	No
Anonymous	2001	C.1.8	RABBIT FEEDING REPELLENCY TRIALS USING GARLIC III	Yes	Ecospray Ltd	Yes	No
Anonymous	2023	A.1.4.	Garlic extract ([redacted]) – Determination of Corrosion to Metals [redacted] GLP Unpublished	Yes	Ecospray Ltd	Yes	Yes

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APPENDIX VI: CONFIDENTIAL INFORMATION

Deleted for the non-confidential version.

APPENDIX VII: STUDY SUMMARIES (IF RELEVANT FOR THE CLH PROPOSAL)

N/A