Regulation (EU) No 528/2012 concerning the making available on the market and use of biocidal products

PRODUCT ASSESSMENT REPORT OF A BIOCIDAL PRODUCT FOR NATIONAL AUTHORISATION APPLICATIONS

Product identifier in R4BP	**Strong**
Product type:	14 (Rodenticide)
Active ingredient(s):	Brodifacoum
Case No. in R4BP	BC-JF018460-57
Asset No. in R4BP	IE-0000280-0000
Evaluating Competent Authority	Ireland – Department of Agriculture, Food & the Marine
Internal registration/file no	**IE/BPA 70516**
Date	24.04.2018 (NA-RNL renewal)

Version 2.0

1 Version History

Date	Version	Reason for revision
2013/07/31	Version 1.0	Initial PAR
2014/02/05	Version 1.1	Updated PAR
2018/04/24	Version 2.0	Updated at 1st Renewal of authorisation RNL

2 Overview of applications

Application type	refMS	Case number in the refMS	Decision date	Assessment carried out (i.e. first authorisation / amendment /renewal)	Page
National Authorisation Dir.98/8/EC	IE	n/a	2013/07/31	1st Authorisation	77
NA-RNL	IE	BC-JF018460-57	2018/04/20	Renewal	20

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1st Renewal PAR – April 2018

Regulation (EU) No 528/2012 concerning the making available on the market and use of biocidal products

PRODUCT ASSESSMENT REPORT OF A BIOCIDAL PRODUCT FOR THE RENEWAL OF A NATIONAL AUTHORISATION (NA-RNL)

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1 Conclusion

The Irish CA for the authorisation of biocidal products has processed an application for renewal for the biocidal product **Strong** which contains the active substance Brodifacoum (0.005 % w/w).
The assessment presented in the Product Assessment Report for the first authorisation showed acceptable efficacy but unacceptable risks for the environment, if the product is used as a rodenticide (product-type 14) for use in and around buildings, by the general public, professionals and trained professionals, and in open areas and waste dumps, by professionals and trained professionals.

The conditions for granting an authorisation according to Article 19 (1) of Regulation (EU) No 528/2012[1] (BPR) are not fulfilled.
In consequence the product can only be authorised in accordance with Article 19 (5) BPR, as this Article provides Member States with the legal basis to authorise products in cases where not authorising the product would result in disproportionate negative impacts for society when compared to the risks to human health arising from the use of the biocidal product.

Detailed information on the uses appropriate at the renewal of authorisation are presented in section 2.4.
General directions for use of the product are summarised in section 2.5.

Prior to renewing the approval of anticoagulant active substances and renewing the authorisations of the respective products discussions took place at EU-level to harmonise use instructions and risk mitigation measures to the greatest possible extend. As an outcome of these discussions a set of three standard SPCs (Summary of Product Characteristics) compiling the relevant sentences for the uses that may be authorised for each of the three user categories (general public, professionals and trained professionals) has been produced (for details please refer to document CA-Nov16-Doc.4.1.b – Final).

The specific conditions from Commission Implementing Regulation (EU) 2017/1381[2] for the active substance Brodifacoum were considered for the re-assessment.

The Irish CA concludes that the conditions set out in Article 5(2) b) and c) of the BPR are currently met. Anticoagulant rodenticides are considered essential to ensure appropriate rodent control in Ireland by

[1] Regulation (EU) No 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products, last amended by Regulation (EU) No 334/2014 of the European Parliament and of the Council of 11 March 2014.
[2] Commission Implementing Regulation (EU) 2017/1381 of 25 July 2017 renewing the approval of Brodifacoum as an active substance for use in biocidal products of product-type 14

efficient pest management and as a consequence, to prevent or control any serious danger to human and animal health in which rodents are involved.
Rodent control in Ireland currently relies largely on the use of anticoagulant rodenticides, the non-renewal of which could lead to insufficient rodent control in Ireland. This may not only cause significant negative impacts on human or animal health or the environment, but may also affect the public's perception of its safety with regard to exposure to rodents or the security of a number of economic activities that could be vulnerable to rodents, resulting in economic and social consequences in Ireland.

The product has been classified according to the 9th ATP of Regulation (EC) No 1272/2008[3]. Detailed information on classification and labelling is provided in Section 2.3.
As a consequence of the new harmonised classification, the active substance Brodifacoum meets the criteria for exclusion according to Article 5(1) BPR as well as for substitution according to Article 10 BPR Therefore, in line with Article 23 (1) BPR a comparative assessment for the product **Strong** has been conducted (for details see Section 3.10).

Comparative assessment
In line with Article 23 (1) BPR a comparative assessment for the product has been conducted (for details see Section 3.10).
In summary it can be concluded that the criteria according Article 23(3) a), b) BPR are not fulfilled.
According to Article 23 (6) BPR the authorisation of the product will be renewed for 5 years.

Approval of the active substance
The active substance Brodifacoum is included in the Union list of approved active substances and the specific provisions laid down there are fulfilled:

The authorisations of biocidal products containing Brodifacoum are subject to the conditions listed in the Annex to Commission Implementing Regulation (EU) 2017/1381:

Composition and formulation
The ready-to-use product is a grain bait and contains the active substance Brodifacoum.
No substance of concern has been identified.
Please refer to section 5.1 for detailed information.

Physical, chemical and technical properties
No new data was provided nor had new guidance to be taken into account for the renewal evaluation.

[3] Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006.

Accordingly, the conclusion from the former assessment regarding physical, chemical and technical properties remains valid.

Physical hazards and respective characteristics

No new data was provided, nor had new guidance to be taken into account for the renewal evaluation. Accordingly, the conclusion from the former assessment regarding physical hazards and respective characteristics remains valid.

Methods for detection and identification

No new data was provided, nor had new guidance to be taken into account for the renewal evaluation. Accordingly, the conclusion from the former assessment regarding methods for detection and identification remains valid.

Efficacy

The IE CA considers that the efficacy data has confirmed that STRONG grain bait is effective in the proposed areas for use, at the recommended dose rate when used as per label recommendations.
No new data was provided nor had new guidance to be taken into account for re-assessment.
An evaluation of the studies provided demonstrated that the ready-to-use grain bait formulation proved to be both palatable to and effective against infestations of rats (*Rattus norvegicus* and *Rattus rattus*) and house mice (*Mus musculus/domesticus*).

The former assessment regarding the product's efficacy against target organisms remains valid and the conclusion of the evaluation is that the product may be authorised.

Risk assessment for human health

The human health risk assessment for this product is based on the active substance.
According to the BPC Opinion the EFSA-Guidance on dermal absorption had been taken into account when reviewing the dermal absorption of the product.
Based on the risk assessment of the active substance, a risk for professional users resulting from the intended use is unlikely.
For risk mitigation measures please refer to section 2.
Due to the new classification (Repr.1A) it is not allowed to grant authorisation for the use by general public (Article 19 (4) and (5) BPR). Therefore the product will not be authorised for the non-professional user.
Based on the risk assessment it is unlikely that the intended use(s) cause any unacceptable acute or chronic risk to professional users, bystanders and residents. Regarding the trained professional users health protection, there are no objections against the intended uses if the directions for use are followed (For details see section 2).

Risk assessment for the environment

No new data was provided. The only area where new guidance was relevant was with respect to the groundwater assessment. Following discussion at the CG-18 meeting and subsequent agreement, Tier II PEC groundwater was calculated using the FOCUS models PEARL or PELMO in the instances where Tier I indicated an exceedance of the relevant trigger value.

According to the risk assessment, the risk for poisoning of non-target predator birds and mammals during primary (acute and long-term exposure) and secondary poisoning is high as the trigger value is exceeded in all cases.

No safe use was established for the Brodifacoum product at a concentration of 50 ppm in the ecotoxicology risk assessment.

In consequence the product can only be authorised in accordance with Article 19 (5) BPR.

Overall conclusion

The assessment of the biocidal product **Strong** remains valid. However, the authorisation has to be adapted where necessary taking into account the points mentioned above.

The biocidal product will be authorised according to Article 19 (5) BPR in conjunction with Article 23 (6) BPR.

According to Article 23 (6) BPR the authorisation of the product will be renewed for 5 years.

2 Summary of the product assessment

2.1 Administrative information

2.1.1 Identifier in R4BP

Strong
Additional trade name(s): Sapphire Grain

2.1.2 Authorisation holder

Name and address of the authorisation holder	**Name**	BELGAGRI SA
	Address	Rue des Tuiliers, 1 4480 Engis Belgium
Authorisation number	IE/BPA 70516	
Date of the authorisation	24/4/18	
Expiry date of the authorisation	24/4/23	

2.1.3 Manufacturer(s) of the product

Name of manufacturer (1)	BELGAGRI SA
Address of manufacturer	Rue des Tuiliers, 1 4480 Engis Belgium
Location of manufacturing sites	Rue des Tuiliers, 1 4480 Engis Belgium
Name of manufacturer (2)	CGB
Address of manufacturer	PA des quatre routes 35390 Grand Fougeray France
Location of manufacturing sites	PA des quatre routes 35390 Grand Fougeray France

2.1.4 Manufacturer(s) of the active substance(s)

Active substance	Brodifacoum
Name of manufacturer	Pelgar
Address of manufacturer	Unit 13, Newman Lane Alton Hants GU34 2QR United Kingdom
[redacted]	[redacted]

2.2 Product composition and formulation

2.2.1 Qualitative and quantitative information on the composition

Table 1

Common name	IUPAC name	Function	CAS number	EC number	Content (%)
Brodifacoum	**3-[3-[4-(4-bromophenyl)phenyl] tetralin-1-yl]-2-hydroxy-chromen-4-one**	Active Substance	**56073-10-0**	**259-980-5**	0.005

- The product contains a bittering agent and a dye.
  - Information on the full composition is provided in the confidential[4] annex (see chapter 4).
- According to the information provided the product contains no nanomaterials as defined in Article 3 paragraph 1 (z) of Regulation No. 528/2012:

2.2.2 Information on the substance(s) of concern

The product contains the co-formulant potassium sorbate which is listed as a PT8 active substance.

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[4] Access level: “Restricted” to applicant and authority

2.2.3 Candidate(s) for substitution

The following substance was identified as a candidate for substitution:

- Brodifacoum

Brodifacoum meets the following exclusion criteria according to Article 5(1) BPR:

- toxic for reproduction category 1A
- persistent and very persistent, bioaccumulative and toxic

Therefore Brodifacoum meets the conditions laid down in Article 10 BPR, and is consequently a candidate for substitution.

2.2.4 Type of formulation

Ready-to-use bait: grain

2.3 Classification and Labelling according to the Regulation (EC) No 1272/2008[5]

Table 2

Classification **Hazard classes, Hazard categories**	**Hazard statements**
STOT RE 2	H373: May cause damage to organs (blood) through prolonged or repeated exposure
Repr. 1A	H360D: May damage the unborn child.

Table 3

Labelling **Code** **Pictogram / Wording**

5 Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006.

	GHS08	
Signal word		Danger
Hazard statements	STOT RE 2	H373: May cause damage to organs (blood) through prolonged or repeated exposure
	Repr. 1A	H360D: May damage the unborn child.
Supplemental hazard information		
Supplemental label elements		
Precautionary statements:	P201	Obtain special instructions before use
	P202	Do not handle until all safety precautions have been read and understood.
	P260	Do not breathe dust.
	P280	Wear protective gloves.
	P308+P313	IF exposed or concerned: Get medical advice/attention.
	P314	Get Medical advice/attention if you feel unwell.
	P405	Store locked up.
	P501	Dispose of contents in accordance with local/regional/national /international regulations
Note		

2.4 Uses appropriate for further authorisation[6]

Table 4: Summary Table of Uses

No.	Use
1	House mice – professionals – indoor
2	Rats – professionals – indoor
3	House mice and/or rats – professionals – outdoor around buildings
4	House mice and/or rats – trained professionals – indoor
5	House mice and/or rats – trained professionals – outdoor around buildings
6	Rats – trained professionals – Outdoor open areas & waste dumps

6 Member States might refuse to grant an authorisation or adjust the terms and conditions of the authorisation to be granted according to Article 37 BPR.

2.4.1 Use 1 appropriate after renewal of the authorisation – House mice – professionals – indoor

Product Type(s)	14
Where relevant, an exact description of the use	Rodenticide
Target organism(s) (including development stage)	House mouse (*Mus musculus / Mus domesticus*) – adults and juveniles
Field(s) of use	Indoors
Application method(s)	Ready-to-use bait to be used in tamper-resistant bait stations
Application rate(s) and frequency	Mice: 20-30 g of bait per bait station. If more than one bait station is needed, the minimum distance between bait stations should be 2 meters.
Category(ies) of users	Professionals
Pack sizes and packaging material	Minimum pack size 2.5kg Grams of bait wrapped individually in PE/PP sachet: 10g, 25g or loose bait Packaging material: Bucket (PP,PE), PE/PP sachet in Cardboard box, Paper craft bag with inner liner in PE (loose bait) Packaging size: 2.5Kg to 25Kg Package is restricted to separately packed bags with a maximum bag size of 10 kg.

2.4.1.1 Use-specific instructions for use

- The bait stations should be visited at least every 2 to 3 days at the beginning of the treatment and at least weekly afterwards, in order to check whether the bait is accepted, the bait stations are intact and to remove rodent bodies. Re-fill bait when necessary.
- [When available] Follow any additional instructions provided by the relevant code of best practice.

2.4.1.2 Use-specific risk mitigation measures

- (None)

2.4.1.3 Where specific to the use, the particulars of likely direct or indirect effects, first aid instructions and emergency measures to protect the environment

When placing bait stations close to water drainage systems, ensure that bait contact with water is avoided.

2.4.1.4 Where specific to the use, the instructions for safe disposal of the product and its packaging

None

2.4.1.5 Where specific to the use, the conditions of storage and shelf-life of the product under normal conditions of storage

None

2.4.2 Use 2 appropriate after renewal of the authorisation – Rats – professionals – indoor

Product Type(s)	14
Where relevant, an exact description of the use	Rodenticide
Target organism(s) (including development stage)	Brown rat (*Rattus norvegicus*) – adults and juveniles Roof rat (*Rattus rattus*) - adults and juveniles
Field(s) of use	Indoors
Application method(s)	Ready-to-use bait to be used in tamper-resistant bait stations
Application rate(s) and frequency	Rats: 50-100 g of bait per bait station. If more than one bait station is needed, the minimum distance between bait stations should be 5 meters.
Category(ies) of users	Professionals
Pack sizes and packaging material	Minimum pack size 2.5kg Grams of bait wrapped individually in PE/PP sachet: 10g, 25g, 50g, 100g or loose bait Packaging material: Bucket (PP,PE), PE/PP sachet in Cardboard box, Paper craft bag with inner liner in PE (loose bait) Packaging size: 2.5Kg to 25Kg

	Package is restricted to separately packed bags with a maximum bag size of 10 kg.

2.4.2.1 Use-specific instructions for use

- The bait stations should be visited only 5 to 7 days after the beginning of the treatment and at least weekly afterwards, in order to check whether the bait is accepted, the bait stations are intact and to remove rodent bodies. Re-fill bait when necessary.
- [When available] Follow any additional instructions provided by the relevant code of best practice.

2.4.2.2 Use-specific risk mitigation measures

(None)

2.4.2.3 Where specific to the use, the particulars of likely direct or indirect effects, first aid instructions and emergency measures to protect the environment

When placing bait stations close to water drainage systems, ensure that bait contact with water is avoided.

2.4.2.4 Where specific to the use, the instructions for safe disposal of the product and its packaging

None

2.4.2.5 Where specific to the use, the conditions of storage and shelf-life of the product under normal conditions of storage

None

2.4.3 Use 3 appropriate after renewal of the authorisation – House mice and/or rats – professionals – outdoor around buildings

Product Type(s)	14
Where relevant, an exact description of the use	Rodenticide
Target organism(s) (including development stage)	House mouse (*Mus musculus / Mus domesticus*) – adults and juveniles Brown rat (*Rattus norvegicus*) – adults and juveniles Roof rat (*Rattus rattus*) - adults and juveniles
Field(s) of use	Outdoors around buildings
Application method(s)	Ready-to-use bait to be used in tamper-resistant bait stations
Application rate(s) and frequency	Mice: 20-30 g of bait per bait station. If more than one bait station is needed, the minimum distance between bait stations should be 2 meters. Rats: 50-100 g of bait per bait station. If more than one bait station is needed, the minimum distance between bait stations should be 5 meters.
Category(ies) of users	Professionals
Pack sizes and packaging material	Minimum pack size 2.5kg Grams of bait wrapped individually in PE/PP sachet: 10g, 25g, 50g, 100g or loose bait Packaging material: Bucket (PP,PE), PE/PP sachet in Cardboard box, Paper craft bag with inner liner in PE (loose bait) Packaging size: 2.5Kg to 25Kg Package is restricted to separately packed bags with a maximum bag size of 10 kg.

2.4.3.1 Use-specific instructions for use

- Protect bait from the atmospheric conditions (e.g. rain, snow, etc.). Place the bait stations in areas not liable to flooding.
- The bait stations should be visited [for mice - at least every 2 to 3 days at] [for rats - only 5 to 7 days after] the beginning of the treatment and at least weekly afterwards, in order to check whether the bait is accepted, the bait stations are intact and to remove rodent bodies. Re-fill bait when necessary.
- Replace any bait in a bait station in which bait has been damaged by water or contaminated

by dirt.
- [*When available]* Follow any additional instructions provided by the relevant code of best practice.

2.4.3.2 Use-specific risk mitigation measures

- Do not apply this product directly in the burrows.

2.4.3.3 Where specific to the use, the particulars of likely direct or indirect effects, first aid instructions and emergency measures to protect the environment

When placing bait stations close to water drainage systems, ensure that bait contact with water is avoided.

2.4.3.4 Where specific to the use, the instructions for safe disposal of the product and its packaging

None

2.4.3.5 Where specific to the use, the conditions of storage and shelf-life of the product under normal conditions of storage

None

2.4.4 Use 4 appropriate after renewal of the authorisation – House mice and/or rats – trained professionals – indoor

Product Type(s)	14
Where relevant, an exact description of the use	Rodenticide
Target organism(s) (including development stage)	House mouse (*Mus musculus / Mus domesticus*) – adults and juveniles Brown rat (*Rattus norvegicus*) – adults and juveniles

	Roof rat (*Rattus rattus*) - adults and juveniles
Field(s) of use	Indoors
Application method(s)	Ready-to-use bait to be used in covered bait points or in tamper-resistant bait stations
Application rate(s) and frequency	Mice: 20-30 g of bait per bait station. If more than one bait station is needed, the minimum distance between bait stations should be 2 meters. Rats: 50-100 g of bait per bait station. If more than one bait station is needed, the minimum distance between bait stations should be 5 meters.
Category(ies) of users	Trained Professionals
Pack sizes and packaging material	Minimum pack size 2.5kg Grams of bait wrapped individually in PE/PP sachet: 10g, 25g, 50g, 100g or loose bait Packaging material: Bucket (PP,PE), PE/PP sachet in Cardboard box, Paper craft bag with inner liner in PE (loose bait) Packaging size: 2.5Kg to 25Kg Package is restricted to separately packed bags with a maximum bag size of 10 kg.

2.4.4.1 Use-specific instructions for use

Remove the remaining product at the end of treatment period. • *[When available]* Follow any additional instructions provided by the relevant code of best practice. • If used for pulsed baiting: Replace eaten bait only after 3 days and then at maximum 7 day intervals. Collect any spilled bait and dead rodents. Follow the specific instructions provided by the applicable code of good practice at national level.

2.4.4.2 Use-specific risk mitigation measures

• Where possible, prior to the treatment inform any possible bystanders (e.g. users of the treated area and their surroundings) about the rodent control campaign *[in accordance with the applicable code of good practice, if any]*. • Consider preventive control measures (e.g. plug holes, remove potential food and drinking as far as possible) to improve product intake and reduce the likelihood of reinvasion. • To reduce risk of secondary poisoning, search for and remove dead rodents during

treatment at frequent intervals, in line with the recommendations provided by the relevant code of best practice. • Do not use this product as permanent baits for the prevention of rodent infestation or monitoring of rodent activities.

2.4.4.3 Where specific to the use, the particulars of likely direct or indirect effects, first aid instructions and emergency measures to protect the environment

When placing bait stations close to water drainage systems, ensure that bait contact with water is avoided.

2.4.4.4 Where specific to the use, the instructions for safe disposal of the product and its packaging

None

2.4.4.5 Where specific to the use, the conditions of storage and shelf-life of the product under normal conditions of storage

None

2.4.5 Use 5 appropriate after renewal of the authorisation – House mice and/or rats – trained professionals – outdoor around buildings

Product Type(s)	14
Where relevant, an exact description of the use	Rodenticide
Target organism(s) (including development stage)	House mouse (*Mus musculus / Mus domesticus*) – adults and juveniles Brown rat (*Rattus norvegicus*) – adults and juveniles Roof rat (*Rattus rattus*) - adults and juveniles
Field(s) of use	Outdoors around buildings
Application method(s)	Ready-to-use bait to be used in covered bait points or in tamper-

	resistant bait stations, or in direct application of ready-to-use bait into the burrow.
Application rate(s) and frequency	Mice: 20-30 g of bait per bait station. If more than one bait station is needed, the minimum distance between bait stations should be 2 meters. Rats: 50-100 g of bait per bait station. If more than one bait station is needed, the minimum distance between bait stations should be 5 meters. - In burrows: 50-100g of bait per burrow.
Category(ies) of users	Trained Professionals
Pack sizes and packaging material	Minimum pack size 2.5kg Grams of bait wrapped individually in PE/PP sachet: 10g, 25g, 50g, 100g or loose bait Packaging material: Bucket (PP,PE), PE/PP sachet in Cardboard box, Paper craft bag with inner liner in PE (loose bait) Packaging size: 2.5Kg to 25Kg Package is restricted to separately packed bags with a maximum bag size of 10 kg.

2.4.5.1 Use-specific instructions for use

- Protect bait from the atmospheric conditions (e.g. rain, snow, etc.). Place the bait stations in areas not liable to flooding.
- Replace any bait in baiting points in which bait has been damaged by water or contaminated by dirt.
- Remove the remaining product at the end of treatment period.
- If used for pulsed baiting: Replace eaten bait only after 3 days and then at maximum 7 day intervals. Collect any spilled bait and dead rodents. Follow the specific instructions provided by the applicable code of good practice at national level.
- *[For outdoor use, baiting points must be covered and placed in strategic sites to minimise the exposure to non-target species]. [When available]* Follow any additional instructions provided by the relevant code of best practice.
- When used in burrows: Baits must be placed to minimise the exposure to non-target species and children. Cover or block the entrances of baited burrows to reduce the risks of bait being rejected and spilled. *[When available]* Follow any additional instructions provided by the relevant code of best practice.

2.4.5.2 Use-specific risk mitigation measures

- Where possible, prior to the treatment inform any possible bystanders (e.g. users of the treated area and their surroundings) about the rodent control campaign *[in accordance with the applicable code of good practice, if any]*.
- Consider preventive control measures (e.g. plug holes, remove potential food and drinking as far as possible) to improve product intake and reduce the likelihood of reinvasion.
  To reduce risk of secondary poisoning, search for and remove dead rodents during treatment at frequent intervals, in line with the recommendations provided by the relevant code of best practice.
  Do not use the product as permanent baits for the prevention of rodent infestation or monitoring of rodent activities.

2.4.5.3 Where specific to the use, the particulars of likely direct or indirect effects, first aid instructions and emergency measures to protect the environment

When placing bait points close to surface waters (e.g. rivers, ponds, water channels, dykes, irrigation ditches) or water drainage systems, ensure that bait contact with water is avoided.

2.4.5.4 Where specific to the use, the instructions for safe disposal of the product and its packaging

None

2.4.5.5 Where specific to the use, the conditions of storage and shelf-life of the product under normal conditions of storage

None

2.4.6 Use 6 appropriate after renewal of the authorisation – Rats – trained professionals – Outdoor open areas & waste dumps

Product Type(s)	14
Where relevant, an exact description of the use	Rodenticide
Target organism(s) (including development stage)	Brown rat (*Rattus norvegicus*) – adults and juveniles Roof rat (*Rattus rattus*) - adults and juveniles
Field(s) of use	Outdoor open areas & waste dumps
Application method(s)	Ready-to-use bait to be used in covered bait points or in tamper-resistant bait stations, or in direct application of ready-to-use bait into the burrow.
Application rate(s) and frequency	Rats: 50-100 g of bait per bait station. If more than one bait station is needed, the minimum distance between bait stations should be 5 meters. - In burrows: 50-100g of bait per burrow.
Category(ies) of users	Trained Professionals
Pack sizes and packaging material	Minimum pack size 2.5kg Grams of bait wrapped individually in PE/PP sachet: 10g, 25g, 50g, 100g or loose bait Packaging material: Bucket (PP,PE), PE/PP sachet in Cardboard box, Paper craft bag with inner liner in PE (loose bait) Packaging size: 2.5Kg to 25Kg Package is restricted to separately packed bags with a maximum bag size of 10 kg.

2.4.6.1 Use-specific instructions for use

- Protect bait from the atmospheric conditions (e.g. rain, snow, etc.). Place the bait stations in areas not liable to flooding.
- Replace any bait in baiting points in which bait has been damaged by water or contaminated by dirt.
- Remove the remaining product at the end of treatment period.
- *[When available]* Follow any additional instructions provided by the relevant code of best practice.
- If used for pulsed baiting: Replace eaten bait only after 3 days and then at maximum 7 day intervals. Collect any spilled bait and dead rodents. Follow the specific instructions provided by the applicable code of good practice at national level.
- *[For outdoor use, baiting points must be covered and placed in strategic sites to minimise the*

exposure to non-target species]. [When available] Follow any additional instructions provided by the relevant code of best practice.

- When used in burrows: Baits must be placed to minimise the exposure to non-target species and children. Cover or block the entrances of baited burrows to reduce the risks of bait being rejected and spilled. *[When available]* Follow any additional instructions provided by the relevant code of best practice.

2.4.6.2 Use-specific risk mitigation measures

- Where possible, prior to the treatment inform any possible bystanders (e.g. users of the treated area and their surroundings) about the rodent control campaign *[in accordance with the applicable code of good practice, if any]*.
- To reduce risk of secondary poisoning, search for and remove dead rodents during treatment at frequent intervals, in line with the recommendations provided by the relevant code of best practice.
- Do not use the product as permanent baits for the prevention of rodent infestation or monitoring of rodent activities.

2.4.6.3 Where specific to the use, the particulars of likely direct or indirect effects, first aid instructions and emergency measures to protect the environment

When placing bait points close to surface waters (e.g. rivers, ponds, water channels, dykes, irrigation ditches) or water drainage systems, ensure that bait contact with water is avoided.

2.4.6.4 Where specific to the use, the instructions for safe disposal of the product and its packaging

None

2.4.6.5 Where specific to the use, the conditions of storage and shelf-life of the product under normal conditions of storage

None

2.5 General directions for use

2.5.1 Instructions for use

2.5.1.1 Instructions for Use - Professionals

- Read and follow the product information as well as any information accompanying the product or provided at the point of sale before using it.
- Carry out a pre-baiting survey of the infested area and an on-site assessment in order to identify the rodent species, their places of activity and determine the likely cause and the extent of the infestation.
- Remove food which is readily attainable for rodents (e.g. spilled grain or food waste). Apart from this, do not clean up the infested area just before the treatment, as this only disturbs the rodent population and makes bait acceptance more difficult to achieve.
- The product should only be used as part of an integrated pest management (IPM) system, including, amongst others, hygiene measures and, where possible, physical methods of control.
- Consider preventive control measures (e.g. plug holes, remove potential food and drink as far as possible) to improve product intake and reduce the likelihood of reinvasion.
- Bait stations/ points should be placed in the immediate vicinity of places where rodent activity has been previously observed (e.g. travel paths, nesting sites, feedlots, holes, burrows etc.).
- Where possible, bait stations must be fixed to the ground or other structures.
- Bait stations must be clearly labelled to show they contain rodenticides and that they must not be moved or opened (see section 2.5.3 for the information to be shown on the label).
- [If national policy or legislation require it] When the product is being used in public areas, the areas treated should be marked during the treatment period and a notice explaining the risk of primary or secondary poisoning by the anticoagulant as well as indicating the first measures to be taken in case of poisoning must be made available alongside the baits.

