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Potential for substitution of substances used in wood treatment preservatives (PT8)

Issues related to future approval decisions - October 2022

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Executive summary

Most of the wood species grown in France do not have sufficient natural durability to withstand the biological stresses to which they are subjected over long periods of time when put into service, particularly in the fields of construction (carpentry, cladding, etc.) and logistics. Wood treatment is used to provide the desired durability to the wood being used. And of all the options available, treatment with fungicides and insecticides is the most common route.
As such, (chemical) wood preservatives are regulated by EU Regulation 528/2012 on the placing on the market and use of biocidal products and may only use approved active substances, whose approval is periodically reviewed.
The first objective of this study is to identify, prior to the re-approval deadlines, the substances for which substitution issues might be necessary even though they are widely used. With different degrees of urgency, four active substances - creosote, propiconazole, boric acid and tebuconazole - stand out.
The second objective of the report is to investigate to what extent alternatives are possible for each of these biocides. When combined with the study of the characteristics of all products available on the market, the analysis of the expected uses of each substance leads to the conclusion that all types of use can be covered with alternative active substances that do not meet any exclusion criteria (some uses can also be covered by non-biocidal treatments). The conclusion is particularly true for propiconazole, even though a significant part of the wood treatment industry has developed around its use.
This report does not provide a detailed socio-economic analysis of the impacts associated with the substitution of these active substances. However, it suggests that substitution could have significant impacts on the industry, which has invested little in research into new active substances and remains highly dependent on the few active substances currently available. It should also be noted that wood treatment elsewhere in Europe is also very dependent on a few substances (notably boron compounds) which are not widely used in France but which also meet the exclusion criteria. To date, the safest alternative solutions (chemical or not) are proposed by a small number of companies.

Use the link provided below for quotations:

French national institute for industrial environment and risks (Ineris), Potential for substitution of substances used in wood treatment preservatives (PT8), Verneuil-en-Halatte : Ineris - 207016 - v1.0, 15 février 2023.

Keywords:

Biocide Regulation, PT8, fungicides, substitution

1 Introduction

This work is an update of the one presented in the Ineris report - 200353 - 2190503 - v2.0 published in May 2021[1]. It includes the most recent data on the hazard properties of biocidal substances approved for wood treatment, and on wood preservatives available on the European market.

1.1 Context

Wood is, on the one hand, a renewable resource that is difficult to relocate and, on the other hand, a material whose environmental, technical and aesthetic characteristics offer a very wide range of outlets. The wood industry is to play an important role in the low-carbon transition and the circular economy. Nonetheless, to do so, it must face up to major technical, organisational and economic challenges.

Wood preservation treatments are at the heart of one of them. They are intended to ensure the durability of wood for a significant part of production and in application sectors as diverse as building and construction, gardening and landscaping, agriculture (poles for fruit and vine growing) or leisure (swings). In the meantime, these (mainly) chemical treatments are following and will still have to follow national and European regulations on the use of biocidal substances

1.2 Issues

Active substances and biocidal products are subject to EU Regulation 528/2012, the main objective of which is to ensure a high level of protection for humans, animals and the environment by restricting the placing on the market of biocidal products to those that are effective and do not present unacceptable risks.

Within this framework, active substances used in biocidal products are subject to approval at European level, which must be periodically renewed.

The objective of this report is to provide an overview of the substitution issues that the wood industry could face in the short to medium term if certain authorisations are not renewed.

The report is divided into four parts. The first part presents a general overview of the rationale for wood preservatives. The second part provides an overview of the approved substances, with particular emphasis on current use levels, and compares the known or suspected hazardous properties of each of these substances with the exclusion and substitution criteria of the Biocide Regulation. The third part summarises the existence of substitution possibilities on the French and European markets. Finally, the fourth part places the question of the substitution of these substances in the broader perspective of the consequences it could have on the sector.

1.3 Methodology

This report is based on the collection and cross-referencing of numerous data, either publicly available (scientific literature, product marketing authorisations, etc.) or obtained through the Ministry of Ecological Transition (industry reports, Simmbad database). The information gathered made it possible to study the composition of the products available in France and in Europe, their sales levels and their expected uses.

In addition, interviews were held with several stakeholders in the wood treatment field in order to identify the potential obstacles (technical, economic or regulatory) to the substitution of certain substances. Representatives from the following stakeholders were consulted:

- The French national Union of wood preservation and related materials industries (Syndicat national des industries de la Préservation du Bois et des matériaux dérivés (SPB)) and the federation of painting and varnishing industries (Fédération Industries Peintures Vernis Couleurs (FIPEC))
- The French national Federation of wood and the association Arbust which includes autoclave impregnators, manufacturers of wood treatment machines and manufacturers of wood preservatives (Fédération Nationale du Bois, et de l'association Arbust qui regroupe les

[1] Available here, only in french: Possibilité de substitution des substances employées dans les produits de traitement du bois (TP8) - Enjeux liés aux prochaines décisions d'approbation | Ineris

imprégnateurs du bois par autoclave, les fabricants de machines de traitement du bois et les fabricants de produits de préservation)
- The formulators AdKalys and Koatchimie,
- The user of wood preservatives France Wood Soaked/Impregnated (France Bois Imprégné (FBI)),
- The Technological Institute Forest Cellulose Wood Construction Furniture (Institut Technologique Forêt Cellulose Bois-construction Ameublement (FCBA),
- The testing platform Durwood,
- The French Agency for Food, Environmental and Occupational Health & Safety (ANSES)

In addition, this report updates the work carried out on the basis of these interviews, using the latest available sales data from 2021, and the latest information on the hazards of authorised biocidal substances provided by Anses[2].

Finally, as a preamble to this study, two points should be made:

- The scope of this report is limited to the investigation of the possibilities of substitution of biocidal substances involved in wood preservatives. However, it does not address the need for (and effects of) substitution from an environmental and health point of view.
- In many applications, wood products compete with other materials such as concrete, steel or various polymers. However, our study was limited to the investigation of wood preservation alternatives. In other words, the study focused on wood preservation solutions and not on the possibilities of substituting treated wood.

[2] The vast majority of the changes relate to parts 3.7 and 3.8 on information associated with active substances, part 4 on the identification of substitution possibilities, and part of the conclusions in part 5.5.

2 Wood treatment

2.1 The function of preventive wood treatment

France has the fourth largest forest area in Europe, behind Sweden, Finland and Spain, and produces around 8 million cubic meters of sawn timber each year, mainly for construction (carpentry and timber frames, joinery, cladding), furnishings (interior linings, outdoor benches, terraces, etc.), packaging (pallets, wood packaging) and energy recovery.

For many of those applications, durability (in the sense of sufficient life span) is a necessary prerequisite for market access. **The challenge is to ensure that the wood in use can withstand the biological stresses (fungal or beetle and termite attack) imposed by the environmental conditions for an adequate period of time.**

The wood industry has standards for characterising the expected classes of use (NF EN 335), the durability of the various species (NF EN 350), and offers nomenclatures for verifying the compatibility of species, durabilities (natural or conferred) and uses.

2.1.1 Use classes

The standard NF EN 335 defines five use classes which correspond to the different situations in service to which wood (or wood-based materials) can be exposed and which can make it degraded by biological agents (insects and/or fungi). These attacks can lead to the rotting of the material by degrading the lignin and/or cellulose and can endanger structural timber, timber frames, joists, deck boards, wooden cladding, etc.

- **Use class 1:** Situations in which the wood or wood-based material is used inside a building, not exposed to weathering and dampness (furniture, parquet, panelling, joinery and interior fittings, etc.).

- **Use class 2:** Situations where the wood or wood-based material is under cover and not exposed to the weather, but where it may be subject to occasional but not persistent dampness (e.g. framing). In this use class, condensation may form on the surface of wood and wood-based products.

- **Use class 3:** Situations where the wood or wood-based material is above ground and exposed to the weather, e.g. windows and other external joinery, external cladding (cladding in general), framing elements exposed to the weather (e.g. certain structural elements).
  Due to the diversity of exposure situations, use class 3 can be subdivided into two subclasses: use class 3.1 and use class 3.2.

    - Use subclass 3.1: In this situation wood and wood-based products will not remain wet for long periods (water will not accumulate). This can be achieved, for example, through the use of suitable, maintained finishes, or through appropriate design or orientation of elements to allow water to drain away or to allow rapid drying.

    - Use subclass 3.2: In this situation wood and wood-based products will remain wet for long periods of time (water may accumulate).

- **Use class 4:** Situation in which the wood or wood-based material is in direct contact with the ground and/or fresh water (poles supporting lines, sleepers, posts, water features (pilings, pontoons, bank retaining structures, etc.), outdoor furniture, outdoor games, green space features, agricultural buildings, decking and gratings, guardrails, logs in a horizontal position).

- **Use class 5:** Situation in which the wood or wood-based material is immersed in salt water (sea water or brackish water) regularly or permanently.

Use class 1 corresponds to situations where, in certain geographical areas, wood can be attacked by insects. Beyond class 1, exposure to insects is still possible, but it is the conditions of exposure to humidity that vary and make fungal attacks more or less severe[3].

2.1.2 Natural durability

The natural durability of wood varies according to the species. In France, oak and chestnut are generally more durable than softwood. The NF EN 350 standard proposes a classification with regard to fungal attacks in 5 categories, from class 1 grouping very durable species to class 5 of non-durable species[4].

2.1.3 Compatibility between natural durability and use class

Erreur ! Source du renvoi introuvable. below, compares durability classes and use classes, and shows the rationale for wood preservation treatments: when a wood species does not have sufficient natural durability for its intended use, it is necessary to make it durable by means of a suitable treatment.

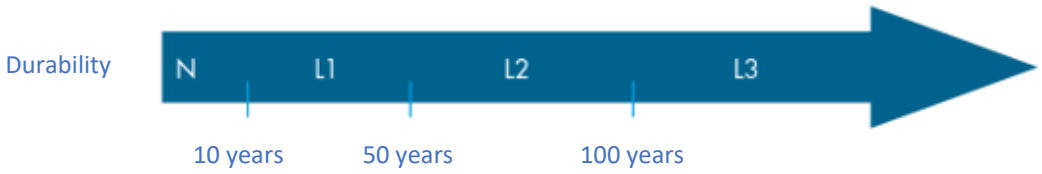
USE CLASS (EN 335 and FD P 20-651)	DURABILITY CLASS (EN350)				
	1	2	3	4	5
1	0	0	0	0	0
2	0	0	0	(0)	(0)
3	0	0	(0)	(0) - (x)	(0) - (x)
4	0	(0)	(x)	x	x
5	0	(x)	(x)	x	x

0	sufficient natural durability
(0)	natural durability usually sufficient, except for some uses for which a preservation treatment could be recommended
0 - (x)	natural durability could be sufficient, but a preservation treatment could be required in function of the wood species, the permeability and final use
(x)	preservation treatment is normally recommended but for some uses natural durability is sufficient
x	preservative treatment is intended

Figure 1 : Compatibility between durability and use class (Source: Ineris translation of « FNB – Fiche Comprendre 4 - Les classes d'emploi et la longévité des ouvrages bois »)

Figure 2, also taken from the documentation of the Fédération Nationale du Bois (National Wood Federation) helps to clarify this interpretation. Apart from preservation against insect attack, wood preservation treatment is intended to give the least durable species a guarantee of use of between 10 and 50 years. On this point, dealers in treated wood are generally only obliged in the construction sector to provide a commercial guarantee of 10 years - through the ten-year guarantee - even though a greater durability is generally expected and observed.

[3] Wood and wood-based products that are permanently immersed or completely buried and saturated with water are not susceptible to fungal attack, but they can be affected by bacteria.
[4] For example, black locust is class 1 to 2, oak and chestnut are class 2, most softwoods are class 3 to 4, poplar and beech are class 5.



Wood species	USE CLASS				
	1	2	3.1	3.2	4
Oak **	*L3*	*L3*	*L3*	*L2*	*L1**
Chestnut **	*L3*	*L3*	*L3*	*L2*	*L1**
Ash	*L3*	*L2*	*L1*	*N*	*N*
Beech	*L3*	*L2*	*N*	*N*	*N*
➢ Beech treated class 4					*L1*
Poplar	*L3*	*L2*	*L1*	*N*	*N*
Douglas fir **	*L3*	*L3*	*L3*	*L2*	*L1*
Spruce	*L3*	*L2*	*L1*	*N*	*N*
Whithe fir	*L3*	*L2*	*L1*	*N*	*N*
Maritime pine	*L3*	*L3*	*L2*	*L1*	*N*
➢ Maritine pine treated class 4					*L1*
➢ Maritine pine treated class 3.2				*L1*	
Scots pine	*L3*	*L3*	*L1*	*L1*	*N*
➢ Scots pine treated class 4					*L1*
➢ Scots pine treated class 3.2				*L1*	
All wood species for a use class 2		*L1*			
All wood species for use class 3.1			*L1*		

*Figure 2: Life expectancy of timber structures according to wood species and use class ; **: Without sapwood[5] (Source : Ineris translation of « FNB – Fiche Comprendre 4 - Les classes d'emploi et la longévité des ouvrages bois »)*

2.1.4 Three options to address sustainability issues:

In conclusion, three types of options are generally considered when deciding to use wood in environments where biological attacks are likely to occur:

[5] The sapwood is the part of the tree between the heartwood and the inner bark. It is a living wood, more porous, more hydrated, and therefore less durable than the heartwood, which is usually dry and rot-proof. Not all species have heartwood.

- The first is to use sustainable wood. However, sustainable wood species are rare locally. To date, the supply of Black locust (or Robinia) is low[6], and more generally, hardwoods of which only the heartwood (i.e. approximately 50% in volume) is sustainable represent less than 20% of sawn timber.

- The second is to increase the durability of the species used by treatment. The most common option is the use of preparations containing biocidal substances: the PT8 products of the Biocide Regulation, which are the focus of this report. However, other types of options can be considered depending on the intended use (physical treatments, etc.).

- Finally, there is a third option, which is culturally more related to the northern regions of Europe. It consists in using untreated wood and monitoring it to ensure an adequate intervention (curative treatments, replacement of damaged parts, etc.) when necessary. This option requires that the wood in use remains accessible.

2.2 Other uses of wood treatments

In addition to preventive treatment to ensure the durability of the wood in use, treatment products can be used for other purposes:

- Professional curative treatment of wood (framework, floor, half-timbering, etc.) by spraying and/or if necessary injecting, against termites in buildings, or against Merula
- Fumigation treatments
- Treatment to prevent blue stain on fresh wood
- Products for the trade and the public to enable craftsmen and private individuals to maintain furniture, frameworks and construction wood.

2.3 Economic context

According to the latest information provided to us by the Arbust association and the SPB, the forestry and wood industry represents, between 400,000 and 500,000 jobs in France. The wood processing sector represents approximately 250,000 jobs in Europe[7].

The timber harvest in France is 20,4 million m^3 of round wood, two thirds of which is softwood (“résineux”) and one third hardwood (“feuillus”).
The associated sawn timber production amounts to 8,4 million m3 per year, of which about 80% is softwood and 20% hardwood, and of which 5 million m^3 are subject to preservation treatment:

- for construction
    - Interior wood
        - Interior joinery (stairs, parquet, panelling)
        - Carpentry (joists, rafters, etc.)
    - Exterior wood
        - Exterior joinery (doors, windows, shutters)
        - Cladding
        - Exterior fittings (terraces, fences, garden sheds, etc.)
- for packaging (wooden packaging, pallets, etc.)

The turnover of the treatment sector according to the types of treatment is illustrated in Figure 3 below.

[6] Although demand is high for certain outlets (vine stakes, etc.).

[7] French data are unavailable

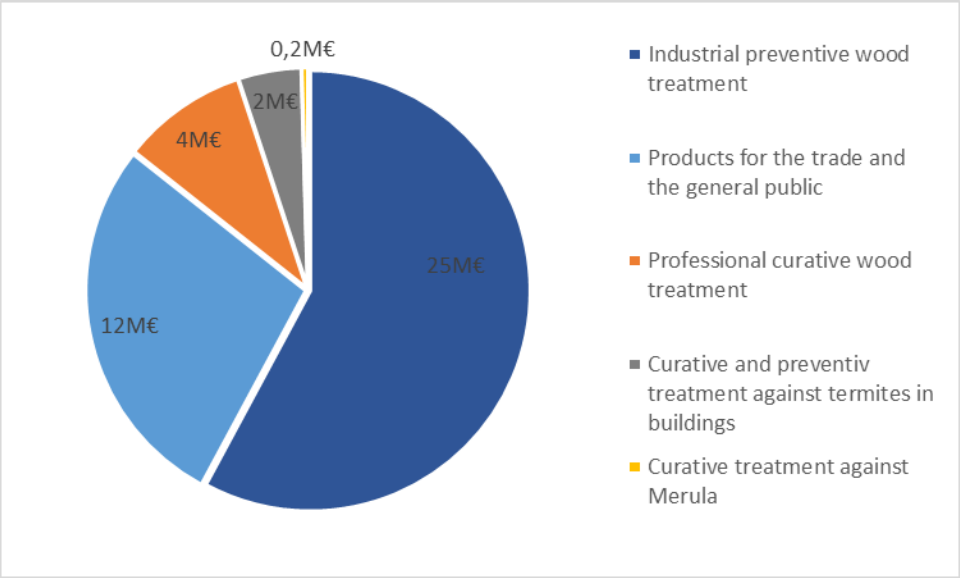


Figure 3 : Distribution of the turnover of the different types of wood preservation treatments (M€: millions of euros)[8] (Source: Syndicat National des Industries de la Préservation du Bois)

While the use classes detailed in section 2.1.1 relate to the conditions under which timber is put into service, they also demonstrate two very distinct types of processes and actors between classes 3.1 and 3.2 (see Table 1).

Table 1 : Summary table of usual techniques: processes / products / use classes (Source: FCBA, technical specifications, via Arbust)

PROCESSES	**PRODUCTS**	Use classes					
		1	2	3		4	5
				3.1	3.2		
Brushing	petroleum solvent	x	x	x			
	water-dispersible	x	x	x			
Spraying	petroleum solvent	x	x	x			
	water-dispersible	x	x	x			
Soaking	petroleum solvent	x	x	x			
	water-dispersible	x	x	x			
Soaking-difusion	water-soluble salts	x	x	x	x		
Autoclave double vaccum	petroleum solvent	x	x	x	x		
	water-dispersible	x	x	x	x		
Autoclave vaccum pressure	oxide or salts	x	x	x	x	x	x
	creosote				x	x	

[8] The turnover of fumigation is insignificant

Beyond class 3.2, the processes must allow for deep impregnation of the treatments and are based on autoclave-type installations.
The metropolitan consumption of autoclave-impregnated wood products is estimated at 1,14 million m^3 in volume. This market share concerns 70 companies and 90 impregnation sites in France; moreover, the activity is concentrated since the 5 largest players own a third of the installations and produce about half of the national volume of wood impregnated in autoclave.