- Bait should be secured so that it cannot be dragged away from the bait station.
- Place the product out of the reach of children, birds, pets, farm animals and other non-target animals.
- Place the product away from food, drink and animal feeding stuffs, as well as from utensils or surfaces that have contact with these.
- Wear protective chemical resistant gloves during product handling phase (glove material to be specified by the authorisation holder within the product information).
- When using the product do not eat, drink or smoke. Wash hands and directly exposed skin after using the product.
- If bait uptake is low relative to the apparent size of the infestation, consider the replacement of bait stations to further places and the possibility to change to another bait formulation.
- If after a treatment period of 35 days baits are continued to be consumed and no decline in rodent activity can be observed, the likely cause has to be determined. Where other elements have been excluded, it is likely that there are resistant rodents so consider the use of a non-anticoagulant rodenticide, where available, or a more potent anticoagulant rodenticide. Also consider the use of traps as an alternative control measure.
- Remove the remaining bait or the bait stations at the end of the treatment period.
- Bait in sachets: Do not open the sachets containing the bait.
- Loose pellets-granules, grains: Place the bait in the bait station by using a dosage devise. Specify the methods to minimise dust (e.g. wet wiping).

2.5.1.2 Instructions for Use – Trained Professionals

- Read and follow the product information as well as any information accompanying the product or provided at the point of sale before using it.

- Carry out a pre-baiting survey of the infested area and an on-site assessment in order to identify the rodent species, their places of activity and determine the likely cause and the extent of the infestation.

- Remove food which is readily attainable for rodents (e.g. spilled grain or food waste). Apart from this, do not clean up the infested area just before the treatment, as this only disturbs the rodent population and makes bait acceptance more difficult to achieve.

- The product should only be used as part of an integrated pest management (IPM) system, including, amongst others, hygiene measures and, where possible, physical methods of control.

- The product should be placed in the immediate vicinity of places where rodent activity has been

previously explored (e.g. travel paths, nesting sites, feedlots, holes, burrows etc.).

- Where possible, bait stations must be fixed to the ground or other structures.

- Bait stations must be clearly labelled to show they contain rodenticides and that they must not be moved or opened *(see section 2.5.3 for the information to be shown on the label)*.

- *[If national policy or legislation requires it]* When the product is being used in public areas, the areas treated should be marked during the treatment period and a notice explaining the risk of primary or secondary poisoning by the anticoagulant as well as indicating the first measures to be taken in case of poisoning must be made available alongside the baits.

- Bait should be secured so that it cannot be dragged away from the bait station.

- Place the product out of the reach of children, birds, pets and farm animals and other non-target animals.

- Place the product away from food, drink and animal feeding stuffs, as well as from utensils or surfaces that have contact with these.

- Wear protective chemical resistant gloves during product handling phase (glove material to be specified by the authorisation holder within the product information).

- When using the product do not eat, drink or smoke. Wash hands and directly exposed skin after using the product.

- The frequency of visits to the treated area should be at the discretion of the operator, in the light of the survey conducted at the outset of the treatment. That frequency should be consistent with the recommendations provided by the relevant code of best practice.

- If bait uptake is low relative to the apparent size of the infestation, consider the replacement of bait points to further places and the possibility to change to another bait formulation.

- If after a treatment period of 35 days baits are continued to be consumed and no decline in rodent activity can be observed, the likely cause has to be determined. Where other elements have been excluded, it is likely that there are resistant rodent so consider the use of a non-anticoagulant rodenticide, where available, or a more potent anticoagulant rodenticide. Also consider the use of traps as an alternative control measure.

Bait in sachets: [For non-emptiable sachets - Do not open the sachets containing the bait].

Loose pellets-granules, grains: Place the bait in the baiting point by using a dosage devise. Specify the methods to minimise dust (e.g. wet wiping).

IE Only: The resistance status of the target population should be taken into account when considering the choice of rodenticide to be used. In those areas where evidence of resistance to specific active ingredients is suspected, avoid their use. To control the spreading of resistance, it is

advisable to alternate baits containing different anticoagulant active ingredients.

2.5.2 Risk mitigation measures

2.5.2.1 Risk mitigation measures - Professionals

- Where possible, prior to the treatment inform any possible bystanders (e.g. users of the treated area and their surroundings) about the rodent control campaign [*in accordance with the applicable code of good practice, if any*]".
- To reduce risk of secondary poisoning, search for and remove dead rodents at frequent intervals during treatment (e.g. at least twice a week). *[Where relevant, specify if more frequent or daily inspection is required*].
- Products shall not be used beyond 35 days without an evaluation of the state of the infestation and of the efficacy of the treatment.
- Do not use baits containing anticoagulant active substances as permanent baits for the prevention of rodent infestation or monitoring of rodent activities.
- The product information (i.e. label and/or leaflet) shall clearly show that:
- -the product shall not be supplied to the general public (e.g. "for professionals only").
- - the product shall be used in adequate tamper resistant bait stations (e.g. "use in tamper resistant bait stations only").
- -users shall properly label bait stations with the information referred to in section 5.3 of the SPC (e.g. label bait stations according to the product recommendations").
- Using this product should eliminate rodents within 35 days. The product information (i.e. label and/or leaflet) shall clearly recommend that in case of suspected lack of efficacy by the end of the treatment (i.e. rodent activity is still observed), the user should seek advice from the product supplier or call a pest control service.
- Do not wash the bait stations with water between applications.
- Dispose dead rodents in accordance with local requirements *[The method of disposal shall be described specifically in the national SPC and be reflected on the product label].*

2.5.2.2 Risk mitigation measures – Trained Professionals

- Where possible, prior to the treatment inform any possible bystanders about the rodent control campaign *[in accordance with the applicable code of good practice, if any]*".
- The product information (i.e. label and/or leaflet) shall clearly show that the product shall only be

supplied to trained professional users holding certification demonstrating compliance with the applicable training requirements (e.g. "for trained professionals only".

- Do not use in areas where resistance to the active substance can be suspected.

- Products shall not be used beyond 35 days without an evaluation of the state of the infestation and of the efficacy of the treatment

- Do not rotate the use of different anticoagulants with comparable or weaker potency for resistance management purposes. For rotational use, consider using a non-anticoagulant rodenticide, if available, or a more potent anticoagulant.

- Do not wash the bait stations or utensils used in covered and protected bait points with water between applications.

- Dispose of dead rodents in accordance with local requirements *[The method of disposal shall be described specifically in the national SPC and be reflected on the product label]*.

2.5.3 Particulars of likely direct or indirect effects, first aid instructions and emergency measures to protect the environment

This product contains an anticoagulant substance. If ingested, symptoms, which may be delayed, may include nosebleed and bleeding gums. In severe cases, there may be bruising and blood present in the faeces or urine.
Antidote: Vitamin K1 administered by medical/veterinary personnel only.

In case of: Dermal exposure, wash skin with water and then with water and soap.
Eye exposure, rinse eyes with eyes-rinse liquid or water, keep eyes lids open at least 10 minutes.
Oral exposure, rinse mouth carefully with water. Never give anything by mouth to unconscious person. Do not provoke vomiting. If swallowed, seek medical advice immediately and show the product's container or label.
Contact a veterinary surgeon in case of ingestion by a pet.

Bait stations must be labelled with the following information: "do not move or open"; "contains a rodenticide"; "Strong or authorisation number"; "active substance(s)" and "in case of incident, call a poison centre [insert national phone number]".

Hazardous to wildlife.

2.5.4 Instructions for safe disposal of the product and its packaging

At the end of the treatment, dispose of uneaten bait and the packaging in accordance with local requirements. Use of gloves is recommended.

2.5.5 Conditions of storage and shelf-life of the product under normal conditions of storage

Shelf-life: 24 months Store in a dry, cool and well ventilated place. Keep the container closed and away from direct sunlight. Store in places prevented from the access of children, birds, pets and farm animals. Keep only in original container.

2.5.6 Other information

Because of their delayed mode of action, anticoagulant rodenticides may take from 4 to 10 days to be effective after consumption of the bait. Rodents can be disease carriers. Do not touch dead rodents with bare hands, use gloves or use tools such as tongs when disposing them. This product contains a bittering agent and a dye.

2.5.7 Documentation

2.5.7.1 Data submitted in relation to product application

Please see General Annexes section 4.1

2.5.7.2 Access to documentation

The applicant supported the evaluation of the active substance at EU level and has full access to the documents submitted by the taskforce for the EU review programme.

3 Assessment of the product

3.1 Proposed Uses

3.1.1 Use 1 – House mice – professionals – indoor

Product Type(s)	14
Where relevant, an exact description of the use	Rodenticide
Target organism(s) (including development stage)	House mouse (*Mus musculus / Mus domesticus*) – adults and juveniles
Field(s) of use	Indoors
Application method(s)	Ready-to-use bait to be used in tamper-resistant bait stations
Application rate(s) and frequency	Mice: 20-30 g of bait per bait station. If more than one bait station is needed, the minimum distance between bait stations should be 2 meters.
Category(ies) of users	Professionals
Pack sizes and packaging material	Minimum pack size 2.5kg Grams of bait wrapped individually in PE/PP sachet: 10g, 25g or loose bait Packaging material: Bucket (PP,PE), PE/PP sachet in Cardboard box, Paper craft bag with inner liner in PE (loose bait) Packaging size: 2.5Kg to 25Kg Package is restricted to separately packed bags with a maximum bag size of 10 kg.

3.1.2 Use 2 – Rats – professionals – indoor

Product Type(s)	14
Where relevant, an exact description of the use	Rodenticide
Target organism(s) (including development stage)	Brown rat (*Rattus norvegicus*) – adults and juveniles Roof rat (*Rattus rattus*) - adults and juveniles
Field(s) of use	Indoors
Application method(s)	Ready-to-use bait to be used in tamper-resistant bait stations
Application rate(s) and	Rats: 50-100 g of bait per bait station.

frequency	If more than one bait station is needed, the minimum distance between bait stations should be 5 meters.
Category(ies) of users	Professionals
Pack sizes and packaging material	Minimum pack size 2.5kg Grams of bait wrapped individually in PE/PP sachet: 10g, 25g, 50g, 100g or loose bait Packaging material: Bucket (PP,PE), PE/PP sachet in Cardboard box, Paper craft bag with inner liner in PE (loose bait) Packaging size: 2.5Kg to 25Kg Package is restricted to separately packed bags with a maximum bag size of 10 kg.

3.1.3 Use 3 - House mice and/or rats – professionals – outdoor around buildings

Product Type(s)	14
Where relevant, an exact description of the use	Rodenticide
Target organism(s) (including development stage)	House mouse (*Mus musculus / Mus domesticus*) – adults and juveniles Brown rat (*Rattus norvegicus*) – adults and juveniles Roof rat (*Rattus rattus*) - adults and juveniles
Field(s) of use	Outdoors around buildings
Application method(s)	Ready-to-use bait to be used in tamper-resistant bait stations
Application rate(s) and frequency	Mice: 20-30 g of bait per bait station. If more than one bait station is needed, the minimum distance between bait stations should be 2 meters. Rats: 50-100 g of bait per bait station. If more than one bait station is needed, the minimum distance between bait stations should be 5 meters.
Category(ies) of users	Professionals
Pack sizes and packaging material	Minimum pack size 2.5kg Grams of bait wrapped individually in PE/PP sachet: 10g, 25g, 50g, 100g or loose bait Packaging material: Bucket (PP,PE), PE/PP sachet in Cardboard box, Paper craft bag with inner liner in PE (loose bait) Packaging size: 2.5Kg to 25Kg Package is restricted to separately packed bags with a maximum bag size of 10 kg.

3.1.4 Use 4 - House mice and/or rats – trained professionals – indoor

Product Type(s)	14
Where relevant, an exact description of the use	Rodenticide
Target organism(s) (including development stage)	House mouse (*Mus musculus / Mus domesticus*) – adults and juveniles Brown rat (*Rattus norvegicus*) – adults and juveniles Roof rat (*Rattus rattus*) - adults and juveniles
Field(s) of use	Indoors
Application method(s)	Ready-to-use bait to be used in covered bait points or in tamper-resistant bait stations
Application rate(s) and frequency	Mice: 20-30 g of bait per bait station. If more than one bait station is needed, the minimum distance between bait stations should be 2 meters. Rats: 50-100 g of bait per bait station. If more than one bait station is needed, the minimum distance between bait stations should be 5 meters.
Category(ies) of users	Trained Professionals
Pack sizes and packaging material	Minimum pack size 2.5kg Grams of bait wrapped individually in PE/PP sachet: 10g, 25g, 50g, 100g or loose bait Packaging material: Bucket (PP,PE), PE/PP sachet in Cardboard box, Paper craft bag with inner liner in PE (loose bait) Packaging size: 2.5Kg to 25Kg Package is restricted to separately packed bags with a maximum bag size of 10 kg.

3.1.5 Use 5 - House mice and/or rats – trained professionals – outdoor around buildings

Product Type(s)	14
Where relevant, an exact description of the use	Rodenticide
Target organism(s) (including development stage)	House mouse (*Mus musculus / Mus domesticus*) – adults and juveniles Brown rat (*Rattus norvegicus*) – adults and juveniles Roof rat (*Rattus rattus*) - adults and juveniles
Field(s) of use	Outdoors around buildings

Application method(s)	Ready-to-use bait to be used in covered bait points or in tamper-resistant bait stations
Application rate(s) and frequency	Mice: 20-30 g of bait per bait station. If more than one bait station is needed, the minimum distance between bait stations should be 2 meters. Rats: 50-100 g of bait per bait station. If more than one bait station is needed, the minimum distance between bait stations should be 5 meters.
Category(ies) of users	Trained Professionals
Pack sizes and packaging material	Minimum pack size 2.5kg Grams of bait wrapped individually in PE/PP sachet: 10g, 25g, 50g, 100g or loose bait Packaging material: Bucket (PP,PE), PE/PP sachet in Cardboard box, Paper craft bag with inner liner in PE (loose bait) Packaging size: 2.5Kg to 25Kg Package is restricted to separately packed bags with a maximum bag size of 10 kg.

3.1.6 Use 6 - Rats – trained professionals – Outdoor open areas & waste dumps

Product Type(s)	14
Where relevant, an exact description of the use	Rodenticide
Target organism(s) (including development stage)	Brown rat (*Rattus norvegicus*) – adults and juveniles Roof rat (*Rattus rattus*) - adults and juveniles
Field(s) of use	Outdoor open areas & waste dumps
Application method(s)	Ready-to-use bait to be used in covered bait points or in tamper-resistant bait stations
Application rate(s) and frequency	Rats: 50-100 g of bait per bait station. If more than one bait station is needed, the minimum distance between bait stations should be 5 meters.
Category(ies) of users	Trained Professionals
Pack sizes and packaging material	Minimum pack size 2.5kg Grams of bait wrapped individually in PE/PP sachet: 10g, 25g, 50g, 100g or loose bait Packaging material: Bucket (PP,PE), PE/PP sachet in Cardboard box, Paper craft bag with inner liner in PE (loose bait) Packaging size: 2.5Kg to 25Kg Package is restricted to separately packed bags with a maximum bag size of 10 kg.

3.2 Physical, chemical and technical properties

No new data was provided nor had new guidance to be taken into account for the renewal evaluation. Accordingly, the conclusion from the former assessment regarding physical, chemical and technical properties remains valid.

3.3 Physical hazards and respective characteristics

No new data was provided, nor had new guidance to be taken into account for the renewal evaluation. Accordingly, the conclusion from the former assessment regarding physical hazards and respective characteristics remains valid.

3.4 Methods for detection and identification

No new data was provided, nor had new guidance to be taken into account for the renewal evaluation. Accordingly, the conclusion from the former assessment regarding methods for detection and identification remains valid.

3.5 Efficacy against target organisms

The results from laboratory palatability and efficacy studies and field trials previously evaluated demonstrate that the product is both palatable to, and effective in controlling target populations of rats (*Rattus norvegicus* and *Rattus rattus*) and house mice (*Mus musculus/domesticus*) when applied according to the label advice. The ready-to-use grain bait formulation proved to be both attractive to and effective against infestations of rats and house mice in the trials and provided excellent control of the infestations treated based upon census baiting and tracking data.
Resistance to the first generation anticoagulants has been widely reported in both *Rattus norvegicus* and *Mus domesticus* since the late 1950's. The incidence of resistance to first generation anticoagulants in areas in which it is established is commonly 25-85%.
The enzyme vitamin K 2, 3 epoxide reductase (VKOR) is the target for anticoagulants. Modifications in the protein structure due to polymorphisms on the gene coding the VKOR may induce anticoagulant resistance. Most resistant strains are characterised by one single nucleotide polymorphism (SNP). These SNPs cause the exchange of one amino acid in the VKOR enzyme. The biochemical mechanism of anticoagulant resistance has been studied in several geographic strains/VKORC1-variants of the

Norway rat. Amino acid substitutions in the VKOR seem to alter its structure and function, resulting in decreased sensitivity to anticoagulant inhibition, depending on strain characteristics.

For house mice, a dominant autosomal warfarin-resistance gene was determined on chromosome 7 in house mice. Three VKORC1 sequence variants mediating resistance to anticoagulants seem to be widely distributed. House Mice carrying the homozygous of one of these variants (Y139C) were found highly resistant to warfarin and bromadiolone.

For roof rats, experiments on warfarin resistant rats indicated considerable instability in the resistance and suggested a multifactorial basis for resistance.

Some degree of resistance to difenacoum has been reported in the UK, Denmark, France and Germany but this is usually found in certain populations of rodents highly resistant to first generation anti-coagulants (Greaves et al., 1982[7]; Lund, 1984[8]; Pelz et al. 1995[9]). The resistance factor tells how much the anticoagulant dose has to be multiplied to kill resistant individuals compared to sensitive ones. The resistant factors for difenacoum in the brown rats ranged from 1.1 to 8.6 (Greaves and Cullen-Ayres 1988[10]). The study included rats resistant to warfarin and difenacoum. Resistance factors for warfarin ranged from approx. 50 to 2300. Greaves et al. (1982) reported a fivefold difenacoum dose needed to kill difenacoum resistant rats. Considerable doubt exists as to the significance of reports in UK of resistance to second-generation anticoagulants and in the UK control failures with the second-generation products are increasingly being attributed to baiting problems rather than physiological resistance (Greaves and Cullen Ayres, 1988; Quy et al. 1992a,b[11]).

Studies carried out in different European countries, in the UK more particularly (Kerins et al, 2001; see annex 1) revealed the occasional occurrence of cross-resistances to second-generation anticoagulants, such as difenacoum and bromadiolone on resistant brown rats populations to coumafene. Moreover, a publication (Baer et al., 2012) has demonstrated that the majority (91%) of warfarin resistant rat trapped in East and West parts of Belgium were also resistant to bromadiolone. The rats trapped in the region of Flanders (Northern Belgium) carried mutation Y139F. This mutation is found extensively in France where it also confers resistance to bromadiolone (Grandemange et al., 2009). The same mutation was

[7] Greaves J. H.; Shepherd D. S.; Gill, J. E. (1982): An investigation of difenacoum resistance in Norway rat populations in Hampshire. *Annals of Applied Biology* 100, 581–587.

[8] LUND, M. (1984): Resistance to the second generation anticoagulant rodenticides. *In Proceedings of 11th vertebrate pest conference*, Sacramento, Ca. March 6-8, 1984: 89-94.

[9] Pelz H-J, Ha¨nisch D, Lauenstein G (1995) Resistance to anticoagulant rodenticides in Germany and future strategies to control *Rattus norvegicus. Pestic Sci* 43, 61–67

[10] Greaves J. H.; Cullen-Ayres P. B. (1988): Genetics of difenacoum resistance in the rat. In: J. W. Suttie (Ed.), Current advances in vitamin K research, Elsevier, N.Y., 381–388.

[11] Quy R.J., Shepherd D.S., Inglis I.R. (1992): Bait avoidance and effectiveness of anticoagulant rodenticides against warfarin- and difenacoum-resistant populations of Norway rats (Rattus norvegicus). *Crop Protection*, Volume 11, Issue 1, February 1992, Pages 14-20

also found in UK (Prescott et al., 2011) where applications of bromadiolone had been unsuccessful. Difenacoum is also thought to be partially resisted by rats which carry Y139F.

House mice carrying the homozygous Y139C sequence variant were found to be highly resistant to warfarin and bromadiolone. It is important to understand that all known resistance mutations, in both rats and mice, are capable of effective control with applications of the most potent second-generation anticoagulants (brodifacoum, difethialone and flocoumafen) and that no practical resistance to any of these active substances is presently known.

So, resistance to second generation anticoagulant rodenticides should not be underestimated.

An exhaustive study carried out at the French and European levels could enable to point-out resistant areas with first generation anticoagulants and potential cross-resistances to second-generation anticoagulants. It is one of the actions undertaken since 2010 in France by a group of scientists (Rodent program “impacts of anticoagulants rodenticides on ecosystems-adaptations of target rodents and effects on their predators”).

The document CropLife International (RRAC 2016) provides guidance to advisors, national authorities, professionals, practitioners and others on the nature of anticoagulant resistance in rodents, the identification of anticoagulant resistance, strategies for rodenticide application that will avoid the development of resistance and the management of resistance where it occurs.

The following are the essential elements of an effective program: survey, use of physical and chemical control techniques, environmental management, record keeping, monitoring and review.

The authorization holder should report any observed resistance incidents to the Competent Authorities or other appointed bodies involved in resistance management at the renewal of the product.

To ensure a satisfactory level of efficacy and avoid the development of resistance, the recommendations proposed in the SPC have to be implemented.

3.6 Risk assessment for human health

A selected value of 4% was used for dermal absorption for the brodifacoum grain product. The default value of 4% was used in the current evaluation over the previously used value of 3%, based on the ECHA working group discussion (WGV2016_Tox_7-9).

3.6.1 Assessment of effects of the active substance on human health

See section 3.6.3.

3.6.2 Assessment of effects of the product on human health

See section 3.6.3.

The following new guidance had to be taken into account for the re-assessment:
A read across from other second generation anti-coagulants to brodifacoum was regarded as appropriate and in-line with section 6.6.2 of the guidance. The default value of 4% was set by the ECHA working group discussion (WGV2016_Tox_7-9)

Re-assessment of the relevant data:
The product has been evaluated using the default active ingredient concentration and new dermal absorption of 4%.

3.6.3 Exposure assessment

The ECHA working group (WGV2016_Tox_7-9) position on dermal absorption was taken into account for the re-assessment of the brodifacoum containing products. A value of 4% was used for grain in the current evaluation based on the conclusion of the ECHA working group (ECHA, WGV2016_Tox_7-9 Dermal absorption of anticoagulant rodenticide formulations).

The AELs considered in the risk characterization for *Brodifacoum* were derived from read across from difenacoum were:
AEL_{acute} of 0.0000033 mg/kg/day based on the maternal NOEL from a teratogenicity study of 0.001 mg/kg bw/day (rat, maternal effect)
$AEL_{medium\ term}$ of 6.7 x 10^{-6} mg/kg bw/day based on the NOAEL from a developmental study (female rabbit) of 0.002 mg/kg bw/day
AEL_{chr} of 3.3 x 10^{-6} mg/kg bw/day based on the NOAEL for females from the reproductive 2-generation study in rat of 0.001 mg/kg bw/day

The chronic AEL is used for the risk assessment for all professional users. The risk assessment utilises the HEEG recommendations 9, 10 and 12. A critical usage of 100 g has been used for the loading and cleaning risk assessment of loose grain products. As the product uses packages with max capacity of 10kg no decanting risk assessment has been performed in accordance with the revision of HEEG Opinion 12 by the Ad hoc Working Group on Human Exposure in September 2016, "For package sizes ≤ 10kg, loose grains have to be placed on the bait point by using a dosage device

(decanting is to be avoided)." A dermal absorption of 4% was used for the risk assessment for loose grain and a dermal absorption of 0.1% was used for sachet application.

For the 'transient mouthing of poison bait' scenario, 5 and 10 mg (TNsG, with bittering agent/repellent) of the product is assumed to be swallowed by an infant per poisoning event as stated in: The Human Exposure to Biocidal Products (Technical Notes for Guidance – June 2002). The weight of the infant is assumed to be 10kg. An oral absorption of 100% was assumed for the mouthing scenarios in the toddler risk assessment. The acute AEL ($3.3x10^{-6}$ mg/kg bw/day) was used as the endpoint for the toddler risk assessment.

Biocidal Exposure Risk assessment for "Strong" Brodifacoum rodenticide (50 ppm) using read across values for dermal absorption of 4%.

Professional user

	Grain
Without PPE	191.1% (0.00000631 mg/kg bw/day)
With PPE	9.6% (0.000000315 mg/kg bw/day)
Sachet application, without PPE	86.4% (0.00000285 mg/kg bw/day)
Sachet application, with PPE	4.3% (0.000000143 mg/kg bw/day)

Non-trained professional user (farmer)

	Grain
Without PPE	29.4% (0.000000972 mg/kg bw/day)
With PPE	1.5% (0.0000000486 mg/kg bw/day)
Sachet application, without PPE	7.7% (0.000000255 mg/kg bw/day)
Sachet application, with PPE	0.4% (0.0000000128 mg/kg bw/day)

Exposure to children (Toddler)

	Grain
Oral exposure -treated with repellent	1515% of AEL (0.00005 mg/kg bw/day)
Oral exposure - without repellent	757575% of AEL (0.025 mg/kg bw/day)

Derived values indicated no safe usage for professional users handling the loose grain product without PPE, though usage of PPE brought usage into safely limits. Derived values for professional users handling the grain product without PPE were 0.00000631 mg/kg bw/day (191.1% AEL). Derived values for professional users handling the grain product with PPE were 0.000000315 mg/kg bw/day (9.6% AEL).

Derived values indicated safe usage for professional users handling the grain product sachets with and without PPE. Derived values for professional users handling the grain product without PPE were 0.00000285 mg/kg bw/day (191.1% AEL). Derived values for professional users handling the grain product with PPE were 0.000000143 mg/kg bw/day (4.3% AEL).

Derived values indicated safe usage for non-trained professional users handling the grain product both with and without PPE. Derived values for professional users handling the grain product without PPE were 0.000000972 mg/kg bw/day (29.4% AEL). Derived values for professional users handling the grain product with PPE were 0.0000000486 mg/kg bw/day (1.5% AEL).

Derived values indicated safe usage for professional users handling the grain product sachets with and without PPE. Derived values for professional users handling the grain product without PPE were 0.000000255 mg/kg bw/day (7.7% AEL). Derived values for professional users handling the grain product with PPE were 0.0000000128 mg/kg bw/day (0.4% AEL).

Derived values indicated no safe exposure scenarios for toddlers through oral exposure/transient mouthing of the grain product. Derived values for oral exposures in the toddler found transient mounting of a grain not containing a repellent to result in a dose of 0.025 mg (757575% AEL). Derived values for oral exposures in the toddler found transient mounting of a grain containing a repellent to result in a dose of 0.00005 mg (1515% AEL). However, the design of the rat bait boxes will incorporate a tamper-proof seal system to prevent easy access to internal compartments. As a result of incorporating a tamper proof seal system toddlers are not expected to be able to gain

access to the rodenticides and subsequent mouthing scenarios are deemed unlikely.

3.6.4 Risk characterisation for human health

3.6.4.1 Risk for professional users

As shown in section 3.6.2.

3.6.4.2 Risk for the general public

Not relevant.

3.6.4.3 Risk for consumers via residues in food

No new data was provided nor had new guidance to be taken into account for the renewal evaluation. Accordingly, the conclusion from the former assessment regarding risks for consumers via residues in food remain valid.

3.6.4.4 Risk characterisation from combined exposure to several active substances or substances of concern within a biocidal product

The biocidal product does not contain other substances in quantities that would be of toxicological concern in the production formulation.

3.6.4.5 Summary of risk characterisation

Derived values indicated no safe usage for professional users handling the loose grain product without PPE, though usage of PPE brought usage into safely limits. Derived values for professional users handling the grain product without PPE were 0.00000631 mg/kg bw/day (191.1% AEL). Derived values for professional users handling the grain product with PPE were 0.000000315 mg/kg bw/day (9.6% AEL).

Derived values indicated safe usage for professional users handling the grain product sachets with and without PPE. Derived values for professional users handling the grain product without PPE were 0.00000285 mg/kg bw/day (191.1% AEL). Derived values for professional users handling the grain product with PPE were 0.000000143 mg/kg bw/day (4.3% AEL).

Derived values indicated safe usage for non-trained professional users handling the grain product both with and without PPE. Derived values for professional users handling the grain product without PPE were 0.000000972 mg/kg bw/day (29.4% AEL). Derived values for professional users handling the grain product with PPE were 0.0000000486 mg/kg bw/day (1.5% AEL).

Derived values indicated safe usage for professional users handling the grain product sachets with and without PPE. Derived values for professional users handling the grain product without PPE were 0.000000255 mg/kg bw/day (7.7% AEL). Derived values for professional users handling the grain product with PPE were 0.0000000128 mg/kg bw/day (0.4% AEL).