- Building-related uses are in the majority: 51%.
- Cladding and decking represent more than a third: 33%.
- The garden market (including fencing) is in the minority: 7%.

There is competition from more technical professional uses (metal, plastic) and wood in general is losing market share.

3 Detailed review of substances approved to date

The reasons for treating wood have been presented. The aim of this section is now to provide an overview of the biocidal substances used for this purpose.

3.1 General information

Under the EU Biocide Regulation n°528/2012, biocidal products have been classified into 4 groups: disinfectants, preservatives, treatments against pests and other biocidal products. They are divided into 22 different Product Types (e.g. PT1 for disinfectants for personal hygiene, PT3 for disinfectants for veterinary hygiene...).

The wood preservatives belong to the group of preservatives and are referred to as "Product Type 8" (PT8). Products are preparations containing one or more biocidal active substances. These biocidal active substances act on harmful organisms (insects, fungi) by chemical action. They are intended to:

- Make them harmless, destroy them or repel them, in the case of curative treatment
- Prevent their action, in the case of a preventive treatment.

In practice, the choice of a biocidal active substance is made by considering several parameters:

- The type of action (insecticide or fungicide)
- The type of treatment (preventive or curative)
- The situation of the wood in service (use class).

3.2 Details on the action of active substances and treatment methods

The fungicidal action of biocidal substances targets fungi that can cause degradation of the mechanical characteristics of wood (basidiomycetes, cubic, soft and fibrous rots), and alter the appearance of wood (blue stain fungi).

Biocidal substances in wood preservatives with an insecticidal action are aimed at insects and/or wood-eating larvae (termites, longhorn beetles, small wood borers, marine borers).

The use of wood protection products can be intended to treat the wood in a preventive or curative way. The type of treatment (curative or preventive) may determine the type of application:

- Surface application (soaking, spraying, brushing, etc.), in-depth application (impregnation, vacuum and pressure autoclave) for preventive treatments (carried out by professionals and Industry);
- Injection or surface application (brushing, spraying, brush) for curative treatments (carried out by individuals and professionals).The dip application consists of immersing the wood for a few minutes in a tank containing the biocides, which then penetrate the wood by capillary action.

The sprayed wood is sprayed with the biocidal product in a cabin and then drained. The spraying system is a closed circuit where the surplus product is collected, filtered and pumped away for further use[9].

The impregnation of a biocide product is carried out by autoclave, a deep treatment which consists of saturating all the cells of the wood with the product[10].

Table 2 below summarises the conditions and biological agents specific to each use class.

[9] When the wood is to be trimmed, the treatment should be applied to the cuts with a whitewash.

[10] The wood is dried to ensure better impregnation of the product in the cells. After loading the wood, an initial vacuum is applied to expel the air contained in the cells. The autoclave is then filled with the treatment product while maintaining the vacuum. A pressure of 10 to 12 bars is then applied (after the vacuum is stopped) until the cells are completely saturated. After emptying the product, a vacuum is again applied to rebalance the internal pressures of the wood and obtain a dry wood surface.

Table 2 : Classes of use of wood and wood-based materials (conditions and biological agents) (Source NF EN 335)

Use classes		**CLASS 1**	**CLASS 2**	**CLASS 3**		**CLASS 4**	**CLASS 5**
				CLASS 3.1	**CLASS 3.2**		
Characteristics of the use class		Indoor, dry	Indoor, or under shelter, not exposed to the weather, possibility of water condensation	outdoor, above the ground, exposed to the weather		Outdoor, in contact with soil and/or fresh water	Immersed in salt water regularly or permanently
				Short humidification conditions	Long humidification conditions		
Processes		Brushing, aspersion, soaking			Autoclave		
Target organisms	Discoloration fungi	-	X	X	X	X	X
	Lignivorous fungi	-	X	X	X	X	X
	Beetles	X	X	X	X	X	X
	Termites	Locally	Locally	Locally	Locally	Locally	Locally
	Pholades (Pholadidae)	-	-	-	-	-	X

3.3 Families of active substances

Biocidal active substances for wood preservatives can be classified into families according to their chemical structure. They include:

- Azoles (fungicidal action)
- Boron compounds (fungicidal and insecticidal action)
- Copper compounds (fungicidal and insecticidal action)
- Quaternary ammoniums (Fungicidal and insecticidal or fungicidal action)
- Carbamates (Fungicidal or insecticidal action)
- Synthetic pyrethroids (Insecticidal action)
- Coal distillation products (Fungicidal and insecticidal action)
- Neonicotinoids (Insecticidal action)
- Sulphonamides (Fungicidal action)
- Isothiazolinones (Fungicidal action)
- Cyanides (Insecticidal action)
- Pyrazole carboxamides (Fungicidal and insecticidal activity)
- Potassium salts (Insecticidal action)
- Morpholine derivatives (Fungicidal action)
- Tetrahydrothiadiazines (Fungicidal action)
- Benzoylureas (Insecticidal action)
- Diphenyl ethers (Insecticidal action)

3.4 Regulatory overview

3.4.1 Biocide regulation

The use of active substances and biocidal products is subject, in France as in all other Member States of the European Union, to Regulation (EU) No 528/2012 concerning the placing on the market and use of biocidal products.

Each active substance is evaluated by a designated Member State. The evaluation report issued is then discussed with all Member States to reach a single decision on the approval or non-approval of the substance at European level. In France, the Ministry of Ecology is the competent authority for the approval of active substances at European level.

Biocidal products containing one or more active substance(s) under evaluation or included in the list of approved active substances[11] are subject to a marketing authorisation application (MA) issued by the Anses[12]. These applications specify the authorised uses and the general conditions of use. They are based on assessment reports, which, in view of the compositions and claimed concentrations of use of the various substances present in the products, conclude on the efficacy, the potential development of resistances, as well as the risks for the environment, human health and via food.

To date, 46 substances have been submitted for approval as wood preservatives under the Biocidal Products Directive (Directive 98/8/EC) or the Biocidal Products Regulation.

Of these 46 biocidal active substances that may be used to produce wood preservatives, there are[13]:

- 18 approved substances ;
- 12 approved substances under renewal[14];
- 2 substances whose initial approval is under review;
- 13 substances whose approval has expired[15];
- 1 substance whose application for approval has been cancelled.

Table 3 summarises the characteristics of these active substances (type of action, family...).

[11] https://echa.europa.eu/fr/regulations/biocidal-products-regulation/approval-of-active-substances/list-of-approved-active-substances

[12] https://www.anses.fr/fr/decisions_biocide.

[13] See « Information on biocides » on the ECHA website

[14] For some of these substances, the approval end dates have passed.

[15] For these substances, no application for renewal of approval has been made.

Table 3. Biocidal substances used for wood protection (PT8) (Source: ECHA)

Substance	EC no.	CAS no.	Group	Type of action	Approval Start	Approval End	Assessment authority
Flufenoxuron	417-680-3	101463-69-8	Benzoylureas	Insecticide	01/02/2014	31/01/2017	France
Dichlofluanid	214-118-7	1085-98-9	Sulphonamides	Fungicide (blue-staining fungi)	01/03/2009	28/02/2019	United Kingdom
Thiacloprid		111988-49-9	Neonicotinoids	Insecticide	01/01/2010	31/12/2019	United Kingdom
Clothianidin	433-460-1	210880-92-5	Neonicotinoids	Insecticide	01/02/2010	31/01/2020	Germany
Thiabendazole	205-725-8	148-79-8	Azoles	Fungicide	01/07/2010	30/06/2020	Spain
Thiamethoxam	428-650-4	153719-23-4	Neonicotinoids	Insecticide	01/07/2010	30/06/2020	Spain
Cyproconazole		94361-06-5	Azoles	Fungicide	01/11/2015	31/10/2020	Irland
Fenpropimorph	266-719-9	67564-91-4	Morpholine derivatives	Fungicide	01/07/2011	30/06/2021	Spain
Disodium octoborate tetrahydrate	234-541-0	12280-03-4	Boron compounds	Insecticide Fungicide	01/09/2011	31/08/2021	Netherlands
Disodium tetraborate decahydrate	215-540-4	1330-43-4	Boron compounds	Insecticide Fungicide	01/09/2011	31/08/2021	Netherlands
Sodium tetraborate decahydrate	215-540-4	1303-96-4	Boron compounds	Insecticide Fungicide	01/09/2011	31/08/2021	Netherlands
Diboron trioxide	215-125-8	1303-86-2	Boron compounds	Insecticide Fungicide	01/09/2011	31/08/2021	Netherlands
Tolylfluanid	211-986-9	731-27-1	Sulphonamides	Fungicide (blue-staining fungi)	01/10/2011	30/09/2021	Finland
Tebuconazole	403-640-2	107534-96-3	Azoles	Fungicide	01/04/2010	30/09/2022	Denmark
Creosote	232-287-5	8001-58-9	Coal distillation products	Insecticide Fungicide	01/05/2013	31/10/2022	United Kingdom
Ethofenprox	407-980-2	80844-07-1	Diphenyl ethers	Insecticide	01/02/2010	31/10/2022	Austria
3-iodo-2-propynyl butylcarbamate (IPBC)	259-627-5	55406-53-6	Carbamates	Fungicide	01/07/2010	31/12/2022	Denmark
K-HDO		66603-10-9	Potassium salts	Fungicide	01/07/2010	31/12/2022	Austria
Propiconazole	262-104-4	60207-90-1	Azoles	Fungicide	01/04/2010	31/12/2022	Finland
DDACarbonate	451-900-9	894406-76-9	Quaternary ammoniums	Insecticide Fungicide	01/02/2013	31/01/2023	United Kingdom
4,5-Dichloro-2-octylisothiazol-3(2H)-one (4,5-Dichloro-2-octyl-2H-isothiazol-3-one (DCOIT))	264-843-8	64359-81-5	Isothiazolinones	Fungicide	01/07/2013	30/06/2023	Norway

Substance	EC no.	CAS no.	Group	Type of action	Approval Start	Approval End	Assessment authority
Sulphuryl difluoride	220-281-5	2699-79-8		Insecticide	01/01/2009	31/12/2023	Sweden
Boric acid	233-139-2	10043-35-3	Boron compounds	Insecticide Fungicide	01/09/2011	28/02/2024	Netherlands
Disodium tetraborate pentahydrate	215-540-4	12179-04-3	Boron compounds	Insecticide Fungicide	01/09/2011	28/02/2024	Netherlands
Dazomet	208-576-7	533-74-4	Tetrahydrothiadiazine	Fungicide	01/08/2012	31/01/2025	Belgium
Didecylpolyoxethylammonium borate (Polymeric betaine)		214710-34-6	Boron compound				Greece
N-(3-aminopropyl)-N-dodecylpropane-1,3-diamine	219-145-8	2372-82-9		Fungicide			Portugal
Bifenthrin		82657-04-3	Synthetic pyrethroids	Insecticide	01/02/2013	31/01/2023	France
Fenoxycarb	276-696-7	72490-01-8	Carbamates	Insecticide	01/02/2013	31/01/2023	Germany
Basic Copper carbonate	235-113-6	12069-69-1	Copper compounds	Insecticide Fungicide	01/02/2014	31/01/2024	France
Copper dihydroxide	243-815-9	20427-59-2	Copper compounds	Insecticide Fungicide	01/02/2014	31/01/2024	France
Copper oxide	215-269-1	1317-38-0	Copper compounds	Insecticide Fungicide	01/02/2014	31/01/2024	France
Hydrogen cyanide	200-821-6	74-90-8	Cyanides	Insecticide	01/10/2014	30/09/2024	Czech Republic
Quaternary ammonium compounds, benzyl C12-C16 (even numbered)-alkyldimethyl chlorides	270-325-2	68424-85-1	Pyrazole carboxamides	Insecticide Fungicide	01/02/2015	31/01/2025	Italy
Didecyldimethylammonium chloride (DDAC)	230-525-2	7173-51-5	Quaternary ammoniums	Insecticide Fungicide	01/02/2015	31/01/2025	Italy
Chlorfenapyr		122453-73-0		Insecticide	01/05/2015	30/04/2025	Portugal
Cypermethrin	257-842-9	52315-07-8	Synthetic pyrethroids	Insecticide	01/06/2015	31/05/2025	Belgium
Cu-HDO		312600-89-8	Copper compounds	Insecticide Fungicide	01/09/2015	31/08/2025	Austria
Permethrin	258-067-9	52645-53-1	Synthetic pyrethroids	Insecticide	01/05/2016	30/04/2026	Irland

Substance	EC no.	CAS no.	Group	Type of action	Approval Start	Approval End	Assessment authority
Potassium sorbate	246-376-1	24634-61-5	Potassium salts	Fungicide ((blue-staining fungi)	01/12/2016	30/11/2026	Germany
Granulated copper		7440-50-8	Copper compounds	Insecticide Fungicide	01/01/2017	31/12/2026	France
Octhilinone (ISO)	247-761-7	26530-20-1	Isothiazolinones	Fungicide	01/01/2018	31/12/2027	United Kingdom
Bardap 26		94667-33-1	Quaternary ammoniums	Insecticide Fungicide	01/01/2018	31/12/2027	Italy
Quaternary ammonium compounds, coco alkyltrimethyl, chlorides	263-038-9	61789-18-2	Quaternary ammoniums	Fungicide	01/05/2018	30/04/2028	Italy
Penflufen		494793-67-8	Pyrazole carboxamides	Fungicide	01/02/2019	31/01/2029	United Kingdom
Trichoderma harzianum strain T-720		67892-31-3		Fungicide			Netherlands

Approval status				
Approved	Initial approval in progress	Approved - Renewal in progress	Expired	Approval request canceled

3.4.2 REACH/CLP regulation

Obtaining certain hazard data has necessitated a focus on the REACH/CLP regulation.

Under the REACH regulation[16], the European Chemicals Agency (ECHA) evaluates dossiers submitted by industry to identify and manage the risks associated with the substances they manufacture and market in the EU. If the risks cannot be managed, the authorities can restrict the use of the substances (e.g. via authorisation requests, authorisation restrictions).

The CLP Regulation[17] aims to ensure that the hazards of a chemical substance are clearly communicated to workers and consumers in the EU through classification and labelling.

Before placing a chemical substance (or mixture of substances) on the European market, industry must determine the potential risks of the substance to human health and the environment, classify it according to the identified hazards and label products containing the substance so that workers and consumers are informed of their effects before handling them.

3.5 Study in the light of toxicity, exclusion and substitution criteria

The assessment of applications for approval of active substances is based on the exclusion and substitution criteria set out in Regulation (EU) No 528/2012 (see section 3.4.1).

3.5.1 What are the exclusion criteria?

A biocidal active substance cannot be approved if it meets any of the exclusion criteria listed in Article 5 of Regulation (EU) No 528/2012, namely:

- Be a category 1A or 1B carcinogen
- Be a category 1A or 1B mutagen
- Be a category 1A or 1B reprotoxic substance
- An endocrine disruptor (see Annex 6)
- Be a persistent, bioaccumulative and toxic (PBT) substance
- Be a very persistent and very bioaccumulative substance (vPvB)

3.5.2 What are the substitution criteria?

According to Article 10 of Regulation (EU) No 528/2012, the substitution of an active substance may be considered if it meets one of the following criteria:

- Meet at least one of the exclusion criteria and still be approved (conditions for derogatory approval are listed in Annex 1 - Conditions for derogatory approval of biocidal substanceses)
- Be classified as a respiratory sensitizer
- Have a significantly lower toxicological reference value (TRV) than the majority of active substances approved for the same product type and use
- Meet two of the criteria to be considered for classification as PBT (see Annex XIII of REACH)
- Cause concern for human or animal health and the environment even with very restrictive risk management measures (RMM)
- Contain a significant proportion of non-active isomers or impurities

In the remainder of the study, three criteria were investigated: classification as a respiratory sensitiser, validation of two of the criteria to be considered as PBT and meeting at least one of the exclusion criteria with approval on waiver.

Research of isomers or impurities, on environmental and heatlh impacts, on risk management measures (RMM) and on the calculation of TVR for each active substance have not been done due to difficulties in collecting the required data.

[16] Registration, Evaluation, Authorisation and Restriction of Chemicals
[17] Classification, Labelling, Packaging

Based on the information provided by ANSES[18] in June 2022, we have identified the biocidal active substances that meet the substitution and exclusion criteria.

3.5.3 CMR

The carcinogenic, mutagenic and reprotoxic (CMR) character of a substance is referenced according to the CLP regulation by its classification:

- Carc. category 1A or 1B for carcinogenic substances;
- Mutagenic category 1A or 1B for mutagenic substances;
- Reprotox. category 1A or 1B for reprotoxic substances.

3.5.4 Persistence et Bioaccumulation

Persistent bioaccumulative and toxic (PBT), very persistent and very bioaccumulative (vPvB) biocidal substances and substances that meet two of the criteria to be considered as PBT (persistent and/or bioaccumulative and/or toxic) were identified using the list of PBT/vPvB substances provided by the ANSES in June 2022.

The search for potentially persistent substances was carried out using the list of Persistent Organic Pollutants (POPs). This list covers a set of substances that have four properties that the Stockholm Convention explained in 2001: these pollutants are persistent, bioaccumulative, toxic and mobile[19].

3.5.5 Endocrine disruption

The search for substances with endocrine disrupting properties was carried out based on data provided by ANSES from the opinions adopted by the BPC (Biocidal Products Committee).

3.5.6 Respiratory sensitizers

Substances identified as "respiratory sensitizers" are classified in the CLP Regulation as "Resp. Sens. 1A or 1B" and their hazard code is: H334.

3.6 PT8 approved substances and exclusion and substitution criteria

Table 4 below compiles the PT8 biocidal active substances meeting the exclusion or substitution criteria.

[18] “Overview of the CLH and the PBT status for existing and new active substances under the biocidal products regulation“ (update on 11/17/2021)

[19] See The POPs on the Stockholm Convention website (http://chm.pops.int/) for a more precise definition.