Derived values indicated no safe exposure scenarios for toddlers through oral exposure/transient mouthing of the grain product. Derived values for oral exposures in the toddler found transient mounting of a grain not containing a repellent to result in a dose of 0.025 mg (757575% AEL). Derived values for oral exposures in the toddler found transient mounting of a grain containing a repellent to result in a dose of 0.00005 mg (1515% AEL). However, the design of the rat bait boxes will incorporate a tamper-proof seal system to prevent easy access to internal compartments. As a result of incorporating a tamper proof seal system toddlers are not expected to be able to gain access to the rodenticides and subsequent mouthing scenarios are deemed unlikely.

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3.7 Risk assessment for animal health

No new data was provided, nor had new guidance to be taken into account for the renewal evaluation. Accordingly, the conclusion from the former assessment regarding animal health remains valid.

3.8 Risk assessment for the environment

The exposure assessment carried out for this product in 2013 is still valid. Regarding groundwater, the recent CG decision requires this now be assessed:

Groundwater assessment for rodenticides
As required by Article 31(3) of the BPR and Article 2(1)(f) of Regulation 492/2014, when carrying out their assessment of whether the conclusions of the first authorisation regarding Article 19(1)(iv) remain valid, applicants will have to address the groundwater assessment. Since no new guidance

was agreed in the past that could become applicable at the time of the completion of the applications for renewal by 28/02/2017, the guidance of reference are the existing methods that are applied since years as standard tools for the assessment of active substances:
- Tier I according to Vol. IV Part B (the former TGD), as provided in chapter 2.3.8.6 of this guidance document.
- Tier II using the FOCUS models PEARL or PELMO for refinements in case Tier I would lead to an exceedance of the relevant trigger values.

The previous exposure assessment contained a Tier 1 assessment of groundwater PECs. The following is an extract from the report:

Exposure of groundwater may occur as a result of soil exposure which occurs via residues present in sewage sludge after using the product in sewers and via direct (spillages) and disperse release (urine and faeces) after the use of the product in the scenarios in and around buildings, open areas and waste dumps. As an indication for potential groundwater levels, the concentration in soil porewater in the various scenarios was examined. It should be noted that this is a worst-case assumption, neglecting transformation and dilution in deeper soil layers. A summary of the PECs obtained are presented in the table below. The calculated value for the open areas scenario exceeds the EU trigger value of 0.1 µg/L. However this figure is derived from a soil concentration value in a small localised area in the immediate vicinity of the baiting point. When taken in the context of a larger area (field, park, etc.) this figure would be several orders of magnitude lower. In addition it must be noted that these two scenarios give a value for groundwater under industrial soil – not agricultural soil as specified by the ESD.

Scenario	***In and around buildings***		***Open area***	***Waste dump***	
	Worst case	***Realistic***		***Worst case***	***Realistic***
PEC groundwater (mg/l)	*5.3×10^{-5}*	*6.62×10^{-6}*	*1.96×10^{-4}*	*9.26×10^{-6}*	*2.31×10^{-6}*

As the value for the open areas scenario exceeds the trigger (0.196µg/L) the eCA has performed a Tier II assessment using FOCUS PEARL v4.4.4. The open areas scenario outlined in the PT14 ESD describes placement of the grain bait at the bottom of a cylindrical hole of radius 4cm and depth 30cm. A larger soil cylinder of radius 28cm is assumed to be exposed to the bait. From the soil exposure performed in the 2013 evaluation, 0.0025g of active substance is deposited each campaign (Elocalsoil). The base of the cylinder has an area of $0.062m^2$ ($\pi \times 0.14^2$). 0.0025g spread over an area of $0.062m^2$ gives an application rate of $0.0406gm^{-2}$ or $0.406kgha^{-1}$. This application rate assumes the bait is placed uniformly across the field or park. In reality bait is placed in specific burrows at distances of 5m or greater where rodents are active. Therefore the actual use rate will be considerably lower than 0.406kg/ha. The ESD proposes a 6 day campaign during which the rodenticide is applied. This allows for a possibility of approximately 50 campaign per year. Again this is likely to be significantly greater than

the actual number of campaigns per year so our assessment is expected to be highly conservative in nature. The input parameters are summarised below:

Input parameter	Unit	Brodifacoum
Physicochemical parameters		
Molecular weight	g mol^{-1}	523.4
Water solubility	mg L^{-1}	0.24 (20°C)
Molar enthalpy of dissolution	kJ mol^{-1}	27 (default)
Saturated vapor pressure	Pa	1E-06 (20°C)
Molar enthalpy of vaporisation	kJ mol^{-1}	95 (default)
Diffusion coefficient in water	m^2 d^{-1}	4.3E-05 (default)
Diffusion coefficient in air	m^2 d^{-1}	0.43 (default)
Degradation parameters		
Half-life at reference condition	d	157 (20°C)
Molar activation energy	kJ mol^{-1}	65.4 (default)
Exponent for the effect of liquid	-	0.7 (default)
Sorption parameters		
Kom value (=Koc/1.724)	L kg^{-1}	29,002
Freundlich exponent 1/n	-	1.0 (worst case assumption)
Method of subroutine	-	pH independent
Crop related parameters		
FOCUS crop	-	Grassland
Crop uptake factor	-	0
Application parameters		
Number of applications per annum	-	50
Application rate	kg ha^{-1}	0.406
Application type	-	Injection at 30 cm
Number of applications per annum	-	50

The 80th percentile PEC_{GW} values are shown below. Based on this assessment it can be concluded that there is no risk to groundwater from use of the product.

PEARL SCENARIO	$PEC_{groundwater}$ (µg/L)
Châteaudun	<0.001

Hamburg	<0.001
Jokioinen	<0.001
Kremsmünster	<0.001
Okehampton	<0.001
Piacenza	<0.001
Porto	<0.001
Seville	<0.001
Thiva	<0.001
• Levels above 0.1 µg/L exceed the drinking water limit for pesticides	

Effect assessment

For the effects assessment of the product containing brodifacoum the most conservative values from the combined assessment report is considered.

Conclusion on hazard to aquatic organisms:

PNEC	Compartment
$PNEC_{aqua}$	0.04 µg/L
$PNEC_{STP}$	> 0.0038 mg/l

Conclusion on hazard to the terrestrial organisms:

PNEC	Compartment
$PNEC_{soil}$	0.88 mg a.s./kg ww

Conclusion on hazard to birds:

PNEC	PNECoral bird diet	PNECoral bird
PNEC bird	1.27×10^{-4} mg/kg	1.28×10^{-5} mg/kg bw/d

Conclusion on hazard to mammals:

PNEC	
PNECoral mammals diet	2.22×10^{-4} mg/kg
PNECoral mammals	1.10×10^{-5} mg/kg bw/d

Environment Exposure Assessment

The environment exposure to brodificoum was assessed for brodificoum as a rodenticide bait (product type 14) for use indoors and around buildings, in sewer systems, open areas and waste dumps. The assessments were carried out according to the ESD PT14, the BPR Vol. IV Part B (the former TGD) and the combined assessment report of brodifacoum (Combined Assessment Report Brodifacoum PT

14; RMS Italy, 17 September 2009, revised 16 December 2010, Renewal of approval, September 2016).

Aquatic compartment

A contamination of surface water with brodifacoum from the placing of product in and around buildings is highly unlikely. A lack of exposure to surface water is also stated in the EUBEES 2 emission scenario document. Contamination of surface waters is however expected to arise following use of bait blocks in sewers.

The most sensitive organism in the aquatic tests was alga with a nominal 72 hr ErC50 of 0.04 mg/L. This **$PNEC_{water}$** of 0.04/1000 AF**= 0.00004 mg/L**.

The test with micro-organisms in inhibition of microbial activity showed that concentrations that it is not likely that brodifacoum will have a negative impact on the microbial processes in a sewage treatment plant at solubility limits. This gives a **$PNEC_{STP}$** of **= 0.0038 mg/L.**

As no specific data are available, the toxicity of brodifacoum to sediment-dwelling organisms is covered by the risk to aquatic compartment. The application of an additional factor of 10, as done in CAR A, is considered not necessary as an experimental log Kow = 4.92 (i.e. lower than 5) is available. **Therefore, the PNECsediment organisms = 0.00004 mg/l**.

The risk characterisation for the aquatic compartment is presented in the following table.

Aquatic PEC/PNEC ratios using the realistic and worst case scenario

Exposed compartment	Endpoint	PNEC mg/L	PEC Worst case	PEC Realistic	Risk quotient PEC/PNEC
Surface water	Algae	0.00004	1.77E-06	1.18E-06	0.044
Sediment	Based on aquatic data and equilibrium partitioning method	4.348E-02	1.92E-03	1.28E-03	0.044
STP	Inhibition of microbial activity	0.0038	1.93E-05	1.27E-05	0.005

The PEC/PNEC risk quotient in all compartments are below the trigger value of 1 indicating brodifacoum following the recommended use of the product does not cause an unacceptable risk to aquatic organisms.

Terrestrial compartment

Contamination of soil following the use of product in sewers is highly unlikely during application and use. However, soil may contain low concentrations of brodificoum from the spreading of sludge on land derived from waste water treatment works receiving water after the baiting of sewer systems.

Exposure of the terrestrial compartment (soil) will also occur when product is deployed outdoors. Exposure is assumed to arise through a combination of transfer (direct release) and deposition via urine and faeces (disperse release) onto soil.

Terrestrial PEC/PNEC ratios using the realistic worst case scenario

Exposed compartment	$PNEC_{soil}$	PEC_{soil}	Risk quotient PEC/PNEC
In and around buildings	0.88 mg/kg ww	4.68E-02 mg/kg w/w	≤ 1
Open areas	0.88 mg/kg ww	1.73E-01 mg/kg w/w	≤ 1
Waste dump	0.88 mg/kg ww	8.17E-03 mg/kg w/w	≤ 1
Sewer application of sewage sludge	0.88 mg/kg ww	4.86E-04 mg/kg w/w	≤ 1

The PEC/PNEC ratios were less than 1 when used in and around buildings, open areas, waste dumps and for sewer applications indicating that brodificoum, following recommended use of the product, does not cause unacceptable risk to organisms in any of these terrestrial compartments assessed.

Primary and Secondary Poisoning

The concentration in the final product is 0.005% for the active substance brodifacoum. The assessments were carried out according to the ESD PT14 (CA-Jun03-Doc.8.2-PT14 and the TGD (2003). It involves tiered approaches for assessing the risks through both primary and secondary poisoning.

Primary Poisoning

In the first tier scenario, the risk is characterised by the ratio between PEC_{oral} and $PNEC_{oral}$. The ratios PEC/PNEC are above 1 for both short and long term exposure (data not shown). This indicates a potential risk, which must be refined.

Acute risk assessment for primary poisoning of a non-target organism:

Tier 2:

In the refined risk assessment the daily uptake (ETE) is compared to the PNEC for birds and mammals. The PNEC values for each representative animal are compared with the ETE values to provide an indication of the risk to non-target animals ingesting a daily dose of the product.

Tier 2 acute risk assessment: $PEC_{oral}/PNEC_{oral}$ for non-target animals accidentally exposed to bait containing brodifacoum after one meal

Non-target animals	ETE, concentration of Brodifacoum after one meal (one day) (mg/kg b.w.)		$PNEC_{oral}$ (dose, mg/kg b.w./d)	PEC/PNEC	
	Step 1	Step 2		Step 1	Step 2
Tree sparrow	17.3	12.1	0.0000128	1676134	946094
Chaffinch	15.00	10.5	0.0000128	1171875	820313
Wood pigeon	5.42	3.79	0.0000128	423438	296406
Pheasant	5.39	3.77	0.0000128	421094	294766
Dog	3.0	2.1	0.000011	272727	190909
Pig	0.375	0.263	0.000011	34091	23864
Pig, young	1.2	0.84	0.000011	109091	76364

The ratios PEC/PNEC are above 1 indicating a potential risk even after refinement.

Long-risk assessment for primary poisoning of a non-target organism:

Tier 2:

In the long-term risk assessment, the EC (expected concentration of active substance in the animal) after metabolism and other elimination is calculated and used to calculate the $EC_{oral}/PNEC_{ratio}$after 1-day and 5-day elimination of brodifacoum. The $EC_{oral}/PNEC_{ratio}$ are above 1 after 1-day elimination of Brodifacoum indicating a potential risk (data not shown). The $EC_{oral}/PNEC_{ratio}$ for the 5-day elimination of Brodifacoum are shown below.

Tier 2 long-term risk assessment: $EC_{oral}/PNEC_{oral}$ ratio after 5-day elimination

Species	EC_{oral} after 5 days (mg/kg b.w./d) with excretion factor = .3, AV = 1, PT = 1 (mg/kg bw)[a]	EC_{oral} after 5 days (mg/kg b.w./d) with excretion factor = 0.3, AV = 0.9, PT = 0.8 (mg/kg bw)[a]	$PNEC_{oral}$ (mg/kg b.w./d)	Ratio $EC_{oral}/PNEC_{oral}$
Tree sparrow	30.7	22	0.0000128	2396455
Chaffinch	26.6	18.6	0.0000128	2077852

Wood pigeon	9.61	6.7	0.0000128	750797
Pheasant	9.55	6.7	0.0000128	746641
Dog	5.3	3.72	0.000011	483573
Pig	0.664	0.466	0.000011	60447
Pig, young	2.13	2	0.000011	193429

[a] calculation according to equation 21 in the ESD

The ratios PEC/PNEC are above 1 indicating a potential risk even after refinement.

Conclusion:
Overall, all acute and long-term $PEC_{oral}/PNEC_{oral}$ ratios are still above the trigger value of 1 indicating acute and long-term unacceptable risks

A Tier 1 risk assessment was carried out to assess the risk for poisoning of non-target predator birds and mammals during acute and long-term exposure via rodents poisoned. The $PEC_{oral}/PNEC_{oral}$ values exceeded the trigger value of 1 (data not shown). Therefore, a refined tier 2 assessment was carried out, based on representative species. The refined tier 2 risk assessment considers exposure of relevant species of predators, based on their bodyweights and food intakes. The brodifacoum concentrations in non-target mammals and birds consuming contaminated rodents is calculated ($ETE_{oral\ predators}$) and compared to the $PNEC_{oral}$.

Tier 2 risk assessment of secondary poisoning (non-resistant and resistant rodents)

Species	Exposure	$ETE_{oral\ predators}$ (mg a.s./kg/d)	$PNEC_{oral}$ (mg a.s./kg/d)	Ratio $ETE_{oral\ predators}$ / $PNEC_{oral}$
Barn owl	Day 5 before the last meal	1.10	0.0000128	86205
	Day 5 after the last meal	1.72		134634
	Day 14 after the last meal	2.06		160786
Kestrel	Day 5 before the last meal	1.68	0.0000128	130912
	Day 5 after the last meal	2.62		204458
	Day 14 after the last meal	3.12		244172
Little owl	Day 5 before the last meal	1.25	0.0000128	98361
	Day 5 after the last meal	1.97		153620
	Day 14 after the last meal	2.35		183460
Tawny owl	Day 5 before the last meal	1.01	0.0000128	79243

Species	Exposure	ETE $_{oral\ predators}$ (mg a.s./kg/d)	PNEC$_{oral}$ (mg a.s./kg/d)	Ratio ETE $_{oral\ predators}$ / PNEC$_{oral}$
	Day 5 after the last meal	1.58		123761
	Day 14 after the last meal	1.89		147801
Fox	Day 5 before the last meal	0.41	0.000011	36920
	Day 5 after the last meal	0.63		57662
	Day 14 after the last meal	0.76		68862
Polecat	Day 5 before the last meal	0.85	0.000011	76858
	Day 5 after the last meal	1.32		120036
	Day 14 after the last meal	1.58		143353
Stoat	Day 5 before the last meal	1.21	0.000011	109918
	Day 5 after the last meal	1.89		171670
	Day 14 after the last meal	2.26		205016
Weasel	Day 5 before the last meal	1.74	0.000011	158608
	Day 5 after the last meal	2.72		24713
	Day 14 after the last meal	3.25		295830

All ratios ETE$_{oral\ predators}$ / PNEC$_{oral}$ are above the trigger value of 1 indicating an unacceptable risk of secondary poisoning.

Secondary poisoning via the terrestrial food chain
Mammalian predators of the terrestrial food chain may be at risk for secondary poisoning if they feed on contaminated soil organisms such as earthworms.

Secondary poisoning risk to earthworm-eating birds and mammals

Scenario	$PEC_{oral,earthworm}$ (mg/kg wet earthworm)		PNEC (mg/kg food)	PEC/PNEC	
	Tier 1[a]	Tier 2[b]		Tier 1[a]	Tier 2[b]
Birds					
Sewer system	0.0033	0.0022	1.27×10^{-4}	1.5	17
In and around buildings	0.3791	0.0474		2985	373
Open areas	1.401	N/a		11037	N/a
Waste dumps	0.0662	0.0165		521	129
Mammals					
Sewer system	N/a	N/a	2.22×10^{-4}	N/a	N/a
In and around buildings	0.3791	0.0474		1707	213
Open areas	1.401	N/a		6313	N/a
Waste dumps	0.0662	0.0165		298	74

[a] Product specific application data and default value for release (90% direct +indirect release)
[b] Product specific application data and refined metabolism

Conclusion

The results for sewers,in and around buildings, open areas and waste dumps scenarios indicate a risk of secondary poisoning for birds and mammals consuming contaminated earthworms.

Overall conclusion

According to this risk assessment the risk for poisoning of non-target predator birds and mammals during primary (acute and long-term exposure) and secondary poisoning is high as the trigger value is exceeded in all cases.

No safe use was established for the brodifacoum product at a concentration of 50 ppm in the ecotoxicology risk assessment.

3.9 Assessment of a combination of biocidal products

A use with other biocidal products is not intended.

3.10 Comparative assessment

The Irish CA for biocides has processed an application for renewal for this biocidal product which contains the active substance Brodifacoum. The active substance Brodifacoum meets the criteria for exclusion according to Article 5(1) BPR as well as for substitution according to Article 10 BPR (for details see chapter 2.2.3).
Therefore, in line with Article 23 (1) BPR, a comparative assessment for this product has to be conducted.

At the 60th meeting of representatives of Members States Competent Authorities for the implementation of the BPR held on 20 and 21 May 2015, all Member States submitted to the Commission a number of questions to be addressed at Union level in the context of the comparative assessment to be carried out at the renewal of anticoagulant rodenticide biocidal products ('anticoagulant rodenticides'). The questions submitted were the following:

(a) Is the chemical diversity of the active substances in authorised rodenticides in the Union adequate to minimise the occurrence of resistance in the target harmful organisms?;
(b) For the different uses specified in the applications for renewal, are alternative authorised biocidal products or non-chemical means of control and prevention methods available?;
(c) Do these alternatives present a significantly lower overall risk for human health, animal health and the environment?;
(d) Are these alternatives sufficiently effective?;
(e) Do these alternatives present no other significant economic or practical disadvantages?

The information addressing these questions is provided in the Annex of the Commission Implementing Decision (EU) 2017/1532[12]. In accordance with Article 1 of Commission Implementing Decision (EU) 2017/1532, the Irish CA considered the information in the Annex during the comparative assessment of anticoagulant rodenticide biocidal products.

Conclusion
Based on the information provided in the Annex of the Commission Implementing Decision (EU) 2017/1532 the Irish CA came to the conclusion that in the absence of anticoagulant rodenticides, the use of rodenticides containing other active substances would lead to an inadequate chemical diversity to minimize the occurrence of resistance in the target harmful organisms. These products also showed some significant practical or economical disadvantages for the relevant uses.

[12] Commission Implementing Decision (EU) 2017/532 of 7 September 2017 addressing questions regarding the comparative assessment of anticoagulant rodenticides in accordance with Article 23(5) of Regulation (EU) No 528/2012 of the European Parliament and of the Council.

The Irish CA also considered a number of non-chemical control or prevention methods ("non-chemical alternatives"), which in our view do not provide sufficient alternatives to anticoagulant rodenticides.

In summary it can be concluded that the criteria according Article 23(3) a), b) BPR are not fulfilled. Therefore, the authorisation of this product will be renewed for 5 years.

4 General Annexes

4.1 List of studies for the biocidal product (family)

Author	Year	Title	Publication	Report no.	Legal entity owner	Report date	GLP/ GEP	Data Protection Claimed

4.2 Output tables from exposure assessment tools

None

4.3 New information on the active substance

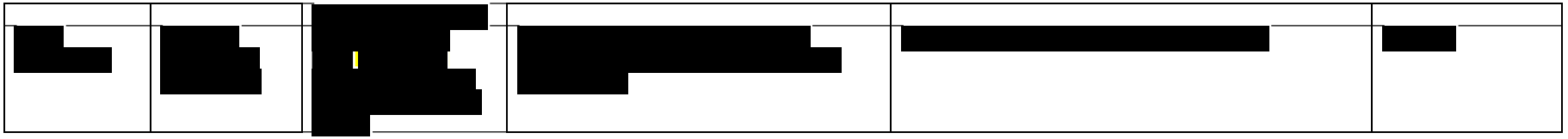
Under the 9th Adaptation to Technical Progress of the Classification and Labelling regulation (Commission Regulation (EU) 2016/1179), anticoagulant rodenticides were classified as Toxic to Reproduction Category 1A or 1B with a specific concentration limit of 0.003%. Under Article 19 of the Biocidal Products Regulation, biocidal products with such classifications (including anticoagulant rodenticides at this and higher concentrations) shall not be authorised for use by the general public.

4.4 Residue behaviour

No assessment necessary.

4.5 [redacted]

[13] If an IUCLID file is not available, please indicate here the summaries of the efficacy studies.



4.6 Other

None.

5 Confidential annex (Access level: “Restricted” to applicant and authority)

5.1

14 g/l, g/kg, other. For biological products, the concentration should state the number of activity units/units of potency (as appropriate) per defined unit of formulation (e.g. per gram or per litre).

[redacted]								
[redacted]	[redacted]			[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
			[redacted]	[redacted]	[redacted]	[redacted]		

Annex 1 - Initial PAR – July 2013

Product Assessment Report

Strong

Active substance:	**Brodifacoun**
Product-type:	**PT 14**
Type of application:	**Authorisation**
Authorisation No:	**IE/BPA 70288 (Professional)** **IE/BPA 70289 (Non-professional)**
Date:	**31 July 2013**

Biocidal Product Assessment Report (PAR) related to Product Authorisation under Directive 98/8/EC.

Department of Agriculture, Food and the Marine
An Roinn Talmhaíochta, Bia agus Mara

Pesticide Registration and Control Division
Department of Agriculture, Food and the Marine
Backweston Campus
Young's Cross
Celbridge
Co. Kildare
Ireland

CONTENTS

1. General information about the product application

This application for product authorisation is for:

Trade name:	Strong
Authorisation No.:	IE/BPA 70288 (Professional and Trained Professional) IE/BPA 70289 (General public / Non-professional)

1.1 Applicant/ Authorization Holder

Company Name:	Belgagri S.A.
Address:	Rue des Tuiliers 1 B4480 Engis Belgium
Tel:	+32 85519519
E-mail:	belgagri@belgagri.com
Contact:	Mr Antoine Trigaux

1.2 Marketing/Distributing Company (where applicable)

Company Name:	N/A
Address:	N/A
Tel:	N/A
E-mail:	N/A
Contact:	N/A

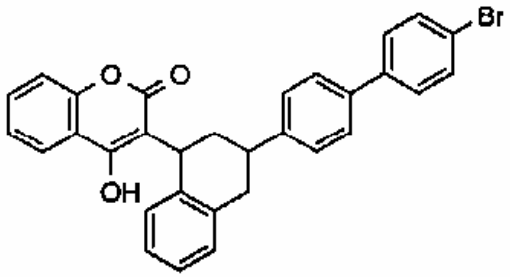
1.3 General Information on the Biocidal Product

Trade name:	Strong
Manufacturer's development code number(s):	N/A
Active substance content:	0.005% w/w Brodifacoum
Main group:	MG03 Pest Control
Product type:	PT14 (Rodenticides)
Product Specification:	See Confidential Annex
Site of product formulation:	See Confidential Annex
Frame formulation (yes/no):	No
Formulation type:	Ready-to-use (RB) Grain Bait (AB)
Ready to use product (yes/no):	Yes
Chemical/micro-organism:	Chemical Substance

Contain or consist of GMOs[15] (yes/no):	N/A
Is the product already notified/authorised (Directive 98/8/EC) (yes/no); If yes: product name:	No
Is the biocidal product equivalent to the product assessed for the purpose of Annex I inclusion to 98/8/EC (yes/no):	No.

Manufacturer of Formulated Product	
Company Name:	Belgagri S.A.
Address:	Rue des Tuiliers 1 B4480 Engis Belgium
Tel:	+32 85519519
E-mail:	belgagri@belgagri.com
Contact:	Mr Antoine Trigaux

1.4 Information on active substance(s)[16]

Active substance chemical name:	Brodifacoum
IUPAC name:	3-[3-(4'-bromobiphenyl-4-yl)-1,2,3,4-tetrahydro-1-naphthyl]-4-hydroxycoumarin
CAS No:	56073-10-0
EC No:	259-980-5
Purity (minimum, g/kg or g/l):	950 g/kg
Molecular formula:	$C_{31}H_{23}BrO_3$
Structural Formula:	
Manufacturing site:	See Confidential Annex

[15] A copy of any written consent(s) of the competent authorities to the deliberate release into the environment of the GMOs for research and development purposes where provided for by Part B of the above-mentioned Directive was provided.

[16] Please insert additional columns as necessary

Specification of pure active substance:	See Confidential Annex
Is a new active substance data package (source) supplied (yes/no):	No
If yes, Is the active substance equivalent to the active substance listed in Annex I to 98/8/EC (yes/no):	N/A
If no, does the applicant have a LoA to the active substance data packaged used to support Annex I inclusion (yes/no):	Yes (Pelgar International Ltd.)

Manufacturer of active substance(s)	
Company Name:	Pelgar International Ltd.
Address:	Unit 13 Newman Lane Industrial Estate Alton. Hants. GU34 2 QR UK
Tel:	+44 (0)1420 80744
E-mail:	anne@pelgar.co.uk
Contact:	Ms Anne Withall

1.5 Information on the intended use(s) of the biocidal product

Main Group:	MG03 (Pest control)
Product-type:	PT14 (Rodenticide)
Intended use:	A ready-to-use grain bait containing Brodifacoum (0.005% w/w) for use as a rodenticide for the control of rats and mice indoors, outdoors around buildings for amateur and professional users and open areas and waste dumps for professionals only users for the protection of public health, stored products and materials.
Target organisms:	(I.1) Rodents (I.1.1) Murids (I.1.1.1) Brown rats (Rattus Norvegicus) (I.1.1.2) House rat (Rattus rattus) (I.1.1.3) House mouse (Mus musculus)
Development stage:	(II.1) Juveniles (II.2) Adults
Function:	Rodenticide
Mode of action:	Anticoagulant III.2 long-term action III.2.1 anticoagulant III.2.1.1 ingestion toxin III.2.1.1.1 ingestion by eating
Application aim:	VII.1 Stored product protection/food protection VII.2 Health protection VII.3 Material protection (e.g. historical buildings, technical objects)
Category of users:	V.1 Non Professional/General public V.2 Professional V.3 Trained/specialised professional
Area of use (indoors/outdoors):	IV.1 Indoors (warehouses, houses, outbuildings) IV.2 Outdoors (in and around buildings), IE/BPA 70288 ONLY IV.2 Outdoors (open spaces and waste dumps)
Application method:	VI.2 Covered applications VI.2.1 In bait stations (product can only be applied in bait stations for waste dump and open area applications) VI.2.2 Other coverings (this does not include application

	down rat holes)
Directions for use including minimum and maximum application rates, typical size of application area:	IE/BPA 70288, IE/BPA 70289 Indoors and outdoors (in and around buildings only) Rats (Adult and Juvenile): Secure 45 - 60g of bait in covered, tamper resistant baiting stations spaced 10m apart (5m apart in areas of high infestation) in areas where rats are active. Regularly check bait consumption and replace consumed or spoilt bait until consumption has stopped. Repeat treatment in situations where there is evidence of new infestation (e.g. fresh tracks or droppings). Mice (Adult and Juvenile): Secure 10 - 25g of bait, in covered, tamper resistant baiting stations spaced 5m apart (2m apart in high infestation areas) in areas where mice are active. Regularly check bait consumption and replace consumed or spoilt bait until consumption has stopped. Repeat treatment in situations where there is evidence of new infestation (e.g. fresh tracks or droppings). IE/BPA 70288, Outdoors (open areas and waste dumps) Rats (Adult and Juvenile): Secure 45 - 60g of bait in covered, tamper resistant baiting stations spaced 10m apart (5m apart in areas of high infestation) in areas where rats are active. Inspect bait consumption frequently particularly during the first 10 to 15 days and replace consumed or spoilt bait until consumption has stopped. Repeat treatment in situations where there is evidence of new infestation (e.g. fresh tracks or droppings). Mice (Adult and Juvenile): Secure 10 - 25g of bait, in covered, tamper resistant baiting stations spaced 5m apart (2m apart in high infestation areas) in areas where mice are active. Inspect bait consumption frequently particularly during the first 10 to 15 days and replace consumed or spoilt bait until consumption has stopped. Repeat treatment in situations where there is

	evidence of new infestation (e.g. fresh tracks or droppings).
Potential for release into the environment (yes/no):	Yes
Potential for contamination of food/feedingstuff (yes/no):	No

1.6 Documentation

1.6.1 Data submitted in relation to product application

A full new product dossier was submitted by Belgagri S.A. in support of the product Strong containing brodifacoum.

Please see the attached reference list in Annex IV:

1.6.2 Access to documentation

Belgagri S.A. has a letter of access to data held by PelGar International Ltd which was used to support the Annex I listing of the active substance brodifacoum in Directive 98/8/EC. Belgagri S.A. does not have access to the Annex III product data package held by PelGar International Ltd.

Belgagri S.A has a letter of access to formulation toxicological data for the product Vertox Whole Wheat Bait held by Pelgar International Limited.

2. *Classification, labelling and packaging*

Under this heading the assessment of the classification, labelling and packaging should be summarised. Further, any result of the assessments made under the following headings that require recommendations or restrictions appearing on the label should be summarised here.

2.1. Harmonised classification of the active substance

Brodifacoum is not currently classified in Annex I of Council Directive 67/548/EEC or according to Annex VI of Regulation (EC) no 1907/2006 (REACH). The following classification and labelling is proposed on the basis of available data resulting from the review programme for brodifacoum and is provided in the table below according to Directive 67/548/EEC/Regulation (EC) 1272/2008. Additionally, the extrapolation of these proposals using the BG RCI converter tool (http://www.gischem.de/ghs/konverter) is also provided in the table below in accordance with Regulation (EC) 1272/2008.

Classification of the active substance, brodifacoum, according to Directive 67/548/EEC and CLP Regulation (EC) 1272/2008:

Symbol(s):		**Pictogram(s):**	
Indication(s) of danger:	T+ Very Toxic N Dangerous for the Environment	**Signal word(s):**	Danger
Risk phrases:	R26/27/28: Very toxic by inhalation, in contact with skin and if swallowed. R43: May cause sensitisation by skin contact R48/23/24/25: Toxic: Danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed. R61: May cause harm to the unborn child. R50/53: Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.	**Hazard statements:**	H300: Fatal if swallowed. H310: Fatal in contact with skin. H317: May cause an allergic skin reaction H330: Fatal if inhaled. H360D: May damage the unborn child. H372: Causes damage to organs through prolonged or repeated exposure through inhalation. H400: Very toxic to aquatic life H410: Very toxic to aquatic life with long lasting effects.
Safety phrases:	S20/21: When eating do not eat, drink or smoke S35: The material and its container must be disposed of in a safe way S36/37: Wear suitable protective clothing and gloves S45: In case of accident or if you feel unwell seek medical advice immediately (show the label where possible) S60: This material and its container must be disposed of as hazardous waste. S61: Avoid release to the environment. Refer to special	**Precautionary statements:**	P101: If medical advice ist needed, have product container or label at hand. P103: Read label before use. P270: Do not eat, drink or smoke when using this product. P273: Avoid release to the environment. P280: Wear protective gloves and clothing P281: Use personal protective equipment as required. P301 + P310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician. P308 + P313: IF exposed or

	instructions/safety data sheet.		concerned: Get medical advice/attention. P314: Get medical advice/attention if you feel unwell. P501: Dispose of contents/container to hazardous waste facilities in accordance with national regulations.

Specific concentration limits for brodifacoum are proved below in accordance with Directive 67/548/EEC:

Specific concentration limits:	C≥2.5% 1%≤C<2.5% 0.5%≤C<1% 0.25%≤C<0.5% 0.025%≤C<0.25% 0.0025%≤C<0.025%	T+, N; R26/27/28-48/23/24/25-43-61-50/53 T+, N; R26/27/28-48/23/24/25-43-61-51/53 T+, N; R26/27/28-48/23/24/25-61-51/53 T+, N; R26/27/28-48/23/24/25-51/53 T ; R23/24/25-48/20/21/22-52/53 Xn; R20/21/22

Additionally, brodifacoum does not exhibit hazardous physical-chemical properties. Brodifacoum is thermally stable at 52°C. It is not classified as highly flammable and does not undergo self ignition below its melting point. It is not considered to be explosive or to have oxidising properties. There is no record that it has reacted with any storage container during many years of industrial production. It is concluded therefore, that there are no hazards associated with its physico-chemical properties under normal conditions of use.

2.2. Harmonised classification and labelling of the biocidal product

The current classification and labelling, based on the biocidal product evaluation for Strong, is provided in the tables below according to Directive 99/45/EC and Regulation (EC) 1272/2008, Annex VI, Part 3.

Classification and Labelling of the biocidal product according to Directive 99/45/EC:

Symbol(s):	N/A	N/A
Indication(s) of danger:	N/A	N/A
Risk phrases:	N/A	
Safety phrases:	S1+S2: Keep locked up and out of reach of children S13: Keep away from food, drink and animal feeding stuffs. S20 + S21: When using do not eat, drink or smoke. S24: Avoid contact with skin S35: This material and its container must be disposed of in a safe way. S37: Wear suitable gloves (Prof only) S46: If swallowed, seek medical advice immediately and show this container or label. S49: Keep only in the original container	

	S61: Avoid release to the environment. Refer to special instructions/safety data sheet

Classification and Labelling of the biocidal product according to the CLP Regulation (EC) 1272/2008:

Pictogram(s):	N/A
Signal word(s):	N/A
Hazard statements:	N/A
Precautionary statements	P102: Keep out of reach of children. P103: Read label before use. P220: Keep/Store away from food, drink and animal feedingstuffs. P262: Do not get on skin P270: Do not eat, drink or smoke when using this product. P273: Avoid release to the environment P280: Wear protective gloves (prof only) P301+310: IF SWALLOWED: Immediately call a poison centre or doctor/physician. P404+405: Store locked up in a closed container. P501: Dispose of contents/container in accordance with national regulations.

Physical-chemical properties:
Not explosive, oxidising or highly flammable and therefore does not classify from a physical-chemical point of view.

Toxicology:
There is no toxicology classification for the product under the Directive 99/45.

There is no toxicology classification for the product under the CLP Regulation 1272/2008.

Environment:
There is no environmental classification for the product under the Directive 99/45.

There is no environmental classification for the product under the CLP Regulation 1272/2008.

Other:
Further, the content of the label should be updated to comply with the labelling requirements established (for biocidal products) where the labelling requirements in Article 20(3) of Directive 98/8/EC has been implemented. The safety data sheet should comply with the requirements in Regulation (EC) 1907/2006.

Additional Labelling Requirements:

Addition safety Information:	To avoid risks to human health and the environment, comply with the instructions for use. Harmful to wildlife Use bait containers clearly marked “poison” at all surface baiting points. Remove all remains of bait, dead rodents during and after treatment and dispose of safely. Apply only in positions inaccessible to children and pets.
Special labelling provisions for Ireland:	Use Biocides Safely and Sustainably (IE/BPA 70288) Not For Amateur Sale It is illegal to use this product for uses or in a manner other than that prescribed on this label.
If a separate leaflet is attached to or supplied with the product, add the following information to the front label:	Read attached instructions before use

2.3. Packaging

The packaging details for the biocidal product, Strong, as presented by the applicant, are outlined below for amateur and professional users.

Nomenclature: PP = polypropylene, PS = polystyrene, PE = polyethylene, HDPE = high-density polyethylene, PVC = polyvinylchloride, AL = Aluminium

Amateur product packaging:
On the basis of the packaging details presented, it is considered appropriate to limit aspects of the packaging for amateur users as a risk mitigation measure. Packaging restrictions are to be limited to pre-baited bait stations and refill packs with a **maximum pack-size of 500g**. Additionally, the grain bait should be supplied to the amateur market in sachets/wrapped in order to reduce exposure risks to amateur operators during application to bait stations.

Amateur Product Packaging:

Product packaging: PP Sachets

Container description:	PP Sachets	
Pack size(s):	25g	50g
Baits per pack:	1 x 25g	1 x 50g
Packaging materials:	PP	
Child safety features (yes/no):	No	
	N/A	
Ready-to-use (yes/no)	Yes	
Shelf-life:	2 years	
Conditions of storage:	Store in dry, cool area. Store in tightly closed packaging. Keep in original containers. Store away from damp or wet conditions. Keep away from children.	

Product packaging: Cardboard box

Container description:	Cardboard Box		
Pack size(s):	250g	300g	400g
Baits per pack:	10 x 25g 5 x 50g	6 x 50g	8 x 50g 16 x 25g
Pack dimensions (LxWxH):	85x135x90	85x135x180	85x135x180
Packaging materials:	Cardboard box	Cardboard box + 2 PVC baiting stations	Cardboard box
Inner Packaging materials:	PP sachets		
Child safety features (yes/no):	No		
	N/A		
Ready-to-use (yes/no)	Yes		

Shelf-life:	2 years
Conditions of storage:	Store in dry, cool area. Store in tightly closed packaging. Keep in original containers. Store away from damp or wet conditions. Keep away from children.

Professional Product Packaging:

Product packaging: Cardboard box

Container description:	Cardboard Box	
Pack size(s):	600g	1kg
Baits per pack:	24 x 25g 12 x 50g 6 x 100g	40 x 25g 20 x 50g 10 x 100g
Pack dimensions (LxWxH):	85x135x180	85x135x180
Packaging materials:	Cardboard box	
Inner Packaging materials:	PP sachets	
Child safety features (yes/no):	No	
	N/A	
Ready-to-use (yes/no)	Yes	
Shelf-life:	2 years	
Conditions of storage:	Store in dry, cool area. Store in tightly closed packaging. Keep in original containers. Store away from damp or wet conditions. Keep away from children.	

Product packaging: Pot

Container description:	Pot
Pack size(s):	800g
Baits per pack:	1 x 800g
Pack dimensions (LxWxH):	116x116x206
Packaging materials:	PP pot
Child safety features (yes/no):	No
	N/A
Ready-to-use (yes/no)	Yes
Shelf-life:	2 years
Conditions of storage:	Store in dry, cool area. Store in tightly closed packaging. Keep in

	original containers. Store away from damp or wet conditions. Keep away from children.

Product packaging: Cardboard Can

Container description:	Cardboard Can		
Pack size(s):	1 kg	1.2 kg	1.5 kg
Baits per pack:	1 x 1kg	1 x 1.2 kg	1 x 1.5 kg
Pack dimensions (LxWxH):	240x55	240x55	240x55
Packaging materials:	Cardboard can		
Inner Packaging materials:	PP sachets		
Child safety features (yes/no):	No		
	N/A		
Ready-to-use (yes/no)	Yes		
Shelf-life:	2 years		
Conditions of storage:	Store in dry, cool area. Store in tightly closed packaging. Keep in original containers. Store away from damp or wet conditions. Keep away from children.		

Product packaging: Bucket

Container description:	Bucket							
Pack size(s):	2kg	2.5 kg	3 kg	4 kg	5 kg	6 kg	10 kg	15 kg
Baits per pack:	1 x 2kg 20 x 100g	1 x 2.5kg 50 x 50g	1 x 3 kg 30 x 100g	1 x 4 kg 40 x 100g	1 x 5 kg 50 x 100g	1 x 6 kg 60 x 100g	1 x 10kg	1 x 15kg
Pack dimensions (LxWxH):	244x173	244x173	244x173	207x300x213	300x275	288x230	288x330	350x350
Packaging materials:	PP Bucket							
Inner Packaging materials:	Loose bait or PP sachets							
Child	No							

safety features (yes/no):	N/A
Ready-to-use (yes/no)	Yes
Shelf-life:	2 years
Conditions of storage:	Store in dry, cool area. Store in tightly closed packaging. Keep in original containers. Store away from damp or wet conditions. Keep away from children.

Pack size:

IE/BPA 70289 – **Maximum Amateur refill pack size of 500g**

PP sachets: 25g, 50g

Cardboard box containing sachets (25g, 50g): 250g, 300g, 400g, (the bait must be supplied in inner packs or units, each containing enough bait for one point)

Cardboard box containing sachets (50g) and 2 soft PVC baiting stations: 300g (the bait must be supplied in inner packs or units, each containing enough bait for one point)

Bait sizes: 25g, 50g

IE/BPA 70288: Professional packs[17].

Sachets (PP): 25g, 50g, 100g

Cardboard box containing sachets (25g, 50g or 100g): 600g, 1kg,

Pot (PP): 800g

Cardboard Can containing sachets (25g, 50g or 100g): 1kg, 1.2kg or 1.5kg

Bucket (PP): 2kg, 2.5kg, 3kg, 4kg, 5kg, 6kg, 10kg, 15kg

Bucket (PP) containing sachets (100g): 2kg, 3kg, 4kg, 5kg, 6kg

Bucket (PP) containing sachets (50g): 2.5kg

[17] PP = polypropylene, PS = polystyrene, PE = polyethylene, HDPE = high-density polyethylene, PVC = polyvinylchloride

Container materials[18]:	Box container – cardboard
	Can – cardboard
	Pot – PP
	Bucket container – PP
	Bags – double-layer Kraft paper bags
Safety features:	Covered bait stations (tamper resistant)
	Wrapped bait (sachets)

3. Summary of the product assessment

3.1. Physico/chemical properties and analytical methods

Active substance (taken from the Activa/PelGar Brodifacoum and Difenacoum Task Force CAR):
Brodifacoum is an off-white powder at 20°C and atmospheric pressure, with a relative density of 1.53. It was observed to darken and decompose at 235.8°C, whereas no decomposition or transformation occurred below 150°C. Brodifacoum is non-volatile, with a Henry's Law Constant value of 2.35E-18 $Pa.m^3.mol^{-1}$. It is essentially insoluble in water at pH 5, but its solubility proved to increase with pH, due to the variation of the ionisation degree of the 4-hydroxycoumarin group in pH range under investigation (5-9). Brodifacoum also turned out to be soluble in organic solvents; results showed that solubility did not vary with temperature, except for dichloromethane.

Brodifacoum dissociation constant was estimated to be 4.50. Log P_{ow} was found to be 4.92 at pH 7 and 20°C. As expected, Log P_{ow} decreased with higher temperature and pH. Brodifacoum is not highly flammable. Besides, it does not show explosive or oxidising properties. Reaction with container materials (mild steel) has not been observed, either. All results considered, it can be concluded that Brodifacoum does not exhibit hazardous physical-chemical properties.

Biocidal product:
Strong is not explosive, oxidising or highly flammable and therefore does not classify from a physical chemical point of view. The grain bait is stable when stored for 2 weeks at 54°C. This indicates that the paste bait will be stable when stored at ambient temperatures for up to 2 years. The grain bait is stable when stored for 12 months at ambient temperatures (20°C ± 2°C). The product showed no signs of interaction with its packaging material up to 12 months of storage. The test item is a ready-to-use grain bait and is not intended to be added or mixed with any other product.

[18] PP = polypropylene, PS = polystyrene, PE = polyethylene, HDPE = high-density polyethylene, PVC = polyvinylchloride

3.1.1. Identity related issues

An equivalence check was carried out by Italy that showed that the PelGar source of Brodifacoum active substance was equivalent to the source of Brodifacoum active substance listed in Annex I of 98/8/EC (see Annex I: Confidential Information and Data).

Composition of the biocidal product Strong

Component	% w/w	g/kg	Chemical name	CAS no	Function
Brodifacoum	0.005	0.05	3-[3-(4'-bromobiphenyl-4-yl)-1,2,3,4-tetrahydro-1-naphthyl]-4-hydroxycoumarin	56073-10-0	Active substance
Co-formulants	See Confidential Data and Information (Annex I)				

Note: The biocidal product Strong is not the same as the representative biocidal product accompanying the Annex I inclusion. See confidential information and data for details of the composition of Strong.

3.1.2. Physico-chemical properties

Belgagri SA have a letter of access from PelGar International Limited which covers the all the data for the Annex I listing of the active ingredient Brodifacoum. PelGar International Limited is a member of the Activa/PelGar Difenacoum and Brodifacoum Task Force and as such has access to the complete Annex I listing documentation submitted by this group. Belgagri SA do not have access to any of PelGar's product studies (Annex III) data for the purpose of product authorisation at the Member State level.

3.1.3. Physical, Chemical and Technical Properties of the Biocidal Product

[redacted]

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
			[redacted]		
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
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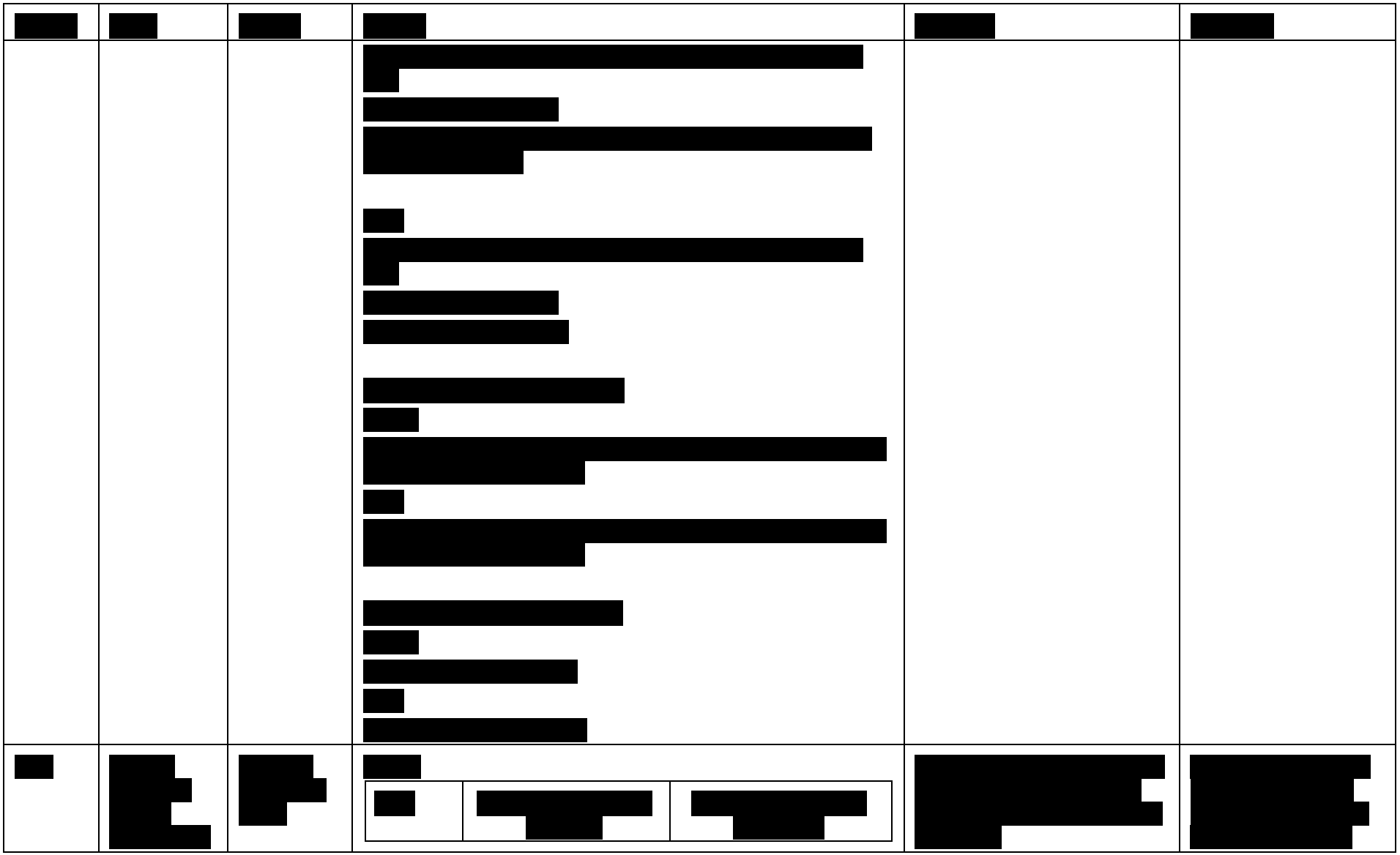

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			[redacted]		[redacted]
[redacted]	[redacted]			[redacted]	

Conclusions:

Strong is not explosive, oxidising or highly flammable and therefore does not classify from a physical chemical point of view. The grain bait is stable when stored for 2 weeks at 54°C. This indicates that the paste bait will be stable when stored at ambient temperatures for up to 2 years. The grain bait is stable when stored for 12 months at ambient temperatures (20°C ± 2°C). The product showed no signs of interaction with its packaging material up to 12 months of storage. The test item is a ready-to-use grain bait and is not intended to be added or mixed with any other product.

Data requirements:

The 24 month and 36 month storage stability studies will not be available until January 2014 and January 2015 respectively. Belgagri have committed to submitting this information to the RefMS once it becomes available.

The grain bait is considered compatible with the following packaging:

Cardboard box with transparent printed plastic bags inside.

Proposed shelf life for the whole wheat bait:

2 year shelf life (based on ambient and accelerated storage stability data).

3.1.4. Analytical methods

Strong was not assessed as part of the Annex I inclusion process therefore the Applicant has submitted the following method of analysis to cover the outstanding data gap.

<table>
<tr><td>Report:</td><td>Defitraces report no. 11-902007-015</td></tr>
<tr><td>Title:</td><td>“Validation of an analytical method for the determination of Brodifacoum in Brodifacoum grain bait 0.005% w/w”</td></tr>
<tr><td>Author(s):</td><td>Ricau Hélène</td></tr>
<tr><td>Date:</td><td>17th February 2012</td></tr>
<tr><td>GLP: Yes/No</td><td>Yes.</td></tr>
<tr><td>Principle of the Method:</td><td>Brodifacoum was analysed after extraction from the formulation and quantified by liquid chromatography using a reverse phase column and UV detector (at 265 nm).</td></tr>
<tr><td>Linearity:</td><td>Five concentrations between 50 and 150% (0.49, 0.78, 1.00, 1.28 and 1.48 mg/L) of the reference item concentration were analysed. A 5-point calibration curve was included and was linear. The correlation coefficient r^2 was 0.9965.
The response of the detector was linear within the range 0.49-1.48 mg/L.</td></tr>
<tr><td>Precision/repeatability:</td><td>The precision was determined by analysing five specimen samples twice. The concentration of Brodifacoum was 0.0052% w/w of 0.052 g/kg. The RSD was 2.19% which was less than the result of the modified Horwitz equation (5.914).
The precision was acceptable as the RSD < modified Horwitz equation.</td></tr>
<tr><td>Accuracy:</td><td>The accuracy was determined by comparison of the reference items and two reconstituted samples.
<table>
<tr><th>Extract</th><th>Conc. in soln. (mg/L)</th><th>Amount found (g/kg)</th><th>Accuracy (%)</th><th>Mean accuracy (%)</th></tr>
<tr><td>Ex 100%A</td><td>0.98</td><td>973.8</td><td>98</td><td rowspan="2">98</td></tr>
<tr><td>Ex 100%A</td><td>0.97</td><td>966.6</td><td>97</td></tr>
<tr><td>Ex 100%B</td><td>1.08</td><td>984.0</td><td>99</td><td rowspan="2">100</td></tr>
<tr><td>Ex 100%B</td><td>1.08</td><td>990.6</td><td>100</td></tr>
</table>
The results fall within the range 80-120% and are acceptable.</td></tr>
<tr><td>Specificity:</td><td>A solvent blank, a formulation blank, the reference item and the test item were analysed in order to define the specificity.
No peak appeared in the solvent blank and the formulation blank.
In the reference item and in the test item, the peaks at the retention times around about 4.455 and 4.915 min represent isomers of Brodifacoum. No additional peak appeared in the reference item and in the test item.
The method is specific.</td></tr>
</table>

Conclusion:
The method of analysis is acceptable for the determination of Brodifacoum in Brodifacoum grain bait.

Data requirements:
None.

3.1.5. Analytical method for the relevant impurities, isomers and co-formulants in the biocidal product

Not applicable.

3.2. Efficacy of the Biocidal Product

3.2.1. Function/Field of use

PT14: Rodenticide

3.2.2. Organisms to be controlled

STRONG (containing 50 mg/kg brodifacoum) is a ready-to-use cereal grain bait intended to control the brown rat (Rattus norvegicus), roof rat (Rattus rattus) and the house mouse mice (Mus musculus). Belgagri has proposed the use area indoors and outdoors around buildings, open spaces and waste dumps for the protection of public health, stored products and materials. Belgagri has claimed amateur and professional use of STRONG bait in and around buildings. For rats, each bait point will contain up to 60g of bait; a mouse bait point will contain up to 25g bait.

Advice concerning application frequency should be included on the draft label.
Reference to “sewer rat” should be changed to “brown rat” on both the amateur and professional draft labels as it is a more common name for the target species.
There is no indication on the draft label on how long the bait can be stored while still remaining effective.
The dosage rates on the professional draft label should be brought in line with those on the amateur version, i.e. 45-60g for rats; 10-25g for mice.

3.2.3. Dose/Mode of action

Anticoagulant rodenticides are vitamin K antagonists. The main site of their action is the liver, where several of the blood coagulation precursors undergo vitamin K dependent post translation processing before they are converted into the respective procoagulant zymogens. The specific point of action is thought to be the inhibition of K_1 epoxide reductase. The anticoagulants accumulate and are stored in the liver until broken down. The plasma prothrombin (procoagulant factor II) concentration provides a suitable guide to the severity of acute intoxication and to the effectiveness and required duration of the antidoting therapy (vitamin K_1).

3.2.4. Effects on the target organisms (efficacy)

Data from trials using the grain bait formulation were provided in the form of laboratory and field studies to verify the proposed label claims.

Laboratory palatability and efficacy studies:
One laboratory palatability and efficacy (choice) test conducted on rats with fresh bait.
One laboratory palatability and efficacy (choice) test conducted on mice with fresh bait.
One laboratory palatability and efficacy (choice) test conducted on rats with bait aged for two weeks at 54°C.
One laboratory palatability and efficacy (choice) test conducted on rats with bait aged for two weeks at 54°C.

Field efficacy studies:
Two field studies conducted on rats (one on Rattus norvegicus & one on Rattus rattus).
Two field studies conducted on mice.

Belgagri provided the study reports from four laboratory studies conducted on STRONG ready-to-use cereal bait. The experiments were all choice studies conducted according to OEPP/EPPO (1982) and US EPA (1982) guidance. Two studies were conducted on the house mouse, one with fresh bait and

one with aged bait (accelerated to reproduce two years of storage). Two additional studies were done on the brown rat, one of which used aged bait. The results from the studies are summarised in **Table 3.2**. The results achieved demonstrated that STRONG is palatable to the house mouse and the brown rat according to the criteria given in TNsG on Product Evaluation as the bait intake was much greater than 20% of the total food consumption in all the studies. The accelerated storage treatment was found not to adversely affect the palatability or effectiveness of the product. As all test animals (mice & brown rats) died within 3-14 days after the start of the experiments the results from the laboratory testing scheme confirm that product is both palatable to and effective against the target organisms. Results from three field studies using STRONG bait were also provided. The field trial programme demonstrated total efficacy against wild populations of the brown rat (Rattus norvegicus), roof rat (Rattus rattus) and for the mouse (Mus musculus/domesticus). No daily bait consumption or activity was noted during the post-treatment monitoring period indicating complete control of the target pests.

Table 3.2: Experimental data on the effectiveness of STRONG Grain Bait containing 50 mg/kg brodifacoum.