Table 4. PT8 biocidal active substances meeting the exclusion or substitution criteria

Substance	CAS no.	Exclusion / Substitution	REACH status	EXCLUSION CRITERIA						SUBSTITUTION CRITERIA STUDIED [1]		Comments
				ED		CMR 1A ou 1B [1]	PERSISTENCE					
				Meets intermediate ED criteria [3]	Meets scientific ED criteria [3]		PBT	vPvB	POP	Respiratory sensitisers	« PBT » criteria [2]	
Thiacloprid	111988-49-9	Exclusion		N		Repr. 1B						
Cyproconazole	94361-06-5	Exclusion				Repr. 1B						
Diboron trioxide	1303-86-2	Exclusion	Candidate list	N		Repr. 1B						
Disodium octoborate tetrahydrate	12280-03-4	Exclusion	Candidate list	N		Repr. 1B						
Disodium tetraborate decahydrate	1330-43-4	Exclusion	Candidate list	N		Repr. 1B						
Sodium tetraborate decahydrate	1303-96-4	Exclusion	Candidate list	N		Repr. 1B						
Boric acid	10043-35-3	Exclusion / Substitution	Candidate list	N		Repr. 1B						Biocide still approved on 23/06/2022
Disodium tetraborate pentahydrate	12179-04-3	Exclusion / Substitution	Candidate list	N		Repr. 1B						Biocide still approved on 23/06/2022
Creosote	8001-58-9	Exclusion / Substitution		N		Carc. 1B Repr. 1B	X	X	Potential			Biocide still approved on 23/06/2022
Propiconazole	60207-90-1	Exclusion / Substitution		N		Repr. 1B						Biocide still approved on 23/06/2022
Chlorfenapyr	122453-73-0	Substitution		N							P/T	
Bifenthrin	82657-04-3	Substitution		N							P/T	
Permethrin	52645-53-1	Substitution		N							P/T	
Ethofenprox	80844-07-1	Substitution		N							B/T	
Clothianidin	210880-92-5	Substitution		N							P/T	
Fenpropimorph	67564-91-4	Substitution									P/T	
Flufenoxuron	101463-69-8	Potential Exclusion					?					According to the assessment report, flufenoxuron has been identified as a PBT by the ad hoc working group on PBT
Bardap 26	94667-33-1	Potential Substitution ?		N								
Cypermethrin	52315-07-8			N								
Fenoxycarb	72490-01-8			N								
Hydrogen cyanide	74-90-8			N								
Penflufen	494793-67-8			N								
Basic Copper carbonate	12069-69-1			N								
octhilinone (ISO)	26530-20-1			N								

Substance	CAS no.	Exclusion / Substitution	REACH status	EXCLUSION CRITERIA						SUBSTITUTION CRITERIA STUDIED [1]		Comments
				ED		CMR 1A ou 1B [1]	PERSISTENCE					
				Meets intermediate ED criteria [3]	Meets scientific ED criteria [3]		PBT	vPvB	POP	Respiratory sensitisers	« PBT » criteria [2]	
Copper oxide	1317-38-0			N								
Cu-HDO	312600-89-8			N								
Granulated copper	7440-50-8			N								
Didecyldimethylammonium chloride (DDAC)	7173-51-5			N								
Copper dihydroxide	20427-59-2			N								
Potassium sorbate	24634-61-5			N								
Quaternary ammonium compounds, coco alkyltrimethyl, chlorides	61789-18-2			N								
Quaternary ammonium compounds, benzyl C12-C16 (even numbered)-alkyldimethyl chlorides	68424-85-1			N								
Sulphuryl difluoride	2699-79-8			N								
Dazomet	533-74-4			N								
Tebuconazole	107534-96-3											
3-iodo-2-propynyl butylcarbamate (IPBC)	55406-53-6			N								
K-HDO	66603-10-9			N								
DDACarbonate	894406-76-9			N								
4,5-Dichloro-2-octylisothiazol-3(2H)-one (4,5-Dichloro-2-octyl-2H-isothiazol-3-one (DCOIT))	64359-81-5			N								
Didecylpolyoxethylammonium borate (Polymeric betaine)	214710-34-6											Assessment report in progress
N-(3-aminopropyl)-N-dodecylpropane-1,3-diamine	2372-82-9											Assessment report in progress
Dichlofluanid	1085-98-9			N								
Thiabendazole	148-79-8			N								
Thiamethoxam	153719-23-4			N								
Tolylfluanid	731-27-1			N								
Trichoderma harzianum strain T-720	67892-31-3											Request for approval cancelled

[1] The criteria "TRV" (TRV significantly lower than the majority of active substances approved for the same product type and use), "Concern" (Causes concern for human or animal health and the environment even with very restrictive risk management measures (RMM)) and "Isomers" (Contains a significant proportion of non-active isomers or impurities) have not been considered
[2] PBT criteria: Meets two of the criteria P, B and T (Source: ECHA - Assessment report)
[3] Refers to information provided in the opinion adopted by the Biocidal Products Committee (BPC)

P : Persistent **B : Bioaccumulative** **T : Toxic**

Liste de substances non-règlementaire mais complémentaire
Substance meeting an exclusion criterion without derogation
Substance meeting an exclusion criterion but with a derogation
Substance meeting a substitution criterion
Potentially excluded substance; potentially substitutable substance

3.7 Quantitative study of the uses of active substances

3.7.1 Methodology

Co-managed by the Ministry of the Environment and ANSES, Simmbad[20] is a website that allows manufacturers to fulfil several regulatory obligations, including the declaration of the quantities of biocidal products placed on the market during the previous year.

The quantitative study of the use of substances was carried out on the basis of the "Simmbad" extraction of the quantities of PT8 wood preservatives placed on the market in 2021[21] (as a previous version of this report was carried out on the basis of a 2017 extraction).

The data from the extraction corresponds to the quantities of products placed on the market. By studying the composition of each of these products, it was then possible to deduce the quantity of each biocidal active substance placed on the market. However, for practical reasons we had to restrict the study to the 36 most used products among the 142 products on the market, as this sample represents 90% of the market in terms of tonnages[22].

In the remainder of the study, this sample will be considered as representative of all wood preservatives on the market in 2021. It should be stressed that this assumption is therefore dependent on the correct reporting of data in the Simmbad database.

The quantitative study of the uses of biocidal active substances to produce wood preservatives (PT8) in 2021 was finally based on:

- the quantities of products placed on the market
- the concentration ranges of active substances in the products
- the frequency of use of the active substances (i.e. the share of PT8 products in which the active substance is used)

3.7.2 Main results

3.7.2.1 Substances most used in 2021

The study of the frequency of use of the active substances indicates that propiconazole (present in 20 products) and cypermethrin (present in 18 products) are present in at least half of the products we studied (36). Tebuconazole, IPBC, and permethrin follow and are present in at least 8 products.

Figure 4 and Table 5 present the inventory of active substances present in PT8 products placed on the French market in 2021.

[20] https://simmbad.fr/servlet/accueilMinistere.html
[21] The data available to us only relate to this year 2021. Possible temporal fluctuations are therefore not considered in this study.
[22] The study of these products indicates that the 5 most frequently used substances are identical to the 5 most frequently used substances to produce the remaining 10%.

Table 5. Frequency of use of biocidal active substances in the formulation of PT8 products marketed in 2021 (Source: Simmbad)

Active substances	CAS no.	Number of products containing active substance
Propiconazole	60207-90-1	20
Cypermethrin	52315-07-8	18
Tebuconazole	107534-96-3	15
3-iodo-2-propynyl butylcarbamate (IPBC)	55406-53-6	11
Permethrin	52645-53-1	8
ATMAC/TMAC	61789-18-2	6
ADBAC/BKC (C12-16)	68424-85-1	5
DDAC	7173-51-5	4
Basic Copper carbonate	12069-69-1	3
N-(3-aminopropyl)-N-dodecylpropane-1,3-diamine (Diamine)	2372-82-9	2
Boric acid	10043-35-3	1
Granulated copper	7440-50-8	1
Creosote	8001-58-9	1
DDACarbonate	894406-76-9	1
Cyproconazole	94361-06-5	1

In terms of quantities placed on the market, five substances account for 96% of the quantities placed on the market in 2021. Table 6 shows the ranking of the substances in descending order of tonnage on the market. For information purposes, sales data from the National Plant Protection Products Sales Bank[23] are also presented and show that for cypermethrin, cyproconazole and tebuconazole, the quantities placed on the market via PT8 represent a minor but not negligible share compared to the quantities placed on the market via plant protection products.

[23] BNV-D Traçabilité (eaufrance.fr)

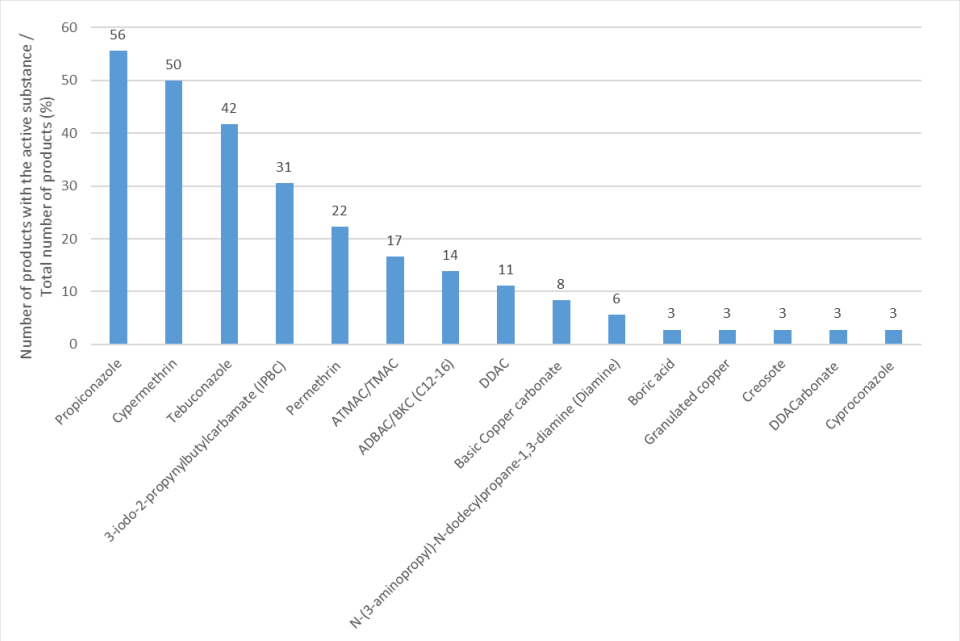


Figure 4. Share of PT8 products available on the French market in 2021 using each of the biocidal active substances actually used (Number of products with the substance / Total number of products (%)) (Source: Simmbad)

Table 6. Quantities of biocidal active substances of PT8 wood preservatives placed on the market in 2021 (Source: Simmbad)

Active substances	CAS no.	Sales (t)	BNV-D (2021) (t)
Creosote	8001-58-9	2186	/
ADBAC/BKC (C12-16)	68424-85-1	845	0,05
DDAC	7173-51-5	504	0,01
Basic Copper carbonate	12069-69-1	271	/
Granulated copper	7440-50-8	109	/
Propiconazole	60207-90-1	54	0,1
Cypermethrin	52315-07-8	34	176
Permethrin	52645-53-1	28	/
Tebuconazole	107534-96-3	22	561
Boric acid	10043-35-3	20	/
3-iodo-2-propynyl butylcarbamate (IPBC)	55406-53-6	16	/
DDACarbonate	894406-76-9	7	/
N-(3-aminopropyl)-N-dodecylpropane-1,3-diamine (Diamine)	2372-82-9	2	0,003
Cyproconazole	94361-06-5	0,2	11
ATMAC/TMAC	61789-18-2	0,2	/

The distribution of the quantities of active substances placed on the market is illustrated in Figure 5 below.

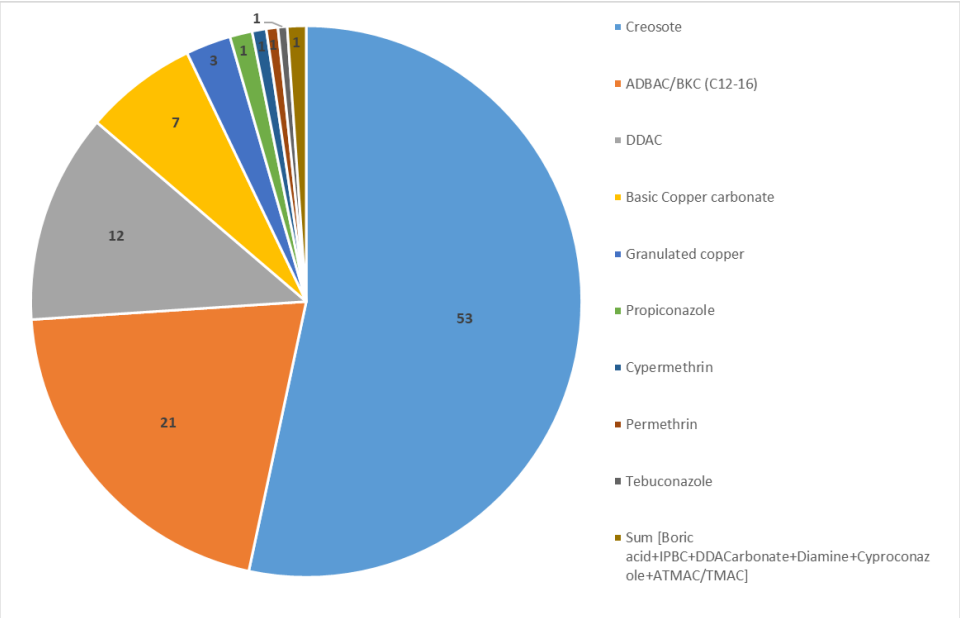


Figure 5. Distribution of quantities of biocidal active substances of wood preservatives PT8 placed on the market in 2021 (as % of total tonnages)

The study of the quantities of active substances placed on the market indicates that the most marketed substances in terms of tonnage do not correspond to the substances most frequently present in the formulated products. Propiconazole, the most frequently used substance in the formulation of wood preservatives, represents only 1% of the sales of active substances in terms of tonnage.

This difference is due to two factors:

- the standard concentrations of use of each active substance differ significantly. Thus, creosote is systematically used as the only ingredient whereas propiconazole is present in wood preservatives with concentrations not exceeding 1.45% (see Table 7).
- Six wood preservatives account for more than 40% of sales. Some of these products contain high levels of active substances (between 8 and 100%). The active substances in question are creosote, ADBAC/BKC (C12-16), Basic Copper carbonate and copper (granulated).

As a result, the hierarchy of active substances is modified depending on whether one assesses the masses presented on the market or the frequency of use in products.

Table 7. Concentration ranges of active substances in PT8 wood preservatives placed on the market in 2021

Active substances	Mass concentrations (%)	
	Min	Max
Creosote	100	100
ADBAC/BKC (C12-16)	4,75	80
DDAC	0,5	70
Basic Copper carbonate	16,38	17,3
Granulated copper	8	8
Boric acid	5	5
Permethrin	0,12	2
Propiconazole	0,073	1,45
Cypermethrin	0,07	1,12
Tebuconazole	0,05	1,1
3-iodo-2-propynyl butylcarbamate (IPBC)	0,05	1
DDACarbonate	0,5	0,5
N-(3-aminopropyl)-N-dodecylpropane-1,3-diamine (Diamine)	0,1	0,1
Cyproconazole	0,1	0,1
ATMAC/TMAC	0,0001	0,01

3.7.2.2 Substances with low use in 2021

Two substances can be considered as not widely used in 2021 because they are neither frequently used nor placed on the market in large quantities. These are cyproconazole and DDACarbonate.

3.7.2.3 Substances not used in 2021

31 of the 46 approved substances have not been placed on the market by 2021. These and the possible barriers to their use in 2021 are listed in Table 8 below.

Table 8. Active substances not placed on the market in 2021

Substances	Comments[24] (Source: interviews with professionals)
Didecylpolyoxethylammonium borate (Polymeric betaine)	Initial approval under consideration
Thiamethoxam	Substance whose use is limited to indoor applications due to its affinity with water
Chlorfenapyr	The substance would not be really effective on termites, and, because of its mode of action, it would require excessive dosages with destruction of the substrate to pass the standard tests
Bifenthrin	Problems with the supplier's establishment on the European market which impacts the availability of the substance Non-repulsive substance
Fenoxycarb	This substance is no longer produced (date of cessation of production not found)
Penflufen	Field testing of the substance is in progress for the attribution of the ten-year guarantee required in construction
Fenpropimorph	Listed as a candidate for substitution
Dazomet	Specific preventive use (formulation of a wood preservative in granular form for the curative treatment of wooden transmission poles against internal rot by basidiomycetes)
Ethofenprox	/
Thiabendazole	/
Sulphuryl difluoride	/
Flufenoxuron	/
Dichlofluanid	/
Thiacloprid	/
Clothianidin	/
Tolylfluanid	/
4,5-Dichloro-2-octylisothiazol-3(2H)-one (4,5-Dichloro-2-octyl-2H-isothiazol-3-one (DCOIT))	/
Hydrogen cyanide	/
Disodium octoborate tetrahydrate	/
octhilinone (ISO)	/
Copper oxide	/
K-HDO	/
Disodium tetraborate decahydrate	/
Cu-HDO	/
Copper dihydroxide	/
Diboron trioxide	/
Disodium tetraborate pentahydrate	/
Sodium tetraborate decahydrate	/
Potassium sorbate	/
Bardap 26	/
Trichoderma harzianum strain T-720	/

[24] Use approval data applicable in 2017

3.7.2.4 Results comparison between 2017 and 2021

This report is an update of a previous version based on 2017 data. A quick analysis leads to the following comments:

- A greater diversity of active substances (AS) is used in 2021: 15 AS in 2021 compared to 12 in 2017, including 4 new ones (Diamine, Boric acid, Copper granules, DDACarbonate).

  Conversely, Bardap 26 was not used in 2021.

  Among the substances newly used in 2021, some have a non-negligible level of use: granulated copper represents in 2021 3% of the sales of SA (with only one product) and Diamine is used in 6% of the products.

- The quantities of SA placed on the market decreased by 29% between 2017 and 2021: from 5,790 tonnes to 4,097 tonnes.

- In 2021, the market for PT8 products is concentrated on a smaller number of products: in 2017, the PT8 biocides market had 201 products compared to 142 in 2021 (a decrease in the number of products of 30%).

- Cyproconazole was no longer approved in 2021 but was still marketed (see CELCURE C4). these are probably leftover sales during the grace period.

It should of course be stressed that without a more systematic study of the annual data, this comparison does not allow trends to be defined. Nevertheless, as presented in the following sections, it implies a broadening of the scope of our proxy study compared to the previous version of the report.

3.7.2.5 Further analysis: combinations of substances in products

Table 9 below compiles data on the frequency of combination of active substances for PT8 product formulation in 2021:

- The most frequently used combination is: Tebuconazole/Cypermethrin/3-iodo-2-propynyl butylcarbamate (IPBC)/Propiconazole (7 products - 13% of PT8 product sales in 2021).

- Creosote is a biocide that is always used alone, with products based on this substance accounting for 10% of PT8 product sales in 2021.

- Other substances can be used alone: cypermethrin (3 products - 5% of PT8 product sales in 2021), permethrin (4 products - 8% of PT8 product sales in 2021), Didecyldimethylammonium chloride (DDAC) (2 products - 4% of PT8 product sales in 2021) and Alkyl (C12-16) dimethylbenzyl ammonium chloride (ADBAC/BKC (C12-16)) (2 products - 7% of PT8 product sales in 2021)

Annex 2 - Combinations of biocidal active substances for the formulation of PT8 products in 2021 summarises the active substance combinations identified for the formulation of wood preservatives in 2021.

Table 9. Frequency of combination of biocidal active substances for the formulation of PT8 products in 2021

Composition of PT8 products	Number of products associated with the composition	Percentage of 2021 sales of products associated with the composition
Tebuconazole/Cypermethrin/3-iodo-2-propynyl butylcarbamate (IPBC) /Propiconazole	7	13
Cypermethrin/Propiconazole/Coco alkyltrimethylammonium chloride (ATMAC/TMAC)	4	10
Permethrin	4	8
Tebuconazole/Cypermethrin/Propiconazole	3	7
Cypermethrin	3	5
Tebuconazole/Permethrin /3-iodo-2-propynyl butylcarbamate (IPBC) /Propiconazole	2	7
Alkyl (C12-16) dimethylbenzyl ammonium chloride (ADBAC/BKC (C12-16))	2	7
Didecyldimethylammonium chloride(DDAC)	2	4
Tebuconazole/Basic Copper carbonate /Propiconazole	1	5
Tebuconazole/3-iodo-2-propynyl butylcarbamate (IPBC) /Propiconazole	1	1
Tebuconazole/N-(3-aminopropyl)-N-dodecylpropane-1,3-diamine (Diamine)/Propiconazole/Didecyldimethylammonium chloride(DDAC) /Granulated copper/DDACarbonate	1	6
Basic Copper carbonate /Alkyl (C12-16) dimethylbenzyl ammonium chloride (ADBAC/BKC (C12-16))/Cyproconazole	1	1
Cypermethrin/Alkyl (C12-16) dimethylbenzyl ammonium chloride (ADBAC/BKC (C12-16))/Didecyldimethylammonium chloride(DDAC)	1	1
Permethrin /3-iodo-2-propynyl butylcarbamate (IPBC) /N-(3-aminopropyl)-N-dodecylpropane-1,3-diamine (Diamine)	1	1
Permethrin /Propiconazole/Coco alkyltrimethylammonium chloride (ATMAC/TMAC)	1	1
Creosote	1	10

3.8 Summary: uses of biocidal active substances in PT8 and possibilities for non-renewal

Cross-checking the information in Table 4 on substances meeting the exclusion and substitution criteria with the information in Figure 4 and Figure 5 on the most commonly used substances, the list of substances for which the investigation of substitution possibilities is most urgent can be determined (see Table 10).

Table 10. Summary of substances used on the French market (Source: ECHA, Simmbad)

Biocidal active substances	CAS no.	**Amounts placed on the market in 2021 (t)**	**Number of products with the substance / Total number of products (%)**	**End date of approval of the substance**
Cyproconazole	94361-06-5	0,2	3	31/10/2020
Creosote	8001-58-9	2186	3	31/10/2022
Propiconazole	60207-90-1	54	56	31/12/2022
Boric acid	10043-35-3	20	3	28/02/2024
Permethrin	52645-53-1	28	22	30/04/2026
ADBAC/BKC (C12-16)	68424-85-1	845	14	31/01/2025
DDAC	7173-51-5	504	11	31/01/2025
Basic Copper carbonate	12069-69-1	271	8	31/01/2024
Granulated copper	7440-50-8	109	3	31/12/2026
Cypermethrin	52315-07-8	34	50	31/05/2025
Tebuconazole	107534-96-3	22	42	30/09/2022
3-iodo-2-propynyl butylcarbamate (IPBC)	55406-53-6	16	31	31/12/2022
DDACarbonate	894406-76-9	7	3	31/01/2023
N-(3-aminopropyl)-N-dodecylpropane-1,3-diamine (Diamine)	2372-82-9	2	6	Demande initiale d'approbation en cours
ATMAC/TMAC	61789-18-2	0,2	17	30/04/2028

Substance meeting an exclusion criterion without derogation
Substance meeting an exclusion criterion but with a derogation
Substance meeting a substitution criterion
Approved substance not meeting any criteria

In the remainder of this study, the case of the three substances meeting an exclusion criterion is specifically investigated: propiconazole, boric acid and creosote. In addition, according to other information, tebuconazole, which is currently under evaluation, may meet an exclusion criterion and is therefore also subject to a substitution study.

The study of alternatives to permethrin, which verifies a substitution criterion, was not considered a priority in the context of this report since the deadline for its approval, scheduled for 2026, leaves time to consider a specific study for this substance which is of an important strategic nature. Indeed, together with cypermethrin, it is one of the two insecticides commonly used in PT8 products.

4 Detailed study of substitution issues

4.1 Foreword on substitution

The objective of this part is to study the availability of alternative techniques or substances on the market that fully or partially cover the uses of the substances to substitute.

A three-step approach is followed:

- The first step of the substitution study was to study the assessment reports of the biocidal substances in order to investigate whether the properties of the substances to be considered for substitution could be covered by other substances. The assessment reports provide for each biocidal active substance information on:
    - its function (insecticide/fungicide)
    - its type of treatment (curative/preventive)
    - its use class (1 to 5)
    - its users (individuals/professionals/industrial)
    - its mode of application (brushing/injection/impregnation)

  The objective of this study is not so much to identify substitutes with certainty, as to identify solutions "to be studied". Indeed, in general, the proof of effectiveness of a substitute solution must be established empirically and over the long term.
- The second step consisted in researching, by cross-referencing the information available in the marketing authorisations and in the technical notes of CTB P+[25] certified products, whether there were alternative solutions among the products sold in France in 2021 (see Annex 3 - Uses of alternative products (Source: ANSES / FCBA)). For the record, this list of products is based on the analysis of the "Simmbad" extraction of the quantities of PT8 wood preservatives placed on the market in 2021.
- Finally, the search for substitutes was upscaled to the European level by analysing the data available on the ECHA website. For information purposes, Table 11 below summarises the fungicidal substances used in Europe and shows a wide diversity of practices; boron derivatives are, for instance, used elsewhere in Europe and little in France.

In summary, the objective of the study is to answer the following question: **are there products on the market that cover[26] all the uses currently associated with the products using the substance to substitute[27]**?

To complete the analysis, section 4.5 presents alternative non-chemical wood preservation techniques.

[25] The CTB P+ certification is issued by the FCBA technological institute and applies to wood preservation products.

[26] In addition, the possibility of partial overlap between uses can be studied with the same analyses.

[27] In the rest of the study, what is meant by "uses" of the products corresponds to what is claimed in the authorisation dossiers. It is the study of the possibilities of substitution of these uses that is conducted.

Table 11. Biocides used in Europe (Source : ECHA[28])

	France	Germany	Sweden	Norway	Finland	Switzerland	Spain	Austria	Belgium	Bulgaria	Croatia	Cyprus	Denmark	Czech Republic	Estonia	Greece	Hungary	Iceland	Irland	Italy	Latvia	Lithuania	Luxembourg	Malta	Netherlands	Poland	Portugal	Romania	Slovakia	Slovenia	United Kingdom
ADBAC/BKC (C12-16)	X	X					X	X	X		X			X	X		X			X	X	X				X	X		X	X	
DDACarbonate	X	X	X	X	X	X	X	X	X		X				X	X	X		X		X	X			X	X	X		X		X
Dazomet		X							X																						
Didecyldimethylammonium chloride (DDAC)	X	X	X	X	X		X		X				X		X				X		X	X			X	X	X		X		X
IPBC	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Granulated copper	X																														
K-HDO	X	X			X			X																		X					
Basic Copper carbonate	X	X	X	X	X	X	X	X	X	X			X	X	X	X			X		X	X			X	X	X	X	X	X	X
Tebuconazole	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X
Copper hydroxyde	X	X	X	X	X	X	X	X	X		X				X	X	X		X		X				X	X	X			X	
4,5-Dichloro-2-octylisothiazol-3(2H)-one (4,5-Dichloro-2-octyl-2H-isothiazol-3-one (DCOIT))																															
Penflufen	X	X	X	X	X	X	X	X	X		X				X	X	X		X		X	X			X		X			X	X
Bardap 26							X																								
Copper oxide																															
Cu-HDO	X	X	X	X	X	X	X	X	X				X	X	X						X				X		X		X	X	
octhilinone (ISO)																															
ATMAC/TMAC	X	X			X																X										
Sulphuryl difluoride	X	X	X	X	X	X	X	X	X										X	X					X		X			X	X
Fenoxycarb		X																											X		
Cyanure d'hydrogène	X	X					X	X	X		X			X						X					X	X		X	X		X
Cypermethrin	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X		X	X	X	X	X	X
Ethofenprox																															

[28] https://echa.europa.eu/fr/information-on-chemicals/biocidal-products

	France	Germany	Sweden	Norway	Finland	Switzerland	Spain	Austria	Belgium	Bulgaria	Croatia	Cyprus	Denmark	Czech Republic	Estonia	Greece	Hungary	Iceland	Irland	Italy	Latvia	Lithuania	Luxembourg	Malta	Netherlands	Poland	Portugal	Romania	Slovakia	Slovenia	United Kingdom
Bifenthrin	X	X	X					X					X												X						
Chlorfenapyr																															
Permethrin	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X		X	X	X	X	X	X	X
Fenpropimorph	X	X					X	X	X		X			X	X						X	X				X	X	X	X	X	X
Propiconazole	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Creosote	X	X	X	X	X	X	X	X	X	X	X					X	X		X		X					X	X	X		X	X
Boric acid	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X				X	X			X	X	X	X	X	X	X
Disodium tetraborate pentahydrate	X	X	X		X	X			X								X														

Substance meeting an exclusion criterion but with a derogation
Substance meeting a substitution criterion

4.2 Investigation of chemical substitution possibilities for propiconazole and boric acid

4.2.1 Review of assessment reports for the identification of candidate substances

Table 12 below summarises the uses of propiconazole and boric acid as presented in their assessment reports (see Annex 4).

Boric acid has fungicidal and insecticidal activity compatible with use classes 1 to 4 and is suitable for all types of users (except private individuals) and applications[29]. Propiconazole is a fungicide whose use by Industry and professionals is compatible with all modes of application, nevertheless its range of use classes is more restricted than that of boric acid and includes only classes 2 and 3 (class 1 is not associated with this substance, probably because this use class is not a priori likely to favour fungal development).

Beyond this, these two substances cover almost all the use classes, types of users and modes of application. However, it is clear from our interviews that use classes 2 and 3 for uses such as impregnation by Industry or brushing by professionals are the most commonly expected uses.

In order to study a priori the potential substitution possibilities, Table 13 presents, for each of the two substances, the extent to which their intended uses are partially or fully covered by the other approved active substances. This analysis is not a complete substitute for an experimental analysis of the performance of alternatives, nor does it cover certain technical issues that could lead to favouring one substance for one purpose or another. However, it can help identify candidate solutions and draw some lessons. For example, it appears that IPBC is the only substance that can cover all the uses associated with propiconazole without verifying any of the substitution or exclusion criteria. It also appears that penflufen and tebuconazole are the only candidate substances (not meeting any exclusion criteria) for substitution of boric acid for its fungicidal action (except for injection application) and chlorfenapyr for its insecticidal action.

[29] The assessment report for boric acid mentions its insecticidal action without specifying the target organisms.

Table 12. Conditions of use of propiconazole and boric acid (Source: Evaluation Reports - ECHA - Extract from the full study presented in Annex 4 - Use data from evaluation reports of biocides approved in Europe (ECHA)

Substance	Use class					Type of user			Mode of application			Type of treatment	
	Class 1	Class 2	Class 3	Class 4	Class 5	Private individuals	Professionnals	Industry	Brushing…	Injection	Impregnation	Curative	Preventive
Propiconazole		X	X			[1]	X	X	X	X	X	X	X
Boric acid	X	X	X	X		[1]	X	X	X	X	X	X	X

[1] According to Regulation 528/2012, propiconazole and boric acid cannot be placed on the market for use by the general public as both active substances are classified as Repr. 1B

Table 13. Potential substitutes for propiconazole and boric acid (Source: Evaluation reports – ECHA)[30]

NB : P : Substitution for part of the uses T : Substitution for all uses except injection application T : Substitution for all uses*

Possible substitutes	CAS no.	Propiconazole	Boric acid		Comments
			Fungicidal function	Insecticide function	
Disodium tetraborate pentahydrate	12179-04-3	T	T		
DDACarbonate	894406-76-9	P	P		
Cu-HDO	312600-89-8	P	P		
Granulated copper	7440-50-8	P	P		
Didecyldimethylammonium chloride (DDAC)	7173-51-5	P	P		
ADBAC/BKC (C12-16)	68424-85-1	P	P		
Copper oxide	1317-38-0	P	P		
Copper dihydroxide	20427-59-2	P	P		
Basic Copper carbonate	12069-69-1	P	P		
Bardap 26	94667-33-1	P	P		
Creosote	8001-58-9	P	P		Creosote is not compatible with use class 2, its use is reserved for Industry and is only applied by impregnation Substitution studied elsewhere in this report.

[30] Tolylfluanide and potassium sorbate were not considered as potential substitutes because these fungicides only act on wood staining and blue stain fungi (e.g. Aureobasidium pullulans and Sclerophoma pityophila). Similarly, sulphur fluoride and hydrogen cyanide were not considered because of their mode of application (fumigant)

Possible substitutes	CAS no.	Propiconazole	Boric acid		Comments
			Fungicidal function	Insecticide function	
Penflufen	494793-67-8	T*	T*	/	Uncertainties remain about its use for curative treatments. According to SPB[31], the use classes for this substance could probably be between 2 and 4. This uncertainty is linked to the fact that there is no field experience with the substance and that ongoing field trials do not guarantee the required ten-year construction period.
Tebuconazole	107534-96-3	T*	T*	/	Substitution considered elsewhere in this report
3-iodo-2-propynyl butylcarbamate (IPBC)	55406-53-6	T	P	/	
4,5-Dichloro-2-octylisothiazol-3(2H)-one (4,5-Dichloro-2-octyl-2H-isothiazol-3-one (DCOIT))	64359-81-5	P	P	/	According to its assessment report, it is likely that in the future the spectrum of use of the substance will widen because, although in situ treatments by professionals and private individuals are not actual uses at present, it is planned to develop ready-to-use formulations for application by professional users by brushing and hand spraying.
octhilinone (ISO)	26530-20-1	P	P	/	
Quaternary ammonium compounds, coco alkyltrimethyl, chlorides	61789-18-2	P	P	/	
K-HDO	66603-10-9	P	P	/	
Dazomet	533-74-4	/	P	/	
Chlorfenapyr	122453-73-0	/	/	T*	
Bifenthrin	82657-04-3	/	/	P	
Fenoxycarb	72490-01-8	/	/	P	
Cypermethrin	52315-07-8	/	/	P	
Permethrin	52645-53-1	/	/	P	
Ethofenprox	80844-07-1	/	/	P	

Renewal of current approval
Substance meeting an exclusion criterion but with an exemption

[31] « Syndicat national des industries de la Préservation du Bois »

4.2.2 Products from Simmbad database

The analysis of the assessment reports makes it possible to envisage theoretical substitutes. But the study of products available on the market allows us to observe the existence or not of alternatives already available.

For a good understanding of the terms, in the rest of the study, the term "use" will be associated with a triplet “Class of use / Type of application / Type of user”, in accordance with the description of uses made in the marketing authorisation applications. Two products meet the same use if they apply to the same triplet.

We therefore studied the marketing authorisation applications of the products available on the market and observed for each of the two fungicides the uses that were expected. As an example, two uses are claimed for the products containing propiconazole:

- Firstly, use (i) in use class 2, (ii) by industrial or professional users, (iii) for surface application (hereafter "Use #1")
- Secondly, use (i) in use classes 2, 3.1 or 3.2, (ii) by Industry, (iii) by impregnation (hereafter "Use #2")

We then observed whether there were solutions on the market for the same uses, but without the active substance "to be substituted". If so, the fungicides used were inventoried and we checked whether they met any exclusion or substitution criteria under the Biocides Regulation.

The results obtained from the information reported in Simmbad are presented in the two tables below.

Table 14 below summarises this approach for the case of propiconazole. It shows that "propiconazole-free" alternatives exist or have existed on the market for each of the uses to which propiconazole is currently associated[32].

Table 14. Alternative products without propiconazole according to the different types of use (Source: SIMMBAD)

	Use class	Type of application	Type of user	Trade name of alternatives	Fungicides used in the alternatives
Use #1	Class 2	Superficial ("spraying" / "soaking")	Industry Professionals	Hydrokoat 6$^{\alpha}$	Didecyldimethylammonium chloride (DDAC) Alkyl (C12-16) dimethylbenzyl ammonium chloride (ADBAC/BKC (C12-16))
Use #2	Class 2 Class 3.1 Class 3.2	Impregnation	Industry	Korasit KS2	Bardap26 Basic copper carbonate
				Celcure AC-500$^{\alpha\alpha}$	Boric acid** Basic copper carbonate ADBAC/BKC (C12-16)
				Celcure C4 $^{\alpha\alpha}$	Cyproconazole* Basic copper carbonate ADBAC/BKC (C12-16)

* : substance meeting an exclusion criterion and no longer approved for use
** : substances meeting an exclusion criterion but benefiting from a derogation

$^{\alpha}$: This product is also compatible with Class 1 (hardwood and softwood) and 3.1 (softwood) uses

$^{\alpha\alpha}$: These products are also compatible with Class 4 uses

[32] It should be noted, however, that use #1 is, with respect to the MA, compatible with use by private individuals, whereas Hydrokoat 6 is not.

However, several remarks should be made about alternatives to use #2 by impregnation:

- One of the alternatives, Celsure AC-500, requires the use of boric acid, which itself meets an exclusion criterion and is also the subject of our substitution study.
- Another, Celsure C4, should no longer be marketed as cyproconazole is no longer an approved active substance as of 01/11/2020.
- Korasit KS2 is a treatment product that is still authorised, but it no longer appears in the Simmbad database, which would suggest that it was not sold in 2021. Its presence among the available alternatives stems from the initial study that was conducted based on 2017 data.
- Finally, Hydrokoat 6 is a possible alternative but does not cover class 3.2, and more generally treatments by impregnation or injection.