Test system/conditions	Test results: effects, mode of action, resistance	Reference
Laboratory test. Choice feeding test: fresh baits. CD albino Norway rats (Rattus norvegicus) 10 animals (5 males, 5 females)	The results show a mean acceptance of the test item of 38.86% (standard error. 6.15%). Total mortality was observed in both male and female rats. The mean time-to-death was 4.4 days (range 3 to 6 days). The efficacy was total: 100% in less than 14 days.	B5.10/01
Laboratory test. Choice feeding test: fresh baits. CD-1 albino house mice (Mus musculus) 10 animals (5 males, 5 females)	The results show a mean acceptance of the test item of 64.34% (standard error. 4.07%). Total mortality was observed in both male and female mice. The mean time-to-death was 6.4 days (range 3 to 9 days). The efficacy was total: 100% in less than 14 days.	B5.10/02
Laboratory test. Choice feeding test: aged baits (2 weeks at 54°C). CD albino Norway rats (Rattus norvegicus) 10 animals (5 males, 5 females)	The results demonstrated a mean acceptance of the test item of 56.7% (standard error. 15.1%). Total mortality was observed in both male and female mice. The mean time-to-death was 4.2 days (range 3 to 7 days). The efficacy was total: 100% in less than 14 days.	B5.10/03
Laboratory test. Choice feeding test: aged baits (2 weeks at 54°C). CD-1 albino house mice (Mus musculus) 10 animals (5 males, 5 females)	The results demonstrated a mean acceptance of the test item of 67.4% (standard error. 24.4%). Total mortality was observed in both male and female mice. The mean time-to-death was 6.6 days (range 4 to 14 days). The efficacy was total: 100% in less than 14 days.	B5.10/04
Field test carried out on a farm (henhouses, fodder and equipment warehouses). Wild Norway rats (Rattus norvegicus). About 30-35, estimated by pre-treatment bait census	The efficacy measured was complete (100%)	B5.10/05

Test system/conditions	Test results: effects, mode of action, resistance	Reference
Field test carried out on a farm (cow breeding stables, fodder and equipment warehouses). Wild Roof rats (Rattus rattus). About 30-35, estimated by pre-treatment bait census	The efficacy measured was complete (100%)	B5.10/06
Field test carried out on a farm (cow breeding stables, fodder and equipment warehouses). Wild House mice (Mus musculus). About 30, estimated by pre-treatment bait census	The efficacy measured was complete (100%)	B5.10/07

3.2.5. Known limitations (e.g. resistance)

Resistance is exclusively related to the active substance Brodifacoum and is discussed in Doc. II-A (please see Brodifacoum Assessment Report – 17/09/2009, revised 16/12/2010 and refer to Letter of Access from Pelgar International Limited). The resistance to Brodifacoum is not regarded as unacceptable and only few events are referred as “suspected” resistance to Brodifacoum products. In conclusion there is no reason to suspect a lack of efficacy of Brodifacoum-based products and it is possible to state that Brodifacoum is fully active against rodents' populations that developed resistance to Warfarin.

Where resistance to Brodifacoum is suspected or has been shown, resistant management strategies should be employed and products containing an alternative active substance should be used or a professional pest control operator be consulted.

Moreover, the following measures from Codes of Good Practice in Rodent control[19] (EPPO standards - Guidelines on Good Plant Protection Practice – Rodent control for crop protection and on farms- PP 2/5) are recommended and usually respected by the applicators:
- The population size of the target rodent should be evaluated before a control campaign. The number of baits and the timing of the control campaign should be in proportion to the size of the infestation.
- A complete elimination of rodents in the infested area should be achieved.
- The use instruction of products should contain guidance on resistance management for rodenticides.
- Resistant management strategies should be developed, and Brodifacoum should not be used in an area where resistance to this substance is suspected.
- The authorisation holder shall report any observed resistance incidents to the Competent Authorities or other appointed bodies involved in resistance management.

19 EPPO standards - Guidelines on Good Plant Protection Practice – Rodent control for crop protection and on farms- PP 2/5

- When the product is being used in public areas, the areas treated must be marked during the treatment period and a notice explaining the risk of primary or secondary poisoning by the anticoagulant as well as indicating the first measures to be taken in case of poisoning must be made available alongside the baits.

In addition, the IE CA recommends the following in relation to resistance management:
The immediate aim of resistance management is to prevent or retard the development of resistance to a given anticoagulant while, as far as is not counterproductive, permitting its continued use. The ultimate aim is to reduce or eliminate the adverse consequences of resistance.

CropLife International has published a strategy for resistant management of rodenticides (RRAC 2003). The habitat management is addressed in the strategy in addition to chemical control. The access of rodents should be restricted by physical barriers and no food should be available for rodents. Rotation between different anticoagulants is not a reliable means of managing the anticoagulant resistance, as all anticoagulants have the same mode of action and the nature of resistance is also similar. The resistant individuals can be identified by conducting a blood clotting response (BCR) test (Gill et al. 1993, RRAC 2003).

Resistance management strategies

The immediate aim of resistance management is to prevent or retard the development of resistance to a given anticoagulant while, as far as is not counterproductive, permitting its continued use.

To this extent the applicant suggests the following measures to aid in the prevention of resistance:

- Maximum use of non-chemical control techniques.
- Preferential use of rodenticides and formulations to which resistance rarely develops.
- Ensure the complete eradication of the target population whenever a rodenticide is used.
- Avoid the use of first generation anticoagulants, to which resistance develops relatively easily.
- Maintain uncontrolled, susceptible populations in refugia from which emigration can occur.

It is recommended that the label states that any instances of resistance are referred to the manufacturer of the a.s.

In order to prevent the development and spreading of resistance, some resistance management strategies measures such as those from the Codes of Good Practices in rodent control are recommended:

- The population size of the target rodent should be evaluated before a control campaign. The number of baits and the timing of the control campaign should be in proportion to the infestation level.
- A complete elimination of rodents in the infested area should be achieved.

- The use instruction of products should contain guidance on resistance management for rodenticides.
- The authorisation holder shall report any observed resistance incident to the Competent Authorities or other appointed bodies involved in resistance management.

The proposed labels contain detailed instructions for use.

- The population size of the target rodent should be evaluated before a control campaign.
- The number of baits and the timing of the control campaign must be in proportion to the infestation level.
- Baits must be placed in a safe manner inaccessible to children and non-target species and not be applied to areas where food/feed, food utensils or food processing surfaces may come into contact with, or be contaminated by the product.
- Bait consumption should be regularly checked and consumed or spoilt bait replaced until consumption has stopped. The remaining baits and material must be removed and disposed of safely at the end of the treatment according to local/national wastes disposal regulation.
- Water must not be contaminated with the product or its container.
- The rodents' bodies all along the treatment must be disposed of according to local/national regulation.

In addition to the above applicant and label recommendations the RMS advocates the adoption of the following advice to avoid the development of resistance in susceptible rodent populations.

Details of treatment should be recorded.

- Apply effective Integrated Pest Management measures (remove alternative food sources, remove water sources, remove harbourage and proof susceptible areas against rodent access).
- Inspected baiting points weekly and replace old bait where necessary.
- Do not routinely use anticoagulant rodenticides as permanent baits. Use permanent baits only where there is a clear and identified risk of immigration or introduction or where protection is afforded to high-risk areas. (The RMS view is that routine use of anticoagulant baits should not be recommended in above described situations.) .
- Where rodent activity persists due to problems other than resistance, use alternative baits or baiting strategies, extend the baiting programme or apply alternative control techniques to eliminate the residual infestation (acute or sub-acute rodenticides, gassing or trapping).

Treatment of rodent infestations containing resistant individuals

- Where rodent infestations containing resistant individuals are identified, immediately use an alternative anticoagulant of higher potency. If in doubt, seek expert advice on the local circumstances.
- Alternatively use an acute or sub-acute but non-anticoagulant rodenticide.
- In both cases it is essential that complete elimination of the rodent population is achieved. Where residual activity is identified apply intensive trapping to eliminate remaining rodents. Gassing or fumigation may be useful in specific situations.
- Apply thorough Integrated Pest Management procedures (environmental hygiene, proofing and exclusion).

Application of area or block rodent control to eliminate resistance

- Where individual infestations are found to be resistant or contain resistant individuals it is possible that the resistance extends further to neighbouring properties.
- Where there are indications that resistance may be more extensive than a single infestation, apply area or block control rodent programmes.
- The area under such management should extend at least to the boundaries of the area known resistance and ideally beyond.
- These programmes must be effectively coordinated and should encompass the procedures identified above.

3.2.6. Humaneness

The use of Brodifacoum as a rodenticide could cause suffering of vertebrate target organisms. The use of anti-coagulant rodenticides is necessary as there are at present no other valuable measures available to control the rodent population in the European Union. Rodent control is needed to prevent disease transmission, contamination of food and feeding stuffs and structural damage. It is recognised that such substances do cause pain in rodents but it is considered that this is not in conflict with the requirements of Article 5.1 of Directive 98/8/EC 'to avoid unnecessary pain and suffering of vertebrates', as long as effective, but comparable less painful alternative biocidal substances or biocidal products or even non-biocidal alternatives are not available.

Conclusion:
The IE CA considers that the palatability and efficacy data provided is adequate to support the recommendation for the use of the product against rats and mice, even when stored for up to two years.

Issues identified:

Advice concerning application frequency should be included on the draft label.
Reference to "sewer rat" should be changed to "brown rat" on both the amateur and professional draft labels as it is a more common name for the target species.
There is no indication on the draft label on how long the bait can be stored while still remaining effective.
The dosage rates on the professional draft label should be brought in line with those on the amateur version, i.e. 45-60g for rats; 10-25g for mice.

3.3 Biocidal Product Risk Assessment (Human Health and the Environment)

3.3.1 Description of the intended use(s)

The product "**Strong"** grain bait is a rodenticide. It is a ready-to-use sachet and a bulk product for professional use only. The grain bait contains 50 ppm (0.005% w/w) Brodifacoum (56073-10-0). The bait is used in and around buildings and in sewer systems. The target organisms to be controlled are Brown rat, Roof rat or House rat, House mouse and Field mouse.

3.3.2 Hazard Assessment for Human Health

No new exposure studies have been submitted for evaluation. Signs of poisoning in rodents and other mammals are those associated with an increased tendency to bleed, leading ultimately to profuse haemorrhage. Non-target organisms are most at risk from secondary poisoning, i.e. consumption of rodent carcasses by predators such as raptors.

3.3.2.1 Toxicology of the active substance

Brodifacoum is a second-generation single-dose anticoagulant rodenticide. It disrupts the normal blood clotting mechanisms resulting in increased bleeding tendency and, eventually, profuse haemorrhage and death. Like all anticoagulant rodenticides, brodifacoum is structurally similar to vitamin K. Blood forms a clot at the site of injury by virtue of a complicated 'clotting cascade', involving numerous clotting factors. The clotting factors are made in the liver as inactive precursors, converted to active form and allowed to circulate in the bloodstream. Vitamin K is employed in the liver in the activation process, and is used in a continuous cyclic process involving several enzymes. The anticoagulant rodenticides block these enzymes, preventing regeneration of the vitamin K and preventing activation of the clotting factors.

Brodifacoum requires labelling with the symbol T+ and the risk phrases R 28 'Very toxic if swallowed'; R27 'Very toxic in contact with the skin' and R26 'Very toxic by inhalation'. Brodifacoum is not classified as a skin irritant or eye irritant.

Repeated dosing studies show effects on blood coagulation and death at low doses (µg/kg bw/day), and therefore labelling with R48/23/24/25 is warranted.

Under the GHS scheme Acute tox. 1, H310, Acute tox. 2 H300 and STOT RE 1 H372.

The Commission Working Group of Specialised Experts on Reproductive Toxicity has unanimously recommended that all AVK rodenticides should collectively be regarded as human teratogens due to the structural similarity to and the same mode of action as the known developmental toxicant warfarin (meeting in Ispra, 19-20 September 2006). Therefore based on read across data from warfarin, brodifacoum is considered to be a possible developmental toxicant and requires the classification as Reprotoxic with the labelling R61, may cause harm to the unborn child.

An almost complete oral absorption can be considered, on the basis of amount of radioactivity recovered in the excreta and retained in the tissues. Brodifacoum is widely distributed and bioaccumulates mainly in the liver with lower concentrations in the kidney. Hepatic bioaccumulation of

Brodifacoum is a non-linear vs dose and time. The elimination kinetic from the liver was biphasic, with an half-life in the range of 282-350 days. The excretion after oral administration is very slow (11 – 14% in 10 days), occurring via the urine and the bile, both as polar metabolites (glucuronide) and parent compound. The metabolism of Brodifacoum is limited and the toxicologically relevant chemical species is the parent compound.

As long as dermal absorption is concerned, on the basis of the available study and reading acroos from data on other 2nd generation anticoagulant rodenticides, two different values could be used for risk characterisation depending on the type of formulation, that is 3% (pellets and grains) or 0.047% (wax block bait).

Brodifacoum is very toxic after oral administration and also via the dermal and inhalation routes. Death was the result of internal haemorrhage. Classification with T+; R26/27/28; 'Very toxic by inhalation, in contact with skin and if swallowed' is warranted.
Brodifacoum does not fulfil the EU criteria for classification as a skin or eye irritant. Although showed no sensitizing potential in a LLNA study in mice, it was able to cause skin sensitization in guinea pig and fulfils the EU criteria for classification as a skin sensitizer.

Summary of brodifacoum subchronic, chronic, mutagenic and reproductive toxicity.

Repeated oral exposure to Brodifacoum resulted in clinical signs and toxicity consistent with the mode of action of the rodenticide and its properties of anti-coagulant agent (lethal haemorrhages). The NOEL for subchronic oral toxicity is in the range 0.04 -0.001 mg/kg/day (the lowest values identified with sensitive end-points, such as increases in both the kaolin-cephalin time and the prothrombin time). Based on results from the acute dermal and inhalation toxicity studies, route-to-route extrapolation, consistently with the decision adopted for Difenacoum, it is justified to assume serious damages associated to prolonged exposure through dermal and inhalation routes also. Therefore, classification with T; R48/23/24/25 "Toxic: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed" is warranted.

Genotoxicity and Carcinogenicity

Brodifacoum displayed no mutagenic activity in a standard range of genotoxicity tests. No long-term carcinogenicity study was submitted by the two applicants. In fact, chronic toxicity studies were not considered to be technically feasible due to the specific action of the active substance on the test/target species. However, the anticoagulant action is apparently the only pharmacological action of Brodifacoum. The active substance has no structural alerts for carcinogenicity and no concern about possible non-genotoxic carcinogenic potential can be derived from the toxicological studies. Therefore

the justifications of both the applicants for not-submission of carcinogenicity data was considered acceptable.

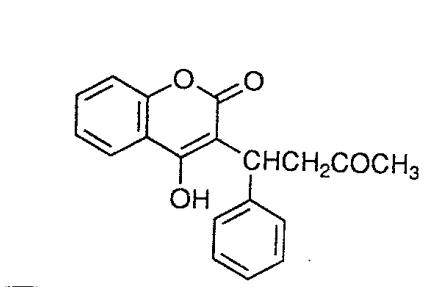
Conclusion on Reproductive toxicity

Reproductive and developmental toxicity studies on Brodifacoum did not reveal any specific effects. General toxicity effects were consistent with the mode of action of the rodenticide and its properties of anti-coagulant agent. The lowest NOAELs for rabbits and rats were 0.002 and 0.001 mg/kg bw.
In spite of these findings, a provisional decision has been made at the Technical Meeting of Classification and Labelling that [R61] should be applied to all anticoagulant active substances on the basis of analogy to Warfarin.
None of the acute or subchronic performed tests gave any indication for a potential neurotoxic effect of Brodifacoum

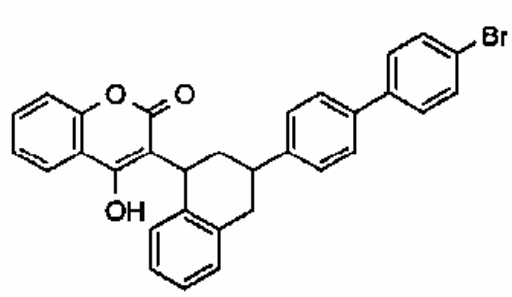
Medical data

Routine monitoring of workers (industrial users) producing Brodifacoum and formulating products has been carried out for the last forty years. Between June 1981 and September 1982, three poisoning incidents occurred with successful recovery. With the exception of these incidents, routine monitoring has shown no clinical effects in any workers. During this time there has been no evidence of allergenicity, sensitisation or any other abnormal effects induced by repeated and continual exposure to these anticoagulant rodenticides.

The molecules both have significant structural similarity to vitamin K. This structural similarity is responsible for the ability to interfere with i.e. block the enzymes used to regenerate vitamin K. The major differences in the active substances lie in their ‘tails’, which have varying degree of lipophilicity. There is long term experience with warfarin, widely used in anti-clotting therapy in humans for over forty years, with no association with increased incidence of cancer. The absence of adverse effects in millions of humans following four decades of long term warfarin therapy is considered sufficient evidence that warfarin is not carcinogenic. The structural similarity of brodifacoum to warfarin (see below), together with the negative results in the guideline mutagenicity tests, indicates that brodifacoum is not carcinogenic.



Warfarin



Brodifacoum

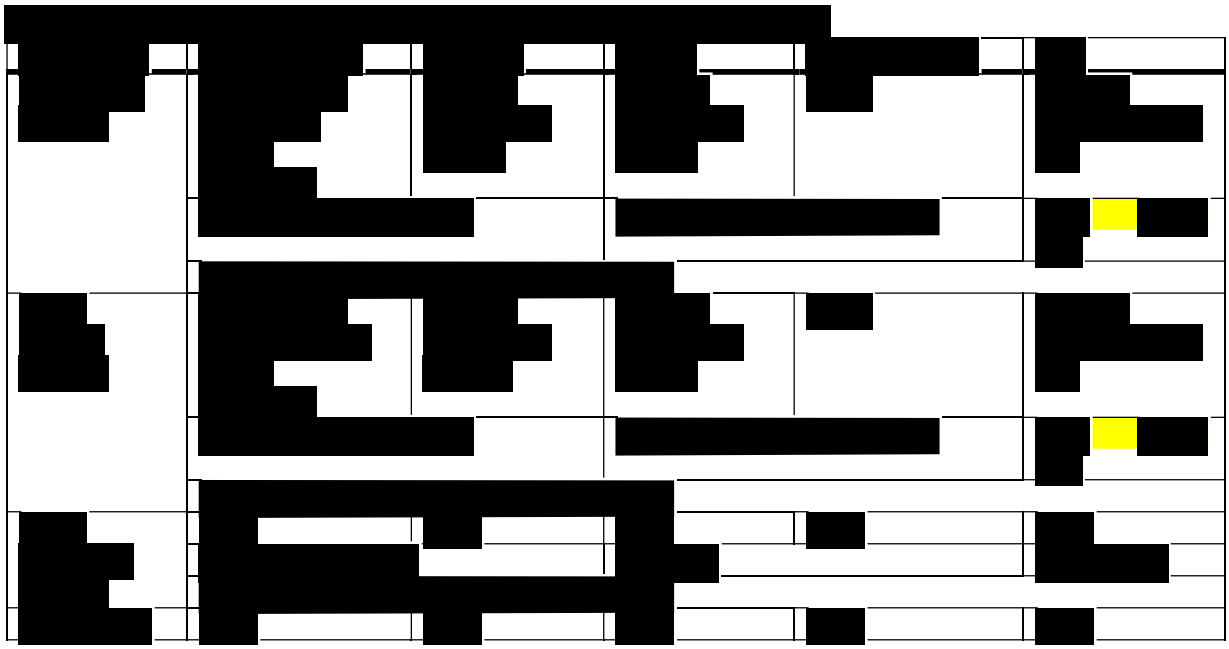
TMIII09 agreed to derive $AEL_{medium\ term}$ consistently with what decided for the other AVK rodenticides. Therefore, $AEL_{medium\ term}$ was calculated from the NOAEL of 0.002 mg/kg bw/day (developmental oral toxicity study in rabbit) divided by an Assessment Factor of 300 (10 for interspecies x 10 for intraspecies x 3 additional factor for severity of effects). The $AEL_{medium\ term}$ results to be of 6.7×10^{-6} mg/kg bw/day.

Conclusions:
The following AELs should be considered in the risk characterization for Brodifacoum:

- AEL_{acute} of 0.0000033 mg/kg/day based on the maternal NOEL from a teratogenicity study of 0.001 mg/kg bw/day (rat, maternal effect)
- $AEL_{medium\ term}$ of 6.7×10^{-6} mg/kg bw/day based on the NOAEL from a developmental study (female rabbit) of 0.002 mg/kg bw/day
- AEL_{chr} of 3.3×10^{-6} mg/kg bw/day based on the NOAEL for females from the reproductive 2-generation study in rat of 0.001 mg/kg bw/day

3.3.2.2 Toxicology of the biocidal product

The toxicology of the biocidal product was examined appropriately according to standard requirements. The product was not a dummy product in the EU- review program for inclusion of the active substance in Annex I of Directive 98/8/EC.



Conclusion:
According to the results of the toxicological studies, Brodifacoum Block bait does not classify with respect to Directive 1999/45/EC or Regulation (EC) No 1272/2008. However, safety phrases and precautionary statements are proposed by the Rapporteur.

Data requirements: (List if applicable)
None.

Data requirements: (List if applicable)
None.

3.3.2.3 Toxicology of the co-formulants (substances of concern)

The biocidal product contains no other substances in quantities that would be of toxicological concern. The majority of these components are food grade materials and are not classified.

Summary of toxicological properties of the co-formulants in Grain

3.3.3 Exposure Assessment for Human Health

The most relevant route of exposure to the active substance is the dermal route. For exposure assessment only active substance from wax blocks has been modelled. The block product typically takes the form of a solid waxy block with a strong sweet smell containing 0.005% w/w Brodifacoum.

In the final CAR for brodifacoum dermal absorption values were derived from read across from data on Difenacoum. The values chosen were 0.047% for wax formulations and 3% for grain/pellet formulations. These values were deemed appropriate in the absence of product specific data.

The active substance has a low vapour pressure, therefore the potential for evaporation is low, and hence the potential for inhalation exposure is low. Inhalation exposure is only of concern during the formulation process where the active substance has a potential for becoming airborne when mixed with dry bait ingredients. In the case of wax blocks, inhalation exposure is irrelevant. Inhalation exposure from handling grain bait during loading/application and cleaning is also proposed as negligible. The only relevant inhalation exposure is assumed to be that from the decanting of loose grain, pellets and granules due to the potential release of airborne dusts.

Any potential oral exposure will be indirect exposure via possible release to the environment. Other possible exposure scenarios include dermal contact with dead animals and accidental ingestion of poison baits by children.

Key Endpoints for Exposure Assessment

The following AELs should be considered in the risk characterization for Brodifacoum:

- AEL_{acute} of 0.0000033 mg/kg/day based on the maternal NOEL from a teratogenicity study of 0.001 mg/kg bw/day (rat, maternal effect)
- $AEL_{medium\ term}$ of 6.7×10^{-6} mg/kg bw/day based on the NOAEL from a developmental study (female rabbit) of 0.002 mg/kg bw/day
- AEL_{chr} of 3.3×10^{-6} mg/kg bw/day based on the NOAEL for females from the reproductive 2-generation study in rat of 0.001 mg/kg bw/day

Data requirements: (List if applicable)
None.

3.3.3.1 Exposure to professional users

MG/PT	Field of uses envisaged	Likely concentrations at which a.s. will be used
Main group 03; PT 14	**Professional uses**	
	Rodenticide used in and around buildings Use in sewerage (only against rats)	0.005% w/w
	Non-professional uses	
	Rodenticide used in and around buildings	0.005% w/w

There are two groups of humans which may be potentially exposed to the rodenticide baits : those who handle, apply and dispose of the product or other residues such as carcasses or faeces (direct

exposure) and those who may be incidentally exposed while the product is in use (incidental exposure).

Method of application

Block bait is made of paraffinic blocks to which the active substance has been added. These Brodifacoum baits are used indoors and outdoors to kill mice and rats: they are placed at the appropriate places in bait stations or covered under a curved tile, a wooden board or in a piece of tube; the animals eat some of the product and die. Baits must be deposited in a way to minimize the risk for non-target animals and for children. Where possible, baits are secured so that they cannot be dragged away by the rodents. Preferably bait stations will be used where the bait can't be hidden, fixed or locked up. The common strategy is to explore the site, locate runs, burrows, droppings or signs of damage and place the bait boxes at entry points into buildings and around areas where rats are known to feed. For the mice control, as mice are sporadic feeders, many bait points are placed throughout the areas where mice are known to feed.

In sewers, the bait is eaten in situ by target rodents. The brown rat is the only mammal able to live in sewers. For house and field mice control, the recommended dose is 20 to 30 g of bait every 2 to 5 meters. For rat control, the recommended dose is 60 to 100 g of bait every 5 to 10 meters.
In sewers, place 200 to 300 g every 30-50m (never more than 300 g at each manhole).

There are three phases for the human exposure:

- Application phase: application of rodenticides by professionals and non-professionals.
In and around domestic, industrial and commercial buildings, the product is applied manually, at measured amounts in bait boxes or covered. Professional users are assumed to wear protective gloves when handling the product unlike amateur users.
In sewerage, the bait is applied only by professionals, typically hanged to a wire tied up to the wall a few centimetres above the bottom of manholes.
Bait points are controlled regularly. Any bait eaten or damaged has to be replaced. Depending on infestation rate, an advised frequency of inspection is 3 to 5 days. During the bait inspections, also a search in the zone will be done for dead rodents.

- Use phase: Post-application, i.e. from the use of rodenticide products and from contact with the product (e.g. residential exposure including indoor air contamination, contact with the product during use). The use phase is the period when the biocidal product is waiting to be consumed by the target organism. This means that no primary exposure of humans is intended and should not take place (please refer to point 3.2.4 Secondary exposure).

- Disposal phase: Disposal (including handling of surplus formulated product, burning/incineration, dumping, empty containers, dead rodents (carcasses) disposal).

Human exposure assessment

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

Exposure path	Industrial use[1)]	Professional use[2)]	General public[3)]	via the environment[4)]
Inhalation[5)]	Not appropriate	Yes	Yes	No
Dermal[6)]	Not appropriate	Yes	Yes	No
Oral	Not appropriate	No	Yes	No

[1)] Industrial use (manufacture of active substance and formulation of products) is not covered by BPD. Workers in formulation manufacture are not exposed to levels of a.s. that would affect blood clotting.
[2)] Includes non-trained professionals.
[3)] Indirect exposure due to transient mouthing by infants is included in the scenarios for the general public.
[4)] According to the TNsG, indirect exposure via the environment is considered to be of minor importance as the release of rodenticides to the environment is limited.
[5)] The skin is the main exposure route with a small proportion of inhalation exposure to dust when grain-based baits are mechanically handled by professionals. The active substance is of low volatility and it is incorporated at very low concentrations into a solid, non-volatile matrix. Therefore inhalation exposure is considered as negligible.
[6)] Except for the grain block bait which is always packed in individual sachets for both professionals and general public and for grain bait only for the amateurs, dermal contact with the product is a realistic scenario.

The magnitude of human exposure to block bait can be assessed by applying standard exposure models of TNsG[20] for human exposure (2007) or the Harmonised approach for the assessment of rodenticides (anticoagulants) endorsed at TM II 2011 for professionals and amateurs users. Moreover, CONSEXPO 4.1 model can be used to assess the exposure to the biocidal product used by non-professionals.

The following basic primary exposure pathways have to be considered for a risk assessment in order to sum up the exposure of humans to Brodifacoum. The main exposure path is direct skin contact during the use of the biocidal product.
Ingestion is a secondary pathway or an accidental primary exposure during the use of the biocidal product.
Inhalation is considered as negligible.
According to the various pathways, the following absorptions will be applied in the assessment:
- Inhalatory uptake fraction: 1 (default value of 100%);
  Inhalation rate: 1.25 m^3/h (default value)
- Dermal uptake: 0.047% for wax formulations and 3 % for and grain/pellet.
- Oral uptake fraction 100%

[20] Human exposure to Biocidal products-Technical Notes for Guidance, June 2007

3.3.3.2 Professional exposure

For professional use, the operator is trained in the correct use of the bait, i.e. placement, number of bait points/boxes required based on the infestation rate area, the amount of bait or number of bait place packs per bait point/box and safe handling procedures.
The use of PPE - disposable gloves and a dust mask may be employed when decanting bait and disposable gloves may be employed when loading bait boxes and disposing of remaining bait and carcasses. However, when the bait is contained within a bait box there will be no exposure of the operator to the product.
PPE (coverall, boots and gloves) is required as standard when the bait is used in sewage systems.

Exposure calculations – professionals

The CEFIC/EBPF Rodenticides Data Development Group conducted an operator exposure study using flocoumafen (which may be considered a suitable surrogate for all other second generation anti-coagulants) to determine exposure during simulated use of rodenticide baits (Chambers 2004, unpublished, confidential). This study examined exposure to wax blocks (20g wax block baits, 5 blocks/bait box) and grain bait. Guidance is also taken from a confidential paper entitled "Harmonised Approach for Rodenticides" by the German Competent Authority, Bundesanstalt für Arbeitsschutz und Arbeitsmedizin (BAuA).

The Chambers study determined exposure from the decanting phase from the following scenario: 3kg grain bait is decanted from 25kg drums into a 10L plastic bucket (termed 1 manipulation). Decanting of 3kg portions are performed 1, 5, and 10 times. The results show an increase in exposure with increasing manipulations. The determined value is lower than that used by Finland in their exposure estimates in the CAR. The proposed value of **52.34mg (of grain bait) per decanting of 3kg grain bait** is determined to represent the dermal exposure for this manipulation. The following assessment considers both the total used amount of grain in the decanting process and the number of bait station manipulations per day.