The update of this report therefore seems to show lower reported sales of alternatives for impregnation treatments on the French market compared to the results of the previous study.

Similarly, Table 15 shows the "boric acid-free" alternatives to the uses for which boric acid is currently used.

The most notable result is that almost all the alternatives to boric acid for its fungicidal function require either the use of cyproconazole, which is no longer approved, or propiconazole. This suggests that the current market situation appears to make propiconazole (which meets an exclusion criterion) an alternative to the fungicidal action of boric acid (which also meets an exclusion criterion), and vice versa. However, this result is not completely generalizable. Hydrokoat 6 covers classes 1, 2 and 3.1 without using a substance that meets an exclusion criterion. Korasit KS2 covers all classes from 1 to 4.

Regarding the insecticidal function of boric acid, two types of alternatives are emerging:

- insecticidal active substances (cypermethrin and permethrin)

- active substances which, like boric acid, are both insecticides and fungicides, with, in ascending order of frequency of use: basic copper carbonate, didecyldimethylammonium chloride (DDAC), ADBAC/BKC (C12-16), Bardap 26 and copper (granules).

It should be noted that none of these alternatives meet any substitution or exclusion criteria. From a broader perspective, in line with the ambitions of the "one substance, one assessment" concept, it would however be relevant to study in more detail the eco-toxicological impacts of insecticide substances such as cypermethrin and permethrin. However, this is currently outside the scope of the Biocides Regulation.

Table 15. Alternative products without boric acid according to different types of use (Source: SIMMBAD)

	Use class	Type of application	Type of user	Trade name of alternatives	Fungicides used in the alternatives	Insecticides used in alternatives
Use #1	Class 2	Superficial (sprinkling/soaking)	Industry Professionals	SARPECO 9-PLUS	IPBC Tebuconazole Propiconazole**	Permethrin
				XYLOPHENE Preventif EX 2002 Plus AXIL 3000		Cypermethrin
				Hydrokoat 6 α α α	Didecyldimethylammonium chloride (DDAC) ADBAC/BKC (C12-16)	Cypermethrin Didecyldimethylammonium chloride (DDAC) ADBAC/BKC (C12-16)
				SARPALO 860	ATMAC/TMAC Propiconazole**	Cypermethrin
Use #2	Class 2 Class 3.1	Superficial Injection	Professionals	TRAITEMENT TOUS USAGES D'XYL TRAITEMENT Bois tous usages XILIX Traitement Tous Usages	Propiconazole** ATMAC/TMAC	Cypermethrin
				XILIX GEL CURATIF FONGI +		Permethrin
				TX203 Traitement multi-usages Axton Traitement universel α	Propiconazole** Tebuconazole	Cypermethrin
				XILIX 3000 P	IPBC Propiconazole** Tebuconazole	Permethrin
				XYLOPHENE MULTI-USAGES α XYLOPHENE BOIS EXTERIEUR α XYLO TOTAL α XYL CE 2006 α		Cypermethrin
Use #3	Class 2 Class 3.1 Class 3.2 Class 4	Impregnation	Industry	Celcure C4	Basic copper carbonate ADBAC/BKC (C12-16) Cyproconazole*	Basic copper carbonate ADBAC/BKC (C12-16)
				Korasit KS2	Bardap26 Basic copper carbonate	
				Tanalith E 3474 α α	Basic Copper carbonate Propiconazole** Tebuconazole	Basic Copper carbonate
				Tanalith E 8001B α α	Granulated copper	Granulated copper

	Use class	Type of application	Type of user	Trade name of alternatives	Fungicides used in the alternatives	Insecticides used in alternatives
					DDACarbonate Didecyldimethylammonium chloride(DDAC) N-(3-aminopropyl)-N-dodecylpropane-1,3-diamine (Diamine) Propiconazole** Tebuconazole	DDACarbonate Didecyldimethylammonium chloride(DDAC)
				Tanalith E 8001	Basic Copper carbonate Propiconazole** Tebuconazole Didecyldimethylammonium chloride(DDAC)	Basic Copper carbonate Didecyldimethylammonium chloride(DDAC)

* : substance meeting an exclusion criterion and no longer approved for use
** : substances meeting an exclusion criterion but benefiting from a derogation

α : Except for use class 3.1 - Hardwoods

α α : Except for use class 4 - Hardwoods

α α α : This product is also compatible with use class 1 (hardwood and softwood) and 3.1 (softwood)

4.2.3 Extension of the study to products documented at European level

Beyond the French market, the data concerning products marketed in Europe available on the ECHA website were collected in order to observe the existence or not of alternatives to the substances studied. **Only alternatives that do not contain an active substance that meets an exclusion criterion were retained.**

Table 16 shows a list of "propiconazole-free" products, which are compatible with use classes 2 and 3 for superficial or impregnated applications. The fungicides used as alternatives to propiconazole are generally penflufen, basic copper carbonate, IPBC, tebuconazole and DDAC Carbonate.

It should be noted that some products have marketing authorisations for the French market. These products are not present in the Simmbad database because they are not actually marketed or were not marketed until after 2021, unless they have simply not been declared.

Table 16. Alternative products without propiconazole according to the different types of use (Data: ECHA)

	Use class	Type of application	Type of user	Trade name of alternatives	Fungicides used in the alternatives	Country[33]	Composition available on the French market ?
Use #1	Class 2	Superficial (sprinkling/soaking)	Industry Professionals	Xyladecor range Vivexyl range Sikkens Cetol SADOLIN	IBPC	BE, BG, HR, CY, CZ, DK, EE, FI, DE, GR, HU, IS, IT, LV, LT, LU, NL, NO, PL, RO, SK, SI, ES, SE, CH, FR	X
			Industry Professionals	Aquawood range Gamme IG-10	IBPC Tebuconazole	BG, HR, CY, CZ, DE, GR, HU, IT, NO, PL, SK, SI, ES, SE, CH, LT, DK, FR	X
			Industry	Cut-End Preserver range Platzhalter range Tanalith MF | Vacsol Aqua 6118	Penflufen	IE, EE, NL, BE, IE, LV, PT, FI, LT, NL, SE, FR	X (post 2021)
Use #2	Class 2 Class 3	Impregnation	Industry	Celcure M65 Celcure C65	Didecyldimethylammonium chloride (DDAC) Basic Copper carbonate DDACarbonate	LT, SE, FI, IE, NO, EE, LV, PT, PL, FR	X
				Wolmanit CX-8M | Wolmanit CX-8WB Wolmanit CX-8F	Basic Copper carbonate Cu-HDO	AT, FI, LV, NO, PT, DK, SE, SK, DE, ES, SI, NL, CZ, EE, FR	X (post 2021)
				Tanasote S40	Copper hydroxide Penflufen DDACarbonate	SI, PT, IE, NO, BE, FI, NL, LV, SE, DE, CH, GR, AT, EE, HU, ES, HR, FR	X (post 2021)
				Cut-End Preserver range Platzhalter range Tanalith MF | Vacsol Aqua 6118	Penflufen	IE, EE, NL, BE, IE, LV, PT, FI, LT, NL, SE, FR	X (post 2021)
				Celcure MC-T2 Celcure MC-T3	Basic copper carbonate Tebuconazole	DE, NO, NL, FI, PL, EE, SE, LT, FR	

Finally, Table 17 lists the alternatives available for the claimed use of products containing boric acid. The products identified are often based on the use of IPBC and Basic Copper Carbonate.

[33] Country codes according to ISO 3166

The study of products containing boric acid placed on the European market (55 in number) showed that boric acid is almost never used alone (5% of products) but rather with 2 (for 38% of products) or even 3 (for 35% of products) other active substances. Moreover, when boric acid is used with other active substances, in 40% of cases it is a combination [Fungicide + Fungicide/Insecticide] and in 36% of cases Fungicide/Insecticide active substances

Table 17. Alternative products without boric acid according to the different types of use (Source: ECHA)

	Use class	Type of application	Type of user	Trade name of alternatives	Fungicides used in the alternatives	Insecticides used in alternatives	Country	Composition available on the French market ?
Use #1	Class 2	Superficial (sprinkling/soaking)	Industry Professionals	Cut-End Preserver range Platzhalter range Tanalith MF | Vacsol Aqua 6118	Penflufen	Permethrin	IE, EE, NL, BE, IE, LV, PT, FI, LT, NL, SE, FR	X (post 2021)
				Aquawood range	IBPC Tebuconazole	/	BG, HR, CY, CZ, DE, GR, HU, IT, NO, PL, SK, SI, ES, SE, CH, LT, DK, FR	X
				IG-10 range		Cypermethrin		
				Xyladecor-Holzschutzlasur range Vivexyl ° Sikkens Cetol HLS plus, HLS extra ° SADOLIN Classic° ranges	IBPC	/	BE, BG, HR, CY, CZ, DK, EE, FI, DE, GR, HU, IS, IT, LV, LT, LU, NL, NO, PL, RO, SK, SI, ES, SE, CH, FR	X
Use #2	Class 2 Class 3	Superficial Injection	Professionals	Cetol range Novatech BP	IBPC Alkyl (C12-16) diméthylbenzyl ammonium chloride (ADBAC/BKC (C12-16))	Alkyl (C12-16) diméthylbenzyl ammonium chloride (ADBAC/BKC (C12-16))	AT, IT	
Use #3	Class 2 Class 3 Class 4	Impregnation	Industry	Celcure M65 Celcure C65	Didecyldimethylammonium chloride (DDAC) Basic Copper carbonate DDACarbonate		LT, SE, FI, IE, NO, EE, LV, PT, PL, FR	X
				Tanasote S40	Copper hydroxide Penflufen DDACarbonate	Copper hydroxide DDACarbonate	SI, PT, IE, NO, BE, FI, NL, LV, SE, DE, CH, GR, AT, EE, HU, ES, HR, FR	X (post 2021)
				Wolmanit CX-8M | Wolmanit CX-8WB Wolmanit CX-8F	Basic Copper carbonate Cu-HDO		AT, FI, LV, NO, PT, DK, SE, SK, DE, ES, SI, NL, CZ, EE, FR	X (post 2021)

The study therefore shows that the European market appears to have alternatives without substances meeting exclusion criteria for all uses covered by products containing propiconazole or boric acid. However, the comparison with the results from the Simmbad data suggests that the identified alternative products would not have been sold on the French market in 2021.

4.3 Investigation of chemical substitution for creosote

The same methodology as for propiconazole and boric acid was used for creosote[34].

4.3.1 Study on ECHA evaluation reports

Creosote is both a fungicide and an insecticide. According to its assessment report, this substance is applied by impregnation by the industry. The treated wood is intended for use in classes 3 to 5 (see Annex 4).

Based on the assessment reports, it can be considered that only tebuconazole would be able to replace creosote for its fungicidal use in classes 3 to 5. All other substances marked T* are a priori compatible with the use of classes 3 to 4 after treatment by industrial impregnation.

From the same data, it can be concluded that many fungicidal and insecticidal substances (DDACarbonate, Cu-HDO, granulated copper...) and one insecticide (chlorfenapyr) would be able to replace creosote for its insecticidal action.

[34] See also on this topic Ineris (2015) « Evaluation de la faisabilité technique et économique de la substitution de la créosote pour l'usage de protection de bois utilisé en traverse de chemin de fer – Analyse critique », N°DRC-15-149385-07097A (in French).

Table 18. Potential fungicidal substitutes for creosote (Source: Assessment reports - ECHA)

Possible substitutes	CAS no.	Possibility of total or partial substitution of the fungicidal function	Possibility of total or partial substitution of the fungicidal/insecticidal function	Comments
DDACarbonate	894406-76-9	T*		
Cu-HDO	312600-89-8	T*		
Granulated copper	7440-50-8	T*		
Didecyldimethylammonium chloride (DDAC)	7173-51-5	T*		
Alkyl (C12-16) dimethylbenzyl ammonium chloride (ADBAC/BKC (C12-16))	68424-85-1	T*		
Copper oxide	1317-38-0	T*		
Basic copper carbonate	12069-69-1	T*		
Copper dihydroxide	20427-59-2	T*		
Bardap 26	**94667-33-1**	T*		
Disodium tetraborate pentahydrate	12179-04-3	T*		
Boric acid	10043-35-3	T*		Substitution studied elsewhere in this report
Tebuconazole	107534-96-3	T	**/**	Substitution considered elsewhere in this report
4,5-Dichloro-2-octylisothiazol-3(2H)-one (4,5-Dichloro-2-octyl-2H-isothiazol-3-one (DCOIT))	64359-81-5	T*	/	According to its evaluation report, it is likely that in the future its spectrum of use will expand (*cf*. Table 13).
Penflufen	494793-67-8	T*	/	Uncertainties remain about its use (*cf*. Table 13)
Coco dimethylbenzylammonium chloride (ATMAC/TMAC)	61789-18-2	T*	/	
3-iodo-2-propynyl butylcarbamate (IPBC)	55406-53-6	P	/	
octhilinone (ISO)	26530-20-1	P	/	
Dazomet	533-74-4	P	/	
K-HDO	66603-10-9	P	/	
Propiconazole	60207-90-1	P	/	Substitution studied elsewhere in this report
Chlorfenapyr	122453-73-0	/	T*	
Bifenthrin	82657-04-3	/	P	
Fenoxycarb	72490-01-8	/	P	
Cypermethrin	52315-07-8	/	P	
Permethrin	52645-53-1	/	P	
Ethofenprox	80844-07-1	/	P	

P : Substitution for part of the uses T* : Substitution for all uses except class 5

T : Substitution for all uses

Renewal of current approval
Substance meeting an exclusion criterion but with an exemption

4.3.2 Products in the Simmbad database

The uses for use classes 1 to 4 after treatment by impregnation by Industry have "creosote-free" alternatives on the French market:

- alternatives comprising fungicides (cyproconazole, propiconazole and tebuconazole) and substances with a dual fungicidal and insecticidal function (Basic copper carbonate, Didecyldimethylammoniumchloride (DDAC), ADBAC/BKC (C12-16), copper (granules) and DDACarbonate).

- alternatives combining active substances with a dual fungicidal and insecticidal function: [bardap26 / basic copper carbonate] and [boric acid, basic copper carbonate and ADBAC/BKC (C12-16).

There are no products corresponding to use class 5 in the Simmbad database.

Table 19. Alternative products without creosote according to different types of use (Data: SIMMBAD)

Use class	Type of application	Type of user	Trade name of alternatives	Fungicides used in the alternatives	Insecticides used in alternatives
Class 3 Class 4	Impregnation	Industry	Celcure C4	Basic copper carbonate ADBAC/BKC (C12-16) Cyproconazole*	Basic copper carbonate ADBAC/BKC (C12-16)
			Korasit KS2	Bardap26 Basic copper carbonate	
			Tanalith E 3474 α α	Basic Copper carbonate Propiconazole** Tebuconazole	Basic Copper carbonate
			Tanalith E 8001B α α	Granulated copper DDACarbonate Didecyldimethylammonium chloride(DDAC) N-(3-aminopropyl)-N-dodecylpropane-1,3-diamine (Diamine) Propiconazole** Tebuconazole	Granulated copper DDACarbonate Didecyldimethylammonium chloride(DDAC)
			Celcure AC500	Boric acid** Basic copper carbonate ADBAC/BKC (C12-16)	
			Tanalith E 8001	Basic Copper carbonate Propiconazole** Tebuconazole Didecyldimethylammonium chloride(DDAC)	Basic Copper carbonate Didecyldimethylammonium chloride(DDAC)

* : substances no longer approved for use

** : substances meeting a substitution criterion but with an exemption

α : Except for use class 3.1 - Hardwoods

α α : Except for use class 4 - Hardwoods

4.3.3 Extension of the study to products documented at European level

The same results are observed more widely at the European level as shown in the inventory presented in Table 20. Only alternatives without an active substance meeting an exclusion criterion have been retained.

Table 20. Creosote-free alternatives according to different types of use (Source: ECHA)

Use class	Type of application	Type of user	Trade name of alternatives	Fungicides used in the alternatives	Insecticides used in alternatives	Country	Composition available on the French market ?
Class 3 Class 4	Impregnation	Industry	Celcure M65 Celcure C65	Didecyldimethylammonium chloride (DDAC) Basic Copper carbonate DDACarbonate		LT, SE, FI, IE, NO, EE, LV, PT, PL, FR	X
			Tanasote S40	Copper hydroxide Penflufen DDACarbonate	Copper hydroxide DDACarbonate	SI, PT, IE, NO, BE, FI, NL, LV, SE, DE, CH, GR, AT, EE, HU, ES, HR, FR	X (post 2021)
			Wolmanit CX-8M | Wolmanit CX-8WB Wolmanit CX-8F	Basic Copper carbonate Cu-HDO		AT, FI, LV, NO, PT, DK, SE, SK, DE, ES, SI, NL, CZ, EE, FR	X (post 2021)

4.4 Investigation of chemical substitution possibilities for tebuconazole

Finally, the same methodology was used to identify alternatives to tebuconazole which are under evaluation and which could indicate that this substance meets an exclusion criteria.

4.4.1 Study on ECHA evaluation reports

Tebuconazole is a fungicide covering all use classes, all types of users and all modes of application except injections (see Annex 4). It appears that penflufen would be the most suitable substance to replace tebuconazole for all its uses between use classes 1 and 4 without any substitution or exclusion criteria. It should be noted that one active substance meeting an exclusion criterion covers all types of applications, users and use classes of tebuconazole, namely boric acid, but whose substitution is considered in this report. Furthermore, it appears that creosote is the only candidate substance for substitution of tebuconazole for use class 5.

NB : P : Substitution pour une partie des usages T : Substitution pour tous les usages, hormis la classe 5 T : Substitution pour la totalité des usages*

Possible substitutes	CAS no.	Tebuconazole	Comments
3-iodo-2-propynyl butylcarbamate (IPBC)	55406-53-6	P	
4,5-Dichloro-2-octylisothiazol-3(2H)-one (4,5-Dichloro-2-octyl-2H-isothiazol-3-one (DCOIT))	64359-81-5	P	According to its assessment report, it is likely that in the future the spectrum of use of the substance will widen because even if in situ treatments by professionals and private individuals are not effective uses at present, it is planned to develop ready-to-use formulations for application by professional users by brushing and hand spraying
DDACarbonate	894406-76-9	P	
Penflufen	494793-67-8	T*	Uncertainties remain about its use for curative treatments According to SPB[35], the use classes of this substance could probably be between 2 and 4, this uncertainty lies in the fact that there is no field experience with the substance and that ongoing field trials cannot guarantee the ten-year period required in construction.
octhilinone (ISO)	26530-20-1	P	

[35] Syndicat national des industries de la Préservation du Bois, communication personnelle

Possible substitutes	CAS no.	Tebuconazole	Comments
Cu-HDO	312600-89-8	P	
Granulated copper	7440-50-8	P	
Didecyldimethylammonium chloride (DDAC)	7173-51-5	P	
Dazomet	533-74-4	P	Specified application: poles
Quaternary ammonium compounds, coco alkyltrimethyl, chlorides	61789-18-2	P	
ADBAC/BKC (C12-16)	68424-85-1	P	
K-HDO	66603-10-9	P	
Copper oxide	1317-38-0	P	
Copper dihydroxide	20427-59-2	P	
Basic Copper carbonate	12069-69-1	P	
Bardap 26	94667-33-1	P	
Creosote	8001-58-9	P	Creosote is not compatible with use class 2, its use is reserved for Industry and is only applied by impregnation Substitution studied elsewhere in this report
Propiconazole	60207-90-1	P	Substitution studied elsewhere in this report
Boric acid	10043-35-3	T	Substitution studied elsewhere in this report
Disodium tetraborate pentahydrate	12179-04-3	T*	

Substance meeting an exclusion criterion but with an exemption
Potentially excluded substance; potentially substitutable

4.4.2 Study of products in the Simmbad database

There is no product on the French market without tebuconazole covering the same spectrum of uses. By studying the spectrum of uses "use class by use class" (see Table 21), it is possible to identify alternatives. However, with the exception of Hydrokoat 6, these require the use of active substances verifying an exclusion criterion (propiconazole, boric acid or cyproconazole).

Table 21 : Alternative products without tebuconazole by sub-categories of use (Source: SIMMBAD)

	Use class	Type of application	Type of user	Trade name of alternatives	Fungicides used in the alternatives
Use #1	Class 2	Superficial (sprinkling/soaking)	Industry Professionals	Hydrokoat 6	Didecyldimethylammonium chloride (DDAC) ADBAC/BKC (C12-16)
				SARPALO 860	ATMAC/TMAC Propiconazole**
Use #2	Class 2 Class 3.1	Superficial Injection	Non-professional users Professionals	TRAITEMENT TOUS USAGES D'XYL TRAITEMENT Bois tous usages XILIX Traitement Tous Usages XILIX GEL CURATIF FONGI +	ATMAC/TMAC Propiconazole**
Use #3	Class 2 Class 3.1 Class 3.2 Class 4	Impregnation	Industry	Celcure C4 Cyproconazole* Basic copper carbonate	ADBAC/BKC (C12-16)
				Korasit KS2	Bardap26 Basic copper carbonate
				Celcure AC-500	Boric acid** Basic copper carbonate ADBAC/BKC (C12-16)

* : substances no longer approved for use

** : substances meeting an exclusion criterion but with an exemption

4.4.3 Extension of the study to products documented at European level

The results of this study are comparable to those of boric acid: alternatives exist and the most frequently encountered substitute fungicides are IBPC and basic copper carbonate.

Table 22 : Alternative products without tebuconazole according to the different types of use (Source: ECHA)

	Use class	Type of application	Type of user	Trade name of alternatives	Fungicides used in the alternatives	Country	Composition available on the French market ?
Use #1	Class 2	Superficial (sprinkling/soaking)	Industry Professionals	Cut-End Preserver range Platzhalter Tanalith MF range | Vacsol Aqua 6118	Penflufen	IE, EE, NL, BE, IE, LV, PT, FI, LT, NL, SE, FR	X (post 2021)
				Xyladecor range Vivexyl range Sikkens Cetol range SADOLIN...	IBPC	BE, BG, HR, CY, CZ, DK, EE, FI, DE, GR, HU, IS, IT, LV, LT, LU, NL, NO, PL, RO, SK, SI, ES, SE, CH, FR	X
Use #2	Class 2 Class 3	Superficial Injection	Non-professional users Professionals	Cetol Novatech BP range	IBPC Alkyl (C12-16) diméthylbenzyl ammonium chloride (ADBAC/BKC (C12-16))	AT, IT	
Use #3	Class 2 Class 3 Class 4	Impregnation	Industry	Celcure M65 Celcure C65	Didecyldimethylammonium chloride (DDAC) Basic Copper carbonate DDACarbonate	LT, SE, FI, IE, NO, EE, LV, PT, PL, FR	X
				Tanasote S40	Copper hydroxide Penflufen DDACarbonate	SI, PT, IE, NO, BE, FI, NL, LV, SE, DE, CH, GR, AT, EE, HU, ES, HR, FR	X (post 2021)
				Wolmanit CX-8M | Wolmanit CX-8WB Wolmanit CX-8F	Basic Copper carbonate Cu-HDO	AT, FI, LV, NO, PT, DK, SE, SK, DE, ES, SI, NL, CZ, EE, FR	X (post 2021)

For information purposes, an inventory of wood preservatives available on the European market that do not use any of the specifically studied fungicides (propiconazole, tebuconazole, creosote, boric acid) and no boron derivatives (reprotoxic substances more widely used in other European countries) was made from the data available on the ECHA website. It is presented in Table 23 below and shows that there are alternatives for all use classes (except class 5).

Table 23. Inventory of wood preservatives whose formulations do not include any of the substances studied and no boron derivatives

Produit	Use class			Type of user			Type of application		
	Class 2	Class 3	Class 4	Non-professional users	Professionals	Industry	Superficial	Injection	Impregnation
Wolmanit CX-8 Wolmanit CX-8WB Wolmanit CX-8F	X	X	X			X			X
Celcure M65 Celcure C65	X	X	X			X			X
Tanasote S40		X	X		X	X			X
Cut-End Preserver range Platzhalter range Tanalith MF | Vacsol Aqua 6118	X	X				X	X		X
HYDROKOAT 16 HYDROKOAT 6	X	X (3.1-Résineux)			X	X	X		
Wolmanit Fume	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Xyladecor range Vivexyl range Sikkens Cetol SADOLIN	*X*	*X*			*X*	*X*	*X*		
Cetol Novatech BP range	*X*	*X*		*X*	*X*		*X*		

4.5 Function substitution: inventory of alternatives to the use of biocides

The objective of this section is to present a synthetic inventory of alternative options to the use of biocides for wood preservation, presenting their possible limitations. These alternatives should be considered as potential options, whose effectiveness and compatibility with the different types of expected use should be assessed. This inventory does not pretend to replace an experimental validation, considering the operational and technical constraints faced by the stakeholders.

4.5.1 Alternatives to biocidal treatment

Part 2.1 concluded that treatment of wood with insecticides and fungicides is a priori only one of three options for ensuring the durability of wood in service.

Not treating the wood at all may be an option that should be combined with adequate monitoring of the structures and, if necessary, repair operations. This option has the advantage of not requiring the use of any biocidal substances, but the major disadvantage of monitoring and repair costs. It should be noted that there are many waterproofing treatments that can in some cases partially or totally limit the configurations that encourage the development of fungi: use of linseed oil, film-forming products such as varnishes or paints, etc.

The other option is to use naturally durable woods (see section 2.1.2). While some species are exotic and therefore have an uncertain environmental record, others are locally available and suitable for use in grades 1 to 4. However, the most obvious limitation of this option is the clear mismatch between available supply and potential demand. For economic reasons, two thirds of French holdings are made up of softwoods, which ultimately account for four fifths of sawmill volumes. Moreover, for the most present "sustainable" species (oak and chestnut), only the heartwood, which represents about 50% of the volume, offers sufficient guarantees. Extended exploitation of these species would therefore require that outlets be anticipated for the half of the wood from these species (the sapwood as opposed to the heartwood), which is not sustainable.

4.5.2 High temperature treatment

High temperature treatment (HTT) is a process of physical modification of wood. It consists of heating it to a very high temperature (200 to 270°C) in an oven under an inert atmosphere with nitrogen (this is called retified wood), or with steam injections (Finnish heat-treated wood).

HTT has different actions:

- It sterilises the wood and thus eliminates micro-organisms
- It slows down the progression of moulds by depriving them of the moisture necessary for their growth and makes the wood resistant to fungal attacks thanks to the disappearance of their nutritive elements and the appearance of tars during the process
- It reduces terpene emissions (compounds attractive to insects)

This process has the advantage of already being industrially developed[36] and of having proven its effectiveness up to use class 3. It also makes it possible to enhance the value of species for which there are generally limited outlets, such as ash, beech, and poplar, while remaining adapted to the treatment of softwoods.

However, it has known limitations:

- While treated wood benefits from increased dimensional stability and gains in hardness, it becomes more brittle, which excludes it for use as a structural element. However, it is suitable for non-load-bearing outdoor uses such as decking and cladding, or indoor use for flooring and joinery.
- At current stage of development, this technology is generally more expensive than chemical preservation processes (investment cost, time to mobilise facilities).
- The process may generate oils or tars, the ecological impact of which should be studied.
- It is not guaranteed against termite attack.

4.5.3 Oleothermy or thermo-oiling

The principle of oleothermy is to replace the water in the wood with oil to a depth of about 2 to 3 mm. To do this, the wood is immersed for 1 to 4 hours in a tank containing a mixture of oils of vegetable origin heated to temperatures between 60 and 150°C.

The replacement of the water initially present and the hydrophobic properties conferred by the oil make the wood less susceptible to lignivorous fungi (which require water for their development) and to insects which the water attracts.

On the other hand, thermo-oiling is not considered as an insecticide treatment (wood-eating larvae and termites) according to the NF B 50-105-3 standard[37]. Moreover, oiling has some disadvantages:

- thermo-oiling does not allow any finishing to be applied to the wood;
- the appearance of thermo-oiled wood can be altered by dirt (air particles tend to cling to the excess oil and create a thin black film).

4.5.4 Chemically modified wood

There are two processes on the European market that chemically modify wood: furfurylation (Kebony process) and acetylation (Accoya process). The processes consist of injecting furfuryl acid (a substance obtained from the waste products of plant production) and acetic anhydride (a vinegar derivative) into

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[36] According to our interviews, between one and two dozen sawmills are equipped in France. Major players are also present in Scandinavia.

[37] Durability of wood and wood-based materials - Wood and wood-based materials treated with a preventive preservative - Part 3: Preservative specifications for wood and wood-based materials and treatment certificate - Adaptation for mainland France and overseas departments (« Durabilité du bois et des matériaux dérivés du bois - Bois et matériaux à base de bois traités avec un produit de préservation préventif - Partie 3 : spécifications de préservation des bois et matériaux à base de bois et attestation de traitement - Adaptation à la France Métropolitaine et aux DOM »)

the wood to make it partially hydrophobic and less susceptible to biological pathogens. To date, manufacturers use Scots pine for the Kebony process and radiata pine[38] for the Accoya process, with trials underway with hardwoods (Beech and Maple).

According to their manufacturer, acetylated wood can be exposed to situations corresponding to use class 3 (windows and doors, decking, cladding). They also appear to be unlikely to be attacked by wood-boring insects and termites.

According to the manufacturer, Kebony-treated wood is intended for use in class 2 (carpentry) and class 3 (windows and doors, decking, cladding and deck boards).

However, the use of chemically modified wood has two disadvantages:

- The injected and unreacted substances (furfuryl acid and acetic anhydride) may react with the finishes and hardware
- The extra cost (for example, acetylated wood would cost 20% more than red cedar, a naturally durable species suitable for use in class 3)

[38] Also known as Monterey pine, common in North America and found in Brittany and southwest France.

5 Discussion

5.1 Alternatives exist

This study allowed to identify the substances whose substitution deserves to be assessed because of their hazard properties and their significant levels of use in PT8. The work then led to the observation that there are alternatives to products made from the most problematic substances on the French and European markets (a summary of all these solutions is presented in Annex 5).

Answering this question was the main objective of this report, which does not aim to measure all the technical and economic implications that a non-renewal of the approvals of the most critical active substances could entail.

However, the simple conclusion we have reached - the existence of substitutes - should not hide the complexity of certain issues.

5.2 Methodological discussion

The analysis of alternatives was conducted within the framework of the Biocides Regulation. This results in two working hypotheses that could merit further discussion for a full study of the substitution possibilities.

Firstly, the uses of the biocidal products were analysed according to the nomenclature presented in the marketing authorisation applications, which include in particular the classes of use (classes 1 to 5) determined by standard NF EN 335-1 to 3. There is no doubt that this nomenclature is relevant for a substitution study, as it covers the initial needs met by treated wood. However, it cannot cover all the factors that lead economic actors to favour the use of a particular substance or product. They may be subject to technological constraints that limit the range of possible substitutions. The need to refine the concept of use and to identify possible barriers and possibilities to circumvent them should be studied on a case-by-case basis.

Secondly, the identification of substances for which alternatives should be identified has been carried out according to the exclusion and substitution criteria of the Biocidal Products Regulation. These criteria do not, in the current state of knowledge, designate certain substances such as cypermethrin, which are known to have an eco-toxicological impact and are monitored in relation to other environmental issues (e.g. cypermethrin is a priority substance under the Water Framework Directive). The appropriateness of substituting one substance for another should be studied, considering all potential impacts on health and the environment.

5.3 Economic context and scope of solutions

In the field of wood preservation, the number of approved active substances is low, and the number of substances actually used is even lower, around ten in France.

The reason generally given to justify this weak development dynamic is the disproportionate costs associated with the approval of substances and then with marketing authorisations (several hundred thousand euros) compared with the industry's turnover, around 20 to 30 million euros in France. Industry currently using products whose active substances meet exclusion criteria (propiconazole in the first place), particularly impregnators, indicated during the interviews that they do not envisage a transition to the use of new products, which would be to the detriment of traditional solutions that have proven their effectiveness over the long term. In the short or medium term, only the derogation is envisaged.

Although solutions without propiconazole, boric acid, tebuconazole or creosote exist, they are currently marginal and proposed by a small number of players. It should be noted that non-biocidal solutions, such as chemical wood modifications, are also the property of two players who address niche markets and could not claim to have an immediate and general development since they concern specific species. The cost of these treatments is also higher.

It is generally recognised that chemical preservation of wood leads to an increase in the price of wood of around 2% for class 2, 3% for class 3 and 5% for class 4 for durability guarantees beyond 10 years (and around 10% for guarantees beyond 30 years). Thus, the cost structure of the material is such that chemical treatment does not lead to a deterioration of its competitiveness compared to competing materials. A specific study should be carried out to assess whether this remains true with other options: non-chemical treatment or, for example, no treatment coupled with monitoring and maintenance.

5.4 Three open points

Three points deserve to be brought to the attention of the reader without a definitive answer being given.

- The large number of reprotoxic or suspected endocrine disrupting substances among the active substances still approved suggests that in the future, unless investment is made in researching new solutions, the range of options could be significantly reduced. The extent to which the use of fewer fungicidal or insecticidal substances for wood treatment could lead to forms of biological resistance should be investigated. If so, there could be major repercussions, particularly if curative treatments were to fail.
- According to the formulators interviewed, the use of a cocktail of biocides not only broadens the spectrum of action of PT8 products, but also reduces the dose of each active substance used. This would mean that if the number of approved substances were reduced, the dose would increase. From a regulatory point of view, it should be stressed that this aspect is only partially studied. The marketing authorisation process ensures that the doses used do not exceed the regulatory risk thresholds; but there is no incentive to preferentially market products that would provide the lowest risk ratios. It should be noted that, it would also be necessary to consider mixture effects, for which scientific uncertainty is still high.
- By their very nature, wood treatments can only prove their effectiveness in the long term. The development of new formulas must therefore be widely anticipated so that their marketing is compatible with the guarantees expected by users. And the search for chemical alternatives must generally be accompanied by the adaptation of treatment processes. The triple constraint - economic, temporal, and technical - probably explains the difficulty for the players in the sector to develop new solutions. There seems to be a lack of linkage between "fundamental" research into possible solutions, such as that conducted at the FCBA, and concrete application by industrial impregnators. The case of creosote, whose hazardous and persistent properties have been known for a long time and for which there are still very few alternatives, is symptomatic. In this respect, the emergence of platforms such as the one at Durwood in Belgium, which make it possible to test new formulations developed in the laboratory on a "real scale", without intellectual appropriation, by creating pilot installations, seems to be an encouraging innovation lever.

5.5 Conclusion

Three substances among those used for biocidal preservation of wood in France unambiguously meet an exclusion criterion under EU Regulation 528/2012 concerning the placing on the market and use of biocidal products: boric acid, propiconazole, and creosote. In addition, tebuconazole, which is currently under evaluation, could also check an exclusion criterion. In this respect, the need for their substitution could be imposed on the sector in the short term and could have significant impacts, particularly with regard to propiconazole, which is widely and traditionally used by the main players in the sector in France. Possible substitutes for these substances exist: at the European level, they involve in most cases the use of other reprotoxic substances, in particular boron derivatives; but substitutions by products - generally based on copper derivatives - not including any substance verifying an exclusion criterion (i.e., generally reprotoxic) in the state of current knowledge are available on the European market for use classes 2 to 4. But the path is narrow.

This study focused mainly on the analysis of alternatives to biocidal preservation treatments. It should be noted that most non-chemical options offer little (or no) guarantee against termites and wood-boring insects. However, this problem, specific to certain European regions, is treated with a very limited number of substances.

The anticipation of these health and environmental issues will undoubtedly have to be at the heart of a global strategy for the wood sector in general, and for wood preservation in particular, to play its part in the context of the low-carbon transition and the circular economy.

6 Annexes

List of annexes :

Annex 1 - Conditions for derogatory approval of biocidal substances

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6.1 Annex 1 - Conditions for derogatory approval of biocidal substanceses

Active substances covered by an exclusion may be approved if it is demonstrated that at least one of the following conditions is met

(a) the risk to humans, animals or the environment from exposure to the active substance in a biocidal product under realistic worst-case conditions of use is negligible, in particular where the product is used in closed systems or under other conditions designed to exclude contact with humans and release into the environment

(b) it is established on the basis of evidence that the active substance is essential to prevent or control a serious risk to human health, animal health or the environment; or

(c) the non-approval of the active substance would have disproportionately negative consequences for society in relation to the risks to human health, animal health and the environment arising from its use.

When deciding that an active substance can be approved, an essential element to be considered is the availability of suitable and sufficient alternative substances or technologies.