For professional operators the potential total daily dermal exposure (assuming the previously agreed number of 63bait station loadings from TM III/10 is applied and a total of 200g bait is applied per bait station, thus requiring 12.6kg grain bait in total) from the decanting-phase is **220mg** grain product per day (i.e. 52.3mg × 12.6kg / 3kg).

Dermal Exposure during the loading and placement of bait stations:

The Chambers study determined exposure from the application phase from the following scenario: 5 operators transferred 200g of loose grain bait from a 10L bucket using a plastic scoop into a bait station, this was repeated to give a total of 1, 5 and 10 manipulations. The proposed value of **2.04mg (of grain bait) per bait station application** is determined to represent the dermal exposure for this manipulation. If we consider the total daily number of applications to 63 bait stations then this represents a total calculated daily dermal exposure of **128mg** grain product per day (i.e. 2.04mg × 63). No linear relationship was found between exposure and the handled amount of grain per bait station, therefore the value of 2.04mg per bait station application is assumed regardless of the total amount of grain bait loaded into each bait station.

Dermal Exposure during the cleaning of bait stations:

The Chambers study determined exposure from the cleaning phase from the following scenario: 5 operators emptied a loaded bait station containing 200g of grain bait, into a 10L bucket. This was repeated to give a total of 1, 5 and 10 such manipulations. The proposed value of **3.79mg (of grain bait) per bait station manipulation** is determined to represent the potential dermal exposure for this activity. If we consider the total daily number of cleaning manipulations to be done on 16 bait stations then this represents a total calculated daily dermal exposure of **60.6mg** grain product per day (i.e. 3.79mg × 16). No linear relationship was found between exposure and the handled amount of grain per bait station, therefore the value of 3.79mg per bait station cleanup is assumed regardless of the total amount of grain bait emptied from each bait station.

Inhalation Exposure:

A pilot study (Snowdon2003, unpublished, confidential) done previously determined the only relevant inhalation exposure occurred during the decanting of loose treated grain. Inhalation exposure measurements from the handling of grain bait during loading and cleaning phases was negligible (similar results obtained for wax blocks). Inhalation exposure is only assessed for the decanting phase.

Inhalation Exposure during the decanting of grain bait:

The Chambers study determined exposure from the decanting phase from the following scenario: 3kg grain bait is decanted from 25kg drums into a 10L plastic bucket (termed 1 manipulation). Decanting of 3kg portions are performed 1, 5, and 10 times. A statistical comparison of the inhalation data for 5 and 10 manipulations of these 3kg grain portions indicates no difference between the datasets. This implies that the inhalation exposure is similar whether 3kg, 15kg or 30kg of grain is decanted in total. The proposed 75th percentile air concentration value of **9.62mg/m^3 (of grain bait) per decanting event of grain bait** is determined to represent the inhalation exposure for this manipulation. If we consider the total daily number of 63 bait stations for loading with 200g in each, then a total of 12.6kg

of treated grain is required. The results of the Chambers Study indicate that the total inhalation exposure to grain dusts will be **9.62mg/m3** air and that the time required for 5 and 10 × 3kg manipulations varied from 1 – 4 minutes. For the purposes of exposure assessment the following values are taken as defaults: total time for decanting = 5 minutes; inhalation rate = 1.25m^3/hr; inhalation absorption = 100%; operator body weight = 60kg.

The calculation of PCO (pest control operator) and amateur dermal exposure in decanting, placing and clean-up of rodenticidal grain bait stations, taking into account measured values (75th percentiles), defaults according to ECB guidelines and the common agreement on daily exposure frequencies (TM III/10, BAuA) is presented in the following table.

Exposure to grain bait.

Pest Control Operator, No PPE:	
Inhalation Exposure:	
Air concentration of dusts from the decanting phase	**9.62mg/m^3**
Exposure to dusts inhaled while decanting: (respiration 1.25m^3/hr, 5min decanting time)	9.62 mg/m^3 × (1.25m^3/hr × 5/60) = 1.002 mg
Systemic dose from inhaled dusts: (inhalation absorption 100%, bw 60kg)	(1.002 mg / 60kg) × (0.005 / 100) = **8.35×10^{-7} mg/kg**
Dermal Exposure:	
Amount of exposure to product (75th percentile) following decanting of 12.6kg treated grain.	**220 mg**
Amount of brodifacoum on fingers/hands (0.005% in grain)	220 mg × (0.005 / 100) = 1.1×10^{-2} mg
Amount of exposure to product (75th percentile) during loading and placement of 63 bait stations in one day.	(2.04 mg per bait station) **128mg**
Amount of brodifacoum on fingers/hands (0.005% in grain)	128 mg × (0.005 / 100) = 6.4×10^{-3} mg
Amount of exposure to product (75th percentile) during clean-up and disposal of 16 bait stations	(3.79 mg per bait station) **60.6mg**
Amount of brodifacoum on fingers/hands (0.005% in grain)	60.6 mg × (0.005 / 100) = 3.0×10^{-3} mg
Total Dermal dose of product dusts per day:	(1.1×10^{-2} mg + 6.4×10^{-3} mg + 3.0×10^{-3} mg) = 2.04×10^{-2} mg
Total Dermal Systemic dose per day (brodifacoum concentration 0.005%, dermal absorption 3%, bw 60 kg).	(2.04×10^{-2} mg × (3/ 100)) / 60kg = 1.0×10^{-5} mg/kg
Total Systemic Dose per day: (Inhaled dose + dermal dose)	(1.0×10^{-5}+ 8.35×10^{-7}) mg/kg = **1.1×10^{-5} mg/kg bw/day** **0.01 µg/kg bw/day**
Expressed as a % of the AEL: AEL medium term 6.7×10^{-6} mg/kg bw day AEL = 0.0067 µg/kg bw/day	**164%**

Pest Control Operator,With PPE (gloves)	
Default 10-fold reduction of dermal exposure.	**0.002 µg/kg bw/day**
Expressed as a % of the AEL: AEL medium term 6.7×10^{-6} mg/kg bw day AEL = 0.0067 µg/kg bw/day	**30%**

Non-Trained Professional (e.g. farmer), No PPE:

Amount of exposure to product (75th percentile) during loading and placement a single bait station.	2.04 mg
Amount of brodifacoum on fingers/hands (0.005% in grain)	2.04 mg ×(0.005 / 100) = 1.02× 10^{-4} mg
Systemic dose after a single manipulation: (assuming 3% dermal absorption, bw 60kg)	(1.02 × 10^{-4} mg × (3 / 100)) / 60kg = 5.1× 10^{-8} mg/kg
Amount of exposure to product (75th percentile) during clean-up of a single bait station.	3.79mg
Amount of brodifacoum on fingers/hands after 1 manipulation (0.005% in grain)	3.79 mg ×(0.005 / 100) = 1.875× 10^{-4} mg
Systemic dose after a single manipulation: (assuming 3% dermal absorption, bw 60kg)	(1.875 × 10^{-4} mg × (3/ 100)) / 60kg = 9.38× 10^{-8} mg/kg
Systemic dose resulting from application of grain product to 10 bait sites plus 10 bait sites cleaned per day, no PPE (brodifacoum concentration 0.005%, dermal absorption 3 %, bw 60 kg). For non-trained professionals and amateurs, 10 manipulations per day are assumed in this risk assessment because non-trained-professionals (e.g. farmers) and amateurs are expected to handle much smaller amounts of baits daily, baits are pre packed in polyethylene sachets, thus, the exposure is at a lower level than for the pest control operators. In addition decanting is not taken into account for these users.	((3.79 x 10^{-8} mg/kg x 10) + (9.38 x 10^{-8} mg/kg x 10)) = **1.32 x 10^{-6} mg/kg/day** **0.001 µg/kg bw/day**
Expressed as a % of the AOEL: AEL = 0.0067 µg/kg bw/day	**16%**

Non-Trained Professional (e.g. farmer), With PPE (gloves):

Default 10-fold reduction of exposure.	**1.32 x 10^{-7} mg/kg/day** **0.0001 µg/kg bw/day**
Expressed as a % of the AOEL: AEL = 0.0063 µg/kg bw/day	**1.6%**

Sachet Application

When grain product is applied via sachet exposure is only expected at cleanup.

Amount of exposure to product (75th percentile) during clean-up and disposal of 16 bait stations	(3.79 mg per bait station) **60.6mg**
Amount of brodifacoum on fingers/hands (0.005% in grain)	60.6 mg × (0.005 / 100) = 3.0×10^{-3} mg
Total Dermal dose of product dusts per day:	(3.0×10^{-3} mg)
Total Dermal Systemic dose per day (dermal absorption 3%, bw 60 kg).	(3.0×10^{-3} mg × (3/ 100)) / 60kg = 1.5×10^{-6} mg/kg **1.5×10^{-6} mg/kg bw/day** **0.0015 µg/kg bw/day**
Expressed as a % of the AEL: AEL medium term 6.7×10^{-6} mg/kg bw day AEL = 0.0067 µg/kg bw/day	**22%**

3.3.3.3 Exposure to non-professional users

Bait boxes for use by the general public may be supplied as sealed units or as lockable, tamper-proof units that may be refilled by the user. Bait may be used in covered/protected bait points, rather than bait boxes, where appropriate.

Calculations for non-professional exposure are presented below; the first scenario assumes no exposure during application phase while the second scenario assumes that the bait boxes would have to be loaded by the user. As for the non-trained professionals, it is assumed that a non-professional user places ten bait blocks per site (200g) on five bait sites and cleans five bait sites per day.

Exposure to grain bait.

Product type	Exposure scenario	PPE	Inhalation uptake	Dermal uptake
14	Non-professional (amateur)	None	Not relevant	3.78× 10^{-7} mg/kg 0.00004 µg/kg bw/day
14	Non- professional (amateur)	None	Not relevant	1.32 x 10^{-6} mg/kg/day 0.001 µg/kg bw/day

1) scenario 1, 2) scenario 2.

Scenario 1: No dermal contact during placing of baits due to sealed bait boxes. Potential exposure is only during clean-up. Default exposure value for cleanup is 3.79mg product per bait site, brodifacoum

present at a concentration of 0.005% (w/w), 60kg body mass, 3% dermal absorption value. The value is calculated from the cleanup exposure per bait station of ((3.78.00×10^{-8} mg/kg) × 10).

Scenario 2: Assuming that conventional bait boxes are loaded then the exposure is equal to that of the non-trained professional (e.g. farmer) with no PPE.

3.3.3.4 Exposure to children/workers/general public

Bait points should be covered or protected in such a way to prevent access to the bait. However, the ingestion of bait by infants has been assessed as a potential secondary exposure route associated with the use of brodifacoum in rodenticide products. Secondary exposure is anticipated to be acute in nature. Two different scenarios of secondary exposure are available, the 'handling of dead rodents' scenario and the 'transient mouthing of poison bait' scenario. The former is excluded from the risk assessment due to unrealistic assumptions. The estimated exposure for the 'transient mouthing of poison bait' scenario is either 2.5×10^{-}2 mg/kg or 5.0×10^{-5} mg/kg, depending on the default assumptions. This results in Margin of Exposure MOE values of 0.004 or 10 (NOAEL modified for severity of effect and use of LOAEL), respectively. It shows that infants are at significant risk for secondary exposure, i.e. there is no safe use for children.

For the 'transient mouthing of poison bait' scenario, either 5g (User Guidance) or 10 mg (TNsG, with bittering agent) of the product is assumed to be swallowed by an infant per poisoning event.

Oral exposure infant. TNsG Assumptions: Transient mouthing of poison bait (10mg) treated with repellent: (10mg × 0.00005) / 10kg bw

Transient mouthing infant. User Guidance Assumptions: Transient mouthing of poison bait (5000mg) without repellent; (5000mg × 0.00005) / 10kg bw

	Total dose (mg/kg b.w./day)	% AELacute (0.0033 µg/kg b.w.)
Oral exposure infant	0.00005	1515%
Transient mouthing infant	0.025	757575%

The RMS considered that in connection with transient mouthing of poison baits, infants are also exposed via the dermal route while handling the bait. This however is assumed to play a minor role relative to the amount that could be ingested. It is therefore not included in the overall exposure scenario.

Exposure to consumers from residues in food

Not applicable.

Overall Summary

The exposure data based on measurements in simulated use conditions are acceptable and should be used in risk assessment. The models assume that inhalation exposure is of minor importance compared with dermal exposure. The calculations have been made with the

assumptions of rat control, and there are no separate calculations to assess exposure in mice control in which smaller bait sizes are used.

3.3.4 Risk Characterisation for Human Health

3.3.4.1 Professional users

Grain bait application

The exposure assessment for professional pest control operators (PCOs) under reasonable worst case assumptions, as presented, yielded a potential dermal exposure leading to a systemic dose 0.01µg/kg/day day for an unprotected operator during bait handling operations. Comparison to calculated NOAEL for MOE shows that the use of rodenticide baits containing 0.005% brodifacoum results in a margin of exposure of 62.

Since pest control operators wear protective gloves by default during pest control operations, a refined assessment is conducted. The resulting margin of exposure (MOE = 335) indicates that the use of rodenticide baits containing 0.005% brodifacoum does not cause a risk for PCOs if gloves are worn.

The exposure assessment for non-trained professionals (e. g., farmers) under reasonable worst case assumptions (ten loadings and ten clean-ups/day), yielded a potential dermal exposure leading to a systemic dose of 0.001µg/kg/day day for an unprotected person. Without PPE, the resulting margin of exposure (MOE = 670) indicates that use of rodenticide baits containing 0.005 % brodifacoum is not a risk at the stated exposure frequency. A refined assessment was, conducted since wearing of protective gloves is recommended in the instructions for use. The resulting margin of exposure (MOE =6700) indicates a high level of protection for non-trained professional users when gloves are worn.

The result of the risk assessment concerning use of brodifacoum in grain bait indicates that the acceptable exposure level (AEL) is not exceeded for trained professionals (PCOs) with PPE (gloves and face mask The risk is at an acceptable level without gloves for non-trained professionals. However, use of protective gloves is recommended in all cases for hygiene reasons. Exposure during manufacture of the active substance and formulation of products is beyond the scope of BPD and therefore has not been addressed in this document.

Sachet Application

Sachet application assumes no exposure at application stage but exposure at cleanup. It also assumes no inhalation exposure. Consequently in sachet application exposure is to just 16 cleanups. This yields an exposure estimate of 22% of the AEL or a MOE of 446.

3.3.4.2 Non-professional users

Grains are supplied either in pre-sealed bags or for professionals as loose, treated grain for use in covered/protected bait points or refillable bait boxes. An exposure assessment has been performed taking into account potential exposure both from application and post-application tasks as a worst-case scenario. In the calculations, amateurs were assumed to load 10 bait points and clean 10 bait points per day in the absence of PPE. The estimated daily systemic dose, 0.001µg/kg bw/day, results in an MOE value of 670 showing that there is no risk to amateurs.

3.3.4.3 Children/Workers/general public

As a potential secondary exposure route, associated with the use of brodifacoum in rodenticide products, ingestion of wax block bait by infants has been assessed. Secondary exposure is anticipated

to be acute in nature. The estimated exposure for the scenario, 2.5×10^{-2} mg/kg/day or 5.0×10^{-5} mg/kg/day, depending on the default assumptions, results in MOE values of 0.001 or 6.6 (NOAEL modified for severity of effect and use of LOAEL), respectively indicating that infants are at risk of poisoning. This should be addressed by ensuring all brodifacoum products targeted for amateur use are provided in sealed packs and tamper resistant bait boxes with a bittering agent. The potential exposure due to dermal contact with poisoned rodents is not included in the risk assessment because the available scenarios are unrealistic.

Consumers from residues in food

Not applicable, product is not used to treat food stuffs.

Overall Summary

The calculations presented have been made with the assumptions of rat control, and there are no separate calculations to assess exposure for mice control in which smaller bait sizes are used.

Using both the MOE and AEL approaches for risk assessment indicates that there is a satisfactory margin between the predicted exposure and the NOAEL (LOAEL) for intended uses by trained professionals with PPE, untrained professionals and amateurs (with and without PPE). The product is deemed suitable for authorisation and appropriate personal protective equipment is advised.

Secondary exposure from transient mouthing of the product exceeds the AEL reference value (0.0033µg/kg/day), both with the assumption of 0.01 g and 5 g of product ingested by infants. This is of concern. There is no margin of safety using the existing data and models. There is no safe scenario for indirect exposure if estimated according to TNsG and User Guidance. Mitigation and protection measures such as the inclusion of bittering agents and the enclosure of product in sealed packs and tamper resistant bait boxes are essential to reducing the risk of secondary exposure. Baits should not be placed where food, feeding stuffs or drinking water could be contaminated.

Workplace operation	PPE	Exposure path	Dose (µg/kg/day)	MOE	%AEL
Trained Professional: Decanting placing of baits and clean-up.	None	Dermal, hands inhalation	0.01	67	164%
Trained Professional: Decanting placing of baits and clean-up.	Gloves	Dermal, hands inhalation	0.02	335	30%
Trained Professional: Sachet clean-up.	None	Dermal, hands	0.0015	446	22%
Non-Trained Professional: Placing of pre-packed baits and clean-up	None	Dermal, hands	0.001	670	16.4%

Non-Trained Professional: Placing of pre-packed baits and clean-up	Protective gloves	Dermal, hands	0.0001	6700	1.64%
Amateur: Placing of pre-packed baits and clean-up	None	Dermal, hands	0.001	670	16.4%
Secondary Exposure Transient Mouthing of bait by infants	--	Oral	5.0×10^{-2} (TNsG)	6.6	
			250 (User Guidance)	0.001	

3.3.5 Effect and Exposure Assessment for the Environment

An overview of the EU review of environmental fate and behaviour and ecotoxicology for the active substance is presented below in conjunction with the exposure assessment and environmental effects for the biocidal product.

3.3.5.1 Environmental fate and behaviour of the active substance

Degradation

Biodegradation

Brodifacoum is not readily or inherently biodegradable.
The overall conclusion on biodegradation is that Brodifacoum is not readily or inherently biodegradable**.**

Abiotic Degradation

Brodifacoum is stable to hydrolysis (t½ > 1 year). It is however predicted to undergo rapid indirect photolysis with OH radicals and ozone (t½ = approximately 2 hours) and undergoes rapid direct photodegradation (t½ = 0.217 days). There are no predicted effects on the atmosphere.
The overall conclusion on abiotic degradation is that Brodifacoum is hydrolytically stable to hydrolysis (t½ > 1 year).

Distribution

Brodifacoum is a large aromatic organic compound of low volatility with two polar groups, which can potentially ionise at environmental pH. The active substance has a Log Pow (4.92), and is of low solubility in water (5.8 x 10-5 g/l at pH 7 and 20°C).
The DT50 value of 157 days (The Pesticide Manual 13th ed) and the Koc of 50000 (The Pesticide Manual 13th ed) indicate that Brodifacoum would be persistent and immobile in soil. The exposure to the groundwater is unlikely.
On the basis of its low volatility (vapour pressure of 2.6 10^{-22} Pa at 20°C) the exposure to the atmosphere is highly unlikely.
The overall conclusion on distribution is as follows: Brodifacoum is persistent (DT50 157 days) and immobile in soil (Koc > 9155 l/kg). Under basic conditions (high pH), Brodifacoum is not likely to be adsorbed onto soils or sewage sludge due to the ionisation of the molecule; whereas under acidic conditions (low pH), Brodifacoum is likely to be adsorbed onto soils or sewage sludge as the molecule is in its neutral or non-ionised form.

Mobility in soil

The Koc value (50000 The Pesticide Manual 13th Edition) indicates that the active substance would not be mobile in soil and is not expected to contaminate groundwater (PEC < 0.1 μg/l).

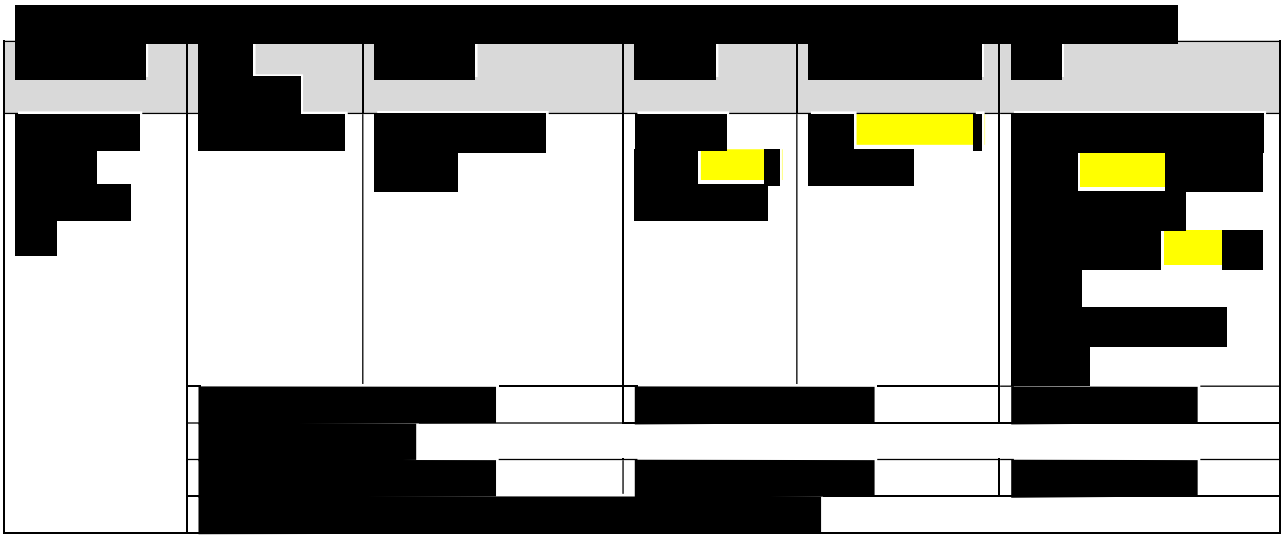
The overall conclusion on mobility in soil is as follows Brodifacoum is immobile in soil (Koc > 9155 l/kg). Brodifacoum is not expected to contaminate groundwater.

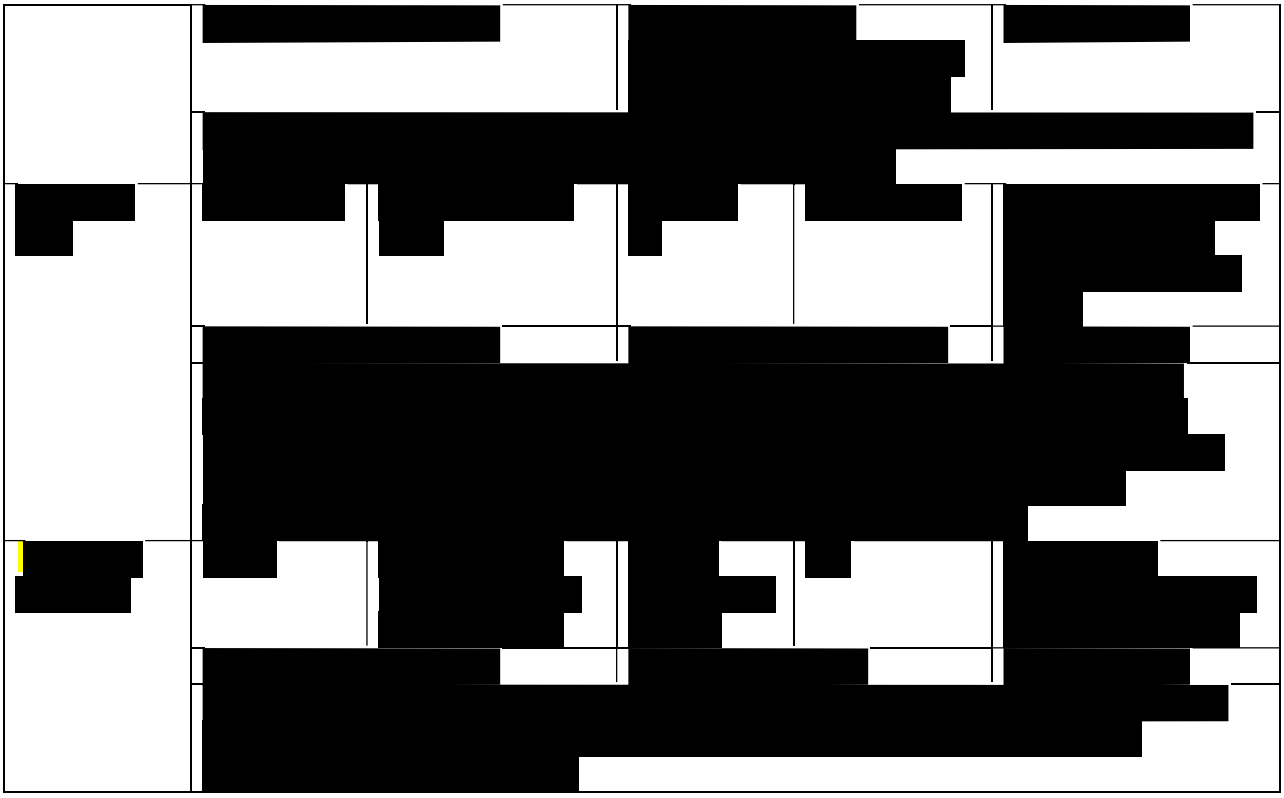
Accumulation

Based on a measured Log Kow = 4.92 it is considered that Brodifacoum has a potential for bioaccumulation. The BCFfish (3034) was calculated using the equation 74 of TGD (part II); the BCFearthworm (999) was calculated according to the equation 82d of TGD

The overall conclusion on bioaccumulation potential is as follows: No reliable bioaccumulation study is available. The measured log Kow = 4.92 (retrieved from CAR B) indicates that Brodifacoum can be potentially bioaccumulative and provides a calculated BCFfish = 3034. The experimental Kow confirms the adequacy of using, in CAR A, the calculated log Kow of 6.12 (rather than 8.5) and indicates that this value still overestimated the actual lipophilicity and, consequently, the BCF values estimated herein. The measured log Kow = 4.92 and a BCFfish = 3034 and BCFearthworm = 999, are considered therefore more reliable endpoints to be used in risk assessment.

3.3.5.2 Environmental effects (hazard) of the active substance (ecotoxicology)





Effects on Aquatic Organisms including the determination of PNECs:

Toxicity data are available for aquatic organisms exposed in an acute test. In a test performed under semi-static conditions, the 96-hour LC50 was 0.042mg/L for Oncorhynchus mykiss, based on measured concentrations. Daphnia magna was less sensitive than fish, with a 48-hour EC50 of 250 µg/L recorded under semi-static conditions. The endpoint was based on immobilisation and on measured concentrations of Brodifacoum in the test media. In a 72-hour algal growth inhibition test with Selenastrum capricornutum (Pseudokirkneriella subcapitata) the ErC50was 40 µg/l. The NOEC was 10µg/l with respect to specific growth rate. Results are based on measured concentrations. The outcome is that Brodifacoum is considered very toxic to aquatic organisms. The PNEC is derived from the algae 72h ErC50 = 0.04 mg/l (or fish 72h LC50 = 0.042 mg/l), and the application of an assessment factor of 1000. Therefore the **PNEC = 0.00004 mg/l**.

No experimental data are available for sediment dwelling organisms. A PNECsediment (0.043 mg/kg wwt) was derived through the Equilibrium Partitioning Method described in the TGD. However, due to the absence of measured data for the determination of a PECsed, according to TGD a quantitative risk characterization cannot be carried out. Therefore the risk for the sediment compartment will be covered by the risk for the aquatic compartment.

Based on the result of a 3h respiration inhibition test with activated sludge from a sewage treatment plant treating predominantly domestic sewage, no effects of Brodifacoum on aerobic biological

sewage treatment processes are expected. As the test was carried out at nominal concentration much higher than the water solubility of Brodifacoum, the EC10 was set as greater than the water solubility limit of 0.058 mg/l measured at pH=7 and T=20°C. According to TGD, PNEC is derived applying an AF=10 to the NOEC from the respiration inhibition test. Therefore, the **PNECmicro-organisms > 0.0058 mg/l.**

No degradation or transformation products of Brodifacoum in water were detected. Toxicity of metabolites is not of concern.

PNECaquatic organisms = 0.00004 mg/l
PNECsediment organisms = 0.00004 mg/l
PNECmicro-organisms = > 0.0058 mg/l

Conclusion on hazard to the aquatic organisms:

PNEC	Task Force
PNECaquatic organisms	0.00004 mg/l
PNECsediment organisms	0.00004 mg/l
PNECmicro-organisms	> 0.0058 mg/l

The Brodifacoum a.s. results in the classification of toxic to aquatic organisms.

Effects on the Atmosphere including the determination of PNECs

Brodifacoum has a low vapour pressure (1 x 10^{-6} Pa) and a Henry's Law constant of 2.18 x 10^{-3} Pa.m3mol^{-1} (pH 7). Release to air via water is expected to be negligible. This is also supported by calculations using the TGD on risk assessment for percent release to air from a sewage treatment plant where a default of 0 is given (i.e., no release to air). The manufacture of the active substance is in a closed system. There are no releases to air of Brodifacoum from manufacturing, formulating, use or disposal phases.