The use of a biocidal product containing active substances approved in accordance with this paragraph shall be subject to appropriate risk mitigation measures to ensure that the exposure of humans, animals and the environment to those active substances is as low as possible. The use of the biocidal product, with the corresponding active substances, shall be restricted to Member States under conditions.

6.2 Annex 2 - Combinations of biocidal active substances for the formulation of PT8 products in 2021

The study of combinations of active substances was carried out on the basis of the compositions of PT8 products representing 90% of sales in 2021.

	Tebuconazole	Basic Copper carbonate	Cypermethrin	Permethrin	3-iodo- 2 propynylbutylcarbamate (IPBC)	Propiconazole	Coco alkyltrimethylammonium chloride (ATMAC/TMAC)	Alkyl (C12-16) dimethylbenzyl ammonium chloride (ADBAC/BKC (C12-16))	Didecyldimethylammonium chloride (DDAC)	Creosote	Cyproconazole	Boric acid	N-(3-aminopropyl)- N-dodecylpropane-1,3-diamine (Diamine)	Granulated copper	DDACarbonate
Tebuconazole		X	X	X	X	X			X				X	X	X
Basic Copper carbonate	X					X		X			X	X			
Cypermethrin	X		X		X	X	X	X	X						
Permethrin	X			X	X	X	X						X		
3-iodo-2-propynylbutylcarbamate (IPBC)	X		X	X		X							X		
Propiconazole	X	X	X	X	X		X		X				X	X	X
Coco alkyltrimethylammonium chloride (ATMAC/TMAC)			X	X		X									
Alkyl (C12-16) dimethylbenzyl ammonium chloride (ADBAC/BKC (C12-16))		X	X						X		X	X			
Didecyldimethylammonium chloride(DDAC)	X		X			X		X					X	X	X
Creosote										X					
Cyproconazole		X						X							
Boric acid		X						X							
N-(3-aminopropyl)-N-dodecylpropane-1,3-diamine (Diamine)	X			X	X	X			X					X	X
Granulated copper	X					X			X				X		X
DDACarbonate	X					X			X				X	X	

Biocide used alone	
X	The substance whose cell is coloured is always used together with the other substance of this combination

6.3 Annex 3 - Uses of alternative products (Source: ANSES / FCBA)

Product	Producer	Target fungi						Target insects				Application	Type of users	Composition																French marketing authorization	CTB P+	CLASS 1		CLASS 2		CLASS 3				CLASS 4		CLASS 4 SP		CLASS 5	
																																			CLASS 3.1		CLASS 3.2							
		Basidiomycetes	Cubic rot	Fibrous rot	Soft rot	Blue stain in service	Marine Terebrants	Capricorn beetle	Lyctes	Leafcutter beetle	Termites			3-iodo-2-propynyl butylcarbamate (IPBC)	Boric acid	ADBAC/BKC (C12-16)	Bardap 26	Basic Copper carbonate	Coco alkyltrimethylammonium chloride (ATMAC/TMAC)	Creosote	Copper	Cypermethrin	Cyproconazole	DDACarbonate	Didecyldimethylammonium chloride(DDAC)	N-(3-aminopropyl)-N-dodecylpropane-1,3-diamine (Diamine)	Permethrin	Propiconazole	Tebuconazole			S	H	S	H	S	H	S	H	S	H	S	H	S	H
Creosote EN 13991	RÜTGERS Belgium BVBA	X										Impregnation in industrial sites (closed system, pressure process) Surface application (brush/roll) of impregnated wood after cutting	Professionals							X											FR-2017-0035	-	-	-	-	-	P	P	P	P	-	-	-	-	-	-
SARPALO 860	ADKALIS		X					X	X	X	X	Surface application (dipping, spraying, brushing)	Professionals / Industry						X			X						X		-	-	P	P	P	P	P	-	-	-	-	-	-	-	-	-
ACTICIDE BAC50M	THOR SARL															X														-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tanalith E 8001B	LONZA France		X	X	X			X	X	X	X	Vacuum and pressure autoclave	Industry								X			X	X	X		X	X	-	X	P	P	P	P	P	P	P	P	P	-	P	-	-	-
XYLOPHENE MULTI-USAGES	PPG AC		X					X	X	X	X	Preventive treatment: Surface application (brushing / rolling / dabbing / spraying) Curative treatment: Injection + surface application	Professionals / Non-professional users	X								X						X	X	BC-AP017518-34	-	P/C	P/C	P/C	P/C	P	-	-	-	-	-	-	-	-	-
Tanalith E 3474	LONZA Cologne		X	X	X			X	X	X	X	Impregnation / vacuum and pressure autoclave	Industry					X										X	X	FR-2016-0003	X	P	P	P	P	P	P	P	P	P	-	P	-	-	-
TX202 TRAITEMENT CHARPENTES-POUTRES	V33							X	X	X	X	Preventive treatment: Surface application (Brushing/Spraying) Curative treatment: Injection + Surface application (Brushing/Spraying)	Professionals / Non-professional users									X								FR-2018-0078	-	P/?	P/?	C	C	-	-	-	-	-	-	-	-	-	-
XYLOPHENE Poutres et charpentes 25 ans																						X								-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ACTICIDE DDQ 50	THOR SARL																							X						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
XILIX 3000 P	ADKALIS		X	X				X	X	X	X	Injection/double spraying		X													X	X	X	-	X	P/C	P/C	P/C	P/C	P/C	P/C	-	-	-	-	-	-	-	-
Axton Traitement universel	PPG AC		X					X	X	X	X	Preventive treatment: Surface application (Brushing / rolling / dabbing / spraying) Curative treatment: Injection + surface application	Professionals / Non-professional users									X						X	X	BC-AP017518-34	-	P/C	P/C	P/C	P/C	P	-	-	-	-	-	-	-	-	-
SARPECO 9-PLUS	ADKALIS		X	X				X	X	X	X	Surface application (Spraying/Short soaking)	Professionals	X													X	X	X	FR-2019-0062	X	P	P	P	P	P	P	P	P	-	-	-	-	-	-
XILIX GEL	BERKEM DEVELOPPEMENT							X		X		Surface application / Spraying / Injection	Professionals														X			FR-2019-0051	X	P	P	-	-	-	-	-	-	-	-	-	-	-	-

Product	Producer	Target fungi						Target insects				Application	Type of users	Composition																French marketing authorization	CTB P+	CLASS 1		CLASS 2		CLASS 3				CLASS 4		CLASS 4 SP		CLASS 5	
																																			CLASS 3.1		CLASS 3.2							
		Basidiomycetes	Cubic rot	Fibrous rot	Soft rot	Blue stain in service	Marine Terebrants	Capricorn beetle	Lyctes	Leafcutter beetle	Termites			3-iodo-2-propynyl butylcarbamate (IPBC)	Boric acid	ADBAC/BKC (C12-16)	Bardap 26	Basic Copper carbonate	Coco alkyltrimethylammonium chloride (ATMAC/TMAC)	Creosote	Copper	Cypermethrin	Cyproconazole	DDACarbonate	Didecyldimethylammonium chloride(DDAC)	N-(3-aminopropyl)-N-dodecylpropane-1,3-diamine (Diamine)	Permethrin	Propiconazole	Tebuconazole			S	H	S	H	S	H	S	H	S	H	S	H	S	H
XYLOPHENE BOIS EXTERIEUR	PPG AC		X					X	X	X	X	Preventive treatment: Surface application (brushing / rolling / dabbing / spraying) Curative treatment: Injection + surface application	Professionals / Non-professional users	X								X							X	X	BC-AP017 518-34	-	P/C	P/C	P/C	P/C	P	-	-	-	-	-	-	-	-	-
XYLOPHENE Preventif EXO 1000 Plus	ADKALIS		X	X				X	X	X	X	Short soaking / Tunnel spraying / Vacuum and pressure autoclave	Professionals / Industry	X								X							X	X	-	X	P	P	P	P	P	P	P	P	-	-	-	-	-	-
TX203 Traitement multi-usages	V33		X	X				X	X	X	X	Preventive treatment: Surface application (Brush/Spray) Curative treatment: Injection application + Surface application (Brush/Spray)	Professionals / Non-professional users									X							X	X	FR-2017-0044	-	P/?	P/?	P/C	P/C	P/?	P/?	P/?	P/?	-	-	-	-	-	-
Celcure AC-500	PROTIM SOLIGNUM Lt		X	X	X			X	X	X	X	Vacuum and pressure autoclave	Industry		X	X		X													-	X	P	P	P	P	P	P	P	P	P	P				
V33 Traitement Multi-usages	V33		X	X				X	X	X	X	Preventive treatment: Surface application (Brush/Spray) Curative treatment: Injection application + Surface application (Brush/Spray)	Professionals / Non-professional users									X							X	X	FR-2017-0027	-	P/?	P/?	P/C	P/C	P/?	P/?	P/?	P/?	-	-	-	-	-	-
Axton Traitement poutres et charpentes	V33							X	X	X	X	Preventive treatment: Surface application (Brushing/Spraying) Curative treatment: Injection application + Surface application (Brushing/Spraying)	Professionals / Non-professional users															X			FR-2018-0083 BC-CC017 499-50	-	P/?	P/?	C	C	-	-	-	-	-	-	-	-	-	-
XILIX GEL CURATIF FONGI +	ADKALIS		X	X				X	X	X	X	Injection/double spraying							X								X	X		-	X	P/C	P/C	P/C	P/C	P/C	P/C	-	-	-	-	-	-
Celcure C4	PROTIM SOLIGNUM Ltd)		X	X	X			X	X	X	X	Vacuum and pressure autoclave	Industry			X		X					X								-	X	P	P	P	P	P	P	P	P	P	P	P	P	-	-
TRAITEMENT TOUS USAGES	ADKALIS	X	X					X	X	X	X	Roller, Injection	Professionals / Non-professional users						X			X							X		-	-	P/C	P/C	P/C	P/C	P/C	P/C	-	-	-	-	-	-
XYLO TOTAL	PPG AC		X					X	X	X	X	Preventive treatment: Surface application (Brushing / Rolling / Dabbing / Spraying) Curative treatment: Injection + surface application	Professionals / Non-professional users	X								X							X	X	BC-AP017 518-34	-	P/C	P/C	P/C	P/C	P	-	-	-	-	-	-	-	-	-
V33 Traitement poutres et charpentes	V33							X	X	X	X	Preventive treatment: Surface application (Brushing/Spraying) Curative treatment: Injection application + Surface application (Brushing/Spraying)	Professionals / Non-professional users															X			FR-2018-0049	-	P/?	P/?	C	C	-	-	-	-	-	-	-	-	-	-
XYL CE 2000	ADKALIS							X	X	X	X	Surface application (brushing, rolling, brushing and spraying) / Injections	Professionals									X									AMM FR-2019-0028	X	P/C	P/C	-	-	-	-	-	-	-	-	-	-	-	-
XYL SC 2000	ADKALIS							X	X	X	X	Surface application (brushing, spraying, short soaking)	Professionals / Industry									X									FR-2019-0024	-	P/C	P/C	-	-	-	-	-	-	-	-	-	-	-	-

Product	Producer	Target fungi						Target insects				Application	Type of users	Composition																		French marketing authorization	CTB P+	CLASS 1		CLASS 2		CLASS 3				CLASS 4		CLASS 4 SP		CLASS 5	
																																					CLASS 3.1		CLASS 3.2							
		Basidiomycetes	Cubic rot	Fibrous rot	Soft rot	Blue stain in service	Marine Terebrants	Capricorn beetle	Lyctes	Leafcutter beetle	Termites			3-iodo-2-propynyl butylcarbamate (IPBC)	Boric acid	ADBAC/BKC (C12-16)	Bardap 26	Basic Copper carbonate	Coco alkyltrimethylammonium chloride (ATMAC/TMAC)	Creosote	Copper	Cypermethrin	Cyproconazole	DDACarbonate	Didecyldimethylammonium chloride(DDAC)	N-(3-aminopropyl)-N-dodecylpropane-1,3-diamine (Diamine)	Permethrin	Propiconazole	Tebuconazole			S	H	S	H	S	H	S	H	S	H	S	H	S	H
HYDROKOAT 6	KOATCHIMIE		X					X	X	X	X	Surface application (spraying/dipping)	Industry			X						X			X						FR-2017-0083	X	P	P	P	P	P	-	-	-	-	-	-	-	-	-	-
XYLOPHENE Preventif EX 2002 Plus	ADKALIS		X	X				X	X	X	X	Surface application (short soaking / tunnel spraying) / Vacuum and pressure autoclave	Professionals / Industry	X								X						X	X		X	P	P	P	P	P	P	P	P	-	-	-	-	-	-
XYL CE 2006	ADKALIS		X	X	X			X	X	X	X	Surface application (brushing, rolling, dabbing, spraying) / Injections	Professionals	X								X						X	X	FR-2020-0031	X	P/C	P/C	P/C	P/C	P	-	-	-	-	-	-	-	-	-	-
AXIL 2000	ADKALIS		X			X						Spraying / Spraying / Short soak	Industry	X														X	X	FR-2017-0074	-	-	-	-	-	-	P	P	P	P	-	-	-	-	-	-
Obbiacryl ABI	OBBIA	X	X			X		X	X	X		Coating (brush or (brush or roller), spraying (trickle, flow coat), spray (pneumatic, airless, electrostatic) and dipping	Professionals	X												X	X				-	-	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
AXIL 3000	ADKALIS		X	X				X	X	X	X	Short dipping / Tunnel spraying / Vacuum and pressure autoclave	Industry	X								X						X	X	-	X	P	P	P	P	P	P	P	P	-	-	-	-	-	-
D'XYL TRAITEMENT Bois tous usages	ADKALIS	X	X	X				X	X	X	X	Surface application (brushing, spraying) and/or deep injection	Professionals / Non-professional users						X			X						X			-	-	P/C	P/C	P/C	P/C	P/C	P/C	-	-	-	-	-	-	-	-	-	-
ACTICIDE DDQ 70	THOR SARL																								X						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
XILIX Traitement Tous Usages	ADKALIS	X	X					X	X	X	X	Brushing, Spraying, Injection	Professionals / Non-professional users						X			X						X			-	-	P/C	P/C	P/C	P/C	P/C	P/C	-	-	-	-	-	-	-	-	-	-
ACTICIDE BAC 80	THOR SARL															X															-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
XYLO STRUCTURE	PPG AC							X	X	X	X	Preventive treatment: Surface application (brush/roll/spray) Curative treatment: Injection application + Surface application (brush/roll/spray)	Professionals / Non-professional users									X									BC-CC017499-50	-	P/?	P/?	C	C	-	-	-	-	-	-	-	-	-	-
Tanalith E 8001	LONZA Cologne		X	X	X			X	?	?	X	Penetrating treatment: Vacuum-pressure impregnation	Professionals / Industry					X							X			X	X	FR-2018-0064	X	P	P	P	P	P	P	P	P	P	P	P	P	P	-	-
Korasit KS2	Kurt Obermeier GmbH & Co. KG		X	X	X			X	X	X	X	Vacuum and pressure autoclave	Industry				X	X													X	P	P	P	P	P	P	P	P	P	P	P	P		

S : Softwood (Résineux) H : Hardwood (Feuillus)

6.4 Annex 4 - Use data from evaluation reports of biocides approved in Europe (ECHA)

Substance	CAS no.	Function	Class					Type of treatment		Type of user			Type ofapplication			
			Class 1	Class 2	Class 3	Class 4	Class 5	Curative	Préventive	Non-professional users	Professionals	Industry	Superficial	Injection	Automated process [1]	Other
Propiconazole	60207-90-1	Fungicide		X	X			X	X	[2]	X	X	X	X	X	
Creosote	8001-58-9	Insecticide Fungicide			X	X	X		X		?	X			X	
Boric acid	10043-35-3	Insecticide Fungicide	X	X	X	X		X	X	[2]	X	X	X	X	X	
Tebuconazole	107534-96-3	Fungicide	X	X	X	X	X	?	X	X	X	X	X		X	
Basic copper carbonate	12069-69-1	Insecticide Fungicide	X	X	X	X			X			X			X	
3-iodo-2-propynyl butylcarbamate (IPBC)	55406-53-6	Fungicide	X	X	X			X	X	X	X	X	X	X	X	
4,5-Dichloro-2-octylisothiazol-3(2H)-one (4,5-Dichloro-2-octyl-2H-isothiazol-3-one (DCOIT))	64359-81-5	Fungicide		X	X	X			X		?	X	?		X	
DDACarbonate	894406-76-9	Insecticide Fungicide	X	X	X	X			?		X	X			X	
Penflufen	494793-67-8	Fungicide	X	X	X	X		?	X	X	X	X	X		X	
octhilinone (ISO)	26530-20-1	Fungicide	X	X					X			X			X	
Cu-HDO	312600-89-8	Insecticide Fungicide	X	X	X	X			X			X			X	
Granulated copper	7440-50-8	Insecticide Fungicide	X	X	X	X			X			X			X	
Didecyldimethylammonium chloride (DDAC)	7173-51-5	Insecticide Fungicide	X	X	X	X			X		X	X			X	
Dazomet	533-74-4	Fungicide				X			X		X	?				X
Potassium sorbate	24634-61-5	Fungicide(champignons décolorants)	?	?	?	?	?		X		X	?			X	
Quaternary ammonium compounds, coco alkyltrimethyl, chlorides	61789-18-2	Fungicide	X	X	X	X			X		X	X			X	
ADBAC/BKC (C12-16)	68424-85-1	Insecticide Fungicide	X	X	X	X			X		X	X			X	
K-HDO	66603-10-9	Fungicide		X					X			X			X	
Tolylfluanid	731-27-1	Fungicide(champignons décolorants)		X	X				X	X	X	X	X		X	
Copper oxide	1317-38-0	Insecticide Fungicide	X	X	X	X			X			X			X	
Copper dihydroxide	20427-59-2	Insecticide Fungicide	X	X	X	X			X			X			X	
Ethofenprox	80844-07-1	Insecticide	X	X	X				X			X			X	

Substance	CAS no.	Function	Class					Type of treatment		Type of user			Type ofapplication			
			Class 1	Class 2	Class 3	Class 4	Class 5	Curative	Préventive	Non-professional users	Professionals	Industry	Superficial	Injection	Automated process [1]	Other
Bifenthrin	82657-04-3	Insecticide	X	X	X			X	X		X	X	X	X	X	
Fenoxycarb	72490-01-8	Insecticide	X	X	X				X		X	X			X	
Chlorfenapyr	122453-73-0	Insecticide	X	X	X	X			X		X	X	X		X	
Cypermethrin	52315-07-8	Insecticide	X	X	X			X	X	X	X	X	X		X	
Permethrin	52645-53-1	Insecticide	X	X	X	4a		X	X	X	X	X	X	X	X	
Bardap 26	**94667-33-1**	Insecticide Fungicide	X	X	X	X			X		X	X			X	
Fenpropimorph	67564-91-4	Fungicide	X	X	X				X			X			X	
Disodium tetraborate pentahydrate	12179-04-3	Insecticide Fungicide	X	X	X	X		X	X	X	X	X	X	X	X	

[1] Dipping, spraying, flow coat, double vacuum, supercritical CO2 and vacuum pressure

[2] According to Regulation 528/2012, propiconazole and boric acid are not approved for marketing for use by the consumer as both active substances are classified as Repr. 1B

6.5 Annex 5 - Summary of alternative products

6.5.1 Alternative products without propiconazole

	Alternative products without propiconazole						
	Use class	**Type of application**	**Type of user**	**Trade name of alternatives**	**Fungicides used in the alternatives**	**Composition available on the French market**	**Source**
Use #1	Class 2	Superficial (sprinkling/soaking)	Industry Professionals	Hydrokoat 6[α]	Didecyldimethylammonium chloride (DDAC) Alkyl (C12-16) dimethylbenzyl ammonium chloride (ADBAC/BKC (C12-16))	X	SIMMBAD
				Xyladecor range Vivexyl range Sikkens Cetol SADOLIN	IBPC	X	ECHA
				Aquawood range IG-10 range	IBPC Tebuconazole	X	ECHA
				Cut-End Preserver range Platzhalter range Tanalith MF | Vacsol Aqua 6118	Penflufen	X	ECHA
Use #2	Class 2 Class 3	Impregnation	Industry	Korasit KS2	Bardap26 Basic copper carbonate	X	SIMMBAD
				Celcure AC-500[αα]	Boric acid** Basic copper carbonate ADBAC/BKC (C12-16)	X	SIMMBAD
				Celcure C4 [αα]	Cyproconazole* Basic copper carbonate ADBAC/BKC (C12-16)	X	SIMMBAD
				Celcure M65 Celcure C65	Didecyldimethylammonium chloride (DDAC) Basic Copper carbonate DDACarbonate	X	ECHA
				Wolmanit CX-8M | Wolmanit CX-8WB Wolmanit CX-8F	Basic Copper carbonate Cu-HDO	X	ECHA
				Tanasote S40	Copper hydroxide Penflufen DDACarbonate	X	ECHA
				Cut-End Preserver range Platzhalter range Tanalith MF | Vacsol Aqua 6118	Penflufen	X	ECHA
				Celcure MC-T2 Celcure MC-T3	Basic copper carbonate Tebuconazole		ECHA

* : substance meeting an exclusion criterion and no longer approved for use
** : substances meeting an exclusion criterion but benefiting from a derogation
[α] : This product is also compatible with class 1 (hardwood and softwood) and 3.1 (softwood) uses
[αα] : These products are also compatible with class 4 uses

6.5.2 Alternative products without boric acid

	Alternative products without boric acid							
	Use class	**Type of application**	**Type of user**	**Trade name of alternatives**	**Fungicides used in the alternatives**	**Insecticides used in alternatives**	**Composition available on the French market (ECHA/Simmbad)**	**Source**
Use #1	Class 2	Superficial (sprinkling/soaking)	Industry Professionals	SARPECO 9-PLUS	IPBC Tebuconazole Propiconazole**	Permethrin	X	SIMMBAD
				XYLOPHENE Preventif EX 2002 Plus AXIL 3000		Cypermethrin	X	SIMMBAD
				Hydrokoat 6 ᵅ ᵅ ᵅ	Didecyldimethylammonium chloride (DDAC) ADBAC/BKC (C12-16)	Cypermethrin Didecyldimethylammonium chloride (DDAC) ADBAC/BKC (C12-16)	X	SIMMBAD
				SARPALO 860	ATMAC/TMAC Propiconazole**	Cypermethrin	X	SIMMBAD
				Cut-End Preserver range Platzhalter range Tanalith MF | Vacsol Aqua 6118	Penflufen	Permethrin	X	ECHA
				Aquawood range	IBPC Tebuconazole	/	X	ECHA
				IG-10 range		Cypermethrin		ECHA
				Xyladecor- Holzschutzlasur range Vivexyl range Sikkens Cetol HLS plus, HLS extra ° SADOLIN Classic°…	IBPC	/	X	ECHA
Use #2	Class 2 Class 3.1	Superficial Injection	Professionals	TRAITEMENT TOUS USAGES D'XYL TRAITEMENT Bois tous usages XILIX Traitement Tous Usages	Propiconazole** ATMAC/TMAC	Cypermethrin	X	SIMMBAD
				XILIX GEL CURATIF FONGI +		Permethrin	X	SIMMBAD
				TX203 Traitement multi-usages Axton Traitement universel ᵅ	Propiconazole** Tebuconazole	Cypermethrin	X	SIMMBAD
				XILIX 3000 P	IPBC Propiconazole** Tebuconazole	Permethrin	X	SIMMBAD
				XYLOPHENE MULTI-USAGES ᵅ XYLOPHENE BOIS EXTERIEURᵅ XYLO TOTALᵅ XYL CE 2006 ᵅ		Cypermethrin	X	SIMMBAD

	Alternative products without boric acid							
	Use class	**Type of application**	**Type of user**	**Trade name of alternatives**	**Fungicides used in the alternatives**	**Insecticides used in alternatives**	**Composition available on the French market (ECHA/Simmbad)**	**Source**
				Cetol Novatech BP range	IBPC Alkyl (C12-16) diméthylbenzyl ammonium chloride (ADBAC/BKC (C12-16))	Alkyl (C12-16) diméthylbenzyl ammonium chloride (ADBAC/BKC (C12-16))		ECHA
Use #3	Class 2 Class 3 Class 4	Impregnation	Industry	Celcure C4	Basic copper carbonate ADBAC/BKC (C12-16) Cyproconazole*	Basic copper carbonate ADBAC/BKC (C12-16)	X	SIMMBAD
				Korasit KS2	Bardap26 Basic copper carbonate		X	SIMMBAD
				Tanalith E 3474 ᵅᵅ	Basic Copper carbonate Propiconazole** Tebuconazole	Basic Copper carbonate	X	SIMMBAD
				Tanalith E 8001B ᵅᵅ	Granulated copper DDACarbonate Didecyldimethylammonium chloride(DDAC) N-(3-aminopropyl)-N-dodecylpropane-1,3-diamine (Diamine) Propiconazole** Tebuconazole	Granulated copper DDACarbonate Didecyldimethylammonium chloride(DDAC)	X	SIMMBAD
				Tanalith E 8001	Basic Copper carbonate Propiconazole** Tebuconazole Didecyldimethylammonium chloride(DDAC)	Basic Copper carbonate Didecyldimethylammonium chloride(DDAC)	X	SIMMBAD
				Celcure M65 Celcure C65	Didecyldimethylammonium chloride (DDAC) Basic Copper carbonate DDACarbonate		X	ECHA
				Tanasote S40	Copper hydroxide Penflufen DDACarbonate	Copper hydroxide DDACarbonate	X	ECHA
				Wolmanit CX-8M | Wolmanit CX-8WB Wolmanit CX-8F	Basic Copper carbonate Cu-HDO		X	ECHA

* : substance meeting an exclusion criterion and no longer approved for use
** : substances meeting an exclusion criterion but benefiting from a derogation
ᵅ : Except for use class 3.1 - Hardwoods
ᵅᵅ : Except for use class 4 - Hardwoods
ᵅᵅᵅ : This product is also compatible with use class 1 (hardwood and softwood) and 3.1 (softwood)

6.5.3 Alternative products without creosote

	Alternative products without boric acid creosote						
Use class	**Type of application**	**Type of user**	**Trade name of alternatives**	**Fungicides used in the alternatives**	**Insecticides used in alternatives**	**Composition available on the French market (ECHA/Simmbad)**	**Source**
Class 3 Class 4	Impregnation	Industry	Celcure C4	Basic copper carbonate ADBAC/BKC (C12-16) Cyproconazole*	Basic copper carbonate ADBAC/BKC (C12-16)	X	SIMMBAD
			Korasit KS2	Bardap26 Basic copper carbonate		X	SIMMBAD
			Tanalith E 3474 [α]	Basic Copper carbonate Propiconazole** Tebuconazole	Basic Copper carbonate	X	SIMMBAD
			Tanalith E 8001B [α]	Granulated copper DDACarbonate Didecyldimethylammonium chloride(DDAC) N-(3-aminopropyl)-N-dodecylpropane-1,3-diamine (Diamine) Propiconazole** Tebuconazole	Granulated copper DDACarbonate Didecyldimethylammonium chloride(DDAC)	X	SIMMBAD
			Celcure AC500	Boric acid** Basic copper carbonate ADBAC/BKC (C12-16)		X	SIMMBAD
			Tanalith E 8001	Basic Copper carbonate Propiconazole** Tebuconazole Didecyldimethylammonium chloride(DDAC)	Basic Copper carbonate Didecyldimethylammonium chloride(DDAC)	X	SIMMBAD
			Celcure M65 Celcure C65	Didecyldimethylammonium chloride (DDAC) Basic Copper carbonate DDACarbonate		X	ECHA
			Tanasote S40	Copper hydroxide Penflufen DDACarbonate	Copper hydroxide DDACarbonate	X	ECHA
			Wolmanit CX-8M | Wolmanit CX-8WB Wolmanit CX-8F	Basic Copper carbonate Cu-HDO		X	ECHA

* : substances no longer approved for use

** : substances meeting a substitution criterion but benefiting from a derogation

[α] : Except for use class 4 - Hardwoods

6.5.4 Alternative products without tebuconazole

	Alternative products without tebuconazole						
	Use class	**Type of application**	**Type of user**	**Trade name of alternatives**	**Fungicides used in the alternatives**	**Composition available on the French market (ECHA/Simmbad)**	**Source**
Use #1	Class 2	Superficial (sprinkling/soaking)	Industry Professionals	Hydrokoat 6	Didecyldimethylammonium chloride (DDAC) ADBAC/BKC (C12-16)	X	SIMMBAD
				SARPALO 860	ATMAC/TMAC Propiconazole**	X	SIMMBAD
				Cut-End Preserver range Platzhalter range Tanalith MF | Vacsol Aqua 6118	Penflufen	X	ECHA
				Xyladecor range Vivexyl range Sikkens Cetol SADOLIN	IBPC	X	ECHA
Use #2	Class 2 Class 3.1	Superficial Injection	Non-professional users Professionals	TRAITEMENT TOUS USAGES D'XYL TRAITEMENT Bois tous usages XILIX Traitement Tous Usages XILIX GEL CURATIF FONGI +	ATMAC/TMAC Propiconazole**	X	SIMMBAD
				Cetol Novatech BP range	IBPC Alkyl (C12-16) diméthylbenzyl ammonium chloride (ADBAC/BKC (C12-16))		ECHA
Use #3	Class 2 Class 3 Class 4	Impregnation	Industry	Celcure C4 Cyproconazole* Basic copper carbonate	ADBAC/BKC (C12-16)	X	SIMMBAD
				Korasit KS2	Bardap26 Basic copper carbonate	X	SIMMBAD
				Celcure AC-500	Boric acid** Basic copper carbonate ADBAC/BKC (C12-16)	X	SIMMBAD
				Celcure M65 Celcure C65	Didecyldimethylammonium chloride (DDAC) Basic Copper carbonate DDACarbonate	X	ECHA
				Tanasote S40	Copper hydroxide Penflufen DDACarbonate	X	ECHA
				Wolmanit CX-8M | Wolmanit CX-8WB Wolmanit CX-8F	Basic Copper carbonate Cu-HDO	X	ECHA

* : substances no longer approved for use
** : substances meeting an exclusion criterion but benefiting from a derogation

6.6 Annex 6 - Definition of an endocrine disruptor

Article 5 of the regulation (EU) n°528/2012 mentions:

« […] (d) active substances which, on the basis of the criteria specified pursuant to the first subparagraph of paragraph 3 or, pending the adoption of those criteria, on the basis of the second and third subparagraphs of paragraph 3, are considered as having endocrine-disrupting properties that may cause adverse effects in humans or which are identified in accordance with Articles 57(f) and 59(1) of Regulation (EC) No 1907/2006 as having endocrine disrupting properties;

3. No later than 13 December 2013, the Commission shall adopt delegated acts in accordance with Article 83 specifying scientific criteria for the determination of endocrine-disrupting properties

Pending the adoption of those criteria, active substances that are classified in accordance with Regulation (EC) No 1272/2008 as, or meet the criteria to be classified as, carcinogen category 2 and toxic for reproduction category 2, shall be considered as having endocrine-disrupting properties.

Substances such as those that are classified in accordance with Regulation (EC) No 1272/2008 as, or that meet the criteria to be classified as, toxic for reproduction category 2 and that have toxic effects on the endocrine organs, may be considered as having endocrine-disrupting properties.

The first article of the delegated regulation (EU) 2017/2100 of the Commission of 4 September 2017 defining scientific criteria for the determination of endocrine disrupting properties, in accordance with Regulation (EU) N (UE) n°528/2012 mentions :

« The scientific criteria for the determination of endocrine-disrupting properties pursuant to Regulation (EU) No 528/2012 are set out in the Annex to this Regulation *»*

The Annex to Delegated Regulation (EU) 2017/2100 mentions:

« A substance shall be considered as having endocrine-disrupting properties with respect to humans or non-target organisms, where it meets the criteria set out in section A or section B

Section A — Endocrine-disrupting properties with respect to humans

1) A substance shall be considered as having endocrine-disrupting properties that may cause adverse effect in humans if, based on points (a) to (d) of point (2), it is a substance that meets all of the following criteria, unless there is evidence demonstrating that the adverse effects identified are not relevant to humans:
    - *a.* it shows an adverse effect in an intact organism or its progeny, which is a change in the morphology, physiology, growth, development, reproduction or life span of an organism, system or (sub)population that results in an impairment of functional capacity, an impairment of the capacity to compensate for additional stress or an increase in susceptibility to other influences *;*
    - *b.* it has an endocrine mode of action, i.e. it alters the function(s) of the endocrine system *;*
    - *c.* the adverse effect is a consequence of the endocrine mode of action.

2) The identification of a substance as having endocrine-disrupting properties that may cause adverse effect in humans in accordance with point (1) shall be based on all of the following points:
    - *a.* all available relevant scientific data (in vivo studies or adequately validated alternative test systems predictive of adverse effects in humans or animals; as well as in vivo, in vitro, or, if applicable, in silico studies informing about endocrine modes of action) *:*
        - *i.* scientific data generated in accordance with internationally agreed study protocols, in particular those referred to in Annexes II and III of Regulation (EU) No 528/2012 *;*
        - ii. other scientific data selected applying a systematic review methodology;
    - *b.* an assessment of the available relevant scientific data based on a weight of evidence approach in order to establish whether the criteria set out in point (1) are fulfilled; in applying the weight of evidence determination, the assessment of the scientific evidence shall, in particular, consider all of the following factors:

i. both positive and negative results *;*
ii. the relevance of the study designs for the assessment of adverse effects and of the endocrine mode of action;
iii. the quality and consistency of the data, considering the pattern and coherence of the results within and between studies of a similar design and across different species;
iv. the route of exposure, toxicokinetic and metabolism studies;
v. the concept of the limit dose, and international guidelines on maximum recommended doses and for assessing confounding effects of excessive toxicity;

c. Using a weight of evidence approach, the link between the adverse effect(s) and the endocrine mode of action shall be established based on biological plausibility, which shall be determined in the light of current scientific knowledge and under consideration of internationally agreed guidelines;

d. Adverse effects that are non-specific secondary consequences of other toxic effects shall not be considered for the identification of the substance as endocrine disruptor.

Section B — Endocrine-disrupting properties with respect to non-target organisms

1) A substance shall be considered as having endocrine-disrupting properties that may cause adverse effects on non-target organisms if, based on points (a) to (d) of point (2), it is a substance that meets all of following criteria, unless there is evidence demonstrating that the adverse effects identified are not relevant at the (sub)population level for non-target organisms:

a. It shows an adverse effect in non-target organisms, which is a change in the morphology, physiology, growth, development, reproduction or life span of an organism, system or (sub)population that results in an impairment of functional capacity, an impairment of the capacity to compensate for additional stress or an increase in susceptibility to other influences;

b. It has an endocrine mode of action, i.e. it alters the function(s) of the endocrine system;

c. the adverse effect is a consequence of the endocrine mode of action.

2) The identification of a substance as having endocrine-disrupting properties that may cause adverse effects on non-target organisms in accordance with point (1) shall be based on all of the following points:

a. all available relevant scientific data (in vivo studies or adequately validated alternative test systems predictive of adverse effects in humans or animals; as well as in vivo, in vitro or, if applicable, in silico studies informing about endocrine modes of action):

i. scientific data generated in accordance with internationally agreed study protocols, in particular those referred to in Annexes II and III of Regulation (EU) No 528/2012;
ii. other scientific data selected applying a systematic review methodology;

b. an assessment of the available relevant scientific data based on a weight of evidence approach in order to establish whether the criteria set out in point 1 are fulfilled; in applying the weight of evidence determination, the assessment of the scientific evidence shall consider all of the following factors:

i. both positive and negative results, discriminating between taxonomic groups (e.g. mammals, birds, fish, amphibians) where relevant;
ii. the relevance of the study design for the assessment of the adverse effects and its relevance at the (sub) population level, and for the assessment of the endocrine mode of action;
iii. the adverse effects on reproduction, growth/development, and other relevant adverse effects which are likely to impact on (sub)populations. Adequate, reliable and representative field or monitoring data and/or results from population models shall as well be considered where available;
iv. the quality and consistency of the data, considering the pattern and coherence of the results within and between studies of a similar design and across different taxonomic groups;

v. the concept of the limit dose and international guidelines on maximum recommended doses and for assessing confounding effects of excessive toxicity;

c. using a weight of evidence approach, the link between the adverse effect(s) and the endocrine mode of action shall be established based on biological plausibility, which shall be determined in the light of current scientific knowledge and under consideration of internationally agreed guidelines;

d. adverse effects that are non-specific secondary consequences of other toxic effects shall not be considered for the identification of the substance as endocrine disruptor with respect to non-target organisms

3) If the intended biocidal mode of action of the active substance being assessed consists of controlling target organisms other than vertebrates via their endocrine systems, the effects on organisms of the same taxonomic phylum as the targeted one shall not be considered for the identification of the substance as having endocrine disrupting properties with respect to non-target organisms.

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