Effects on Terrestrial Organisms including the determination of PNECs:

The effect of Brodifacoum on earthworms was assessed in an acute toxicity test in which E. fetida in artificial soil was exposed to concentrations of Brodifacoum up to 994 mg/kg dw. The 14-day LC50 was greater than 994 mg/kg dry soil (the highest concentration applied) corresponding to a 14-d LC50 > 879.6 mg/kg wwt. The PNEC for terrestrial organisms is derived from the LC50 with an AF of 1000 used. Therefore, **the PNECsoil ≥ 0.88 mg/kg wwt soil**.

Conclusion on hazard to terrestrial organisms:

PNEC	Task Force
PNECsoil	> 0.88 mg/kg wwt

Earthworms were not affected after acute exposure to Brodifacoum at concentration closed to 1 g/kg dw. It is concluded that Brodifacoum is of low toxicity to earthworms. **The PNECsoil ≥ 0.88 mg/kg wwt soil.**

Effects on Birds including the determination of PNECs:

Brodifacoum is moderately toxic to birds upon acute oral exposure with a LD50 value of 19 mg/kg bw in the Japanese quail.

No studies are available on the avian short term dietary toxicity.

A 6 weeks reproduction test on the Japanese quail exposure to Brodifacoum in drinking water was submitted but it was judged not adequate for risk assessment purposes. Therefore, acknowledging the decision taken at the Biocides TMIII09, the NOEC for Brodifacoum is based on the results of the chronic toxicity study with Difenacoum (with Japanese Quail), chosen as reference chemical for second generation anticoagulants. An extrapolation factor of 8.05 was applied to correct for differences in toxicity based on the acute test results for Difenacoum (LD50 = 66 mg/kg, male and females) and Brodifacoum (LD50 = 19 mg/kg bw), both related to Japanese quail. The Brodifacoum results indicate it is very toxic to birds, with an NOEC = 0.012 mg Brodifacoum/kg diet and an NOEL = 0.0012 mg Brodifacoum/kg bw/d. According to the TGD, an assessment factor of 30 is applied to derive the PNEC. Therefore the **PNECoral-birds = 0.012 mg Brodifacoum/kg diet/30 = 0.0004 mg Brodifacoum/kg diet.** In relation to dose the **PNECoral-birds = 0.0012 mg Brodifacoum/kg bw/d/30 = 0.00004 mg Brodifacoum /kg bw/d**.

Conclusion on hazard to birds:

PNEC	PNECoral bird diet	PNECoral bird
Task Force	0.0004 mg/kg	0.00004 mg/kg bw/d

Effects on Mammals including the determination of PNECs:

The lowest mammalian NOAEL (0.001mg/kg bw/day) comes from a two-generation fertility study with rats and refers to parent females. This endpoint was converted, according to TGD, to NOEC mammal, food = 0.02 mg/kg food. As the exposure lasted 90 days as a minimum, for PNEC derivation an AF oral of 90 is applied (table 23 of TGD). Therefore, the **PNECoral-mammals = 0.02/90 = 2.22E-04**

mg/kg food, corresponding to **PNECoral-mammals = 0.001 mg/kg bw day/90 = 1.1 E-05 mg/kg bw**.

Conclusion on hazard to mammals:

PNEC	Task Force
PNECoral mammals food	2.22E-04 mg/kg
PNECoral mammals	1.1 E-05 mg/kg bw

Brodifacoum is very toxic to mammals.

Metabolites

No significant amounts of metabolites are expected to be formed in soil. In rats, no toxicologically relevant metabolites have been identified which could be introduced in soil via urine or faeces.

3.3.5.4 Environmental effects (hazard) of the biocidal product

The example products in the EU-review program for approval of the active substance for inclusion in Annex I of Directive 98/8/EC were pellet bait and wax block mixtures (formulations) containing Brodifacoum.

There were no additional ecotoxicology studies provided for authorisation of the biocidal product in this process.

3.3.5.5 Environmental effects (hazard) of the co-formulants (substances of concern)

Please refer to Annex I of the consolidated Annexes I-IV which contains the confidential information on the co-formulants that are used in this product along with the active substance.

None of the co-formulants that carry an environmental classification are present at a sufficient concentration to trigger the classification of the product.

Product Classification & Labelling:

There is no requirement for classification and labelling with regard to the co-formulants used in the product.

There is no environmental classification for the product under the Directive 99/45.
There is no environmental classification for the product under the CLP Regulation 1272/2008.

3.3.6 Exposure Assessment for the Environment

The environmental exposure was assessed during the EU active substance review process and the current intended uses are similar.

The rodenticide product is used by professional and amateur users. The product is intended for indoors use, in and around buildings and for outdoors uses in non-agricultural open areas and waste dumps. It is not supported for use in sewers; however the applicant has included this scenario in their application as a worst case scenario.

It is always used in the same manner for all these purposes. Bait points are placed throughout the infested areas with 20g per bait point for mice and 20 to 60 g per bait point for rats. Application sites are located 2-5 m apart for mice and 5-10 m apart for rats. A shorter distance is used in severe infestations. The number of baits and the distances should be adapted to the infestation level. Bait points are inspected frequently and replenished when bait has been eaten.

Bait points are placed securely to help prevent access to non-target animals. For amateur use, the label prescribes to use tamper resistant bait stations for rat control. Baits for amateur mouse control have to be placed into/at a covered or protected bait station. For professional rodent control the use of tamper resistant bait stations is not compulsory however, if tamper resistant bait stations are not employed, the wax blocks must be fixed by strings or wire to avoid uptake by non target animals/humans, or uncontrolled dispersal.

Based on the environmental fate and behaviour of Brodifacoum, as outlined in the detailed calculations provided in Annex VI of this Product Authorisation Report, the environmental exposure assessment was conducted.

3.3.6.1 Aquatic compartment

As mentioned previously the product is not supported for use in sewers but the scenario has been included as part of the risk assessment for the other scenarios. Therefore exposure to the aquatic compartment has been assessed through the STP route also. Based on worst case ESD assumptions the maximum predicted environmental concentration (PEC) of the active substance for microorganisms in the STP is 1.93 x 10^{-5} mg/L. The corresponding amount in surface water is 1.77 x 10^{-6} mg/L. The maximum permissible concentration by directive 80/778/EEC (amended by 98/83/EC) of 0.1 µg/L is not exceeded in surface waters. Full details of the calculations are contained in Annex VI.

3.3.6.2 Atmospheric compartment

Brodifacoum has a vapour pressure of less than 10^{-6} Pa at 20°C and a Henry's Law constant of less than 2.18 x 10^{-3} Pa.m^3.mol^{-1} at pH 7. In the Assessment Report for brodifacoum it has been concluded that releases to air from manufacturing, formulating, use or disposal phases are not to be expected. An exposure assessment for air is therefore not required.

3.3.6.3 Terrestrial compartment

Exposures of soil to the active substance occurs via direct (spillages) and disperse release (deposition by urine and faeces) after the use of the product in and around buildings, open areas and waste dumps. As mentioned previously the product is not supported for use in sewers however exposure to agricultural soil via spreading of sludge from an STP has been included as part of the worst case risk assessment.

Using ESD worst-case assumptions of the typical usage patterns and release mechanisms, the maximum concentration in agricultural soil (averaged over 30 d) after 10 years of sludge application from STP is 4.86 x 10^{-4} mg/kg wwt. When the applicant's dosage rates are used as inputs the figure for agricultural soil is 3.24 x 10^{-4} mg/kg wwt. No information on the metabolism of brodifacoum was used to lower the exposure levels further.

The highest concentration of Brodifacoum in soil following use in and around buildings is 0.047 mg/kg wwt under ESD realistic worst case conditions (see table below). For a normal use pattern the ESD recommends a total of 2.6 replenishments (as opposed to 5 for the worst case). This usage pattern leads to an estimated soil concentration of 0.006 mg/kg wwt.

For the open areas scenario ESD realistic worst-case conditions assume one application site is treated twice with the product. The fraction released during use and application is 0.25. The exposed soil area is assumed to be the lower half of the burrow wall surrounding an 8 cm diameter tunnel, with a soil mixing depth of 10 cm and up to 30 cm from the entrance hole. The amount of product used at each refilling in the control operation is not specified by the ESD. However, the Reviewer notes the ESD states “A typical initial dose for a rat hole in the Nordic countries is 100-200 g grain.hole^{-1}. However, in e.g. France a typical dose for a rat hole is about 50-100 g product.” The applicant supports a dosage of 60 g bait per refill but bearing in mind the ESD statements the reviewer feels that a dosage value of 100 g is a sufficiently worst case value to use in the exposure assessment.. The local concentration arising in soil after a campaign is predicted to be 0.173 mg/kg wwt.

The default area for a waste dump defined in the ESD is 1 ha. If bait points are placed at distances of 5 m apart in a grid covering the entire dump this would yield a total of 441 points (21 x 21). 100 g in each bait point corresponds to a total loading of 44.1 kg of bait. This is higher than the default value considered in the ESD under realistic worst-case conditions (40 kg). Consequently the applicant’s exposure calculation is not sufficient to support this use. The Reviewer generated new exposure calculations for this use. The local concentration arising in soil after such a campaign is predicted to be 0.00817 mg/kg wwt. A more realistic campaign would use a total of 11 kg of bait resulting in a local concentration of 0.00204 mg/kg wwt.

In and around buildings	Open areas	Waste dumps
Amount of product used in control operation for each bait point: 0.25 kg (ESD), 0.06 kg (applicant). Realistic worst-case: 21 day campaign Bait stations: 10 No. of replenishments: 5 (2.6 realistic) Bait stations are 5 m apart. Fraction released due to spillage: 0.01 Fraction ingested: 0.99 Spillage area: 0.09 m^2 (0.1 m around station) Frequented area: 550 m^2 (10 m around building)	Amount of product used at each refilling in the control operation: 100 g Realistic worst-case: 6 day campaign Bait stations: 1 No. of replenishments: 2 Fraction of product released to soil during application: 0.05 Fraction of product released to soil during use: 0.2	Area of waste dump: 1 ha Amount of product per station: 100 g Spacing between blocks: 5 m (worst case), 10 m (realistic) Total mass of product used: 21 x 21 x 100 g = 44.1 kg (worst case) 11 x 10 x 100 g = 11 kg (realistic) No. of replenishments: 7 Fraction of active ingredient released to soil through urine, faeces and dead animals: 0.9

3.3.6.4 Groundwater

Exposure of groundwater may occur as a result of soil exposure which occurs via residues present in sewage sludge after using the product in sewers and via direct (spillages) and disperse release (urine and faeces) after the use of the product in the scenarios in and around buildings, open areas and waste dumps. As an indication for potential groundwater levels, the concentration in soil porewater in the various scenarios was examined. It should be noted that this is a worst-case assumption, neglecting transformation and dilution in deeper soil layers. A summary of the PECs obtained are presented in the table below. The calculated value for the open areas scenario exceeds the EU trigger value of 0.1 µg/L. However this figure is derived from a soil concentration value in a small localised area in the immediate vicinity of the baiting point. When taken in the context of a larger area (field, park, etc.) this figure would be several orders of magnitude lower. In addition it must be noted that these

two scenarios give a value for groundwater under industrial soil – not agricultural soil as specified by the ESD.

Scenario	In and around buildings		Open area	Waste dump		Sewer system
	Worst case	Realistic		Worst case	Realistic	
PEC groundwater (mg/l)	5.3 x 10^{-5}	6.62 x 10^{-6}	1.96 x 10^{-4}	9.26 x 10^{-6}	2.31 x 10^{-6}	1.93 x 10^{-5}

3.3.6.5 Primary & Secondary Poisoning Exposure Assessment

Non-target vertebrates may be exposed to rodenticides primarily through consumption of bait and secondarily from consumption of poisoned rodents and for predators eating earthworms which have ingested the active substance absorbed to soil. Small pellets and whole grain baits are highly attractive to birds.

In and around buildings:
Primary Poisoning:

Regarding the possible primary hazard to non-target animals this is assessed for birds and mammals.

Acute:

In the first tier scenario, PECoral is the concentration of the rodenticide in the food of a non-target organism. The PECoral is **50 mg/kg** (Brodifacoum present at 0.005% w/w in the product) and is used in the quantitative risk assessment for the acute and long-term situation.

In the second tier (refined) risk assessment the daily uptake (ETE) for birds and mammals is considered. This risk assessment considers exposure of relevant species of predators, based on their bodyweights and food intakes and takes into account avoidance factor (AV), the fraction of the diet obtained in the treated area (PT) and a a default excretion factor.

Table-1 Brodifacoum concentrations in non-target birds following a single uptake of the product

Species	Body weight (g)	Daily food intake (FIR) (g/d)[a]	Conc. of a.i. after single meal (mg/kg bw/d) (ETE)	Expected conc. after elimination[b] (mg/kg bw/d) (EC)
Tree sparrow	22	7.6	17.27	12.43
Chaffinch	21.4	6.42	15.00	10.80
Wood pigeon	490	53.1	5.42	3.90
Pheasant	953	102.7	5.39	3.88
Dog	10 000	456[d]	2.28	1.64
Pig	80 000	600[e]	0.375	0.270
Pig, young	25 000	600[e]	1.20	0.864

Long-term:

In the first tier scenario, the risk assessment considers exposure of relevant species of predators, based on their bodyweights and food intakes and takes into account avoidance factor (AV), the fraction of the diet obtained in the treated area (PT) and a default excretion factor.

Expected concentration of Brodifacoum in the animal after one meal followed by a 24-hour elimination period

Species	Estimated daily uptake of a compound (ETE) (mg/kg b.w./d)		Fraction of daily uptake eliminated (number between 0 and 1) (EI)	Expected concentration of active substance in the animal (EC) (mg/kg b.w./d)	
	Step 1	Step 2		Step 1	Step 2
Tree sparrow	17.27	12.43	0.3	12.09	8.71
Chaffinch	15.00	10.80	0.3	10.50	7.56
Wood pigeon	5.42	3.90	0.3	3.79	2.73
Pheasant	5.39	3.88	0.3	3.77	2.72
Dog	2.28	1.64	0.3	1.596	1.149
Pig	0.375	0.270	0.3	0.2625	0.189
Pig, young	1.20	0.864	0.3	0.864	0.6048

In the second tier scenario for primary poisoning long-term exposure according to the guidance agreed at the 23rd Biocides CA meeting, EC5 values are used for quantitative risk assessment of primary poisoning in the long-term situation.

EC_{oral} for different relevant species

Days	EC_{oral} (mg/kg b.w./d)						
Species	Tree sparrow	Chaffinch	Wood pigeon	Pheasant	Dog	Pig	Young pig
Day 1 after first meal	17.27	15.00	5.42	5.39	2.28	0.375	1.20
Day 2 before new meal	12.1	10.5	3.79	3.77	1.60	0.266	0.840
Day 3 before new meal	20.6	17.9	6.45	6.41	2.72	0.449	1.43
Day 4 before new	26.5	23.0	8.31	8.26	3.50	0.577	1.84

meal							
Day 5 before new meal	30.7	26.6	9.61	9.56	4.05	0.666	2.13

Secondary Poisoning:

Secondary poisoning hazard can only be ruled out completely when the rodenticide is used in fully enclosed spaces so that rodents cannot move to outdoor areas or to (parts of) buildings where predators may have access. Predators among mammals and birds may occur inside buildings or they may hunt in the immediate vicinity of buildings, e.g. parks and gardens. Scavengers may also search for food close to buildings.

Tier 1 exposure assessment:

According to the ESD PT 14, a normal susceptible rodent may eat anticoagulant rodenticide for a number of days before it stops eating. The feeding period has been set to a default value of 5-days, which corresponds to the feeding pattern observed in laboratory experiments. The mean time until death has been set to a default value of 7-days. Concentrations in contaminated rodents have been calculated for the time point immediately after the last meal. The factor PD (fraction of food type in diet) is set to 0.2 (minimum factor for normal case), 0.5 (normal use situation), and 1.0 (worst case situation). Regarding the elimination rate, the default of 0.3 supported by the ESD is adopted. The assessment also takes into account the concentration in resistant rodents.

	Residues of rodenticide in target animal, mg a.s./kg b.w. with bait consumption expressed as PD		
	0.2	**0.5**	**1.0**
A normal non-resistant target rodent stops eating on day 5			
Day 1 after the first meal*	1.00	2.50	5.00
Day 2 before new meal**	0.70	1.75	3.50
Day 3 before new meal	1.19	2.97	5.95
Day 4 after the last meal	1.53	3.83	7.66
Day 5**	1.77	4.43	8.86
Day 7 (mean time to death)**	1.36	3.39	6.79

A target rodent continues eating due to resistance			
Day 14 after the meal	2.31	5.79	11.58

Tier 2 Exposure Assessment:

The refined tier 2 considers exposure of relevant species of predators, based on their bodyweights and food intakes and takes into account avoidance factor (AV), the fraction of the diet obtained in the treated area (PT) and a default excretion factor. Food intake of non-target animals can vary significantly, depending on the metabolic rates of species, the nature of their food, weather conditions, time of year, etc.

Brodifacoum concentrations in non-target mammals and birds consuming contaminated rodents

				Normal susceptible rodents caught on day 5, before their last meal.		**Normal susceptible rodents caught on day 5 just after their last meal**		**Resistant rodents caught on day 14 just after their last meal**	
Species		**Body weight *)**	**Daily mean food intake*)**	**Amount a.s. consumed by the non-target animal****	**Concentration in non-target animal**	**Amount a.s. consumed by the non-target animal*****	**Concentration in non-target animal**	**Amount a.s. consumed by the non-target animals********	**Concentration in non-target animal**
		(g)	**(g)**	**(mg)**	**(mg a.s./kg b.w.)**	**(mg)**	**(mg a.s./kg b.w.)**	**(mg)**	**(mg a.s./kg b.w.)**
Barn Owl	Tyto alba	294	72.9	0.32	1.10	0.51	1.72	0.61	2.06
Kestrel	Falco tinnuncul.	209	78.7	0.35	1.68	0.55	2.62	0.65	3.13
Little owl	Athene noctua	164	46.4	0.21	1.26	0.32	1.97	0.39	2.35
Tawny Owl	Strix aluco	426	97.1	0.43	1.01	0.67	1.58	0.81	1.89
Fox	Vulpes vulpes	5 700	520.2	2.31	0.41	3.62	0.63	4.32	0.76
Polecat	Mustela putorius	689	130.9	0.58	0.85	0.91	1.32	1.09	1.58
Stoat	Mustela erminea	205	55.7	0.25	1.21	0.39	1.89	0.46	2.26

Weasel	Mustela nivalis	63	24.7	0.11	1.74	0.17	2.72	0.21	3.25

Calculation of concentration in earthworms:
Calculations for secondary poisoning are undertaken according to the ESD PT 14 for predators eating earthworms which have ingested the active substance absorbed to soil.

Brodifacoum concentrations in earthworms

		Tier 1[a]	Tier 2[b]
Input			
C_{soil} sewer system	Concentration in soil averaged over a period of 180 days and divided by 2 (mg/kg wwt)	8.70×10^{-5}	3.70×10^{-5}
C_{soil} building	Concentration in soil immediately after intake divided by 2 (mg/kg wwt)	0.0056	0.0050
$BCF_{earthworm}$	Bioconcentration factor in earthworm (L/kg wet fish)	15820	15820
$C_{porewater}$ sewer system	Concentration in porewater (mg/L) divided by 2	5.35×10^{-7}	2.29×10^{-7}
$C_{porewater}$ building	Concentration in porewater (mg/L) divided by 2	3.48×10^{-5}	3.10×10^{-5}
F_{gut}	Fraction of gut loading in worm (kg dwt/kg wwt)	0.1	0.1
$CONV_{soil}$	Conversion factor for soil concentration wet-dry weight soil (kg wwt/kg dwt)	1.13	1.13
Output			
$PEC_{oral,\ earthworm}$ building	Predicted environmental concentration in earthworm (mg/kg wet earthworm)	0.495	0.441

3.3.6.6 Overall Summary of exposure assessment

The biocidal product is a ready-to-use bait containing 0.005% Brodifacoum as the active substance. Brodifacoum is a second-generation single-dose anticoagulant rodenticide. It is used against rat at the maximal rate of 60 g of product equivalent to 3 mg a.s. per baiting post and against mouse at 20 g product equivalent to 1 mg a.s. by baiting post. This formulation is intended for indoor and outdoor uses.

PECs were calculated in accordance with the ESD for PT14. These calculations are outlined in the previous sections. Based on environmental fate and behaviour of Brodifacoum the following PEC values were determined:

Scenario	In and around buildings		Sewer system		Open Areas		Waste Dumps	
	Worst case	Realistic	Worst case	Realistic	Worst case	Realistic	Worst case	Realistic
PEC soil (mg/kg wwt)	0.047	0.006			0.173	N/a	0.00817	0.00204
PEC groundwater (mg/l)	5.3×10^{-5}	6.62×10^{-6}			1.96×10^{-4}	n/a	9.26×10^{-6}	2.31×10^{-6}
PEC microorganisms (mg/l)			1.93×10^{-5}	1.27×10^{-5}				
PEC surface water (mg/l)			1.77×10^{-6}	1.18×10^{-6}				
PEC agricultural soil (mg/kg wwt)			4.86×10^{-4}	3.24×10^{-4}				
PEC groundwater (ag) (mg/l)			4.66×10^{-7}	3.11×10^{-7}				
PECsediment (mg/kg)			1.92×10^{-3}	1.28×10^{-3}				

No new data related to the environment fate and behaviour or the ecotoxicology of the active substance or the biocidal product has been submitted by the applicant. There were three studies submitted related to secondary poisoning to dogs and foxes and the hazard/risk to barn owls which are considered only supplementary data and not considered further in the risk assessment.

PNECs were calculated based on the studies submitted for the EU approval of the active substance. PECS for assessment of primary and secondary poisoning were determined based on the ESD for PT14 and the TGD (2003).

3.3.7 Risk Characterisation for the Environment

Brodifacoum products are non-selective and can pose a risk of primary and secondary poisoning to non-target animals.

Product containing brodifacoum are placed at secured bait points. To maximise exposure of the target rodents and minimise unintended exposure of other non-target vertebrates, the products are placed where they are most likely to be encountered by the target organisms (e.g. on habitual rat-runs).

The type of secured bait point suitable for a given situation is determined on a case-by-case basis, taking into account such factors as shielding from sunlight and moisture necessary to maintain bait integrity and the level of security required to prevent access to and/or interference by non-target animals etc.

The risks posed by products containing 50 mg Brodifacoum/kg are characterised for the following scenarios:

1. **In and around buildings (houses, animal houses, commercial and industrial sites)**
2. **Open areas**
3. **Dumps**

Aquatic compartment

A contamination of surface water with Brodifacoum from the placing of product in and around buildings is highly unlikely. A lack of exposure to surface water is also stated in the EUBEES 2 emission scenario document. Contamination of surface waters is however expected to arise following use of bait blocks in sewers.

The most sensitive organism in the aquatic tests was alga with a nominal 72 hr ErC50 of 0.04 mg/L. This **$PNEC_{water}$** of 0.04/1000 AF**= 0.00004 mg/L**.

The test with micro-organisms in inhibition of microbial activity showed that concentrations that it is not likely that Brodifacoum will have a negative impact on the microbial processes in a sewage treatment plant at solubility limits. This gives a **$PNEC_{STP}$** of **= 0.0058 mg/L.**

As no specific data are available, the toxicity of Brodifacoum to sediment-dwelling organisms is covered by the risk to aquatic compartment. The application of an additional factor of 10, as done in CAR A, is considered not necessary as an experimental log Kow = 4.92 (i.e. lower than 5) is available. **Therefore, the PNECsediment organisms = 0.00004 mg/l**.

The risk characterisation for the aquatic compartment is presented in the following table applying the relevant PEC values as indicated in the table in the overall summary of the exposure assessment in the previous section.

Aquatic PEC/PNEC ratios using the realistic and worst case scenario

Exposed compartment	Endpoint	PNEC mg/L	PEC Worst case	PEC Realistic	Risk quotient PEC/PNEC
Surface water	Algae	0.00004	1.77E-06	1.18E-06	0.044
Sediment	Based on aquatic data and equilibrium partitioning method	4.348E-02	1.92E-03	1.28E-03	0.044

STP	Inhibition of microbial activity	0.0058	1.93E-05	1.27E-05	0.003

The PEC/PNEC risk quotient in all compartments are below the trigger value of 1 indicating Brodifacoum following the recommended use of the product does not cause an unacceptable risk to aquatic organisms.

Brodifacoum is not readily biodegradable under environmentally relevant conditions or during sewage treatment processes. Accordingly, the degradation of Brodifacoum in sediment is also anticipated to be low. However, it has limited exposure to the aquatic compartment and this is confirmed by the PEC calculations. The PEC/PNEC ratio is below the level that leads to an unacceptable risk, thus the risk for unacceptable accumulation in sediment can be regarded as low.

For an indication of the risk in relation to surface water and groundwater/porewater used for drinking refer to the section on the aquatic compartment and groundwater in the exposure assessment.

Since the potential for metabolites formation is negligible, risk characterisation is not required.

Summary: No risk is identified

Atmospheric compartment

There are no releases of brodifacoum to air from manufacturing, formulating, use or disposal phases. Based on this and the physical and chemical properties of brodifacoum, the compound is not expected to contribute to global warming, ozone depletions in the stratosphere, or acidification.

Summary: No risk is identified

Terrestrial compartment

Exposure of the terrestrial compartment (soil) will also occur when product is deployed outdoors. Exposure is assumed to arise through a combination of transfer (direct release) and deposition via urine and faeces (disperse release) onto soil.

As there is only one test result available with soil dwelling organisms the risk assessment is performed on the basis of this result using an AF and on the basis of the equilibrium partition method. For the EPM the PNEC is calculated from the aquatic toxicity data **PNECaquatic**= **0.00004 mg/kg**.

PEC/PNEC ratios using the realistic worst case scenario

Exposed compartment	Endpoint	PNEC	PEC Worst case	Risk quotient PEC/PNEC Worst case
In and around buildings	Based on aquatic data and equilibrium partitioning method Based on the availability of test result with soil dwelling organisms and AF	1. 4.348 x E-02 2. 14-d LC50 > 879.6 mg/kg wwt/1000 = 0.8796 mg/kg	0.047	1. 1.08 2. 0.053
Open areas	Based on aquatic data and equilibrium partitioning method	1. 4.348 x E-02	0.173	1. 3.97 2. 0.196

	Based on the availability of test result with soil dwelling organisms and AF	2. 14-d LC50 > 879.6 mg/kg wwt/1000 = 0.8796 mg/kg		
Waste dump	Based on aquatic data and equilibrium partitioning method Based on the availability of test result with soil dwelling organisms and AF	1. 4.348 x E-02 2. 14-d LC50 > 879.6 mg/kg wwt/1000 = 0.8796 mg/kg	0.00817	1. 1.87 2. 9.29 x 10^{-3}

The PEC/PNEC ratio was greater than 1 when used **in and around buildings and in open areas** when applying the EPM indicating for this calculation method that Brodifacoum, following recommended use of the product, causes an unacceptable risk to organisms in this terrestrial compartment. However, this PNEC value based in and around buildings and in open areas **represents only a screening value** of contamination and is superseded by the PNEC value determined from the 14-day earthworm toxicity study.

Summary: No risk is identified

Non compartment specific effects relevant to the food chain

Primary poisoning

Referring to rodenticide applications **in sewer systems**, there is no primary poisoning hazard to non-target mammals or birds because this is not a habitat for them (cf. ESD PT 14).

Regarding the possible primary hazard to non-target animals following applications **in and around buildings**, several non-target species are assessed for primary poisoning risk assessments.

Acute exposure:

Non-target mammals and birds are unlikely to enter sewers and feed on product in sewage systems. Therefore, there will be no significant exposure following the use of product in sewers. Rats that live underground in sewers are also unlikely to take bait and deposit significant quantities in accessible places above ground, thus preventing exposure to non-target animals living above sewers. In conclusion, the risks to non-target mammals and birds following the use of bait blocks containing Brodifacoum in sewers are considered to be very low.

Following applications in and around buildings, the empirical risk assumes direct or indirect consumption of the deployed baits. For primary poisoning the initial PEC_{oral} values assume that there is no bait avoidance by the non-target animals and that they obtain 100% of their diet in the treated area and have access to the product.

The concentration in the final product is 0.005% for the active substance Brodifacoum. The PECoral is 50 mg/kg (Brodifacoum present at 0.005% w/w in the product) and is used in quantitative risk assessment for the acute and long-term situation.

Tier I risk assessment: PEC_{oral}/$PNEC_{oral}$ ratio for birds and mammals exposed to Brodifacoum

	PEC_{oral} (concentration in food, mg/kg)	$PNEC_{oral}$ (concentration in food, mg/kg)	PEC / PNEC
Acute			
Bird	50	19	2.63

Mammal	50	-	-
Long-term			
Bird	50	0.0004	125000
Mammal	50	0.000011	4545454

The ratios PEC/PNEC are above 1 indicating a potential risk.

Therefore, a refined tier 2 assessment is set out below, based on representative species. The refined tier 2 risk assessment considers exposure of relevant species of predators, based on their bodyweights and food intakes. Food intake of non-target animals can vary significantly, depending on the metabolic rates of species, the nature of their food, weather conditions, time of year, etc.

Tier 2 acute risk assessment: $PEC_{oral}/PNEC_{oral}$ for non-target animals accidentally exposed to bait containing Brodifacoum after one meal

Non-target animals	ETE, concentration of Brodifacoum after one meal (one day) (mg/kg b.w.)		$PNEC_{oral}$ (dose, mg/kg b.w./d)	PEC/PNEC	
	Step 1	Step 2		Step 1	Step 2
Tree sparrow	17.27	12.09	0.0004	43175	30225
Chaffinch	15.00	10.50	0.0004	37500	26250
Wood pigeon	5.42	3.79	0.0004	13550	9475
Pheasant	5.39	3.77	0.0004	13475	9425
Dog	2.28	1.596	0.000011	207272	159600
Pig	0.375	0.2625	0.000011	34090	26250
Pig, young	1.20	0.864	0.000011	109090	78545

In Tier 2, Step 1 (worst case) AV, PT and PD are all set to 1, whilst in the realistic worst case (Step 2) these AV and PT are refined to 0.9 and 0.8, respectively.

The ratios PEC/PNEC are above 1 indicating a potential risk even after refinement.

Long -term exposure:
In this assessment, long-term exposure also has to be taken into account in the evaluation of primary poisoning of rodenticides.

Tier 2 long-term risk assessment: $EC_{oral}/PNEC_{oral}$ ratio after 1-day elimination of Brodifacoum

Species	EC_{oral} (mg/kg b.w./d) after 1 day		$PNEC_{oral}$ (mg/kg b.w./d)	Ratio $PEC_{oral}/PNEC_{oral}$	
	Step 1	Step 2		Step 1	Step 2
Tree sparrow	12.09	8.71	0.0004	30225	21775
Chaffinch	10.5	7.56	0.0004	26250	18900
Wood pigeon	3.79	2.73	0.0004	9475	6825
Pheasant	3.77	2.72	0.0004	9425	6800
Dog	1.596	1.149	1.1E-05	145091	104455
Pig	0.2625	0.189	1.1E-05	23864	17182
Pig, young	0.864	0.6048	1.1E-05	78545	54982

The ratios PEC/PNEC are above 1 indicating a potential risk.

According to the guidance agreed at the 23rd Biocides CA meeting, EC_5 values are used for quantitative risk assessment of primary poisoning in the long-term situation.

Tier 2 long-term risk assessment: $EC_{oral}/PNEC_{oral}$ ratio after 5-day elimination

Species	EC_{oral} after 5 days (mg/kg b.w./d) with excretion factor = 0.3, AV = 1, PT = 1 (mg/kg bw)[a]	EC_{oral} after 5 days (mg/kg b.w./d) with excretion factor = 0.3, AV = 0.9, PT = 0.8 (mg/kg bw)[a]	$PNEC_{oral}$ (mg/kg b.w./d)	Ratio $EC_{oral}/PNEC_{oral}$
Tree sparrow	30.7	22	0.0004	55260
Chaffinch	26.6	19	0.0004	47880
Wood pigeon	9.61	7	0.0004	17298
Pheasant	9.56	7	0.0004	17208
Dog	4.05	3	0.000011	265091
Pig	0.666	0.480	0.000011	43593
Pig, young	2.13	2	0.000011	139418

The ratios PEC/PNEC are above 1 indicating a potential risk even after refinement.

Summary: Risk is identified

Overall, for primary poisoning all acute and long-term $PEC_{oral}/PNEC_{oral}$ ratios are still above the trigger value of 1 indicating acute and long-term unacceptable risks

Secondary poisoning

It is unlikely that target rodents that have ingested bait blocks containing Brodifacoum will leave the sewer system and be exposed, in significant numbers, to predators or scavengers. Therefore, the secondary poisoning risks from the use of bait blocks in sewers are considered to be very low.

For the first tier assessment of secondary poisoning in and around buildings the maximum residue levels in target rodents that arise on day-5 after the last meal ($ETE_{oral\ predator}$) are compared to the PNEC values for concentration in food. The first tier assessment also assumes the following three levels of Brodifacoum bait consumption: 20%, 50% and 100% of the daily food intake of the target rodents. For long-term exposure, it is assumed that the rodents have fed entirely on rodenticide and that the non-target animals consume 50% of their daily intake on poisoned rodents.

Tier 1 risk assessment of secondary poisoning at day 5 (non-resistant rodents)

Organism group	$PNEC_{oral}$ (mg a.s./kg b.w.)	$ETE_{oral,\ predator}$ (mg a.s./kg b.w.)			$PEC_{oral}/PNEC_{oral}$ – day 5		
PD values		0.2	0.5	1.0	0.2	0.5	1.0
Acute							
Birds	19	2.77	6.93	13.87	3.84	9.62	19.26
Mammals	-				-	-	-
Long-term							
Birds	0.0004	1.39	3.47	6.93	10692	26692	53307
Mammals	0.000011				6261	15630	31216

Tier 1 risk assessment of secondary poisoning at day 14 (resistant rodents)

Organism group	$PNEC_{oral}$ (mg a.s./kg b.w.)	$ETE_{oral,\ predator}$ (mg a.s./kg b.w.)			$PEC_{oral}/PNEC_{oral}$ – day 14		
PD values	-	0.2	0.5	1.0	0.2	0.5	1.0
Acute							
Birds	19	2.31	5.79	11.58	0.121	0.30	0.60
Mammals	-				-	-	-
Long-term							
Birds	0.0004	1.15	2.31	5.79	287	5775	14475
Mammals	0.000011				104545	231000	526363

According to the tier 1 assessment the risk for secondary poisoning of non-target predator birds and mammals during long-term exposure via rodents poisoned with Brodifacoum is very high as indicated by the trigger value of 1 being exceeded in all cases. Therefore, a refined tier 2 assessment is set out below, based on representative species.

The refined tier 2 risk assessment considers exposure of relevant species of predators, based on their bodyweights and food intakes. Food intake of non-target animals can vary significantly, depending on the metabolic rates of species, the nature of their food, weather conditions, time of year, etc.

Tier 2 risk assessment of secondary poisoning (non resistant and resistant rodents)

Species	Exposure	$ETE_{oral\ predators}$ (mg a.s./kg/d)	$PNEC_{oral}$ (mg a.s./kg/d)	Ratio $ETE_{oral\ predators}$ / $PNEC_{oral}$
Barn owl	Day 5 before the last meal	1.10	0.0004	2750
	Day 5 after the last meal	1.72		4300
	Day 14 after the last meal	2.06		5150
Kestrel	Day 5 before the last meal	1.68	0.0004	4200
	Day 5 after the last meal	2.62		6550
	Day 14 after the last meal	3.13		7825
Little owl	Day 5 before the last meal	1.26	0.0004	3150
	Day 5 after the last meal	1.97		4925
	Day 14 after the last meal	2.35		5875
Tawny owl	Day 5 before the last meal	1.01	0.0004	2525
	Day 5 after the last meal	1.58		3950
	Day 14 after the last meal	1.89		4725

Species	Exposure	ETE $_{oral\ predators}$ (mg a.s./kg/d)	$PNEC_{oral}$ (mg a.s./kg/d)	Ratio ETE $_{oral\ predators}$ / $PNEC_{oral}$
Fox	Day 5 before the last meal	0.41	0.000011	41000
	Day 5 after the last meal	0.63		63000
	Day 14 after the last meal	0.76		76000
Polecat	Day 5 before the last meal	0.85	0.000011	77272
	Day 5 after the last meal	1.32		132000
	Day 14 after the last meal	1.58		143636
Stoat	Day 5 before the last meal	1.21	0.000011	121000
	Day 5 after the last meal	1.89		189000
	Day 14 after the last meal	2.26		226000
Weasel	Day 5 before the last meal	1.74	0.000011	174000
	Day 5 after the last meal	2.72		272000
	Day 14 after the last meal	3.25		325000

Summary: Risk is identified
The ratios PEC/PNEC are all above 1 indicating a potential risk even after refinement.

Secondary poisoning via the terrestrial food chain

Emissions of brodifacoum to soil take place in two scenarios. In the scenario **in and around buildings** the uptake to soil proceeds directly (when considering outdoor applications as proposed in the ESD PT 14), whereas in the scenario for the **sewer** is not applicable in this PAR.

However, the TGD gives advice to take the 180 days averaged PEClocal for soil with respect to sewage sludge when calculating the PEC in earthworms. Hence, the mode of application given in the TGD is in fact not applicable for direct intake of substances.

In the product dossier $PEC_{oral,earthworm}$ for the direct soil intake has been calculated. The applicant advises that these figures be interpreted with care as concentrations in earthworm due to direct soil intake are not dealt with in the TGD. Soil concentrations used for the calculation represent a brodifacoum intake within a soil mixing depth of just 10 cm. Degradation has not been considered. Soil concentrations are halved since the TGD assumes only 50% of the soil uptake by earthworm to origin from the contaminated area.

Table-2: Secondary poisoning risk to earthworm-eating birds and mammals

Scenario	$PEC_{oral,earthworm}$ (mg/kg wet earthworm)		PNEC (mg/kg food)	PEC/PNEC	
	Tier 1[a]	Tier 2[b]		Tier 1[a]	Tier 2[b]
Birds					
Sewer system	N/a	N/a	4.0×10^{-4}	N/a	N/a
In and around buildings	0.495	0.441		1237	1102
Mammals					
Sewer system	N/a	N/a	2.22×10^{-4}	N/a	N/a
In and around buildings	0.495	0.441		2229	2004

[a] Product specific application data and default value for release (90% direct +indirect release)

[b] Product specific application data and refined metabolism

Summary: Risk is identified but is likely to have been overestimated

The results for the **in and around buildings** scenario indicate a risk of secondary poisoning for birds and mammals consuming contaminated earthworms.

3.3.9.1 Overall Summary

Based on toxicity data Brodifacoum presents a hazard to birds and non-target mammals. Non-target vertebrate animals may be exposed to the product containing Brodifacoum, either directly by ingestion of exposed product (primary poisoning) or indirectly by ingestion of the carcasses of target rodents that contain Brodifacoum residues (secondary poisoning). Brodifacoum products are non-selective and can pose a risk of primary and secondary poisoning to non-target animals. There are many uncertainties associated with quantification of the risk associated with the use of Brodifacoum products. Overall, because of the toxic nature of rodenticides and the over-riding public health requirement it is more appropriate to develop and validate risk management measures than to refine the risk assessment procedures further. It is noted that the product contains a bittering agent and this may deter some non-target animals. It is also noted that the attractiveness of the product may be impacted by the use of dye.

Primary poisoning:

Overall, all acute and long-term PECoral/PNECoral ratios are above the trigger value of 1 indicating acute and long-term unacceptable risks. Even when avoidance and elimination are taken into account the empirical exposure levels result in unacceptable risks to birds and mammals.

Secondary poisoning:

Via ingestion of target rodents by non-target vertebrates

All ratios of PECoral/PNECoral are above the trigger value of 1 indicating an unacceptable risk of secondary poisoning. Even when avoidance and elimination are taken into account the empirical exposure levels result in unacceptable risks to birds and mammals. Studies are submitted in the product dossier that indicate that the realistic risk for secondary poisoning is significantly lower than that using the PEC/PNEC approach. These studies are only considered as supplementary information.

Via the aquatic food chain

Only one of the proposed four use scenarios, namely use in sewers, will lead to exposure of surface water. It is concluded that risk to fish-eating birds and mammals in a real situation cannot be excluded it potentially is overestimated.

Via the terrestrial food chain

The results for the **in sewer** and **in and around buildings** scenario indicate a risk of secondary poisoning for birds and mammals consuming contaminated earthworms.

Conclusion for primary and secondary poisoning:

Due to the risk assessment results for primary and secondary poisoning and the uncertainty associated with quantification of this risk, risk mitigation measures must be taken into account to lead to an acceptable use of the rodenticide product.

The following risk mitigation measures are proposed to mitigate the primary and secondary poisoning risk to non-target mammals and lead to an acceptable use of this rodenticide:

- Use of an integrated management strategy and precautionary systems
- Unless under the supervision of a pest control operator use or other competent person do not use anticoagulants as permanent baits
- There should be proper and secure placing of baits so as to minimise the risk of consumption by other animals or children. Where possible secure baits so they cannot be dragged away.

- Users should select tamper-resistant bait boxes, secured bait boxes, covered applications or burrow baiting (placing of bait in appropriate containers or under a curved tile or in a piece of tube) to minimize exposure of non-target animals
- Monitor and replenish bait stations as appropriate
- Frequent visits to bait stations to ensure that any bait that is split or dragged out of bait stations is removed
- Unconsumed baits must be collected after termination of the control campaign and dispose of them in accordance with local requirements
- Remove dead and moribund rodents at frequent intervals, at least as often as baits are checked or replenished during a baiting campaign
- Baits should be deployed in accordance with the product labelling
- Baits should be deployed in accordance with other approved guidance on good practice.
- Restrict the use of the product to treatment campaigns of limited duration
- To minimise the likelihood of target rodents developing resistance to second-generation anticoagulant rodenticides, long-term deployment of baits as a preventative control measure is not recommended
- The resistance status of the population should be taken into account when considering the choice of rodenticide to be used.
- When the product is being used in public areas, the areas treated must be marked during the treatment period and a notice explaining the risk of primary and secondary poisoning by the anticoagulant as well as indicating the first measure to be taken in case of poisoning must be made available alongside the baits

3.4 Measures to protect man, animals and the environment

The information submitted covering the requirements as described in the TNsG on Data Requirements, common core data for the product, section 8, points 8.1 to 8.8 is provided below.

3.4.1. Methods and precautions concerning handling, use, storage, transport or fire

Methods and precautions concerning handling and use:

- Always read the label before use and follow the instructions provided.
- Do not decant product into unlabelled containers.
- Product must be handled in a safe manner.
- Avoid all unnecessary exposure, in particular avoid ingestion.
- A thorough survey of the infested area is essential, particularly in secluded and sheltered places, to determine the extent of the infestation.
- Baits must be securely deposited in baiting stations or other coverings so as to minimise the risk of consumption by companion animals, other non-target animals and children. Where possible, secure baits so that they cannot be dragged away.
- PUBLIC AREA USE: When the product is being used in public areas and tamper-resistant bait stations are not used, the following must be implemented. When the product is being used in public areas, the areas treated must be marked during the treatment period and a notice explaining the risk of primary or secondary poisoning by the anticoagulant as well as indicating the first measures to be taken in case of poisoning must be made available alongside the baits. When tamper-resistant bait stations are used, they should be clearly marked to show that they contain rodenticides and that they should not be disturbed.
- Dead rodent bodies, remains of unused bait or any fragments of bait found away from the bait station must be collected during all control operations to minimize the risk of consumption and poisoning to children, companion animals and other non-target animals.
- It is illegal to use this product for the intentional poisoning of non-target, beneficial and protected animals.
- Wash hands and face after application and use of the product, and before eating, drinking or smoking.
- For professional users the use of appropriate personal protective equipment (PPE) is advised.

Methods and precautions concerning storage:

- Store in a cool, dry, well-ventilated secure (lockable) place
- Store locked up in the original container
- Store original container tightly closed
- Keep/store out of reach of children and companion animals
- Keep/store away from food, drink and animal feedstuffs and products which may have an odour.

Methods and precautions concerning transport:

Hazard classification for transport: TOXIC, MARINE POLLUTANT

UN-No Coumarin derivative pesticide, solid, toxic, n.o.s (BRODIFACOUM)

Class 6.1 Hazard ID 66

Proper Shipping name Coumarin derivative pesticide, solid, toxic (contains brodifacoum)

UN-No 3027 Packing Group 1

Class 6.1

Methods and precautions concerning fire:

Suitable Extinguishing Media:

Keep fire exposed containers cool by spraying with water if exposed to fire. Fight surrounding fire with foam, water fog, or dry powder.

Extinguishing media which must not be used for safety reasons:

DO NOT USE WATER JETS

Specific hazards:

This product is not flammable but is combustible. Avoid run-off into water courses. Self-contained breathing apparatus should be won by fire-fighting personnel.

Special protective equipment for fire-fighters:

In the event of fire, wear self contained breathing apparatus, a chemical protection suit, suitable gloves and boots.

Residues:

Dispose of residues to certified waste disposal operator for incineration and licensed waste disposal site.

3.4.2. Specific precautions and treatment in case of an accident

Personal precautions

Wear suitable protective clothing, gloves and eye/face protection, if applicable and where appropriate.

- Respiratory Protection: No special respiratory protection equipment is recommended under normal conditions of use with adequate ventilation.
- Hand protection: Wear gloves for professional products.
- Skin protection: No special clothing/skin protection equipment is recommended under normal conditions of use.
- Eye protection: Not required.
- Ingestion: When using this product, do not eat, drink or smoke

Personal treatment

- General advice: In the case of accident or if you feel unwell, seek medical advice immediately (show the label where possible and report the authorisation number).
- Skin contact: Obtain medical advice immediately. Remove contaminated clothing. After contact with skin, wash immediately with plenty of water, followed by soap and water in order to minimise skin contact.
- Contaminated clothing should be washed and dried before re-use.
- Eye contact: Obtain medical advice immediately. Rinse eyes immediately with copious amounts of water.
- Inhalation: Unlikely to present an inhalation hazard unless excessive dust is present. Remove person to fresh air. Obtain medical advice immediately.
- Ingestion: Do no induce vomiting. If swallowed, obtain medical advice immediately. Wash out mouth with water.

ADVICE FOR DOCTORS:

Brodifacoum is an indirect anti-coagulant. Phytomenadione, Vitamin K1, is antidotal. In the case of suspected poisoning, determine prothrombin times not less than 18 hours after consumption. If elevated, administer vitamin K1 and continue until prothrombin times normalise. Continue determination of prothrombin time for three days after withdrawal of antidote and resume reatment if elevation recurs in that time.

Report all incidents of poisonings to the relevant national poisons centre; include information on the product authorisation number, product trade name and active substance. In Ireland, this is the National Poisons Information Centre, Beaumont Hospital, Dublin (01-8092166)

Environmental precautions

- Prevent accidental exposure of the product to the environment.
- Keep un-used bait locked-up and in secure storage containers
- Bait must be secured in tamper resistant bait boxes in areas away from drains, water courses and non-target organisms.

Environmental treatment

- Clean up accidental spillages promptly by sweeping or vacuum.
- If the product gets into water or soil, it should be removed mechanically. In the event of a significant accidental release, inform the appropriate authority.
- Transfer to a suitably labelled container and dispose of to a certified waste disposal operator for incineration and licensed waste disposal site.
- Subsequently, wash the contaminated area with water, taking care to prevent the washings entering sewers or drains.
- For further instructions, see section 3.4.6 below.

3.4.3. Procedures for cleaning application equipment

No application equipment is required, therefore, no specific cleaning for equipment is required

If necessary, following use, bait boxes should be washed with detergent and water. The bait box should be washed out 3 times (triple rinsed).

3.4.4. Identity of relevant combustion products in cases of fire

This product contains paraffin wax.

3.4.5. Procedures for waste management of the biocidal product and its packaging

The best means of disposal of any product is through proper use according to the label. For the product incinerate under controlled conditions. For the pack, do not dispose of the pack in domestic refuse. Empty completely, puncture or crush and dispose of safely to Local Authority and National requirements. Dispose of packaging, remains of unused product and dead rodents to a certified waste disposal operator for incineration and licensed waste disposal site.

3.4.6. Possibility of destruction or decontamination following accidental release

Air:
Brodifacoum has a low vapour pressure, therefore the potential for evaporation is low The vapour pressure is 5 x 10^{-5} Pa. As a rodenticide, this material is not intentionally aerosolised. Therefore, destruction in air is not a concern.

Water (including drinking water):
Prevent further leakage or spillage if safe to do so. Prevent entry into watercourses, sewers.

Soil:
Direct and/or intentional release to soil is not anticipated for the use of the product as a rodenticide. In the event of a significant accidental release, inform the appropriate authority.

3.4.7. Undesirable or unintended side-effects

Toxic to mammalian and avian species, including domesticated animals, wildlife and humans. Therefore the risk to these non-target species should be considered when using bait.

3.4.8. Poison control measures

The paste baits are dyed (e.g. red or blue) to make them unattractive to wildlife, and birds in particular. In addition, in case of accidental ingestion, the presence of a dye may help to confirm that there has been ingestion and thus facilitate antidote treatment.

The product contains a human taste deterrent (adversive agent – Bitrex).

To report human poisoning incidents call the relevant national poison information centre. Include information on the product authorisation number, product trade name and active substance. Where possible provide a copy of the label or safety data sheet (SDS).

In Ireland to report a poisoning incident, call: 01 (8092566 / 8379964) The Poisons Information Centre of Ireland, Beaumont Hospital, Beaumont Road, Dublin 9.

ADVICE FOR DOCTORS:

Brodifacoum is an indirect anti-coagulant. Phytomenadione, Vitamin K1, is antidotal. In the case of suspected poisoning, determine prothrombin times not less than 18 hours after consumption. If elevated, administer vitamin K1 and continue until prothrombin times normalise. Continue determination of prothrombin time for three days after withdrawal of antidote and resume reatment if elevation recurs in that time.

Report all incidents of poisonings to the relevant national poisons centre (include information on the product authorisation number, product trade name and active substance)

4. Proposal for Decision

The assessment presented in this report has shown that the ready-to-use product, Strong, formulated by Belgagri S.A. with the active substance Brodifacoum, at a level of 0.005% w/w, may be authorised for use as a rodenticide (product-type 14) for the control of rodents (rats and mice).

Physical-Chemical Properties:
Strong has been shown not to present a physical-chemical hazard to end users and does not classify as highly flammable, oxidising or explosive. The bait is stable when stored at ambient temperatures (20^{o}C) for 12 months and when stored at 54^{o}C for 2 weeks, therefore a shelf life of two years is proposed based on ambient and accelerated storage stability data. A suitable method of analysis for the determination of Brodifacoum in the bait was provided.

The source of active substance used in the biocidal product Strong is the same source of active substance that is listed in Annex I of 98/8/EC. Syngenta initially supported the source, then the task force (Pelgar International Ltd and Activa) also supported the source, Italy carried out an equivalence check on the Task force source of Brodifacoum and found it to be equivalent to the Syngenta source. The RefMS accepted Italy's assessment.

Efficacy:
Effectiveness data has confirmed that Strong is effective in the proposed areas for use, at the recommended dose rate even when stored for up to two years. The bait formulation proved to be both palatable and effective against rats and mice in the trials. Strong is suitable for use in waste dumps and open areas for professonal users.

Human Health:
The calculations presented have been made with the assumptions of rat control, and there are no separate calculations to assess exposure for mice control in which smaller bait sizes are used.

Using both the MOE and AEL approaches for risk assessment indicates that there is a satisfactory margin between the predicted exposure and the NOAEL (LOAEL) as well as exposures below the threshold value for the AEL for all intended uses by trained professionals with PPE, untrained professionals and amateurs (with and without PPE). The product is deemed suitable for authorisation and appropriate personal protective equipment is advised.

Secondary exposure from transient mouthing of the product exceeds the AEL reference value (0.0033µg/kg/day), both with the assumption of 0.01 g and 5 g of product ingested by infants. This is of concern. There is no margin of safety using the existing data and models. There is no safe scenario for indirect exposure if estimated according to TNsG and User Guidance. Mitigation and protection measures such as the inclusion of bittering agents and the enclosure of product in sealed packs and tamper resistant bait boxes are essential to reducing the risk of secondary exposure. Baits should not be placed where food, feeding stuffs or drinking water could be contaminated.

Environment:
The applicant did not submit any new environmental fate and behaviour studies with this product. Therefore the conclusions made at the Annex I inclusion stage for the active substance stand. The uses of this product were assessed here under the TGD and the PT14 ESD and all PEC/PNEC ratios were <1. However there is a risk for primary and secondary poisoning for non-target vertebrates. These identified risks are mitigated by applying all appropriate and available risk mitigation measures.

Conclusion:

During the active substance review of Brodifacoum by Italy, primary and secondary poisoning risks were identified for non-target organisms and for potential accidental poisoning incidents involving children. The assessment of those EU identified risks during the product authorisation evaluation of Brodifacoum have also indicated a potential risk of primary and secondary poisoning to non-target animals and the potential for the accidental primary poisoning of children. Due to these findings risk mitigation measures are applied to product authorisation.

Additionally, as the target rodents are vermin and are both direct transmitters of disease (such as through biting or contamination of food/feed by urine or faeces) or indirect carriers of disease (such as disease vectors, where fleas move from rat to humans) to humans and other animals. Transmitted diseases can include leptospirosis (or Weil's disease), trichinosis and salmonella. Authorisation of this product is considered necessary on the basis of public health grounds, since rodent populations are considered to constitute a danger to public health through the transmission of disease. However, risk mitigation measures and restrictions are required to prevent the possibility of the identified risks to non-target animals, companion animals and children.

Outstanding data must be submitted upon completion as detailed above.

Conditions of authorisation

Two authorisations should be issued. The first authorisation covers professional and trained professional use product. The second authorisation covers amateur use product.

This authorisation of Strong is for a period of 5-years with an annual renewal.

The concentration of the active substance, Brodifacoum, in Strong shall **not** exceed 0.05 g/kg (0.005% w/w).

Only ready-to-use Strong product is authorised.

As a poison control measure, the authorisation requires that the product shall contain an aversive, bittering agent.

The authorisation requires that the product be dyed with a colour to make them unattractive to wildlife, and birds in particular.

This product shall **not** be used as a tracking poison.

The product is authorised only for use against rats and mice (for example brown rats and house mice). Authorisation of this product does **not** allow use against non-target organisms.

The authorisation of this product for professionals and trained professionals only allows for use indoors and outdoors in the following areas: Indoors, including areas such as houses, warehouses, outbuildings and commercial premises. Outdoors uses only includes in-and-around buildings. Brodifacoum baits must not be placed where food, feeding stuffs or drinking water can become contaminated.

The authorisation of this product for amateurs allows for use of this product indoors and outdoors around buildings in the following areas: Indoors, including only privates houses and outbuildings. Outdoors uses, including only around private building premises and private gardens. Brodifacoum baits should not be placed where food, feeding stuffs or drinking water can become contaminated.

The product should be used for rodent control in tamper resistant, secured bait stations or other secure coverings.

Bait stations should be clearly marked to show that they contain rodenticides and that they should not be disturbed.

Baits shall be secured to the bait station(s) so that rodents cannot remove bait from the bait box.

For amateur use products placed on the market in Ireland packaging restrictions are to be limited to pre-baited bait stations and refill packs with a maximum pack-size of 500g. Refill packs for amateurs must contain bait that is wrapped. Loose baits or grain (without wrapping) shall not be packaged for amateurs.

All product placed on the Irish market after the date of authorisation must be in compliance with the conditions of this authorisation and shall carry the approved label with the IE/BPA authorisation number and be packaged in the approved packaging.

Prior to any amendment relating to this authorised product, such as specification, use, labelling or administrative changes, application must be made to this Authority to do so

Upon annual renewal of the biocidal product, the authorisation holder shall provide statistics to PRCD on the import and export from Ireland and also manufacture statistics where appropriate for the product for the given full annual period or part thereof.

Authorisation of the biocidal product may be subject to review, following a detailed assessment of the risks involved, in accordance with the European Communities (Authorisation, Placing on the Market, Use and Control of Biocidal Products) Regulations, 2001, as amended. This review may lead to changes in or revocation of this authorisation.

ANNEXES to Initial PAR – July 2013

Annex:

1. Confidential Information and Data
2. Summary of the Product Characteristics (SPC)
3. Study Summaries of Studies Reviewed
4. List of Studies Reviewed
5. Toxicology Calculations
6. Environmental Calculations
7. Residue Calculations

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21 All sites involved in the manufacturing process of each active substance and of the product must be listed.

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			[redacted]	[redacted]		[redacted]		

22 g/l, g/kg, other. For biological products, the concentration should state the number of activity units/units of potency (as appropriate) per defined unit of formulation (e.g. per gram or per litre).

Annex II: Summary of the Products Characteristics (SPC)

Please see separate SPC accompanying the PAR and authorisation certificate that have uploaded to the R4BP2.